Santos

Barossa Production Operations Environment Plan

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Acronyms

Abbreviation	Description
°C	degrees Celsius
µg/L	micrograms/litre
µPa	micro pascal
24/7	24 hours a day, seven days a week
AAPA	Aboriginal Areas Protection Authority
ABF	Australian Border Force
ACCU	Australian Carbon Credit Units
ACF	Australian Conservation Foundation
ACMA	Australian Communications and Media Authority
AFANT	Amateur Fishermen's Association of the Northern Territory
AFMA	Australian Fisheries Management Authority
AHO	Australian Hydrographic Office
AHS	Australian Hydrographic Service
AIMS	Australian Institute of Marine Science
AIMS Act	*Australian Institute of Marine Science Act 1972*
AIS	Automatic Identification System
ALAN	Artificial Light at Night
ALARP	as low as reasonably practicable
ALR Act	Aboriginal Land Rights Act 1983
ALT	Aboriginal Land Trust
AMCS - NT	Australian Marine Conservation Society – NT
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
AMSA-NT	Australian Marine Sciences Association Northern Territory
ANP	Autoridade Nacional Do Petróleo (ANP - National Petroleum Authority)
ANU	Australian National University
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
APASA	Asia-Pacific Applied Science Associates
APCAD	Australian Parents for Climate Action Darwin and NT
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
ASBTIA	Australian Southern Bluefin Tuna Industry Association
ASC	Aboriginal Sea Company
ATRF	Arafura Timor Research Facility
ATSIHP Act	*Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cwth)
AUV	autonomous underwater vehicle
bara	absolute pressure (ambient pressure + gauge pressure)
barg	a unit of gauge pressure
Barossa GEP	Barossa Gas Export Pipeline

Abbreviation	Description
bbl	barrels
bbls/d	barrels per day
BAC	Balanggarra Aboriginal Corporation
BIA	biologically important area
BFMP	Biofouling Management Plan
BJAC	Bardi and Jawi Niimidiman Aboriginal Corporation
BP	boiling point
BTEX	benzene, toluene, ethylbenzene and xylenes
BWO	BW Offshore
CAMBA	China-Australia Migratory Bird Agreement
CBS	central battery system
CCA	Climate Change Authority
CCGT	combined-cycle gas turbine
CCNT	Chamber of Commerce Northern Territory
CCPGP	combined cycle power generation plant
CCS	carbon capture and storage
CCTV	closed circuit television
CCWA	Conservation Council of Western Australia
CDU	Charles Darwin University
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CER	Clean Energy Regulator
CFA	Commonwealth Fisheries Association
CH_4	methane
CHARM	chemical hazard and risk management
CHEMMAP	chemical discharge modelling and response system
CLR	Commonwealth law reports
cm	centimetre
CM	control measure
CMP	Conservation Management Plan
CO_2	carbon dioxide
CO_2-e	carbon dioxide equivalents
CoA	Commonwealth of Australia
COLREG	International Rules for Preventing Collisions at Sea
CORMIX	Cornell Mixing Zone Expert System
CP	cathodic protection
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cth	Commonwealth
CVI	close visual inspection
D&C	Drilling and Completions
DAFF	Department of Agriculture, Fisheries and Forestry
DAH	dissolved aromatic hydrocarbons
DAWE	Department of Agriculture, Water and the Environment

Abbreviation	Description
db	decibels
DAC	Dambimangari Aboriginal Corporation
DAF	Department of Agriculture and Fisheries (NT)
DBCA WA	Department of Biodiversity, Conservation and Attractions Western Australia
DC	drill centre
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEPWS	Northern Territory Department of Environment, Parks and Water Security
DFAT	Department of Foreign Affairs and Trade
DHA	Department of Home Affairs
DHAC	Darwin Harbour Advisory Committee
DIPL-NT	Department of Infrastructure, Planning and Logistics (NT)
DITT-NT	Department of Industry, Tourism and Trade
DISR	Department of Industry, Science and Resources
DLNG	Darwin liquefied natural gas plant
DNA	deoxyribonucleic acid
DNP	Director of National Parks
DNV	Det Norske Veritas
DoD	Department of Defence
DoE	Department of the Environment
DoEE	Department of the Environment and Energy
DoT WA	Department of Transport Western Australia
DFAT	Department of Foreign Affairs and Trade
DP	dynamic positioning
DPD	Darwin Pipeline Duplication
DPIRD	Department of Primary Industries and Regional Development
DTFHC-NT	Department of Territory Families, Housing and Communities Northern Territory
E	east
EC_{50}	median effective concentration
ECAP	Environmental Compliance Assurance Plan
ECNT	Environment Centre Northern Territory
EDO GEP Reports	Reports commissioned by a third party in relation to the Barossa Gas Export Pipeline (Barossa GEP) and provided by NOPSEMA to Santos on 7 August 2023. • Barossa Gas Export Pipeline Installation Underwater Cultural Heritage Assessment (July 2023). A/Prof Mick O'Leary, UWA. • Barossa Gas Export Pipeline Installation Cultural Heritage
EDO	Environmental Defenders Office
EEZ	Exclusive Economic Zone
EHS	environment, health and safety
EMBA	environment that may be affected
EMP	Environmental Management Plan
ENE	east-northeast
ENVID	environmental hazard identification workshop
EP	Environment Plan

Abbreviation	Description
EPA (NT)	Environment Protection Authority Northern Territory
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPO	environmental performance outcome
EPS	environmental performance standard
ESD	ecologically sustainable development
ESE	east-southeast
FAQ	frequently asked questions
FIA	functions, interests or activities
FLET	flowline end termination
FME	full moon equivalent
FNCC	First Nations Consultative Committee
FPSO	floating production, storage and offloading facility (officially registered as *BW Opal*)
FRDC	Fisheries Research Development Council
g/m²	grams per square metre
GDA	Gwalwa Daraniki Association
GEP	gas export pipeline
GHG	greenhouse gas
GHGEMP	Greenhouse gas emissions management plan
GTG	gas turbine generators
GVI	general visual inspection
HC	habitat critical
HEV	high environmental value
HEVA	high exposure value area
HF	high frequency
HFO	heavy fuel oil
HOCNF	harmonised offshore chemical notification format
HP	high pressure
h	hour
HQ	hazard quotient
HSE	health, safety and environment
IAPP	International Air Pollution Prevention
IEA	International Energy Agency
IGF	induced gas flotation
ILI	In-line inspection
ILUA	Indigenous Land Use Agreement
IMMR	inspection, maintenance, monitoring and repair
IMO	International Maritime Organization
IMS	invasive marine species
IMT	Incident Management Team
IPA	Indigenous Protected Areas
IPCC	Intergovernmental Panel on Climate Change
IRP	Incident Response Plan
ISO	International Organization for Standardization

Abbreviation	Description
ITOPF	International Tanker Owners Pollution Federation
IUCN	International Union for Conservation of Nature
JAMBA	Japan-Australia Migratory Bird Agreement
JARC	Jubilee Australia Research Centre
JKM	Japan Korea Marker
JRCC	Joint Rescue Coordination Centre
JV	Joint venture
KEF	key ecological feature
kg/m^3	Kilogram per square metres
kHz	kilohertz
KLC	Kimberley Land Council
km	kilometre
km^2	square kilometres
KMTA	Kimberley Marine Tourism Association
KP	kilometre point
kW	kilowatt
L	litre
LAT	lowest astronomical tide
LC_{50}	median lethal concentration
LDC	Larrakia Development Corporation
LED	light-emitting diode
LF	low frequency
LNAC	Larrakia Nation Aboriginal Corporation
LNG	liquefied natural gas
Log P_{ow}	octanol-water partition coefficient
LLP	low-low pressure
LP	low pressure
LTS	low-temperature separator
LWI	Light Well Intervention
LWIV	Light Well Intervention Vessels
m	metres
m/s	metres per second
m^2	square metres
m^3	cubic metres
m^3/h	cubic metres per hour
MARPOL	International Convention for the Prevention of Pollution from Ships
MARS	Maritime Arrival Reporting System
MBES	multibeam echo-sounder
MC	measurement criteria
MDO	marine diesel oil
MEG	monoethylene glycol
MEVA	moderate exposure value area
mg	milligram

Abbreviation	Description
mg/L	milligram per litre
MGAC	Miriuwung and Gajerrong Aboriginal Corporation
MGO	marine gas oil
MIAC	Mayala Inninalang Aboriginal Corporation
MLBE	Mooring line buoyance element
mm	millimetre
m^3/d	cubic metres per day
MMO	marine mammal observer
MMscfd	million standard cubic feet per day
MNES	matters of national environmental significance
MoC	management of change
MODU	mobile offshore drilling unit
MoU	Memorandum of Understanding
MPPE	macro-porous polymer extraction
MSL	mean sea level
Mt	million tonnes
MTWA	Marine Tourism WA
MWh	megawatt hour
N	north
N/A	not applicable
N_2O	nitrous oxide
NAILSMA	North Australia Indigenous Land and Sea Management Alliance
NATA	National Association of Testing Authorities
NAXA	North Australian Exercise Area
NDC	Nationally Determined Contribution
NE	northeast
NEBA	net environmental benefit analysis
NGER	national greenhouse and energy reporting
NGER Act	National Greenhouse and Energy Reporting Act 2007
NGFS	Network for Greening the Financial System
NGO	non-government organisation
NIAA	National Indigenous Australians Agency
NLPG	National Light Pollution Guidelines for Wildlife
NLC	Northern Land Council
nm	nanometre
NM	Nautical mile
NMFS	National Marine Fisheries Service
NMR	North Marine Region
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NO_X	nitrogen oxides
NPF	northern prawn fishery

Abbreviation	Description
NPFI	Northern Prawn Fishing Industry Pty Ltd
NT	Northern Territory
NTASS Act	Northern Territory Aboriginal Sacred Sites Act 1989
NTGFIA	Northern Territory Guided Fishing Industry Association
NT Police, Fire and Emergency Services	Department of Police, Fire and Emergency Services Northern Territory
NTRB	Native Title Representative Bodies
NTSC	Northern Territory Seafood Council
NW	northwest
NWCS	North-West Cable System
NWMR	North-West Marine Region
NWS	North West Shelf
NWSA	Northern Wildcatch Seafood Australia
NZE	net zero emissions
OA	operational area
OCNS	Offshore Chemical Notification Scheme
ODS	ozone-depleting substances
OECD	Organisation for Economic Co-operation and Development
OFOV	orientation field of view
OGCI	Oil and Gas Climate Initiative
OGMP 2.0	Oil & Gas Methane Partnership 2.0
OIW	oil in water
OPEP	Oil Pollution Emergency Plan
OPGGS(E)R	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (Cth)
OPP	Offshore Project Proposal
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PBC	Prescribed Bodies Corporate
PAH	polycyclic aromatic hydrocarbons
PFAS	perfluoroalkyl and polyfluoroalkyl substances
PFOS	perfluorooctane sulfonate
pH	acidity
PK	peak
PLET	pipeline end termination
PLONOR	pose little or no risk to the environment
PMS	planned maintenance system
PMST	Protected Matters Search Tool
POB	persons on board
post initial start-up	Refers to the activities of start-up and hot-commissioning to steady state
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
pre initial start-up	Refers to activities undertaken during FPSO hook-up and cold commissioning

Abbreviation	Description
PSZ	petroleum safety zone
PTS	permanent threshold shift
PW	produced water
RATSIB	Representative Aboriginal/Torres Strait Islander Body Areas
RESDVs	riser emergency shut down valves
RFFWI	Request For Further Written Information
Rmax	maximum range to the given sound level over all azimuths
RNTBC	Registered Native Title Body Corporate
RO	reverse osmosis
ROV	remotely operated vehicles
S	south
SE	southeast
SEL	sound exposure level
SID	subsea intervention device
SIMAP	Spill Impact Model Application Package
SIMOPS	simultaneous operations
SMC	Safeguard Mechanism Credit
SME	subject matter expert
SMPEP	Shipboard Marine Pollution Emergency Plan
SOLAS	International Convention of the Safety of Life at Sea 1974
SOPEP	Shipboard Oil Pollution Emergency Plan
SO_X	sulphur oxides
SPL	sound pressure level
sr	steradian
SSIV	subsea isolation valve
SSS	side scan sonar
STG	steam turbine generator
STP	submerged turret production
SURF	subsea umbilicals, risers and flowlines
SW	southwest
tCO_2e	tonnes of carbon dioxide equivalent
TLC	Tiwi Land Council
TTS	temporary threshold shift
UCH	underwater cultural heritage
UCH Act	*Underwater Cultural Heritage Act 2018*
UN	United Nations
USV	Uncrewed surface vessels
UTA	umbilical termination assembly
VOC	volatile organic compounds
Vessels	Includes campaign vessels, support vessels, tow barges,
VRU	Vapour Recovery Unit
VVC	vacuum vapour compression
w	watts

Abbreviation	Description
W	west
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WAGFA	Western Australian Game Fishing Association
WAMSI	WA Marine Science Institution
WGAC	Wunambal Gaambera Aboriginal Corporation
WHRU	Waste Heat Recovery Units
WNW	West-northewest
WOMP	Well Operations Management Plan
Worley	Worley Services Pty Ltd
WSW	west-southwest
WWF	World Wildlife Fund
XT	Christmas tree

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1. Introduction

1.1 Environment Plan Summary

Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)R 2023) requirements
Section 35(6). Submission of summary of accepted plan
Within ten days after receiving notice that National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) has accepted an environment plan (whether in full, in part or subject to limitations or conditions), the titleholder must submit a summary of the accepted plan to NOPSEMA for public disclosure.
Section 35(7). The summary
The summary: • must include the following material from the environment plan for the activity: - the location of the activity - a description of the receiving environment - a description of the activity - details of environmental impacts and risks of the activity - a summary of the control measures for the activity - a summary of the arrangements for ongoing monitoring of the titleholder's environmental performance - a summary of the response arrangements in the oil pollution emergency plan - details of consultation already undertaken, and plans for ongoing consultation - details of the titleholder's nominated liaison for the activity. • must be to the satisfaction of NOPSEMA.

The following Barossa Production Operations Environment Plan (EP) summary has been prepared as required by Section 35(7) of the OPGGS(E)R.

EP summary material requirement	Relevant section of EP containing EP summary material
The location of the Activity	Section 2.2
A description of the receiving environment	Section 3
A description of the Activity	Section 2
Details of the environmental impacts and risks	Sections 5, 6 and 7
The control measures (CM) for the Activity	Sections 6 and 7
The arrangements for ongoing monitoring of the titleholder's environmental performance	Section 8
Response arrangements in the Oil Pollution Emergency Plan	Barossa Production Operations Oil Pollution Emergency Plan (OPEP)
Consultation already undertaken and plans for ongoing consultation	Section 4 Section 8
Details of the titleholders nominated liaison person for the Activity	Section 1.5.1

1.2 Activity Summary

Santos NA Barossa Pty Ltd (Santos), as a titleholder and nominated operator for the Barossa joint venture, proposes to conduct production operations activities within Commonwealth petroleum production licence NT/L1, and Commonwealth petroleum pipeline licences NT/PL5 and NT/PL6 (Figure 1-1). Unless expressly stated otherwise in this EP, a reference to Santos in this EP, is a reference to Santos in its capacity as nominated operator for the Barossa joint venture.

The petroleum activity covered in this EP includes production operations related activities (herein referred to as the Activity) which form part of the Barossa gas and condensate development (the Barossa Development). In summary, the Activity consists of gas and condensate production from six subsea wells and associated subsea infrastructure, treatment and processing at the permanently moored floating production, storage, and offloading

(FPSO) vessel, loading and export of condensate to offtake tankers directly from the FPSO and the transport of dry gas through the Barossa Gas Export Pipeline (Barossa GEP) to Darwin Liquefied Natural Gas (DLNG) facility, and all associated support activities. Activities associated with inspection, monitoring, maintenance and repair (IMMR) of the above infrastructure are also included within the scope of the Activity. The downstream scope boundary of this EP is the Commonwealth waters limit of the Barossa GEP. The operation of the remaining 100 km section of the Barossa GEP (NTC/PL5, PL37) in Northern Territory (NT) waters is out of scope for this EP and will be managed under separate NT approvals

1.2.1 Primary Approvals

OPGGS(E)R 2023 Requirements
Section 26(3)
Submission of plan for offshore project (3) However, an environment plan for an activity that is, or is part of, an offshore project may be submitted only if: (a) there is an accepted offshore project proposal that includes that activity; or (b) the Environment Minister: (i) has made a decision under section 75 of the EPBC Act that an action that is equivalent to or includes the activity is not a controlled action; or (ii) has made a component decision under section 77A of the EPBC Act that a particular provision of Part 3 of that Act is not a controlling provision for an action that is equivalent to or includes the activity, because the Environment Minister believes the action will be taken in a particular manner; or (iii) has approved, under Part 9 of the EPBC Act, the taking of an action that is equivalent to or includes the activity.

The Barossa Development Offshore Project Proposal (OPP) (ConocoPhillips, 2018) was accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in March 2018. The OPP covers all development activities including drilling and construction (covered under other Barossa EPs), and petroleum recovery operations (this EP), inclusive of operation of the FPSO and associated infield infrastructure in NT/L1 and the 262 km portion of the Barossa GEP in Commonwealth waters within NT/PL5. Concordance with the Barossa Development OPP is addressed in Appendix D.

Activities within NT/PL6 for the Barossa GEP (approximately 23 km in Commonwealth waters) are not covered by the OPP but are separately authorised pursuant to an approval granted on 15 March 2024 under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) (EPBC 2022/09372).[1]

Pursuant to EPBC 2022/09372, installation, pre-commissioning, operation and decommissioning of the 123 km portion of the Barossa GEP and associated infrastructure in Commonwealth waters (NT/PL6), NT waters (NTC/PL5, PL37) and on land was approved [2]. The operation and maintenance of the 23 km portion of the Pipeline within Commonwealth waters covered by petroleum pipeline licence NT/PL6 is included within the scope of this EP.

This EP covers FPSO hook-up and integrated commissioning activities, commencement of production operations, and ongoing production operations (inclusive of Barossa GEP operations in Commonwealth waters).

[1] *Available from: https://epbcpublicportal.awe.gov.au/all-referrals/project-referral-summary/project-decision/?id=adc5da6e-e25e-ed11-9562-00224818a1ee*

[2] *Available from: https://epbcpublicportal.awe.gov.au/all-notices/project-decision/?id=22af3944-e975-ed11-81ac-00224818a55a*

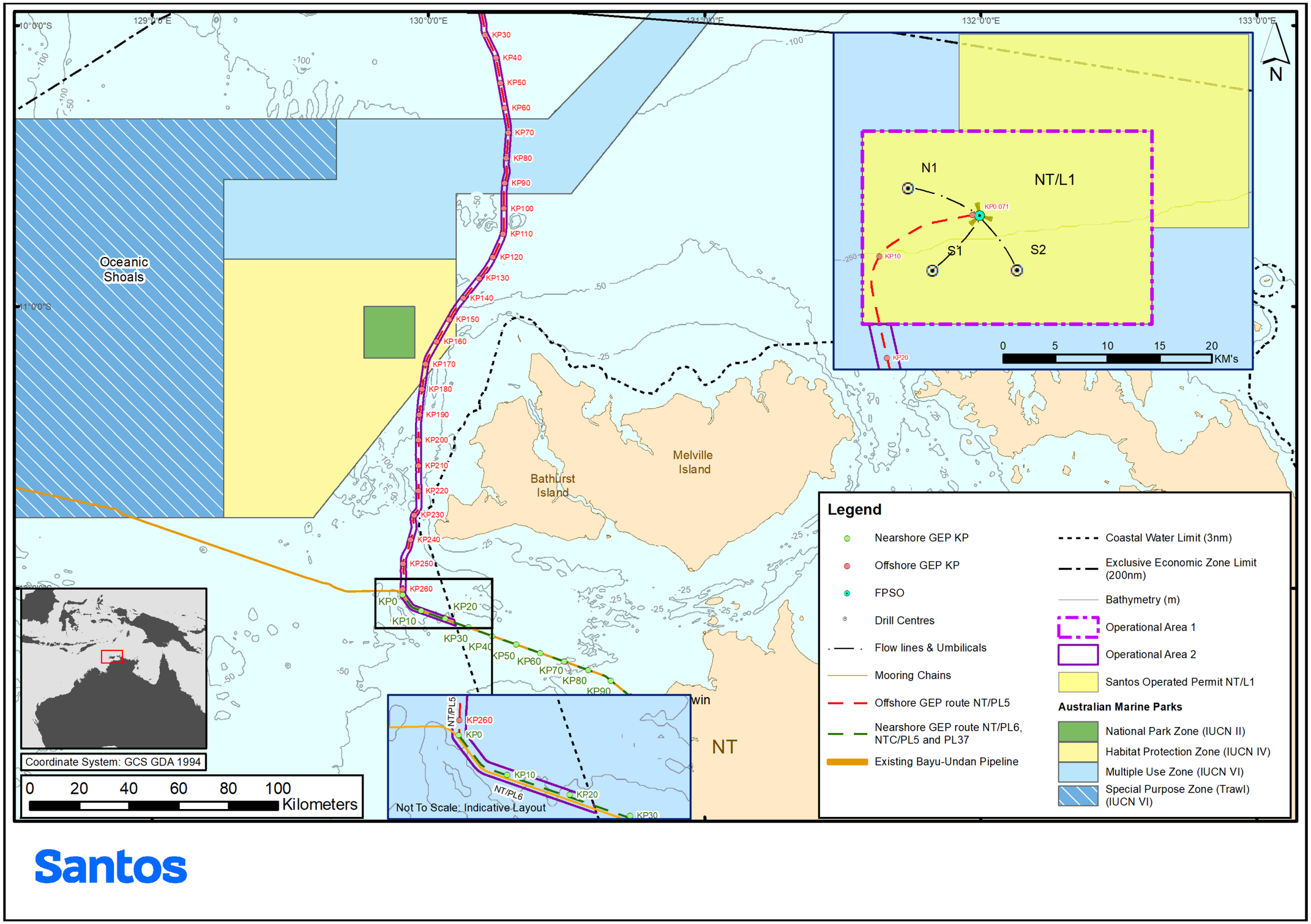


Figure 1-1: Location of the Activity Operational Area

1.3 Purpose of this Environment Plan

OPGGS(E)R 2023 Requirements
Section 34. Criteria for acceptance of environment plan
For the purpose of section 33, the criteria for acceptance of an environment plan (the ***environment plan acceptance criteria***) for an activity are that the plan: a. is appropriate for the nature and scale of the activity; and b. demonstrates that the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable; and c. demonstrates the environmental impacts and risks of the activity will be of an acceptable level; and d. provides for appropriate environmental performance outcomes, environmental performance standards and measurement criteria; and e. includes an appropriate implementation strategy and monitoring, recording and reporting arrangements; and f. does not involve the activity or part of the activity, other than arrangements for environmental monitoring or for responding to an emergency, being undertaken in any part of a declared World Heritage property; and g. demonstrates that: i. the titleholder has carried out the consultations required by section 25; and ii. the measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate. h. complies with the Act, this instrument and the any other regulations made under the Act.

This EP has been prepared in accordance with the OPGGS(E)R for assessment by NOPSEMA.

In accordance with the OPGGS(E)R, this EP details the environmental impacts and risks associated with the Activity and demonstrates how these will be reduced to as low as reasonably practicable (ALARP) and to an acceptable level (Section 6 and 7). The EP provides an implementation strategy (Section 8) that will be used to measure and report on environmental performance to demonstrate impacts and risks are being continuously reduced to ALARP and an acceptable level. The environmental management of the Activity described in the EP complies with the Santos Environment, Health and Safety Policy (Appendix A) and with all relevant legislation (Appendix A). This EP documents and considers all Relevant Persons consultation undertaken in the course of preparing the EP (Section 4).

1.3.1 Other associated Barossa environment plans and approvals

The scope of this EP covers Barossa production operations activities (the Activity) within the defined operational area/s, which are located in Commonwealth waters.

Other Barossa related EPs in Commonwealth waters, both existing accepted EPs and future EPs (to be developed) are listed in Table 1-1.

Table 1-1: Barossa Development activities and relevant Commonwealth waters environmental approvals

Commonwealth waters Barossa Development activities	Relevant Approval
Drilling and completions	Barossa Development Drilling and Completions Environment Plan (accepted)
Gas Export Pipeline installation	Barossa Gas Export Pipeline Installation Environment Plan (accepted)
Infield subsea infrastructure and moorings installation	Barossa Subsea Infrastructure Installation Environment Plan (accepted)
Darwin Pipeline Duplication installation	Barossa Darwin Pipeline Duplication Environment Plan (accepted)
Barossa Phase 2 and Phase 3 Development Drilling	Future EPs (to be developed)
Installation of low pressure phase modules	Future EP (to be developed)
Decommissioning	Future EP (to be developed)

Production operations related activities within the Northern Territory (NT) (i.e. onshore and in internal and coastal waters) are outside NOPSEMA's jurisdiction and are assessed under applicable NT legislation.[3] Approvals and regulatory submissions applicable to the construction and operation of the Barossa GEP in NT waters are listed in Table 1-2 (including those to be developed). There will be complementary approvals to this EP relating to the operation of the Barossa GEP in NT waters.

Table 1-2: Barossa Development activities and relevant Northern Territory waters environmental approvals and regulatory submissions

Northern Territory waters Barossa Development activity	Relevant Approval/Submission
Darwin Pipeline Duplication installation	Darwin Pipeline Duplication (DPD) Project Environmental Approval granted under s133 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) dated 15 March 2024 (EPBC 2022/09372) • Darwin Pipeline Duplication Project Referral (00-2022-09372) • Darwin Pipeline Duplication Project Preliminary Documentation Report DPD Project Environmental Approval (granted under s 69 of the Environment Protection Act (NT) dated 22 December 2023 (EP2022/022-001): • DPD Project Environment Protection Act (NT) Referral • DPD Project Environment Protection Act (NT) Supplementary Environmental Report DPD Project Offshore Construction Environmental Management Plan (CEMP) and DPD Project Onshore CEMP (submitted to the Department of Industry, Tourism and Trade for assessment in relation to construction activities to be undertaken in NT internal waters and land only) DPD Project Coastal Waters CEMP (submitted to the Department of Industry, Tourism and Trade for acceptance in relation to construction activities to be undertaken in NT coastal waters only)
Operation of Gas Export Pipeline	DPD Project Environmental Approval granted under s133 of the EPBC Act dated 15 March 2024 (EPBC 2022/09372) • DPD Project Referral (00-2022-09372) • Darwin Pipeline Duplication Project Preliminary Documentation Report DPD Project Environmental Approval (granted under s 69 of the Environment Protection Act (NT) dated 22 December 2023 (EP2022/022-001): • DPD Project Environment Protection Act (NT) Referral • DPD Project Environment Protection Act (NT) Supplementary Environmental Report Barossa GEP (Coastal Waters) Operations Environmental Management Plan (EMP) (to be developed and submitted to the Department of Industry, Tourism and Trade for acceptance in relation to Barossa GEP operations activities to be undertaken in NT coastal waters only) Barossa GEP Operations EMP (to be developed and submitted to the Department of Industry, Tourism and Trade for assessment in relation to Barossa GEP operations activities to be undertaken in NT internal waters only)

This EP also excludes any potential carbon capture and storage (CCS) developments that may be relevant to future management of Barossa reservoir CO_2 emissions. Any such CCS developments will be subject to their own regulatory approvals process and managed separately from this EP.

1.4 Environment Plan Validity

OPGGS(E)R 2023 Requirements
Section 36. When environment plan is in force
An environment plan for an activity is in force from when NOPSEMA accepts the plan under section 33 until: a. NOPSEMA accepts a revised environment plan for the activity that was submitted in accordance with Division 5; or b. NOPSEMA withdraws acceptance of the environment plan under section 43; or c. the operation of the environment plan ends under section 46.

[3] With the exception of activities in NT coastal waters, which are assessed under the OPGGS(E)R by the relevant NT Minister.

Santos may revise the EP without resubmitting for NOPSEMA assessment, using the Management of Change (MoC) process described in Section 8.5.2.

1.5 Operator and Titleholder Details

OPGGS(E)R 2023 Requirements
Section 23. Details of titleholder and nominated liaison
23(1) The environment plan must include the following details for the titleholder: • name • business address • telephone number (if any) • fax number (if any) • email address (if any) • if the titleholder is a body corporate that has an Australian Company Number (within the meaning of the *Corporations Act 2001*)-ACN. 23(2) The environment plan must also include the following details for the titleholder's nominated liaison for the activity: a. name b. business address c. telephone number (if any) d. fax number (if any) e. email address (if any). 23(3) The environment plan must include arrangements for notifying NOPSEMA of any of the following: a. a change in the titleholder; b. a change in the titleholder's nominated liaison for the activity; c. a change in the contact details for either the titleholder or the nominated liaison.

The titleholder details are provided in Table 1-3, with the nominated operator shown in bold.

Table 1-3: Titleholder details for Barossa Activity

Title	Titleholder (nominated operator in bold)	Australian company number	Interest (%)	Contact details
NT/L1 NT/PL5 NT/PL6	**Santos NA Barossa Pty Ltd**	109 974 932	25.0	Business Address: Level 7, 100 St Georges Terrace, Perth, Western Australia, 6000 Telephone number: (08) 6218 7100 Fax number: (08) 6218 7200 Email address: barossa.regulatory@santos.com
	Santos Offshore Pty Ltd	005 475 589	25.0	
	SK E&S Australia Pty Ltd	158 702 071	37.5	Business Address: Level 27, 152-158 St Georges Terrace, Perth WA 6000 Telephone number: (08) 6186 2320 Fax number: None Email address: upstream@sk.com
	JERA Barossa Pty Ltd	654 004 387	12.5	Business Address: Level 36, QV1, 250 St Georges Terrace, Perth, Western Australia, 6000 Telephone number: (08) 6311 7610 Fax number: (08) 6311 7613 Email address: barossa@jeraaustralia.com.au

1.5.1 Details for Nominated Liaison for the Activity

Details for the titleholders' nominated liaison person for the Activity are as follows:

Name: Michael Marren
Business address: Level 7, 100 St Georges Terrace, Perth, Western Australia, 6000
Telephone number: (08) 6218 7100
Email address: offshore.consultation@santos.com
ACN: 109 974 932

1.5.2 Notification Procedure in the Event of Changed Details

In the event there is a change in a titleholder, the titleholders' nominated liaison, or a change in the contact details for a titleholder or liaison, Santos will notify NOPSEMA and provide updated details.

1.6 Environmental Management Framework

OPGGS(E)R 2023 Requirements
Section 22. Implementation strategy for environment plan
Environmental management system 22(2) The implementation strategy must contain a description of the environmental management system for the activity, including specific measures to be used to ensure that, for the duration of the activity: • the environmental impacts and risks of the activity continue to be identified and reduced to a level that is as low as reasonably practicable; and • control measures detailed in the environment plan are effective in reducing the environmental impacts and risks of the activity to as low as reasonably practicable and an acceptable level; and • environmental performance outcomes and environmental performance standards in the environment plan are being met. 22 (4) The implementation strategy must include measures to ensure that each employee or contractor working on, or in connection with, the activity is aware of the employee's or contractor's responsibilities in relation to the environment plan, including during emergencies or potential emergencies, and has the appropriate competencies and training.
Section 24. Other information in the environment plan
The environment plan must contain the following: • a statement of the titleholder's corporate environmental policy.

1.6.1 Environmental Management System

Section 8.2.1 contains a description of the Environmental Management System for the Activity, as relevant to ongoing management of environmental impacts and risks for the duration of the Activity.

1.6.2 Workforce Training, Competency and Emergency Preparedness

Section 8.2.2 addresses measures to ensure that each employee or contractor working on, or in connection with, the activity is aware of the employee's or contractor's responsibilities in relation to the environment plan, including appropriate competencies and training. Section 8.2.7 addresses arrangements for emergencies or potential emergencies.

1.6.3 Santos Environment, Health and Safety policy

The Activity will be conducted in accordance with the Santos Environment, Health and Safety Policy (Appendix A).

1.7 Requirements of the Activity

OPGGS(E)R 2023 Requirements
Section 21. Environmental Assessment
Requirements 21(4) The environment plan must: (a) describe the requirements, including legislative requirements, that apply to the activity and are relevant to the environmental management of the activity; and (b) demonstrate how those requirements will be met.

Relevant requirements, including legislative requirements, applicable to the Activity are presented in Appendix C, with reference to relevant EP sections where the legislation may prescribe or control how an activity is undertaken. Australia is a signatory to international conventions and agreements that oblige the Commonwealth government to prevent pollution and protect specified habitats, flora and fauna. Relevant government departments have been consulted when developing this EP so as to have the opportunity to identify applicable legislation, conventions and agreements, as detailed in Section 4.

2. Activity description

Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)R 2023) requirements
Section 21. Environmental assessment
Description of the activity 21(1) The environment plan must contain a comprehensive description of the activity including the following: – the location or locations of the activity; – general details of the construction and layout of any facility that is used in undertaking the activity; – an outline of the operational details of the activity (for example, seismic surveys, exploration drilling or production) and proposed timetables for undertaking the activity; and – any additional information relevant to consideration of environmental impacts and risks of the activity. *Note:* An environment plan will not be capable of being accepted by National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) if an activity or part of the activity, other than arrangements for environmental monitoring or for responding to an emergency, will be undertaken in any part of a declared World Heritage property (as per Section 34).

2.1 Environment Plan Activities

This Environment Plan (EP) covers floating production, storage, and offloading (FPSO) vessel hook-up and integrated commissioning activities, commencement of production operations and ongoing production operations. Table 2-1 summarises the activities associated with the Activity. All activities are conducted within the defined operational areas, which are located in Commonwealth waters (Section 2.2.3).

Table 2-1: Summary of EP activities and corresponding EP reference

Permit areas	NT/L1 (production licence), NT/PL5 (pipeline licence), NT/PL6 (pipeline licence)
Location	Bonaparte Basin, Timor Sea
Proposed indicative schedule	• FPSO hook-up, commissioning and initial start-up: 2025 • Steady state operations: 2025 onwards Refer Section 2.3 for further detail about the Activity schedule.
Subsea infrastructure	• Manifolds (Section 2.4.2) • Gas subsea production wells and drill centres (Section 2.4.1) • Rigid flowlines, flexible risers, umbilicals and flying leads (Section 2.4.3) • Turret mooring system (Section 2.4.4) • Barossa Gas Export Pipeline (Section 2.4.5)
Water depths	• Depth of 220 m to 280 m in the Barossa field • Depth of 36 m to 254 m along the Barossa Gas Export Pipeline (Barossa GEP)
Vessels	• FPSO (Section 2.7.1) • Vessels - Support & Campaign vessels (Section 2.8.1 & Section 2.8.2)
Summary of key activities	**FPSO Arrival, Hook-up and Cold-Commissioning (Section 2.5)** • FPSO arrival and turret plug removal • FPSO hook-up to STP buoy • Riser and umbilical connection • Valve and piping reinstatement • Nitrogen helium leak testing • Export riser de-watering • Subsea isolation valves leak testing • Cold commissioning
	Initial Start-up and Hot-Commissioning (Section 2.6) • Preparation for initial start-up • Drill centre displacement and well clean-up

	• Inlet separation, cooling and fuel gas start-up • Gas treatment start-up, CO_2 removal stage 1 and gas export pipeline pressurisation • Establishing CO_2 removal stage 2, CO_2 permeate and export gas compression • Establishing MeOH regeneration and on-spec condensate • Rate ramp-up and additional gas compression and treatment established • Establish thermal oxidiser, produced water treatment and vapour recovery • Start-up of steam turbine generator • Performance testing • Start-up flaring • Contingencies for system/ equipment commissioning delays and DLNG commissioning delays
	FPSO Steady State operations (Section 2.7) • Production and processing of hydrocarbons from wells on board the FPSO, including start-up and shutdown of the facilities as required, monitoring and control of subsea production facilities from the FPSO, and subsea injection of production chemicals stored on the FPSO to support flow assurance • Export of gas from the FPSO via the Barossa GEP (and on to DLNG) • Inspection and maintenance activities on board the FPSO • Inspection, maintenance, and repair activities for subsea facilities • Helicopter operations, including helicopter refuelling • Lifting and material handling, using the facility cranes and material handling devices for operations and maintenance • Storage of condensate in dedicated tanks • FPSO ballasting operations • Periodic tanker offtake operations • Treatment and discharge of produced water • Periodic collection and offloading of elemental mercury • Daughter craft operations (including routine testing and rescue operations) • Supply vessel operations • Support and campaign vessel activities (Section 2.8) including light well intervention and uncrewed vessel surveys • Subsea inspection, maintenance, monitoring and repair (IMMR) (Section 2.9) • Routine IMMR activities for the FPSO, subsea infrastructure and Gas Export Pipeline • Environmental monitoring/sampling (e.g. sediment and marine growth) if required

2.2 Location

2.2.1 Barossa Field Location

The Barossa field is in NT/L1 permit area, located in Commonwealth waters, approximately 285 km north-north-west of Darwin and approximately 130 km north of the Tiwi Islands at the closest point (Figure 1-1). Water depths within the Barossa field range from 220 to 280 m.

Locations of the key subsea infrastructure associated with the activity are provided in Table 2-2.

The operational areas for this Activity are described in Section 2.2.3.

Table 2-2: Infrastructure approximate locations within NT/L1.

Structure	Location (GDA 9)		Water depth
	Longitude	Latitude	
Facility			
FPSO BW Opal (on production turret)	130° 16’ 09.130” E	9° 49’ 17.069” S	255 m lowest astronomical tide (LAT)

Structure	Location (GDA 9)		Water depth
	Longitude	Latitude	
Subsea infrastructure			
Riser Base Manifold	130° 15’ 49.437” E	9° 49’ 17.181” S	254 m LAT
Manifold/Drill Centre (N1)	130° 12’ 27.330” E	09° 47’ 51.390” S	268 m LAT
Manifold/Drill Centre (S1)	130° 13’ 43.698” E	09° 52’ 07.378” S	236 m LAT
Manifold/Drill Centre (S2)	130° 18’ 06.476” E	09° 52’ 06.196” S	230 m LAT
GEP PLET A	130° 15’ 48” E	09° 49’ 15” S	254 m LAT
GEP PLET B	129° 54’ 27” E	12° 01’ 22” S	54 m LAT
GEP PLET C	129° 54’ 26” E	12° 01’ 23” S	54 m LAT
Wells			
BS-03	130° 12’ 26.482”E	09° 47’ 50.973”S	268 m LAT
BS-09	130° 12’ 26.748”E	09° 47’ 52.010”S	268 m LAT
BS-16	130° 13’ 42.843”E	09° 52’ 07.785”S	236 m LAT
BS-17	130° 13’ 43.832”E	09° 52’ 08.214”S	236 m LAT
BS-19	130° 18’ 06.710”E	09° 52’ 07.107”S	230 m LAT
BS-25	130° 18’ 07.330”E	09° 52’ 06.232”S	230 m LAT
Mooring anchors			
Cluster North			
1	130° 15' 54.153” E	9° 49' 17.163” S	259 m LAT
2	130° 15' 57.303” E	9° 48' 40.389” S	259 m LAT
3	130° 16' 00.675” E	9° 48' 39.224” S	260 m LAT
4	130° 16' 04.112” E	9° 48' 38.345” S	260 m LAT
5	130° 16' 07.585” E	9° 48' 37.759” S	260 m LAT
Cluster East			
6	130° 16' 48.738” E	9° 49' 22.476” S	256 m LAT
7	130° 16' 48.114” E	9° 49' 25.880” S	255 m LAT
8	130° 16' 47.195” E	9° 49' 29.217” S	255 m LAT
9	130° 16' 45.987” E	9° 49' 32.460” S	254 m LAT
10	130° 16' 44.499” E	9° 49' 35.588” S	254 m LAT
Cluster Southwest			
11	130° 15' 44.639” E	9° 49' 48.443” S	249 m LAT
12	130° 15' 41.978” E	9° 49' 46.207” S	249 m LAT
13	130° 15' 39.523” E	9° 49' 43.748” S	250 m LAT
14	130° 15' 17.294” E	9° 49' 41.087” S	250 m LAT
15	130° 15' 35.308” E	9° 49' 38.243” S	250 m LAT

2.2.2 Barossa Gas Export Pipeline

The Barossa Gas Export Pipeline (Barossa GEP) extends from the Barossa field to the existing onshore facilities at Darwin Liquefied Natural Gas (DLNG) (Figure 1-1). The Barossa GEP is located in both Commonwealth and NT waters, with the section of the Barossa GEP within Commonwealth waters licensed under pipeline license NT/PL5 and NT/PL6. The start and end locations for the pipeline licence NT/PL5, and pipeline licence NT/PL6, are presented in Table 2-3. The total length of the Barossa GEP within Commonwealth waters is 285 km.

Water depths along the Barossa GEP route (within Commonwealth waters) vary from 254 m at the deepest point at pipeline end terminal (PLET) A, to 36 m at the shallowest point approximately 47 km upstream from PLET B. The water depth at PLET B and PLET C is approximately 54 m. Approximately 30 km of the Barossa GEP route lies within the Oceanic Shoals Marine Park multiple use zone (Figure 1-1), and approximately 31.5 km lies within the habitat protection zone (Table 2-4).

Table 2-3: Barossa GEP key locations

Pipeline licence	Location	Kilometre point (KP)[1]	Water depth	Longitude	Latitude
NT/PL5	PLET A	Barossa GEP KP0	254 m	130° 15' 48" E	9° 49' 15" S
NT/PL5	PLET B	Barossa GEP KP262.2	54 m	129° 54' 27" E	12° 01' 22" S
NT/PL6	PLET C	Additional Barossa GEP Segment KP0	54 m	129° 54' 26" E	12° 01' 23" S
NT/PL6	Commonwealth/ NT waters boundary	Additional Barossa GEP Segment KP23	50 m	130° 05' 30" E	12° 06' 36" S

Note 1: kilometres relative to the distance from the northern to the southern end of the pipeline route corridor (referred to as KPs or Kilometre Points)

Table 2-4: Barossa GEP route co-ordinates within the multiple use zone and habitat protection zone of the Oceanic Shoals Marine Park

Marine Park zone	Longitude	Latitude	Distance (km)
Enters Multiple Use Zone	130° 17' 05" E	10° 20' 00" S	Approx. 30 km
Exits Multiple Use Zone	130° 16' 26" E	10° 36' 00" S	
Enters Habitat Protection Zone	130° 06' 00" E	11° 00' 19" S	Approx. 31.5 km
Exits Habitat Protection Zone	129° 58' 57" E	11° 15' 31" S	

2.2.3 Operational Areas

This EP covers an operational area (refer Figure 1-1) within which all petroleum activities associated with the Activity will occur. For the purpose of this EP the operational area has been segmented as follows:

- Operational area 1: Barossa field operational area (OA1).
- Operational area 2: Barossa GEP operational area (OA2).

OA1 encompasses:

- a 500 m radius around the extremities of the subsea infrastructure.
- a 1 km radius around the FPSO and its weathervane.

OA2 encompasses:

- the area 500 m either side of the Barossa GEP route downstream of PLET A at the Barossa field to the Commonwealth/NT waters boundary.

Jointly these are referred to as the 'operational areas' (OAs).

Petroleum Safety Zones (PSZs) are in place covering the Barossa field. The PSZs extend 500 m from the XTs and key infrastructure near the FPSO (including dynamic portions of risers, moorings, umbilical and the STP buoy).

The relative distances of nearest islands and mainland from the closest point in the OAs are provided in Table 2-5.

Table 2-5: Operational areas approximate distance and direction from the nearest Northern Territory islands and mainland

Key islands and mainland	Approximate distance and direction from OA1	Approximate distance and direction from OA2
Tiwi Islands	Approximately 130 km south	7.5 km east
Darwin	Approximately 285 km south	91 km southeast

2.3 Timing and Duration

The Activity may be undertaken at any time of year within the EP period. The operational design life for all Barossa facilities, including any floating or fixed structures, moorings, pipelines and cables is 25 years.

Planned timing of activities covered by this EP are shown in Table 2-6. Planned timing and durations are indicative only and will be subject to timing of regulator acceptance of this and any other relevant Barossa EPs, and are subject to change due to schedule requirements, vessel availability, weather or other operational reasons. Other future activities authorised under the Barossa Development OPP include drilling of additional development wells and tie-back of the Caldita Field (if economically feasible) as part of future phases of the Barossa development, and subject to a future EP(s).

Table 2-6: Planned Timing of Production Operations Activities

Vessel Type and #	Indicative Activities	Indicative Timing and Duration (concurrent timing shown unless specified otherwise)
FPSO Hook-up and Cold Commissioning – total duration ~ 3 months		
Tow/ Station Keeping Tugs (3)	• Tow the FPSO to OA1 • Hold the FPSO on station during the buoy pull-in operation • Perform rotation test(s) of the FPSO following buoy pull-in • Recovery of the turret seal plug (if required) • Undertake support activities via ROV (if required)	Earliest commencement: 1H 2025 ~ 1 month
Support Vessel (1)	• Transportation of equipment, materials, stores, fuel (MGO) and chemicals to the FPSO • Backload of any equipment, waste and materials from the FPSO • Undertake support activities via ROV (if required)	Earliest commencement: 1H 2025 ~ 3 months
Construction Vessel (1)	• Inspection of XT, manifolds, well jumpers, spools, flowlines, risers, and umbilicals • Installation of electric actuators • ROV observation during function and leak testing of hydraulic actuated valves • Open/Close ROV operated valves	Earliest commencement: 1H 2025 ~ 3 months
Initial start-up and hot-commissioning to steady state – total duration ~ 4 months		
Support Vessel (1)	• Transportation of equipment, materials, stores, fuel (MGO) and chemicals to the FPSO • Backload of any equipment, waste and materials from the FPSO • Undertake support activities via ROV (if required) • Offtake operations support	Commencement upon completion of hook-up and cold commissioning ~ 4 months
Campaign Vessel (1)	• IMMR activities • Open/Close ROV operated valves	Commencement upon completion of hook-up and cold commissioning ~ 4 months
N/A	• Start-up and pressurisation of GEP	~ 4 months

Vessel Type and #	Indicative Activities	Indicative Timing and Duration (concurrent timing shown unless specified otherwise)
FPSO Steady State Operations – total duration ~ 25 years		
N/A	• Transmission of dry gas from the FPSO to DLNG	Commencement upon completion of start-up activities and continuous thereafter for ~25 years
FPSO (1)	• Processing of gas and condensate • Condensate offtake operations • Compression and export of gas via the GEP to DLNG	Approximately 25 years duration following commencement of production operations
Support Vessel (1)	• Transportation of equipment, materials, stores, fuel (MGO) and chemicals to the FPSO • Backload of any equipment, waste and materials from the FPSO • Undertake support activities via ROV (if required) • Offtake operations support • Transport of equipment to the IMMR repair vessel (if contingency repairs are required)	Commencement upon completion of start-up activities and continuous thereafter. Required for the validity period of this EP on a routine schedule.
Offtake tanker (1)	• Condensate offtake activities	The first condensate offtake from the FPSO is planned to occur within four months of the final performance test for the facility. It is anticipated that offtake frequency will be approximately every 3 months during the operational life of the field. The estimated duration of this operation is approximately 72hours.
Campaign Vessels (approximately 1-2 per campaign)	• IMMR activities • Open/Close ROV operated valves • LWI activities via vessels • USV activities • Environmental monitoring	Commencement upon completion of start-up activities at the following indicative frequencies: • Infield inspections – up to two per year for 14 days per campaign • Light well interventions (if required) – 2-yearly up to 34 days per campaign • GEP inspections – 3 yearly up to 30 days per campaign • USV activities 14 – up to 30 days per inspection campaign • Environmental monitoring as required during operations up to half a day in the OA Required for the validity period of this EP to support campaigns as required.

Delays to timing and duration of commissioning activities may occur due to unforeseen events. The initial start-up sequence is developed with consideration for both FPSO cold-commissioning and initial start-up requirements, and DLNG re-commissioning requirements with the intent to minimise fuel, flare and vent emissions and unnecessary flaring in particular (Sections 2.5 and 2.6). Initial start-up and hot-commissioning activities (i.e. introduction of hydrocarbons to the FPSO) will only commence once DLNG is ready to receive gas to minimise unnecessary flaring that would otherwise occur if FPSO start-up and hot-commissioning commenced prior to completion of DLNG commissioning. Measures to minimise environmental impacts and risks of delays to FPSO initial start-up and hot-commissioning and/ or DLNG re-commissioning are further addressed in Sections 6.3 and 6.4.

2.3.1 Concurrent Activities

The Barossa Development activities, under the NOPSEMA accepted Barossa Development Drilling and Completions EP (referred to as the D&C EP), the Barossa Subsea Infrastructure and FPSO Mooring Installation and Pre-commissioning EP (referred to as the Barossa Subsea Umbilicals, Risers and Flowlines (SURF EP) and this EP, are planned to occur concurrently in OA1 (referred to as concurrent activities) during both pre initial start-up activities (FPSO arrival, hook-up and cold-commissioning; refer Section 2.5) and post initial start-up activities (initial start-up, hot commissioning and steady state operations; refer Sections 2.6 and 2.7). Concurrent activities include situations where two or more Santos planned activities occur within OA1 but continuously remain at a 'safe' level of separation (500m PSZ). There are no concurrent activities planned in OA2. All concurrent activities will be managed under Interface Management Plans.

Section 6 assesses the potential for cumulative impacts that may occur from concurrent activities. The approximate duration for concurrent activities between each relevant EP is set out below.

2.3.1.1 Concurrent MODU drilling/ well completion and well workover activities

Drilling and completion activities conducted by a mobile offshore drilling unit (MODU) within OA1 under the D&C EP, will occur concurrently with activities under this EP, during FPSO pre-initial start-up (hook-up and cold-commissioning; Table 2-7), with a potential overlap of ~3 months, and FPSO post initial start-up (initial start-up, hot commissioning and steady state operations; Table 2-8) with a potential overlap of ~3 months following FPSO start-up. The phase at which activities will occur concurrently depends on the timing of the FPSO's arrival in-field, as well as the timing of the drilling campaign under the D&C EP. Given both scenarios are possible, Santos has considered both in this EP

Additionally, contingency MODU well workover activities may occur concurrently following FPSO start-up. Given the MODU workovers would be contingency activities (subject to and will be authorised under a separate EP) the exact number and duration of concurrent activities (if any) cannot be known in advance, as a contingency, these have been conservatively estimated and included in Table 2-8, as one 3-month activity over the life of this EP.

MODU drilling, completion and well workover activities will be spatially confined to areas adjacent to or near one of the three drill centres. The three drill centres are all >6km from the FPSO turret. Furthermore, activity vessels covered under this EP will not enter the MODU's 500 m PSZ and will maintain a cautionary zone with MODU support vessels. The MODU will conduct intermittent and short duration (approximately two to three days for each well) flaring during well flowback activities. The main drilling discharges per well include water-based drilling fluids and cuttings formation water and cement. The D&C EP provides a comprehensive list and assessment of all the planned drilling discharges. There is a potential that drilling discharges may occur at the same time as discharges associated with activities described in this EP.

Table 2-7: Concurrent Drilling/ Completion and FPSO Pre Initial Start-up Activities

Concurrent Activities	Approximate Duration	Sources
FPSO hook-up and cold commissioning	3 months	FPSO (1) FPSO Support Vessel (1) Tow/ Station Keeping Tugs (3) Commissioning Support Vessel (1) Helicopter (1)
Drilling/completion		MODU (1) MODU support Vessels (3) Helicopter (1)

Table 2-8: Concurrent Drilling/ Completion/ MODU Well Workover and FPSO Post Initial Start-up Activities

Concurrent Activities	Approximate Duration	Sources
FPSO start-up/hot commissioning/steady state operations	Drilling/ completion: 3 months following FPSO start-up Contingency MODU well workover: indicatively one 3-month activity within the validity period of this EP	FPSO (1) FPSO support vessel (1) Offtake Tanker (1) (during offtakes only) Offtake Assist Vessel (during offtakes only) Campaign Vessel (1) (during campaigns only)

		Light Well Intervention Vessel (1) (contingency activities only) IMMR Vessel (1) (infrequent planned inspections) Helicopter (1)
Drilling/completion/MODU well workover		MODU (1) MODU Support Vessels (3) Helicopter (1)

2.3.1.2 Concurrent SURF installation and pre-commissioning activities

The installation and pre-commissioning of SURF infrastructure (refer to Section 2 of the SURF EP for a detailed description) could occur concurrently with FPSO pre-start-up activities (hook-up and cold-commissioning) for a period of ~1 month (Figure 2-9). SURF installation and pre-commissioning is expected to occur within a 6-month period following FPSO post initial start-up activities (initial start-up, hot commissioning and steady state operations) for a cumulative duration of ~2 months (Figure 2-10).

SURF activities (including pre-commissioning discharges) concurrent with FPSO activities will primarily be located at drill centres (N1 and S1) located >6km from the FPSO turret, although there is the potential for installation and pre-commissioning of a gas export spool at the FPSO location prior to FPSO start-up. The SURF pre-commissioning fluids are predominantly treated seawater, treated freshwater and monoethylene glycol (MEG) (SURF EP Section 2.10) and similar fluids are discharged during hookup and cold commissioning of the FPSO (Section 2.5).

Table 2-9: Concurrent SURF and FPSO Pre Initial Start-up Activities

Concurrent Activities	Approximate Duration	Sources
FPSO hook-up and cold commissioning	1 month	FPSO (1) FPSO Support Vessel (1) Tow/ Station Keeping Tugs (3) Commissioning Support Vessel (1) Helicopter (1)
SURF installation and pre-commissioning		Construction Vessel (1) Transportation Vessel (1) Helicopter (1)

Table 2-10: Concurrent SURF and FPSO Post Initial Start-up Activities

Concurrent Activities	Approximate Duration	Sources
FPSO start-up/hot commissioning/steady state operations	Cumulative 2 months over 6-month post initial start-up period	FPSO (1) FPSO support vessel (1) Offtake Tanker (1) (during offtakes only) Offtake Assist Vessel (during offtakes only) Campaign Vessel (1) (during campaigns only) Helicopter (1)
SURF installation and pre-commissioning		Construction Vessel (1) Transportation Vessel (1) Helicopter (1)

2.3.1.3 Concurrent MODU drilling/completion and SURF installation and pre-commissioning activities

There is potential for both MODU drilling/completion activities and SURF installation and pre-commissioning activities to be occurring at the same time as FPSO activities, during both the FPSO pre initial start-up phase (Table 2-11) and the FPSO post initial start-up phase (Table 2-12). These durations are included within, not additional to, the durations outlined in Sections 2.3.1.1 and 2.3.1.2. All MODU drilling/completion activities will

be undertaken at drill centres >6km from the FPSO and most SURF activities that will overlap in time with FPSO activities will also occur at drill centres, with the potential exception of the installation and pre-commissioning of a gas export spool at the FPSO location prior to FPSO start-up.

Table 2-11: Concurrent Drilling/Completion, SURF and FPSO Pre Initial Start-up Activities

Concurrent Activities	Approximate Duration	Sources
FPSO hook-up and cold commissioning	1 month	FPSO (1) FPSO Support Vessel (1) Tow/ Station Keeping Tugs (3) Commissioning Support Vessel (1) Helicopter (1)
Drilling/completion		MODU (1) MODU Support Vessels (3) Helicopter (1)
SURF installation and pre-commissioning		Construction Vessel (1) Transportation Vessel (1) Helicopter (1)

Table 2-12: Concurrent Drilling/Completion, SURF and FPSO Post Initial Start-up Activities

Concurrent Activities	Approximate Duration	Sources
FPSO start-up/hot commissioning/steady state operations	Up to cumulative 2 months within 6-month post initial start-up period	FPSO (1) FPSO support vessel (1) Offtake Tanker (1) (during offtakes only) Offtake Assist Vessel (during offtakes only) Campaign Vessel (1) (during campaigns only) Helicopter (1)
Drilling/completion		MODU (1) MODU Support Vessels (3) Helicopter (1)
SURF installation and pre-commissioning		Construction Vessel (1) Transportation Vessel (1) Helicopter (1)

2.4 Subsea infrastructure overview

The Activity includes the operation and inspection, monitoring, maintenance and repair (IMMR, see Section 2.9) of subsea infrastructure to support production operations.

The subsea infrastructure includes:

- production wells and drill centres (Section 2.4.1).
- manifolds (Section 2.4.2).
- rigid flowlines, flexible risers, umbilicals and flying leads (Section 2.4.3).
- turret mooring system (Section 2.4.4).
- Barossa GEP and associated PLETs (Section 2.4.5).

Key subsea infrastructure, referred to as 'infield subsea infrastructure' is shown in Figure 2-1 and the indicative field layout is shown in Figure 2-2. The location of the Barossa GEP is shown in Figure 1-1.

There will be three drill centres, with each drill centre having two subsea wells connected to a single manifold (total of six wells). These drill centres are tied back to the FPSO with rigid flowlines and flexible risers, whilst an umbilical system is used to connect utility services (hydraulic, production chemicals, electrical) to the wells and subsea infrastructure from the FPSO.

The infield subsea system hydrate management requires MEG injection for cold well start-ups and an insulation system to subsequently maintain the temperature of the subsea infrastructure.

2.4.1 Subsea production wells and drill centres

Initial production is from up to six subsea production wells, located at three drill centres (Figure 2-1 and Table 2-2).

Each well has a subsea xmas tree (XT). Each XT is connected to one of the three production manifolds via a production and an annulus jumper. The production jumper provides the primary path for produced fluids, while the annulus jumper is the primary path for pressure management of the well annulus.

The wells' status may change within the period of this EP (e.g. inactive wells may be suspended or re-activated) and they are managed in accordance with the in-force NOPSEMA accepted Well Operations Management Plan (WOMP).

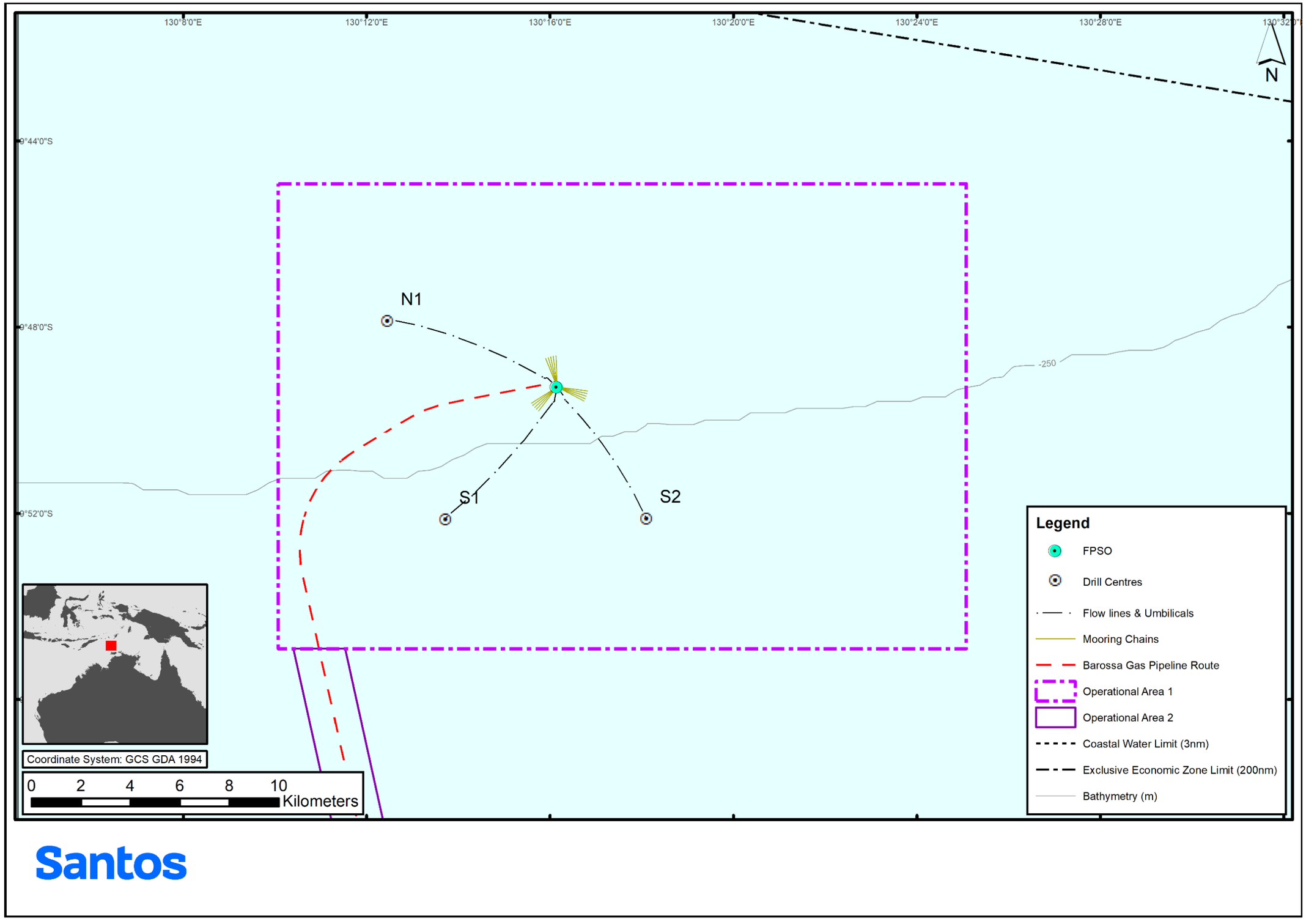


Figure 2-1: Barossa infield subsea infrastructure layout

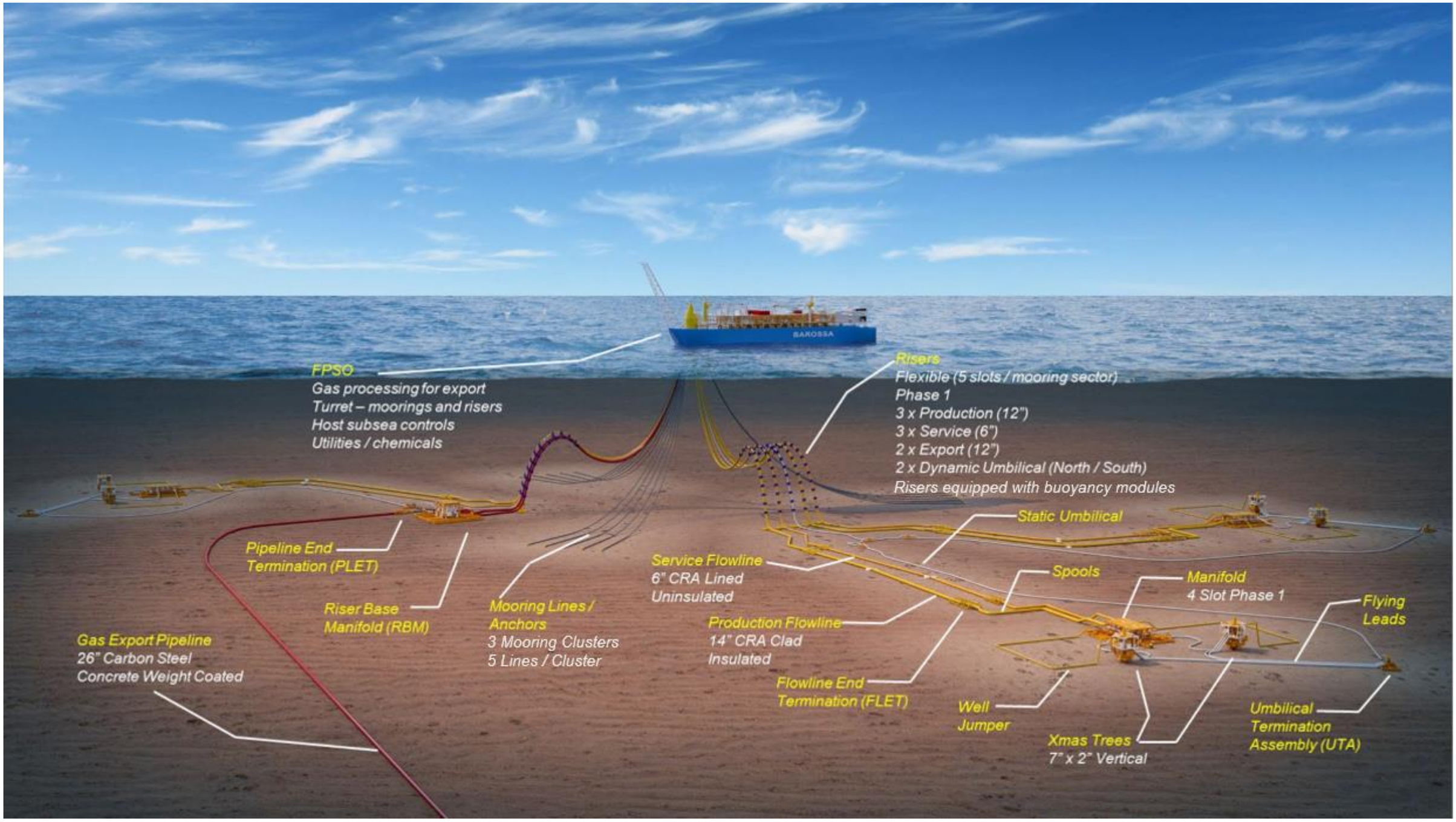


Figure 2-2: Barossa infield subsea infrastructure indicative layout

2.4.1.1 Well Intervention

There are no planned well intervention activities during the life of this EP. However, well intervention activities through the subsea tree system may be required due to a number of unforeseen circumstances that may occur during the operations phase of a wells lifecycle. Interventions may be undertaken for reservoir surveillance, enhancing productivity, assessing wellbore condition and restoring well integrity. Well interventions may also include tree/wellhead maintenance, logging or surveys, mitigating safety critical failures (e.g. failed safety valve), and production logging improvement activities. Management of these activities are addressed in the Barossa WOMP.

Light well interventions required on the Barossa wells will, in principle, be the result of a well integrity issue needing an investigation or repair. These activities may need to be carried out at any point during the life of this EP. Potential well intervention triggers may include:

- Completion tubing leak
- Production packer leak
- Loss of A-annulus integrity
- Subsurface safety valve functionality issues
- Subsea production tree valve leak.

Well interventions most likely require a well entry using slickline/wireline/coil tubing. This can be executed by a vessel with Light Well Intervention (LWI) capability or a mobile offshore drilling unit (MODU). If a MODU is required a separate EP will be prepared for acceptance by NOPSEMA, however LWIV activities are covered under this EP.

2.4.1.1.1 Light well intervention

Planned well intervention activities are executed by LWIV with an accepted vessel Safety Case for those activities consistent with the Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2023. Should the vessel scope demonstrate functionality or significant hazards that are not captured within the accepted vessel Safety Case scope, then a re-assessment shall be undertaken accordingly. Refer to Section 2.8.2.1 for a description of LWIV.

Remotely operated vehicles (ROVs) are used from the LWI vessel in support of the LWI activities. The ROVs are standard work class ROVs, with any specialist equipment or tooling required mounted on the ROVs. Observation ROVs may also be employed to assist the work class ROVs where appropriate. Refer to Section 2.8.6 for a description of ROVs. During LWI, equipment such as ROV baskets and similar sized equipment may be temporarily placed on the seabed.

Well interventions require well bore access into ‘live’ wells. A subsea intervention device (SID) is deployed and utilised to allow wellbore access while maintaining well control. Any selected vessel contractor shall ensure that such a SID shall meet the functionality and operability as per the approved WOMP as required by the Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011. Below are some of the contingency LWI activities which may be required.

- Slickline/Wireline/Coil Tubing interventions
- Deep Set Plugs
- Sub-surface Safety Valve Repairs
- Investigation Run
- Well Surveillance Well Entry
- Well Production Reinstatement

During LWI there may be some limited chemical discharges to sea through valve actuation for example which may result in residual hydrocarbons or chemicals being released to sea, if they occur these are very minimal. Marine growth removal may be required on the subsea wells prior to LWI.

2.4.2 Manifolds

Three manifolds (N1, S1 and S2) are located within OA1. Locations are provided in Table 2-2.

Each manifold incorporates actuated valves to enable routing or isolation of production wells into either the production or service flowline. The manifolds have capacity for up to four wells on each, with two wells initially in production at each, as described in Section 2.4.1.

In addition, a riser base manifold is used to co-mingle flows from two flexible gas export risers prior to the rigid Barossa GEP.

2.4.3 Rigid flowlines, flexible risers, umbilicals and flying leads

Service and production flowlines are rigid, with dedicated flexible risers connecting to the FPSO production turret.

Three 14-inch rigid production flowlines, connected to 12-inch flexible risers, are routed from the subsea drill centres through to the FPSO. A further three 6-inch rigid service flowlines, connected to flexible risers, are connected to the FPSO from the subsea drill centres. An umbilical system, consisting of static and dynamic sections and flying leads, is used to connect utility services (hydraulic, production chemicals, electrical) to the wells and subsea infrastructure from the FPSO.

Gas export risers connect the FPSO to the riser base manifold, where gas is commingled into the Barossa GEP.

Tie-in provision for connecting temporary pig launchers and receivers have been catered for on the FPSO production turret (as described in Section 2.4.4) to provide support to bi-directionally pig, displace, purge and discharge hydrocarbons from risers, as required.

An inventory of the rigid flowlines, flexible risers and umbilicals within the Barossa field are presented in Table 2-13 to Table 2-15.

Table 2-13: Rigid flowlines summary

Description	Location	Nominal Length (km)	Diameter (in)
N1 Service Flowline	N1 DC to N1 Service flowline end termination (FLET)	6.6	6
N1 Production Flowline	N1 DC to N1 Prod FLET	6.6	14
S1 Service Flowline	S1 DC to S1 Service FLET	6.3	6
S1 Production Flowline	S1 DC to S1 Prod FLET	6.3	14
S2 Service Flowline	S2 DC to S2 Service FLET	5.6	6
S2 Production Flowline	S2 DC to S2 Prod FLET	5.6	14
Total length (approximate)		**37.0**	

Table 2-14: Flexible risers summary

Description	Location	Nominal Length (km)	Diameter (in)
N1 Service Riser	FPSO to N1 Service FLET	0.9	6
N1 Production Riser	FPSO to N1 Prod FLET	0.9	12
S1 Service Riser	FPSO to S1 Service FLET	0.9	6
S1 Production Riser	FPSO to S1 Prod FLET	0.9	12
S2 Service Riser	FPSO to S2 Service FLET	0.9	6
S2 Production Riser	FPSO to S2 Prod FLET	0.9	12
Gas Export Riser #1	FPSO to Riser Base Manifold	0.9	12
Gas Export Riser #2	FPSO to Riser Base Manifold	0.9	12
Total length (approximate)		**7.2**	

Table 2-15: Umbilicals summary

Description	Location	Nominal Length (km)
N1 Dynamic Umbilical	FPSO to N Umbilical Termination Assembly (UTA)	1.0
S1/2 Dynamic Umbilical	FPSO to S UTA	0.9
N1 Static Umbilical	N UTA to N1 DC	6.8
S1 Static Umbilical	S UTA to S1 DC	6.6

Description	Location	Nominal Length (km)
S2 Static Umbilical	S UTA to S2 DC	6.0
Total length (approximate)		**21.3**

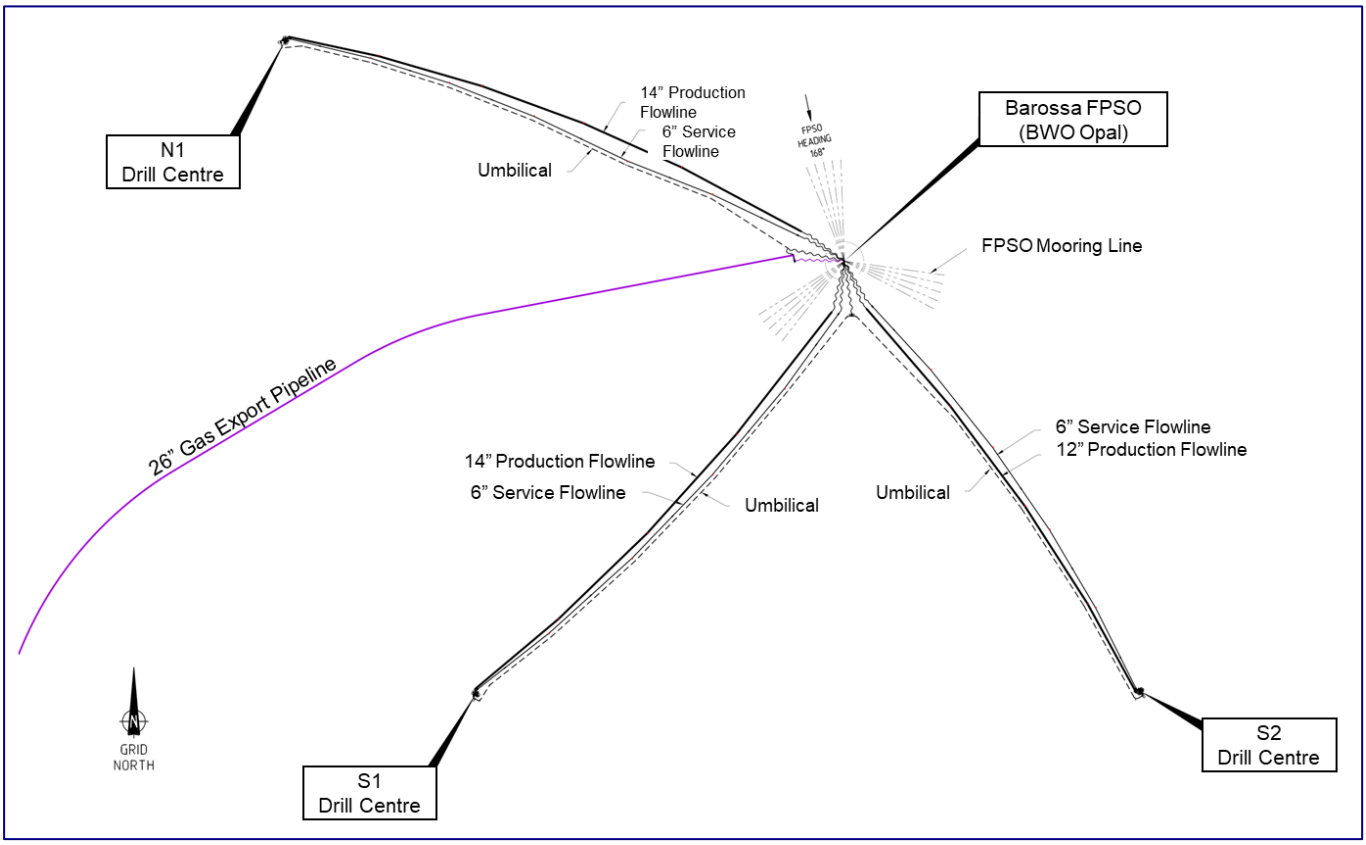


Figure 2-3: Indicative flowline and static umbilical schematic (excludes flexible risers and dynamic umbilicals)

2.4.4 Turret Mooring System

The FPSO has an internal turret (Figure 2-4) connected to the mooring system and risers through the submerged turret production (STP) buoy (Section 2.4.4.2), which is locked to the FPSO hull and located within a compartment at the forward end of the FPSO.

The turret, STP buoy and mooring system are designed to enable the FPSO to be permanently moored (without disconnection for the entire 25 year design life) with a passive, weathervaning system that aligns the FPSO with the prevailing environmental conditions to minimize loads on the mooring system.

A swivel arrangement in the production turret structure allows the FPSO to retain production whilst weathervaning. The turret, STP buoy and mooring system supports the riser and umbilical system (described in Section 2.4.3) and provides the interface to the processing and treatment systems (Section 2.7.2).

The turret mooring system main components include:

- mooring lines and anchors (Section 2.4.4.1)
- STP mooring buoy (Section 2.4.4.2).

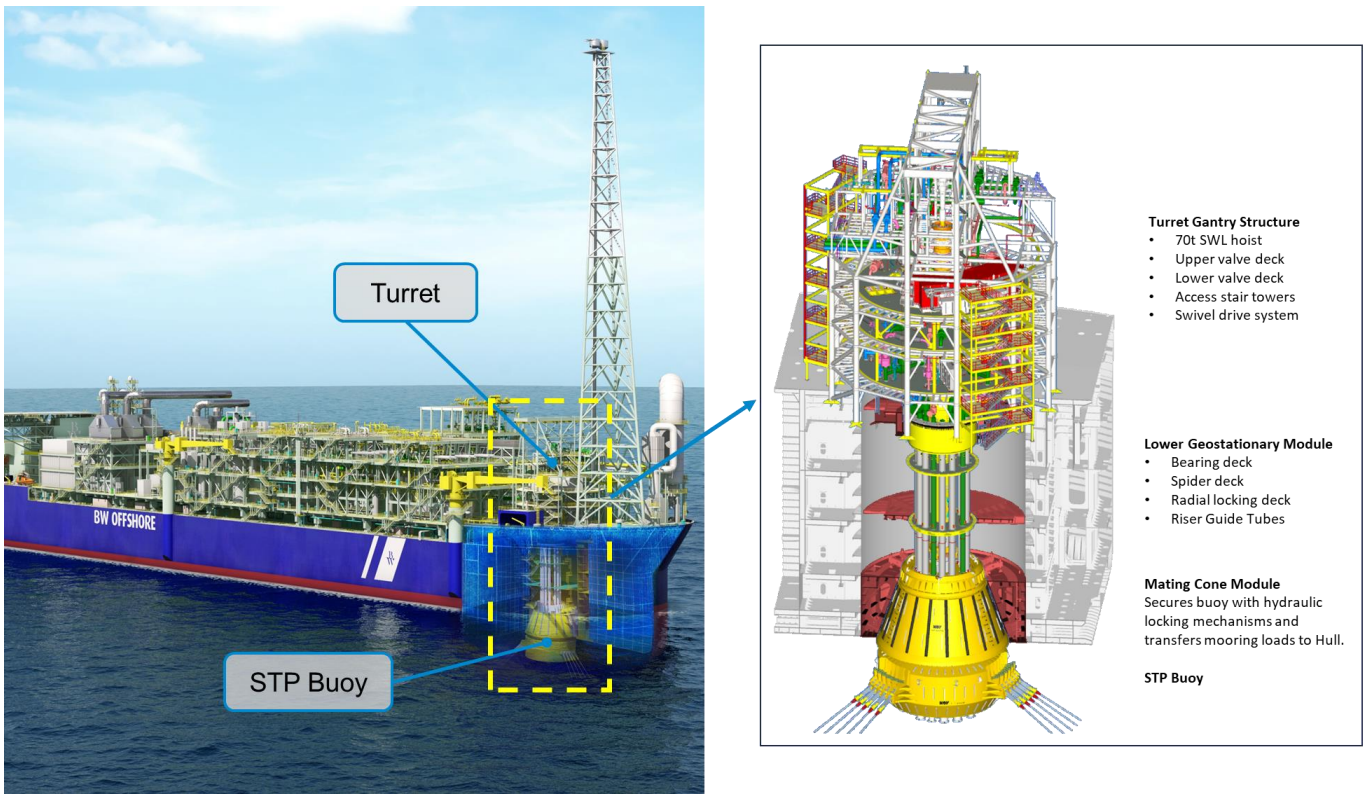


Figure 2-4: FPSO Turret system overview

2.4.4.1 Mooring and Anchors

Fifteen steel mooring lines are attached to the STP mooring buoy and are arranged in three sectors (Cluster North, Cluster East and Cluster Southwest, see Figure 2-4).

The mooring lines comprise (see Figure 2-5, Figure 2-6 and Figure 2-7):

- Submerged mooring cradle connector which attaches the line to the STP buoy;
- A sheathed spiral strand wire rope segment which runs between the mooring connector and the Mooring line buoyance element (MLBE) rod;
- MLBE mounted on the MLBE rod;
- A second sheathed spiral strand wire rope segment which runs between the MLBE rod and a Y-link which connects the wire rope segment to the lower chain segment;
- Two lower chain segments (connected by joining shackle) between the anchor Chain Segment (connected via ROV activated H-Link) to the wire rope (via Y-link); and
- A suction anchor connected by a shackle to the anchor chain segment which terminates the mooring line.

The mooring system is designed to maintain FPSO position within the excursion limits of the attached riser system during the 10,000 yr return period cyclonic conditions, and also during 100 yr return period environmental conditions with one mooring line failure.

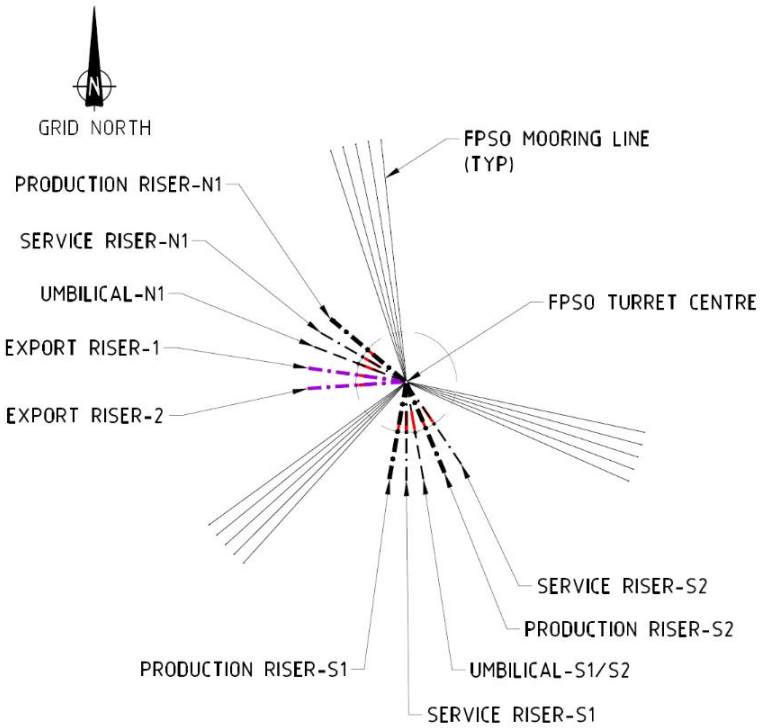


Figure 2-5: Mooring system layout

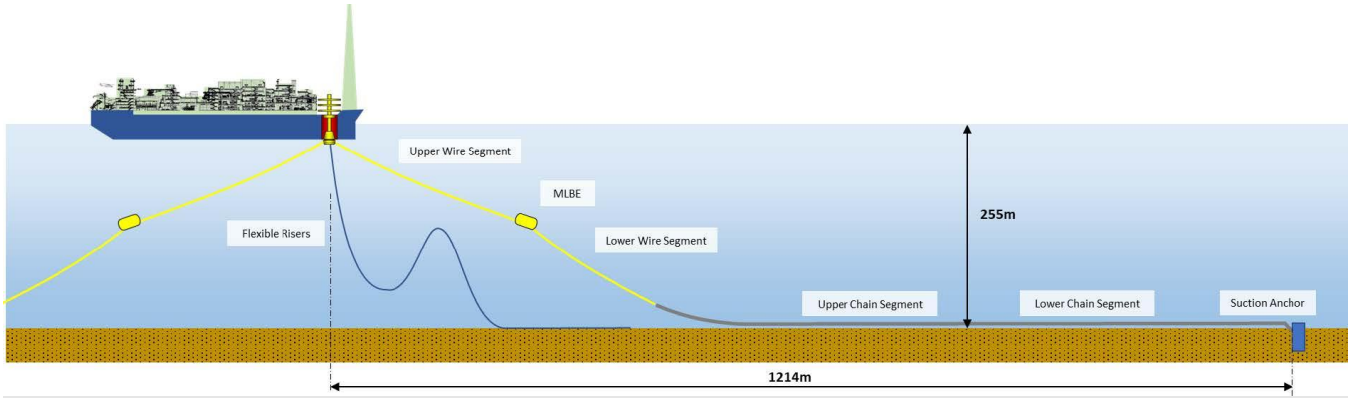


Figure 2-6: Mooring line arrangement

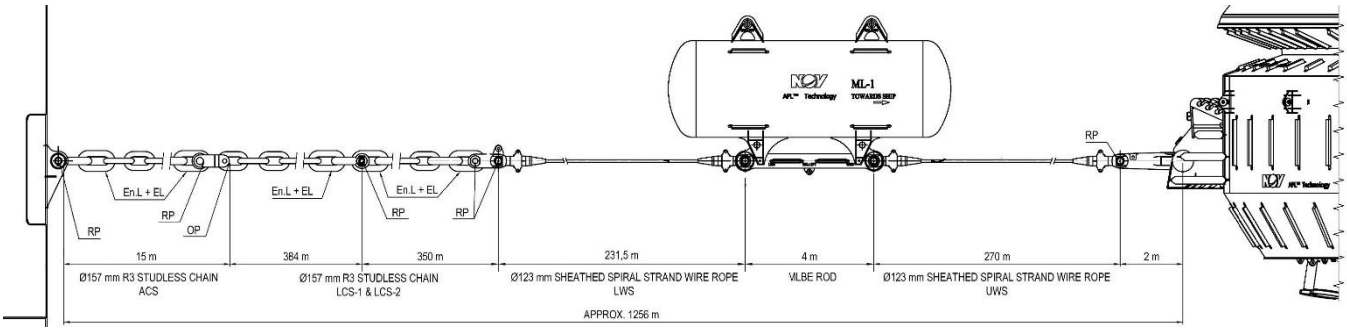


Figure 2-7: Mooring system components

A Mooring Line Monitoring System (MLMS) is used to monitor the departure angle of individual mooring lines (see Figure 2-8). A pair of inclinometers is attached to each mooring line connector that transmit the inclined angle of the mooring lines simultaneously to three receivers. This information is used to determine if there are any anomalies or potential failures with the mooring lines that warrant further investigation.

A Differential Global Positioning System (DGPS) is also provided, which monitors the position of the turret in relation to its mooring centre. If the turret position exceeds a pre-defined excursion rosette, the system will alarm.

The mooring system and line layout is designed to avoid clashing with production risers, umbilicals, flowlines and subsea equipment.

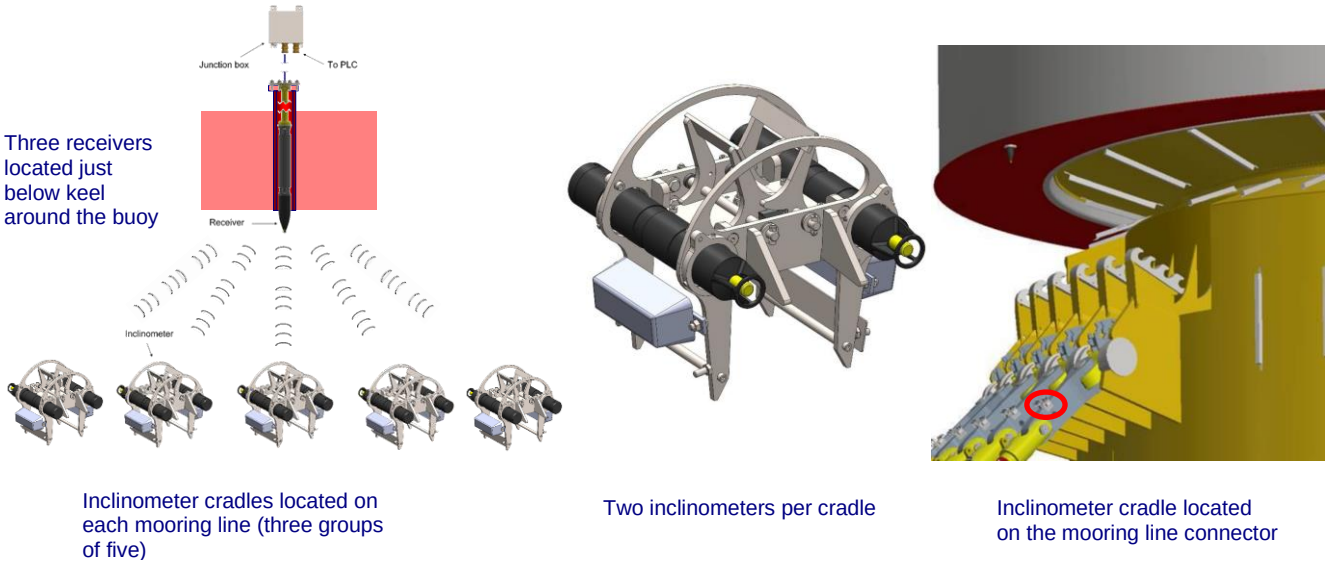


Figure 2-8: Mooring line monitoring system

2.4.4.2 Submerged Turret Production Mooring Buoy

The STP mooring buoy is anchored to the seabed with anchors and mooring lines (Section 2.4.4.1). The STP mooring buoy collects the risers, connects them to the FPSO and provides the mooring system for the FPSO.

The STP buoy is secured to the FPSO via hydraulic locking mechanisms which are mechanically locked after the initial pull-in operation.

A bearing system is provided as part of the STP buoy near the FPSO baseline, which allows the FPSO to rotate around the geostationary part of the turret, which is attached to the mooring system.

The STP buoy is provided with riser guide tubes, with spare tubes for future riser tie-in.

2.4.5 Barossa Gas Export Pipeline

The Activity includes the Barossa GEP operation and associated IMMR operations (see Section 2.10).

The Barossa GEP within Commonwealth waters is a 26-inch nominal diameter carbon steel pipeline. The Barossa GEP is designed to be capable of inspection pigging and stable on the seabed up to 100-year cyclonic metocean conditions. Table 2-16 summarises the key Barossa GEP details.

PLETs (A, B, and C) are present as connection points along the Barossa GEP, either connecting to the subsea infrastructure in the field (PLET A) or back to the Barossa GEP itself (PLET B and C). PLET locations are presented in Table 2-2. Protection structures will be present on PLET B and PLET C to provide protection from fishers operating within their proximity.

Table 2-16: Key Barossa GEP details (Commonwealth waters)

Item	Description
Material	Carbon manganese steel linepipe Concrete weight coating Field joint coatings
Pipe size	26 inches
Internal diameter	619.8 mm
Design temperature	0°C minimum and 50°C maximum
Design pressure	198 bara at 0m LAT

2.5 FPSO Arrival, Hook-up and Cold-Commissioning

2.5.1 STP Buoy As Left Condition

The STP buoy and FPSO mooring system was installed in 2024. The STP buoy is ballasted to approximately 40 m below the sea surface. A pull-in rope messenger line is hung off from a marker buoy on the surface. The marker buoy and messenger line will be collected upon FPSO arrival to conduct the buoy pull-in operation.

Prior to the FPSO arrival the STP buoy will be inspected and cleaned of marine growth that may have accumulated during the period the buoy has been submerged. Inspection and cleaning will be conducted by ROV.

STP buoy and FPSO mooring system installation and STP buoy cleaning activities prior to FPSO arrival are covered under the accepted Barossa SURF EP. These activities are described here for context, but are outside the scope of this EP.

2.5.2 FPSO Arrival and Turret Plug Removal

The FPSO will be towed into the field by tug vessel(s) (including escort tug vessels) provided by the selected towing contractor. The FPSO will transit to a meet point near the Barossa field location (outside OA1). At the meet point there will be a reconfiguration and connection of the final tug spread prior to the final approach to the STP buoy location.

Once the FPSO has arrived at OA1, it will be towed to location, where the three positioning tug vessels will then attach to the FPSO in a station keeping arrangement.

Prior to sail, the FPSO will include a turret seal plug. The plug is not required for operations and is only used (if required) during the voyage to the field. With the dummy buoy top left on, the turret seal plug weight is 65.5 tonne (dry weight). The turret seal plug is planned to be removed quay side at the shipyard in Singapore prior to sail. The FPSO will then sail with an open turret moonpool to the final location.

2.5.2.1 Contingency Activities

If the forerunner line is not transferred back to the FPSO deck during transfer of the turret seal plug, there are two contingency plans to recover the forerunner line to the FPSO.

- The first contingency plan involves tugs to pull the FPSO in a sideways direction while the forerunner line, fitted with sandbags and floating buoys, is simultaneously lowered through the moonpool. The forerunner line would be lowered until approximately 90 m is spooled off the winch. At this point the sandbags would be released allowing the floating buoys at the end of the forerunner line to appear shipside of the FPSO. The floating buoys would then be recovered to the side of the FPSO using a grapnel.
- An alternative forerunner line recovery method is to use an ROV. A polypropylene rope, with a soft eye and clump weight, would be lowered down the side of the FPSO. An ROV would then be used to connect the rope to the end of the forerunner underneath the FPSO. Once the connection is made the rope and forerunner could be recovered to the FPSO deck.

If the turret seal plug is not removed quay side at the shipyard in Singapore prior to sail to OA1, the contingency will be to remove the turret seal plug after the FPSO arrives in OA1 by one of two methods.

- A recovery line, hanging from the underside of the turret seal plug, will be transferred up to the side of the FPSO and over to a tug vessel. The recovery line will then be connected to the tug winch and recovered, while allowing sufficient slack for lowering of the turret seal plug through the moonpool. Using the STP pull-in winch and forerunner rope, the plug will be lowered through the moonpool and into the water. The turret seal plug will then be winched onboard the tug at the same time the pull-in winch onboard the FPSO is spooled out. Once the turret seal plug is on board the tug the forerunner rigging line will be disconnected and passed up to the side of the FPSO.
- Using the STP pull-in winch and Dyneema rope, the plug will be lowered through the moonpool to the seabed at a location away from the STP buoy. An ROV deployed from the hook-up and commissioning (HUC) support vessel will monitor the lowering of the plug. Once the plug has reached the seabed, the ROV will cut the Dyneema rope away from the lowering rigging of the lug and attach it to the tugger winch on the FPSO. The tugger winch will then recover the Dyneema rope. The plug will be recovered by the HUC support vessel using its vessel crane and the ROV, and the plug recovery rigging.

2.5.3 FPSO Hook-up to STP Buoy

Ballast operations will be conducted to bring the FPSO to 14 m draft with even keel to be able to bring in the STP buoy, in readiness for the commencement of the STP buoy pull-in operation.

The FPSO will move over the centre of the STP buoy to start tensioning up the STP buoy using the buoy pull-in winch in the turret (Figure 2-9). The pull-in rope will then be removed from the top of the STP buoy by releasing the locking pin after securely locking the buoy to the FPSO.

The STP buoy pull-in operation will be monitored through underwater closed circuit television (CCTV) inside the turret compartment to verify the final connection to the FPSO. The STP buoy is secured into the buoy mating cone module by means of locking mechanisms. The design consists of 14 mechanisms and allows for under water operation.

After the locking mechanisms are engaged, the FPSO will be de-ballasted and trimmed. The turret open drain system will be used to removal all water from the turret compartment. The turret open drain skid consists of two 25 m^3/h pumps connected to the hazardous open drain header. There is also one 125 m^3/h pump connected to an overboard line and is this intended for removing water from the turret compartment during the hook-up operation.

After the STP buoy is connected to the FPSO, the top of the STP buoy and the messenger line will then be high pressure washed to remove remaining marine growth. Finally, the STP buoy will be de-ballasted, and the ballast tanks preserved with biocide, corrosion inhibitor and oxygen scavenger.

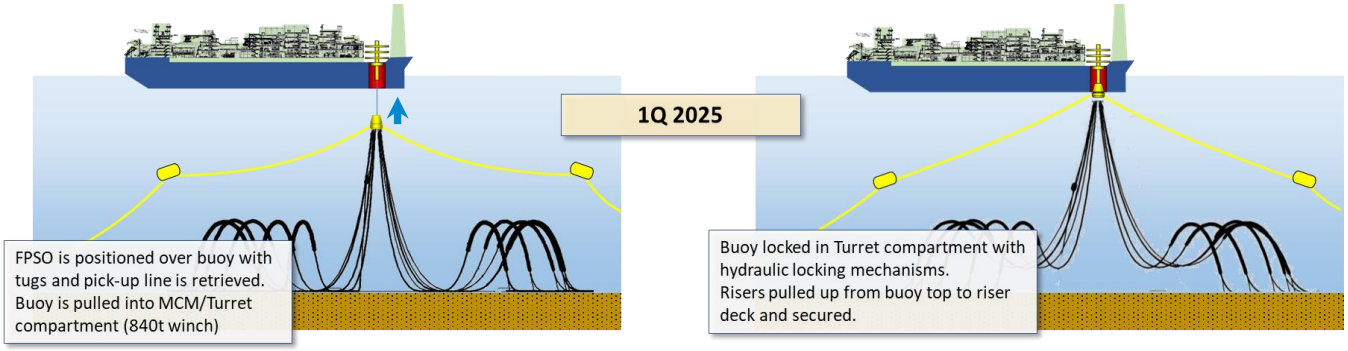


Figure 2-9: FPSO Hook-up to STP buoy

2.5.4 Riser and Umbilical Connection

Following connection of the STP buoy and the initial rotation test of the FPSO, the risers and umbilical will be pulled in and connected with the permanent hang-offs. The pull in method involves connecting the riser/umbilical pull-in head assembly to a pull-in winch rope and pulling the head assembly through a riser guide extension. Once the load is transferred to the split hang-off collar, riser guide tube flange connections are tightened, and clamp plates installed.

2.5.5 Valve and Piping Reinstatement

Once all the risers and umbilicals are permanently hung off, the riser emergency shut down valves (RESDVs) will be installed and bolted on top of the riser end fittings. Two tug vessels may control the heading of the FPSO while the RESDVs are cross hauled between the FPSO weathervaning hull and geostationary section.

2.5.6 Nitrogen Helium Leak Testing

Temporary liquid Nitrogen/ helium spread will be installed on the FPSO for the purpose of nitrogen helium (99%N2/1%He) leak testing during the HUC phase. This will include testing of turret systems, gas compressors and any other systems where containment has been broken. Contingent activities to be provisioned for additional N_2He leak testing and repair of any leak point identified.

2.5.7 Export Riser De-watering

The gas export risers will be prefilled onshore with approximately 120 m^3 of MEG/water (85%wt/15%wt). This is required to be displaced before commencing exporting operations. The MEG will be displaced by sweeping the export risers with nitrogen. The MEG will be displaced via a hose routed overboard, since it is considered to Pose Little or No Risk to the Environment (PLONOR, see Section 2.7.3.8) when discharged to marine environment. The activity is to be completed prior to the pressurisation of the Barossa GEP with hydrocarbon.

2.5.8 Subsea Isolation Valves Leak Testing

Subsea isolation valves (SSIV) leak testing will be conducted following the export riser dewatering. This will be conducted by pressurising one side of the SSIV with nitrogen and monitoring the other side for pressure build up. Following SSIV testing the gas export risers will be left pressurised with nitrogen to 30 bar in preparation for start-up.

2.5.9 Seawater Intake Hoses Installation

Four seawater intake hoses will be installed on the port aft side of the FPSO using the Port Aft Crane No.3, as each hose includes the following components:

- Riser head
- First spool
- Mainline spools
- First off hose segment
- Five mainline hose segments
- Strainer

The sweater lift pumps will be removed, prior to installing the seawater intake hoses and then reinstalled.

2.5.10 Cold Commissioning

Commissioning of FPSO marine and utility systems will be executed prior to the FPSO departing Singapore. This includes but is not limited to:

- Essential and Emergency Generators
- Gas turbine generators (GTGs) commissioned on liquid fuel
- Instrument air
- Nitrogen
- Seawater
- Cooling Medium & Heating Medium
- Inert Gas Generation
- Compressor clean-up runs
- Fire and Gas systems

Once the riser and umbilical hook-up is complete in the field, cold commissioning of the subsea systems can commence, which includes testing communications links between the FPSO and the subsea infrastructure and conducting valve stroke testing prior to the introduction of hydrocarbons. Control fluid discharges will occur during valve stroke testing. During this period a commissioning support vessel (Section 2.8.2) will be operating in the field, which will carry out tasks including but not limited to:

- Inspection of XT, manifolds, well jumpers, spools, flowlines, risers, and umbilicals
- Installation of electrical actuators
- ROV observation during function and leak testing of hydraulic actuated valves
- Open/Close ROV operated valves

Following the subsea controls commissioning, an emergency shut down (ESD) test shall be undertaken. During these activities there may be minor control fluid discharge from subsea valve vent systems on closure (water-based hydraulic fluids). In addition to the above commissioning scopes, minor carry over construction and commissioning work may be executed on board following FPSO hook-up. This includes but is not limited to:

- Painting and coating
- Welding
- Non-destructive testing (NDT)
- Pipe bolting
- Insulation
- hydrotesting
- cable pulling and termination
- reinstatement of instrumentation
- Installation of nucleonic sources for the separator level detectors
- Instrument calibration
- Final testing of firewater and foam deluge

The Barossa GEP will be nitrogen-filled and ready for start-up (completed during the installation activity under other Barossa environment plans). There may be some residual chemicals contained within the Barossa GEP system from the pre-commissioning phase and these will be pushed through to DLNG facility during the start-up phase, where they will be collected and appropriately disposed onshore.

2.5.10.1 Preparation for Initial Start-up including Utilities and Power Generation

Preparation for initial start-up activities includes but is not limited to:

- Reset of ESD & process shutdown (PSD) systems including application of start-up inhibits
- Establish cooling medium supply to power generation
- Establish nitrogen purge to high pressure/low pressure (HP/LP) flare headers
- Establish heating medium circulation
- Start first main power generator on diesel
- Establish seawater (SW) supply to the cooling medium (CM) system
- Prepare flare pilots for ignition
- Prepare MEG system for subsea injection

2.5.10.2 Contingency activities

If faced with a large delay due to unforeseen circumstances (e.g. delay in DLNG readiness to receive gas) then it is expected that the commissioning and start-up sequence will proceed regardless of the delay, to meet the planned ready for start-up (RFSU) date. In the period prior to initial start-up, the FPSO would maintain power supply with diesel fuelled essential generators sufficient for essential living quarters services. There would be routine discharges from the FPSO such as treated sewage and grey water, food waste etc.

2.6 Initial Start-up and Hot-commissioning to Steady State

2.6.1 Initial start-up

Following completion of cold commissioning there will be an initial start-up period. This is planned with the objective to establish stable production in a safe and efficient manner whilst minimising flaring to as low as reasonably practicable (ALARP). The initial start-up of the FPSO will consider the requirements of the DLNG facility for commissioning prior to production ramp-up. Major steps undertaken during the initial start-up phase are as below:

- Preparation for initial start-up including utilities and power generation (Section 2.6.1.1)
- Drill centre MEG displacement and Well Clean-Up (Section 2.6.1.2)
- Inlet Separation, Cooling and Fuel Gas Start-Up (Section 2.6.1.3)
- Gas treatment start-up (CO_2 Removal Stage 1) and gas export pipeline pressurisation (Section 2.6.1.4)
- Establishing CO_2 Removal Stage 2, CO_2 Permeate and Export Gas Compression (Section 2.6.1.5)
- Establishing MeOH Regeneration & On-spec Condensate (Section 2.6.1.6)
- Rate ramp-up and additional gas compression and treatment established (Section 2.6.1.7)
- Establish Thermal Oxidiser, Produced Water Treatment and Vapour Recovery. (Section 2.6.1.8)
- Start-up of Steam Turbine Generator (Section 2.6.1.9)
- Performance Testing (Section 2.6.1.10)

Table 2-17 details the key requirements through the initial start-up phase. This represents the priority of system start-up and sequence of activities. Where possible some of these activities may be conducted concurrently to optimise start-up duration.

Table 2-17: Floating production, storage and offloading initial start-up overview

Descriptor	Status on Completion
Inlet Separation, Cooling and Fuel Gas Start-Up	- Inlet cooling and Separation system online, gas is flared from the Production Gas Separator - Fuel Gas available for HP/LP consumption with critical consumers established - GTG hot commissioning on wet fuel gas complete and GTG running on wet gas - Route for produced water to off-spec storage established (batch)

Gas Treatment Start-Up and Gas Export Pipeline Pressurisation, CO_2 Removal Stage 1	- Methanol injection to Dewpointing Stage 1 & 2 established - Rich Methanol flowing via Condensate/Methanol Stage 1 to Rich Methanol hull tank (Regeneration bypassed) - Dewpointing Stage 1 & 2 (Train A) online - CO_2 Membrane Stage 1 Train A Skid 1 Online (CO_2 disposed via Acid Gas Flare) - Gas Export Pipeline is pressurised to 50barg - On-spec gas is flowing to flare downstream of Dewpointing Stage 2
Establish CO_2 Removal Stage 2, CO_2 Permeate & Export Gas Compression	- Export Gas Compressor Train A online - CO_2 Permeate Gas Compressor Train A Online - Hot commissioning of GTGs on dry fuel gas - CO_2 Membrane Stage 2 Train A Online (CO_2 disposed via Acid Gas Flare) - Export gas flowing to export pipeline
Establishing Methanol Regeneration & On-Spec Condensate	- On-spec condensate to storage established - Methanol recovery and regeneration systems online with lean Methanol recovered back to receiver - Wash water system online, Condensate/Methanol Off-gas Absorber and Permeate Gas Absorbers online to minimise Methanol loss.
Field Ramp-Up and balance of equipment	- CO_2 Membrane Stage 1 Train A & B (4/4 skids) online - CO_2 Permeate Compression Train A/B/C online - CO_2 Membrane Stage 2 Train A & B (2/2 skids) online - Export Compression Train A/B/C online - Dewpointing Stage 1 & 2 Train A & B Online
Establish Thermal Oxidiser, Produced Water (PW) Treatment, Flash Gas & Vapour Recovery Compression	- Thermal Oxidiser Online (CO_2 permeate stream disposal, acid gas flare extinguished) - Flash Gas Compression Train A & B commissioned and single train online - Vapour recovery compressor online - Primary and Tertiary PW Treatment online with on-spec water established
STG Commissioning	- Combined cycle power plant (including STG) online

During the above steps minimum throughput rates must be achieved to prevent equipment damage. This is set by the minimum rate through a single train of the CO_2 membrane system.

Control systems and analysers are all designed to operate at this minimum turndown rate and will be fully available during the start-up period.

During the initial start-up and hot commissioning period, the FPSO will be under all normal operational controls. The period is defined as the commencement and completion of the Initial Start-Up Procedure which is considered complete at successful conclusion of the Final Performance Test. Equipment and systems are sequentially brought online through this phase. On completion of the final performance test the FPSO will commence steady state operations.

Performance testing requirements must be met in order to achieve final acceptance, this milestone occurs for the entire facility at the same time. At this point all systems will be operational including gas trains, Methanol recovery and Thermal Oxidiser. As noted in Section 2.6.3 some systems may not be available at this time due to water throughput and condensate production. Identified performance testing issues may be managed beyond final acceptance as required and subject to the EP Change Management Process (Section 8.5.2).

2.6.1.1 Preparation for Initial Start-up

Prior to the introduction of hydrocarbons the supporting systems and power generation will be established. The following steps will be carried out:

- ESD & PSD Systems reset and blowdown valves closed;
- Seawater system filled and started including anti-fouling system;
- Cooling Medium established to Power Generation;
- Flare headers under Nitrogen purge;
- First GTG started on liquid fuel;

- Heating Medium warm-up circulation established; and
- Flare pilots ignited on propane.

On completion of the above steps the FPSO is ready for introduction of hydrocarbons.

2.6.1.2 Drill Centre Displacement and Well Clean-up

Once FPSO line-up has been confirmed the initial activity is to displace the service system for the start-up drill centre which has been left filled with 85/15 MEG/ Water mix at approximately 30bara.The start-up well will be opened at a minimum rate in order to manage temperature and flowrate with MEG and nitrogen received via the test separator, the nitrogen is vented and the MEG routed to the off-spec tank. Once gas breakthrough has been observed, the activity will be repeated for the production flowline which is left filled with nitrogen at 30bara and risers filled with MEG.

As part of the drilling and completions activity (D&C EP), the Barossa wells will have had initial well clean-up activities undertaken to achieve the primary clean up criteria. On initial well-start each well will be routed to the FPSO test-separator for secondary clean up for a period of up to 24 hours per well. During well clean-up all hydrocarbon gas and nitrogen will be disposed of via the FPSO flare system. Returned liquids including condensate and MEG will be routed to the off-spec condensate tanks for re-processing. Any produced water associated with well clean-up will initially be routed to off-spec storage tanks before being processed prior to discharge, once the water treatment system is online.

Displacement of the flowlines and well clean-up will be required for subsequent drill centres and each well. This is planned to be carried out as further wells are required through initial start-up.

2.6.1.3 Inlet separation, Cooling and Fuel Gas Start-up

Upon completion of well clean-up, inlet cooling and separation will be established with gas routed to the Inlet Production Separator. Once gas is available at the Production Gas Separator the fuel gas system can be established and fuel gas made available to LP users including flare purge, flare pilots and blankets for various process vessels. Fuel gas is also available for power generation.

The main power generation system consists of five gas turbine generators (GTGs) and a single steam turbine generator (STG). All GTG's will have completed load testing at shore (prior to the commencement of activities under this EP) on liquid fuel with the steam turbine generator tested with as much load as practicable during the onshore phase. Once offshore, the GTG's will be tuned to fuel gas to achieve optimum performance followed by fuel changeover testing. Once sufficient load is available final full load testing will be conducted for the STG.

During the start-up phase power generation will be brought online gradually in line with the power demand from online equipment, eventually resulting in either 3 x GTGs and the STG, or four GTGs being online to support the steady state period. An additional GTG will be available on cold-standby as required. Further details of required power are provided in Section 2.7.3.1.

2.6.1.4 Gas treatment start-up, CO_2 removal stage 1 and gas export pipeline pressurisation

Methanol is established to the gas treatment system with a partial start-up of the methanol recovery system and rich methanol being stored in hull tanks.

Gas is gradually fed forward to cool down the system and establish dewpointing stage 1 and 2 and CO_2 removal stage 1. Start-up is performed at minimum rates depending on the turndown requirements of each stage.

Once dewpointing stage 2 is online the gas is at export quality and will be utilised to commence pressurisation of the gas export pipeline.

2.6.1.5 Establishing CO_2 Removal Stage 2, CO_2 Permeate and Export Gas Compression

Once the pipeline has reached circa 57barg the bypass spool will be removed, and a gas export compressor (one of three) will be brought online to further raise gas export pipeline pressure. At this point, dry fuel gas will be available for use and GTG commissioning. The CO_2 permeate compressors and 2nd stage membranes can then then started; this is a key step to minimise CH_4 (methane) losses via the acid gas flare.

2.6.1.6 Establishing MeOH Regeneration & On-spec Condensate

Up until this point condensate has been routed to the off-spec tank, electrostatic coalescer and stabiliser can then be started to establish on-spec condensate for storage. Condensate from the off-spec tank will be reprocessed to achieve specification.

MeOH regeneration will be established at this point which reduces the methanol losses.

2.6.1.7 Rate Ramp-up, Additional Gas Compression and Treatment established

The balance of compressors and gas treatment will then be started. If DLNG is ready to ramp-up production, then this will occur to support the establishment of additional equipment. If not, gas rates will be maintained and equipment commissioned where possible with existing rates.

2.6.1.8 Establish Thermal Oxidiser, Produced Water Treatment and Vapour Recovery

It is not expected to receive produced formation water during initial start-up, with only water of saturation expected to condense out along the infield flowlines, which will be knocked out in the inlet separator. The expected rates are low but will be sufficient to enable continuous operation of the produced water (PW) system. If rates are below minimum rate, then the system will be batch operated.

Treated PW will only be routed overboard once stable performance against design specifications is proven.

Primary produced water treatment (Hydrocyclone/ Induced Gas Flotation/Water Clarifier) will be established initially with water routed to off-specification PW storage until Tertiary PW treatment (to a level of) is established. See Section 2.7.2.6 for a full description of the produced water treatment system.

The thermal oxidiser will be started once the plant is stable to prevent thermal cycling. Once the thermal oxidiser is online, the acid gas flare will be extinguished.

Vapour recovery will be started as noted in Section 2.6.2 once fuel gas blanketing of storage tanks has been established and is within specification.

2.6.1.9 Start-up of Steam Turbine Generator

Steam turbine generators and balance of plant will be established to enable the removal of a GTG from the board resulting in reduced fuel gas usage. The STG can only be brought online once there is sufficient power demand and therefore sufficient heat from the GTG exhausts.

2.6.1.10 Performance Testing

The ultimate step of the start-up phase will be to conduct the final performance test which is designed to prove that the FPSO facilities meet the design intent and achieve the overall FPSO performance guarantees. This includes a demonstration that all systems can operate for a period of 72 hours with on-spec product, within noise and vibration limits and achieve equipment design performance specifications.

2.6.2 Start-Up Flaring

During the period of initial start-up there is a requirement for flaring as equipment is brought online, this includes the disposal of acid gas via the acid gas flare until such time as the thermal oxidiser is online. Disposal via acid gas flare has a lower combustion efficiency (target efficiency >98%) when compared to the thermal oxidiser and requires additional fuel gas for assistance. During the initial start-up period it is expected that the acid gas flare will be required for a period of at least 54 days.

This step is completed toward the end of the initial start-up period to avoid thermal cycling of the thermal oxidiser.

Flaring will be further reduced once the vapour recovery unit (VRU) has been brought online (see Section 2.7.2.3). Initially, cargo tanks will be inert gas blanketed until completion of the first offload. During the first loading cycle (circa 4 months) flaring until it is confirmed that the tanks are within oxygen specification. Chemical storage tanks will initially be nitrogen blanketed, and it is expected there will be a period of cold venting a mixture of nitrogen and fuel gas as these are switched to fuel gas blanketing.

2.6.3 Contingencies

There are several scenarios which may impact planned initial start-up activities as below:

2.6.3.1 System/ Equipment Hot-commissioning Delays

Whilst systems are as comprehensively tested as possible prior to infield testing and hot commissioning, delay in the hot commissioning of any single component may occur. Depending on which system/equipment for which hot commissioning is delayed, this may result in an extended period of diesel use (approximately 18 days) for power generation or extended flaring. In the scenario where hydrocarbon gas is not required in order to resolve the issue and a delay is evident, it may be concluded to either choke the field to minimum rates or to shutdown wells to perform any required maintenance or repair activities.

2.6.3.2 Produced Water Treatment system Commissioning

Commissioning of the PW treatment system will occur following ramp up to full production rates. If the PW treatment system is not meeting design specifications during performance testing, PW will be diverted to the PW off-specification storage tank awaiting re-treatment once the PW treatment system performance issues are resolved. The size of the PW off-specification storage tank combined with the low volumes of PW expected following initial start-up, means it would take several weeks before the off-specification storage capacity is exhausted. In the unlikely event that the off-specification storage capacity is reached, production can either be choked to minimum rates or wells can be shutdown until the PW treatment system performance issues are resolved.

2.6.3.3 Delays to Darwin Liquefied Natural Gas Facility commissioning

Should commissioning at the DLNG facility take longer than the planned two to four weeks, the associated flaring and diesel usage would be extended. As for the contingency scenarios noted above, it may be determined to either choke the field to minimum rates to minimise flaring or to shutdown wells (no flaring) whilst waiting for the DLNG facility.

2.7 Steady State Operations

Steady state operations define the period from the completion of the Final Performance Test through life of field with the FPSO operating in line with standard Operating Procedures and Well Operations guidance. As noted in Section 2.5.9 there will be some carry over of initial start-up activities which may be brought online during steady state operation, these activities will be subject to any additional testing requirements as outlined in the initial start-up procedure.

2.7.1 Floating Production, Storage and Offloading Facility Overview

The Barossa FPSO (the FPSO) is a permanently moored facility, with connections to the subsea wells and the Barossa GEP, as described in the above sections.

Once the FPSO arrives in the field, it will be hooked-up as per the description in Section 2.5.

The FPSO is a purpose built facility designed to process gas and condensate drawn from the Barossa field. It has a gas export capacity of approximately 635 MMscfd with condensate processing capacity of approximately 11,000 bl/d. Table 2-18 presents the dimensions and key details of the FPSO.

Table 2-18: Floating production, storage and offloading facility dimensions and key details

Item[1]	Description
Length	358.6 m
Depth	32 m
Breadth	64 m
Draft (fully loaded)	17.45 m
Primary fuel	Fuel gas
Maximum persons on board (POB)	140
Condensate storage tanks	Five at 26,253 m³ One at 8,398 m³
Total condensate storage capacity	139,668 m³
Off-specification produced water (PW) tank	26,256 m³
Off-specification condensate tank	16,882 m³

Item[1]	Description
Dirty slops tank	8,417 m³
Clean slops tank	8,417 m³
Lean MEG tank	6,305 m³
Lean methanol tank	6,305 m³
Rich methanol tank	10,535 m³
Marine gas oil (MGO) storage capacity	9,195 m³ (total) 2,437 m³ (largest of 6 tanks)

Note 1: Tanks sizes are at 100% capacity and will commonly be filled to 98% capacity.

The FPSO is configured to operate under the Flag State requirements, International Association of Classification Societies class requirements (third-party validation and classification by Det Norske Veritas [DNV]), International Maritime Organization (IMO) (International Convention for the Prevention of Pollution from Ships (1973), Protocol (1978) [MARPOL] and International Convention of the Safety of Life at Sea [SOLAS]) requirements.

The anti-fouling coating for the majority of the hull (>95%) is a biocidal coating (Interswift 6800HS), in line with best practice and lessons learnt, with the remaining hull inspection corridors (<5%) a non-biocidal coating (Intersleek) is applied for operational reasons. All coatings are tributyl tin (TBT) and cybutryne free.

The layout of the topsides is shown in Figure 2-10 and Figure 2-11, Figure 2-11 descriptions are presented in Section 2.7.2.

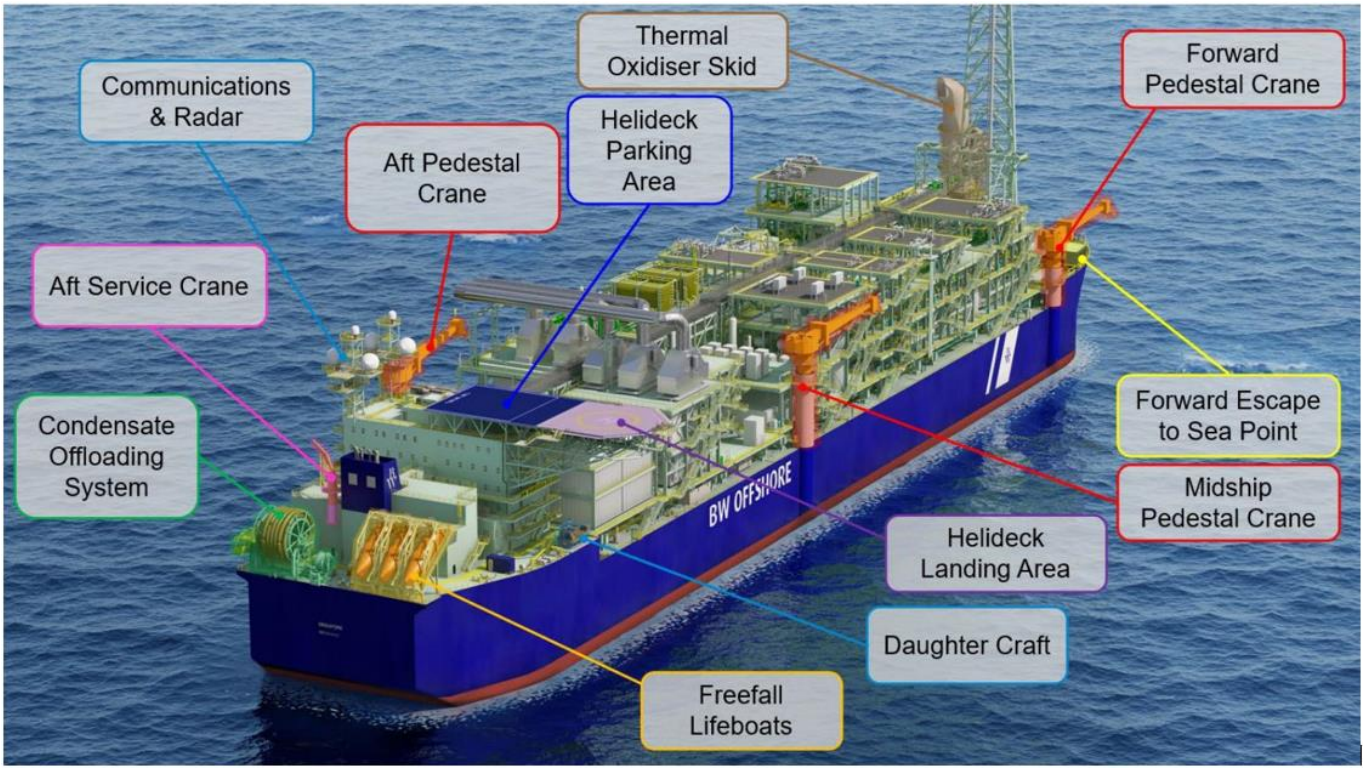


Figure 2-10: FPSO topsides plan (from angle)

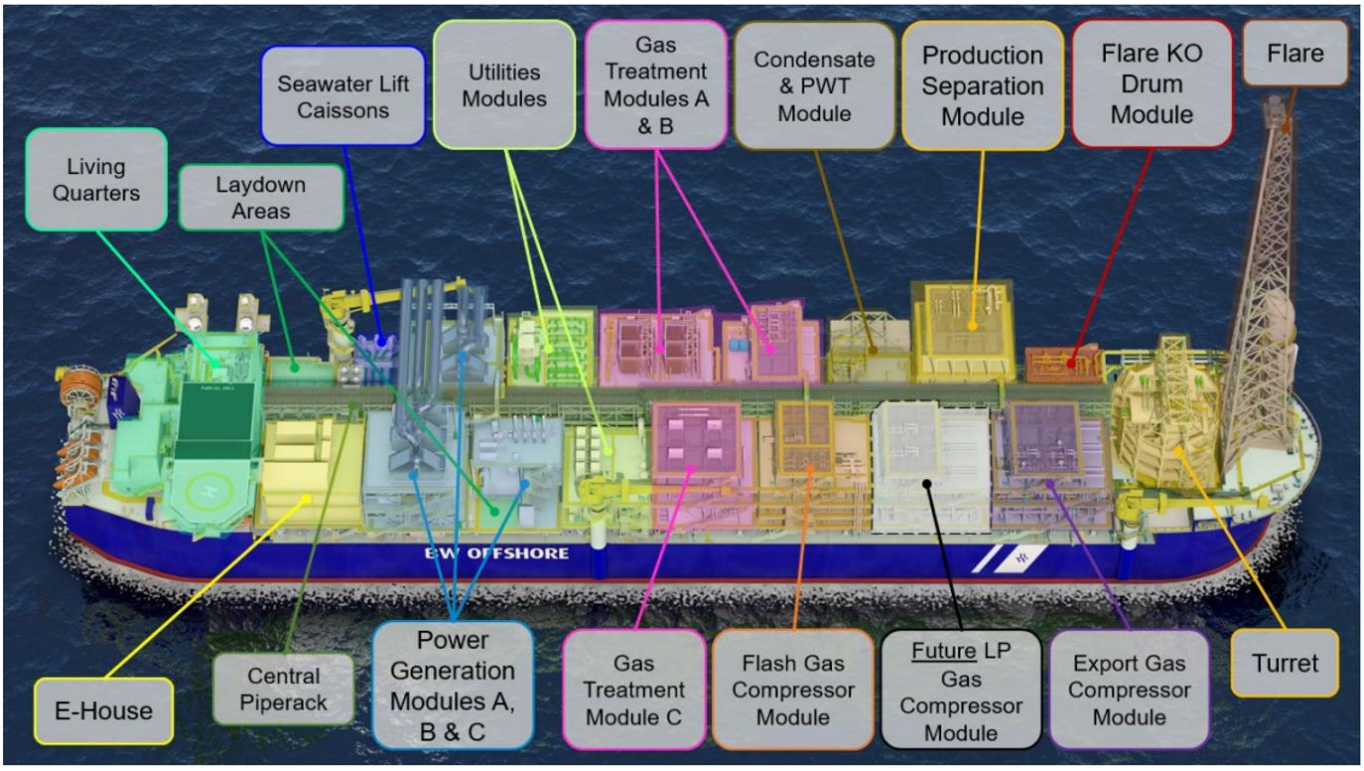


Figure 2-11: FPSO topsides plan (from side)

Figure 2-12 presents the FPSO tank arrangement. The tank arrangement is consistent with a conventional ship shaped FPSO double hull. The water ballast tanks providing a double-sided, double-bottom arrangement.

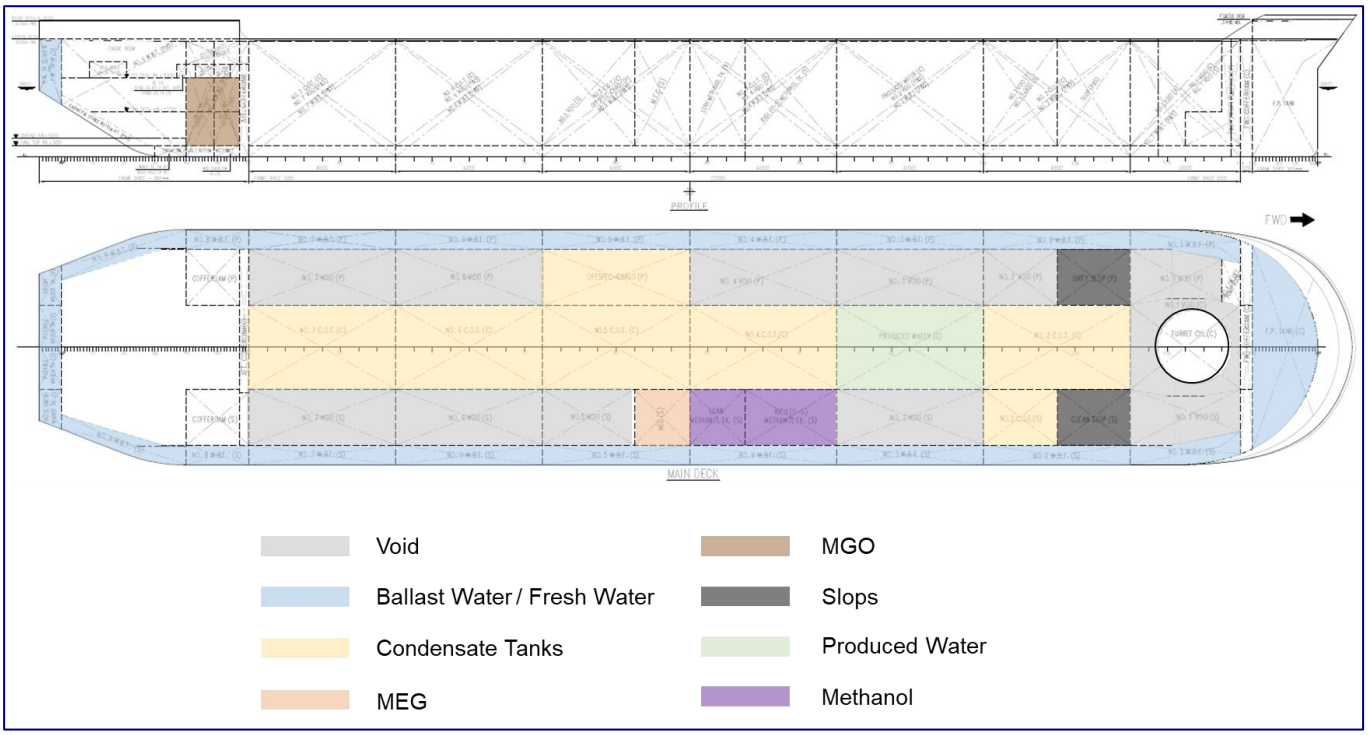


Figure 2-12: FPSO tank layout

2.7.2 Floating Production, Storage and Offloading Facility Processing and Treatment Systems

The following sections describe the FPSO hydrocarbon processing systems. The key processing and treatment systems on the FPSO include the:

- condensate separation, degassing, coalescing and stabilisation (Section 2.7.2.1)

- gas treatment system (Section 2.7.2.2), including:
  - dewpointing and mercury decanting (Section 2.7.2.2.1)
  - carbon dioxide and hydrogen sulphide removal (Section 2.7.2.2.2)
  - gas flare system (Section 2.7.2.4)
  - compression (Section 2.7.2.5)
  - produced water (PW) treatment and discharge system (Section 2.7.2.6).

The nominal design capacities of the FPSO's processing and treatment facilities are provided in Table 2-19. Tank capacities are presented in Table 2-18.

Table 2-19: Processing and treatment facilities design limits

Item	Design limit [1]
Condensate processing	Production rate of 11,000 bbl/d
Gas	635 MMscfd (CO_2 removal mode) 730 MMscfd (CO_2 removal bypass mode)
Produced water processing	3,014 m^3/d (20,000 bbl/d)

Note 1: The above limits represent name plate design figures. Day-to-day figures may vary, depending on reservoir performance, production optimisation and limitations. MMscfd = million standard cubic feet per day. bbl/d = barrels per day.

Figure 2-13 presents a block flow diagram depicting process flow through the FPSO processing systems.

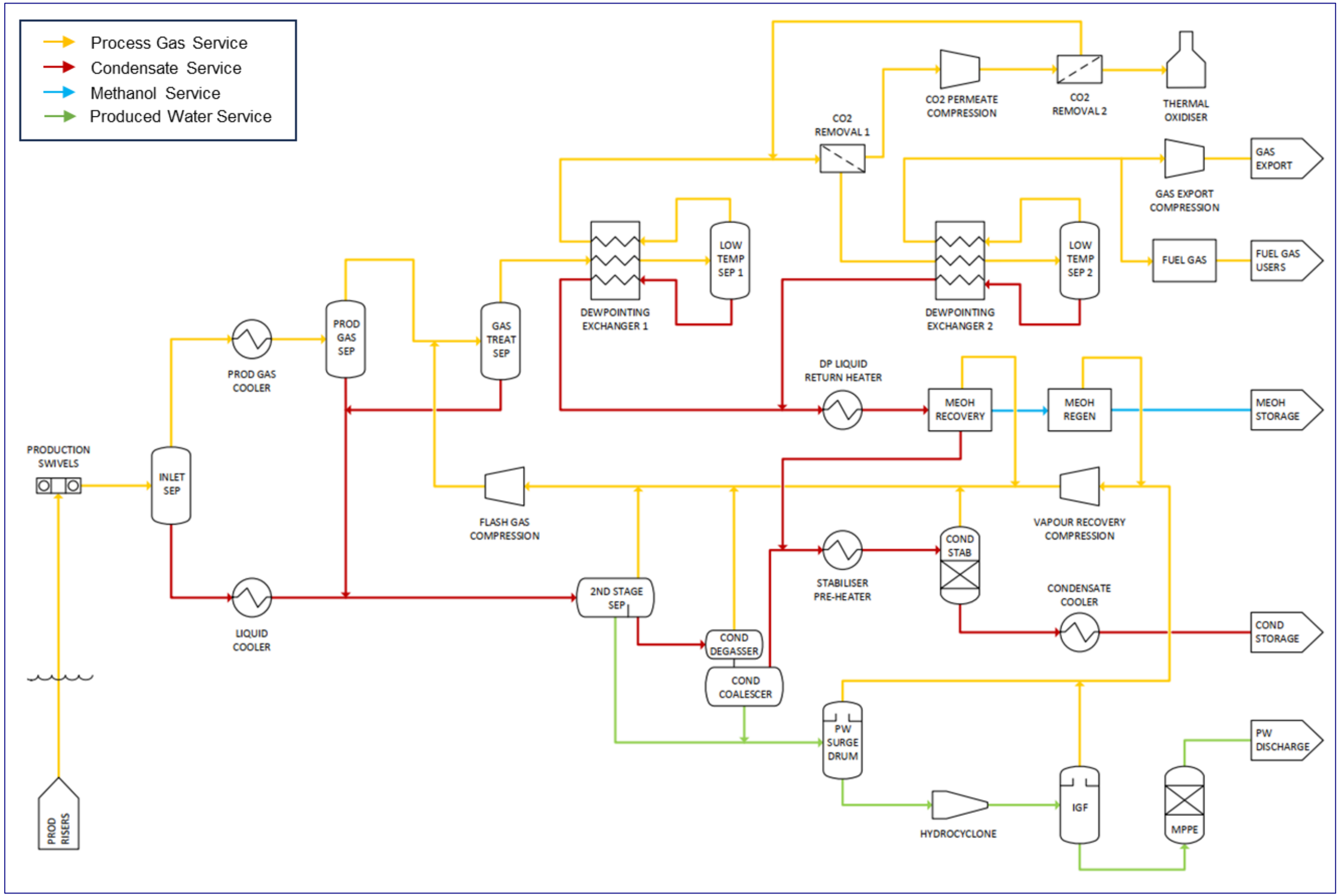


Figure 2-13: FPSO Process Block Flow Diagram

2.7.2.1 Condensate Separation, Degassing, Coalescing and Stabilisation

The inlet separation system is designed to function as the first separation of production fluids into vapour, condensate and water phases that will be further treated in respective downstream systems.

Gas, after being cooled against the cooling medium in the condensate stabiliser overhead cooler, can flow to the flash gas compressor and on to subsequent gas processing.

Stabilised condensate stored in the condensate storage tanks in the FPSO hull is periodically offloaded to an offtake tanker (refer Section 2.7.4.1).

The PW and any residual production chemicals (refer Section 2.7.3.8.2) are sent to the PW treatment and disposal unit (refer Section 2.7.2.6) before being discharged overboard.

The primary PW treatment system (a hydrocyclone followed by induced gas floatation (IGF)) provides bulk dispersed oil removal and partial dissolved oil and mercury removal (in the IGF).

The tertiary PW treatment system (Macro-Porous Polymer Extraction (MPPE) provides dissolved oil removal and dispersed oil polishing. Dissolved and dispersed components that will be removed from the water stream include:

- aromatic hydrocarbons benzene, toluene, ethyl-benzene and xylenes (BTEX)
- polyaromatic hydrocarbons (PAH's)
- naphthalenes, phenanthrenes, dibenzothiophenes
- aliphatic hydrocarbons; dispersed oil
- hydrophobic parts of corrosion, scale and hydrate inhibitors and H_2S scavengers.

Flashed gas streams are recompressed by a vapour recovery system and flash gas compressor, then reinjected to the inlet separation facilities.

2.7.2.2 Gas Treatment System

Separated gas will be conditioned further, including:

- dewpointing and mercury decanting (Section 2.7.2.2.1)
- carbon dioxide (CO_2) and hydrogen sulphide (H_2S) removal (Section 2.7.2.2.2).

Gas meeting the gas export specification is compressed and exported via the production turret, export risers, riser base manifold and into the Barossa GEP for delivery to DLNG facility.

2.7.2.2.1 Dewpointing and Mercury Decanting

The gas is dewpointed to achieve the project gas export water and hydrocarbon dewpoint specification.

The design basis for mercury in the full well-stream is 500 ppb (weight) with the mercury removal from gas stream by low-temperature separation followed by decanting. Management of mercury waste decanted from this system is described in Section 2.7.3.9.

Methanol is used for hydrate inhibition during the low-temperature gas dewpointing process (refer to Section 2.7.3.8.2). A methanol recovery and regeneration system is incorporated into the FPSO design to minimise loss (via the PW treatment system) and consumption of methanol.

2.7.2.2.2 Carbon Dioxide and Hydrogen Sulphide Removal

The Barossa gas field has a CO_2 content of approximately 18% across the field. Before the DLNG facility can process the Barossa gas, it needs to be processed offshore, by removing CO_2 down to a CO_2 content of approximately 6%. CO_2 content of the Barossa gas is reduced via a two stage membrane system, removing CO_2 and H_2S to produce a waste gas stream with a high CO_2 content, called the permeate stream. Two stages of CO_2 removal membrane with interstage compression is utilised to minimise the loss of product CH_4 to the final permeate stream

The final permeate stream is sent to the thermal oxidiser for oxidation of remaining CH_4 (designed to convert up to ~99.9% CH_4 content to CO_2) and H_2S (designed to convert up to ~99.9% H_2S content to SO_2), which significantly reduces the overall carbon dioxide equivalents (CO_2-e) in the stream emitted to the atmosphere. Emissions from the thermal oxidiser will predominantly be comprised of CO_2 with a negligible amount of SO2. The thermal oxidiser is planned to be operational at all times during normal operations and would only be non-operational during planned shutdowns or upset conditions. Should the thermal oxidiser be non-operational, the final CO_2 rich permeate stream will instead be diverted to the acid gas flare, enriched by the addition of fuel gas to enable flame oxidation. Although the destruction efficiency of the acid gas flare (with typical target

combustion efficiency of >98%) is less than that of the thermal oxidiser resulting in marginally higher CH_4 and H_2S emissions, and the additional fuel gas assisting flame oxidation contributes in this mode to overall emissions, this is not considered to be significant given the CO_2 permeate stream would only be diverted to the acid gas flare during upset conditions. The time required to restart the thermal oxidiser following an outage is expected to take anywhere from one to several days depending on the complexity of the outage cause and/or resolution.

Fuel gas is sourced from the second-stage dewpointing heat exchangers and used as the primary fuel supply on the FPSO (see Section 2.7.3.1).

2.7.2.3 Vapour Recovery Unit

Cargo blanket gas and other low-pressure gas recovered from process units, such as from produced water treatment, LP flare and off-gas from methanol regeneration are recovered back into the process via the VRU. During normal FPSO operation, the recovered hydrocarbon gas is directed back to the topsides process instead of flaring. During cargo tank loading, this also includes recovering fuel gas used for tank blanketing. When the VRU is not available, blanketing gas is flared during cargo tank loading. This unplanned event can be caused by a system trip, resulting in the VRU offline for a number of hours before restarting. The vapour recovery unit includes two by 100% sparing to provide redundancy in the event of unpanned outages and to optimise restart duration.

2.7.2.4 Gas Flare System

The FPSO includes a flare stack, which is 145 m high from the deck, for safe disposal of gaseous hydrocarbons, which incorporates an open high pressure (HP) flare tip, a closed low pressure (LP) normally unlit flare tip and an acid gas flare tip.

The FPSO design has incorporated a vapour recovery system that captures continuous or intermittent LP hydrocarbon gas streams, which would otherwise be sent to the LP flare, and recycles this gas back into the process to reduce flaring. Under normal operations, no hydrocarbon streams are sent to the LP flare tip for disposal. Should LP flaring be required (for example, in the event of vapour recovery compressor trips), the fast-acting ignition system will light the pilots to ensure the flared gas is adequately combusted. The inclusion of a vapour recovery system plus a normally unlit LP flare with a nitrogen purge to the flare stack represents best practice and reduces the flaring emissions over comparable facilities in the region.

The HP flare pilot will be continuously lit and purged with fuel gas. HP flaring will be intermittent as required during periods of planned start-up or shutdown (approximately every 4 years). Unplanned HP flaring durations in the order of hours can occur following unplanned equipment failures or during maintenance outages, and for safe management of potential over pressurization or emergency situations (including subsea insulate and blowdown).

When operational, emissions from the LP and HP flares, will comprise greenhouse gases (CO_2) and atmospheric emissions (sulphur oxides (SO_X), nitrogen oxides (NO_X) and volatile organic compounds (VOCs)). The HP flare tip is a multi-point sonic type and the LP flare tip is an open pipe type (high velocity, low smoke), both having a targeted combustion efficiency of at least 98%.

An acid gas flare is present if the thermal oxidiser is offline due to an unplanned outage, as a backup to oxidise the hydrocarbon content in the CO_2 permeate stream. The thermal oxidiser unit design reliability is 99.6% under normal operating conditions and would only be non-operational during planned shutdowns or upset conditions. The acid gas flare would process the CO_2 permeate stream for the time it takes to restart the thermal oxidiser following an outage, which is expected to take anywhere from one to several days depending on the complexity of the outage cause and/or resolution. Refer to 2.7.2.2.2 for a description of emissions from the acid gas flare. The acid gas flare is normally unlit and will be lit when required (similar to LP flare).

The LP flare and acid gas flare share the same common pilots which are normally unlit and the individual non-flowing flare stacks are maintained nitrogen purged. The closed LP flare header is purged with fuel gas which is then recovered by the VRU.

All flare tips are designed to be smokeless (Ringelmann 1 at design rates); however, the LP flare will emit smoke (up to Ringelmann 4) if the vapour recovery unit is offline, which is expected to be an infrequent event. The HP flare will also emit smoke (up to Ringelmann 4) from flaring the relatively low flow condensate stabiliser overheads stream if neither of the two flash gas compressors is online, which should be a limited duration event.

The high energy ignition system is configured so that if an unlit flare pilot is detected (by ionisation rod and duplex thermocouple), the system will automatically attempt to re-light that pilot for up to two minutes. If it remains unlit after this time, the reignition sequence will be terminated and alarm raised. Operator will then attempt to identify failure and ignite using the high energy ignition system manually. Flame front generator is

available as a standby alternative should the high energy ignition fail. CCTV is available to monitor flare and flare pilots as required.

In the event of flare flame-out from HP flare, LP flare and acid gas flare there is no impairment of the FPSO topsides.

Flare monitoring systems during steady state operations are described in Section 8.4.3.3.3.

2.7.2.5 Compression

All of the process compression power requirement on the FPSO is electric motor driven. The electric power needs are provided by a combined cycle power generation plant comprising five gas turbine generators integrated with a steam turbine generator (see Section 2.7.3.1) The installed capacity provides for the anticipated future inlet LP compression power demand.

The main compressors are fixed speed machines given the expected flat export profile and consist of:

- three parallel (3 x 33%), two-stage export gas compressors (17 MW rated motor drives) that compress the gas for export to the GEP.
- three parallel (3 x 33%), two-stage permeate gas compressors (13 MW rated motor drives) that compress the Stage one CO_2 removal membranes permeate gas stream to feed Stage two CO_2 removal membranes for maximizing hydrocarbon recovery from the final permeate.
- two (2 x 100%), two-stage flash gas compressors (5.5 MW rated motor drives) to recover lower pressure flash gas streams for reprocessing with the feed to the gas treatment trains.

The VRU comprises two (2 x 100%), three-stage compressors that recompress very low-pressure streams such as cargo tank blanket gas and another low-pressure gas recovered from process units, such as produced water treatment, closed LP flare and off specification gas from methanol regeneration unit, to feed into the flash gas compressor to allow reprocessing.

As noted above, each compression system has in-built redundancy with two or three motors per system that allows compression rates to be maintained if a compressor motor is offline.

Compression trains are isolatable for maintenance. For both the permeate and gas export compressors, the requirement to isolate trains will result in a reduction in compression rates (33% per train) and this will require well production rates to be reduced to prevent flaring during maintenance. There will be no impact to compression rates during maintenance on the single flash gas compressor (2 x 100%).

The production separator operates in HP mode during early field life, before reducing to a LP mode in mid field life and ultimately a low-low-pressure (LLP) mode in late field life. To accommodate future LP modes, provision has been made for the future installation of three parallel, two-stage Inlet LP Compressors (17 MW rated motor drives) that compress the gas to plant HP inlet pressure. Following an initial increase due to additional fuel requirement to generate the power for Inlet LP compression, operation in LP or LLP modes would result in a progressive reduction in greenhouse gas (GHG) emissions as the production comes off plateau through the latter stages of the field life. Refer to Section 6.3.2.1 for annual emissions over the life of the Activity.

2.7.2.6 Produced Water Treatment and Discharge System

Produced water (PW), consisting of both condensed and formation water, will be produced by the FPSO. While produced water treatment is performed before discharge, the discharge stream may contain residual inorganic (such as production chemicals) and organic (such as oil) contaminants, and low levels of elemental mercury.

The PW treatment and discharge system is designed to separate liquid hydrocarbons (condensate) from water that is brought to the surface from the production wells and handle chemicals added in the production process. The system uses several techniques to stabilise the fluid and separate oil-in-water (OIW) before sending any returning condensate back to the process treatment system.

The PW treatment and discharge system consists of multiple stages of de-oiling, solids removal and pumping equipment. The system consists of a:

- produced water surge drum
- hydrocyclone
- floatation vessel (induced gas flotation unit)
- tertiary produced water treatment unit – macro-porous polymer extraction (MPPE).

The hydrocyclone provides bulk dispersed liquid hydrocarbons (condensate) removal by a centrifugal process, based on the difference in the specific gravity of oil and water. Hydrocyclones are considered the best available technology for bulk dispersed oil removal; however, dissolved oil is not removed.

After the hydrocyclone, an induced gas flotation (IGF) unit provides additional dispersed oil removal, and partial dissolved oil and mercury removal. Fuel gas is induced into the floatation vessel and finely distributed in the PW. The gas strips oil droplets and solids from the PW stream, which are subsequently skimmed. Should mercury be removed by the IGF as a vapour, it would be recirculated and emitted through gas turbine generators.

After the IGF unit, PW is directed to the MPPE system for tertiary treatment. MPPE is considered the best available technology for PW treatment. MPPE provides a high degree of dispersed and dissolved oil removal and can achieve less than 30 mg/L in the PW discharge stream (the upper specification limit of OIW will be 25 mg/L and the average OIW concentration is expected to be 8 mg/L). MPPE is also designed to achieve a concentration of less than 10 ppbw mercury in the discharge stream (based on mercury of 25 ppbw in the feed stream) and has an expected level of mercury removal performance of better than 80% during steady state operations and better than 60% during the start-up period. PW is directed through columns packed with MPPE media. An extraction fluid, immobilised in the media, extracts hydrocarbons from the water phase. The MPPE system includes preventative measures to protect against the release of MPPE media (polymer beads) overboard. Spent media is returned to the supplier for reuse or recycling.

Figure 2-14 presents a block flow diagram depicting the PW process flow through the primary and tertiary PW treatment systems.

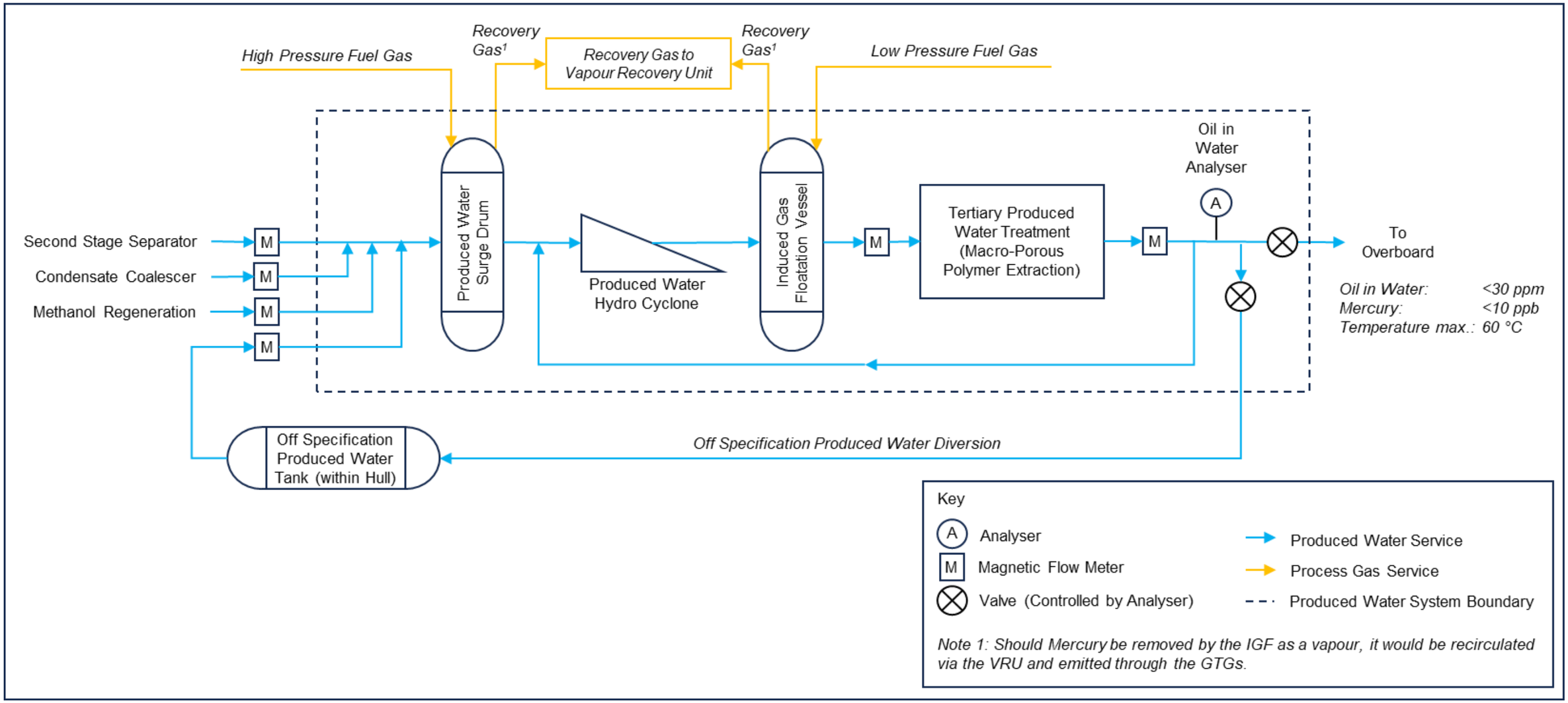


Figure 2-14: Produced Water System Process Flow Diagram

2.7.2.6.1 Produced Water Discharge

The PW passes through an online OIW analyser downstream of the tertiary water treatment (MPPE system), which provides continuous monitoring of volume, total petroleum hydrocarbons and temperature. The PW exiting the tertiary treatment will be discharged to the sea at a temperature below 60 °C.

There is a manual sampling point located prior to the PW treatment system and prior to PW discharge overboard to facilitate the collection of samples for laboratory analysis of the PW stream and verification of the online OIW analyser at appropriate frequencies (see Section 0 and Appendix I). Samples will also be taken to determine the mercury content within produced water to enable performance targets and limits for mercury content to be measured against.

If PW meets the PW discharge specification limits (detailed in Figure 2-14 and Section 0), it is discharged to the sea through the PW discharge caisson, which is 10 m below the sea surface (measured from the minimum draft). If the OIW and mercury content does not meet the PW discharge specifications, it is diverted (automatically in the case of OIW) to the PW off-specification storage tank, which has a capacity of 26,256 m^3 (100% capacity) in the FPSO hull. Off specification PW will then be routed back to the PW treatment and discharge system via off-specification PW transfer pumps.

The PW treatment and discharge system is designed to a maximum processing rate of 3,014 m^3/d (20,000 bbls/d).

Further details are provided in Section 0 about the discharge of PW to the marine environment from the FPSO, including discharge volumes, measurement and controls in place to minimise environmental impact of the PW discharge to ALARP and acceptable levels.

2.7.3 Floating Production, Storage and Offloading Facility Ancillary Systems

Ancillary systems on the FPSO support operations include:

- power generation and distribution
- process cooling and heating, including waste heat recovery
- lighting
- nitrogen and inert gas system
- fresh and potable water production
- ballast system
- drainage system
- chemicals
- waste storage and disposal
- fire and gas detection and fire-fighting equipment
- putrescible waste and sewage treatment.

2.7.3.1 Power Generation

Main power generation is supplied using a combined cycle power generation plant (CCPGP) comprising:

- 5 x 25% Gas Turbine Generators Packages (GTG) 34.23MW each
- 5 x 25% Waste Heat Recovery Units (WHRU)
- 5 x 25% Once-Through Steam Generator (OTSG) Packages
- 1 x 100% Steam Turbine Generator (STG) 29MW

Not listed are balance of plant items including boiler feed water pumps, steam turbine condenser and condensate polishing system.

The design of the CCPGP optimises fuel gas usage and reduces emissions by utilising waste thermal energy to raise steam. This reduces the electrical power demand on the GTGs by relying on generated electrical power from the STG. When online, the STG provides sufficient power to remove the need to operate an additional GTG.

WHRU are provided to recover heat from the GTG exhaust to meet topsides heating demand such as Condensate Stabiliser Reboiler, Methanol Regeneration Reboiler and the Fuel Gas Superheater.

The FPSO power and heat production system provides improved emissions performance for GHG and NO_X emissions. It is considered best available technology for FPSOs in Australian waters for GHG and NO_X emissions. Each gas turbine generator is expected to achieve 100% methane destruction efficiency, and combustion efficiency ranges up to 39% depending on loading.

There are four fuel gas sources available to the power generation and other fuel gas users:

- Water and C5+ dewpointed gas, export specifications, from downstream of dewpointing stage 2 exchangers which is the primary source of fuel. When removing CO_2 onboard the FPSO the gas will contain 6mol% CO_2 and 15 ppmv H_2S. During future export operating scenario, this gas will contain up to 20mol% CO_2, up to 60ppmv H_2S and approx.10ppb (wt) mercury.
- Water dewpointed gas to export water specification from upstream of the dewpointing stage 2 exchangers. This is a secondary back up fuel used in an upset scenario. It will have a similar level of contaminant as the export quality gas.
- Gas from Gas Treatment Separator. This is a wet gas source which is neither water or hydrocarbon dewpointed and upstream of any gas treatment. This source will contain up to 20mol% CO_2, up to 60ppmv H_2S and approx. 600ppb (wt) mercury. This source will be used as a start-up gas to minimise liquid fuel usage.
- Import gas, available by reverse flowing the gas export pipeline to either minimise liquid fuel use or repressure the topsides

In the event of loss of a reliable fuel gas supply, the system senses the fuel gas pressure drop and initiates fuel changeover to enable rapid, controlled switching automatically from fuel gas to marine gas oil (MGO), without triggering a main power blackout.

A MGO fuel system provides backup fuel supply for emergency duties, firewater pumps and inert gas generation (backup blanketing gas when the primary blanketing gas (LP fuel gas) is unavailable). The MGO fuel system is generally not running and will only be operated either during upset conditions – such as loss of main power generation, loss of hydrocarbons (for primary blanketing gas, requiring inert gas as a backup), emergency shutdown, or for testing purposes.

The various fuel gas sources and liquid fuel will result in a variance in performance of the GTG's. The efficiency of the GTG's is further impacted by load and ambient temperature.

Table 2-20 provides detail on the generation sources online during the normal operating scenarios.

Table 2-20: Power Generation Configuration During Normal Operating Scenarios

Description	HP Production	HP Production + Offloading	LP Production	LP Production + Offloading
GTG – Gas Turbine Generator @ 31°C	3	3	4	4
STG – Steam Turbine Generator	1	1	1	1

In the event of a trip of one GTG the remaining GTG and STG will provide power to the switchboard. Load shedding will prevent remaining generators from tripping on overload. This will maintain production at a reduced level. In each scenario an additional GTG will be available on cold stand-by for immediate start.

Water condensate is used in a closed loop that is fed into the once-through-steam-generator, which produces steam to power the steam turbine generator before it returns to liquid via a steam condenser. Ammonia is dosed to a maximum concentration of 2ppm (typically 0.1ppm for normal mode of oxygenated treatment program) into the closed loop circulating high purity steam condensate system. Draining for sampling or rinsing is intermittent and limited, collected in the non-hazardous open drain and stored in the slops tanks where they are further diluted before discharge via the hull slops treatment system. Furthermore, some steam containing low levels of ammonia is drained prior to joining the returning seawater flow from the surface condenser.

Battery backup systems are installed to provide emergency power supply to a number of safety-critical systems.

2.7.3.2 Process Cooling and Heating

2.7.3.2.1 Cooling Medium

The cooling system on the FPSO uses treated freshwater in a closed loop system that is cooled by open loop seawater in a seawater and cooling medium exchanger.

Closed loop freshwater cooling systems are used for process cooling.

Seawater is extracted at a depth of 70 m, through flexible hoses with 15mm mesh screens This takes advantage of the cooler water at depth, increasing the efficiency of the cooling system. The seawater used in the cooling system is continuously discharged from the FPSO. The combined discharge rate will vary depending on operational requirements.

The marine growth prevention system (MGPS) is provided for the purpose of controlling bio-fouling within the marine seawater system that may impair operation of the cooling system. The design of the MGPS takes into account the specific metocean data including criteria for marine growth applicable at the Barossa field location. Hypochlorite is injected to prevent biofouling from marine growth and the unit is designed to provide a residual chlorine concentration less than or equal to 0.5 ppm at the point of discharge. The seawater system uses Seacell feed pumps (pumps) to generate hypochlorite in exit stream. The feed flow to each pump is measured by individual flow transmitters and therefore the feed water flow to individual pumps is controlled at 50% capacity during normal operation. The amount of sodium hypochlorite produced is determined by the amount of electrical current applied to the pumps and sodium chloride content in the feed water. By controlling the amount of feed water flow to the pumps, the amount of sodium hypochlorite produced is controlled. The final amount of sodium hypochlorite in seawater flow discharged overboard based on combination of the either seawater lift pump flow or sodium hypochlorite flow. Cooling water is discharged two metres (at minimum draft) below the surface via a cooling water discharge caisson and the steam turbine generator condenser discharge caisson.

2.7.3.2.2 Heating Medium and Waste Heat Recovery

The heating medium is a closed loop system using freshwater with chemicals added to control corrosion, scavenge for oxygen and maintain a suitable acidity level (pH) for materials of construction. The heat source is the waste heat recovery unit, as part of the FPSO power and heat production system (refer Section 2.7.3.1). The main users of heating medium are methanol reboiler, fuel gas superheater, stabiliser pre-heater, stabiliser reboiler, dew pointing liquid return heater, and depressurisation and start-up heater.

2.7.3.3 Lighting

Lighting is used to safely illuminate the FPSO work, accommodation areas and other vessels during bunkering and supply activities. Lighting is kept on 24 hours a day for safety and navigational purposes in accordance with requirements of the *Navigation Act 1912* and relevant Marine Orders.

The FPSO central battery system (CBS) lighting system involves a centralised lighting system using light-emitting diode (LED) lighting powered by battery, in the form of an uninterruptible power supply capable of supplying escape lighting for 90 minutes, with a digital addressable lighting interface system for controlling and monitoring the light (refer Section 6.2).

Lighting is designed to provide effective lighting to maintain a safe working area, to allow personnel to move safely around the FPSO, and to enable start-up, inspection and testing. The FPSO design considered minimising light spill while meeting personnel safety minimum requirements.

2.7.3.4 Inert gas

2.7.3.4.1 Tank Blanketing

Fuel gas (LP fuel gas) is provided on the FPSO for blanketing the cargo and slops tanks. A vapour recovery unit is provided to recover hydrocarbon gas, back to the topsides process during normal FPSO operation. This reduces emissions by capturing hydrocarbons that would otherwise be flared or vented.

An inert gas generator is provided on the FPSO for:

- backing-up blanketing gas when the primary blanketing gas (LP fuel gas) is unavailable
- returning tanks to service after maintenance works
- purging cargo tanks before maintenance, or to ballast tanks, voids, and cofferdams under emergency conditions; for example, should hydrocarbon gas be detected in these compartments.

Inert gas is produced by burning MGO, which is an infrequent, intermittent activity.

During cargo tank loading, hydrocarbon gas is used for tank blanketing and is recovered through the VRU. The inert gas generator cooling water (seawater) is intermittently discharged during start-up and cargo tank inspections.

2.7.3.4.2 Nitrogen System

There is a membrane-based nitrogen generation system onboard the FPSO to provide a source of nitrogen for purging of equipment under maintenance, inert gas blanketing, separation gas for compressor dry gas seals and other uses.

2.7.3.5 Freshwater Production

Fresh water is generated at the FPSO for both process and utility requirements via a vacuum vapour compression (VVC) desalination system. VVC uses a distillation process, where evaporation of seawater is obtained by applying heat delivered by compressed vapour. A byproduct of the desalination system is brine discharge, which has an average salt concentration of approximately twice the initial concentration of seawater.

Part of the fresh water is subsequently treated further to be used as potable water. The potable water is sent through an ultraviolet steriliser and chlorination dosing unit before distribution to users.

2.7.3.6 Ballast System

The ballast system provides reliable facilities for ballast water distribution on the FPSO during normal operations, abnormal operations and emergency situations. It is used to ensure stability, heel, trim and draft, and hull stresses do not exceed the design strength criteria.

The ballast system is completely segregated from the cargo, diesel fuel or other non-hazardous ballast systems and permanently allocated to carrying ballast water.

The wing water ballast tanks are arranged throughout the entire length of the cargo tanks, reducing the risk of breaching the cargo tanks (and potential for hydrocarbon release) if the FPSO hull is damaged due to collision.

MGPS in the ballast system is provided by a hypochlorite dosing unit for periodical injection of hypochlorite near the ballast water inlet sea tubes, when the ballast water pumps are running. The unit is designed to provide a residual chlorine concentration less than or equal to 0.5 ppm at the point of discharge. Discharges from the ballast system would occur periodically during ballast water exchange operation when there is release of internal ballast water to sea or intake of seawater depending on ballast water distribution requirements.

2.7.3.7 Drainage System

The FPSO has a closed and open drainage system for collecting, handling and treating drainage from the open deck and from topsides processing equipment, respectively.

The FPSO main deck directs deck water to the slops tank (Section 2.7.3.7.1). A coaming is in place to minimise potential for spillage of drainage water overboard. The drains system for the helideck will direct any unplanned heli fuel releases and firewater directly overboard, due to safety reasons.

2.7.3.7.1 Slops System

The FPSO has two slops tanks: a dirty slops tank and a clean slops tank. Hazardous open drains go to the dirty slops tank while non-hazardous open drains go to the clean slops tank.

The slops water treatment system consists of a hydrocyclone for bulk oil removal, followed by a coalescer for polishing the drainage water. An OIW analyser has been incorporated for the slops tank outlet prior to discharge to sea, with automatic diversion back to the slops system for retreatment if the design limit is exceeded (15 ppm). As such, no open drains effluent is discharged unless it meets the specification. Should OIW exceed 15 ppm, the off-specification slops water will be recirculated back into the slops tank for storage prior to re-treatment.

2.7.3.7.2 Open Drain System

The open drain system consists of bunding, drip trays, drain pots and boxes, fire seals, piping and valves, pumps and collection tanks for collecting and safely disposing of rainwater, firewater, deck wash, spills and leaks.

The open drains consist of non-hazardous and hazardous drainage systems, specifically:

- hazardous drain, with a dedicated header to collect drainage from hazardous modules and areas. The header is routed via a hazardous open drain tank before going into the dirty slops tank
- non-hazardous drain, with a dedicated header to collect drainage from non-hazardous modules and areas. The header is routed via a non-hazardous open drain tank before going into the clean slops tank
- hazardous pumped drain, with a dedicated header to collect discharges from open drain transfer pumps.

All drainage water from the open drains system is sent to the slops tanks and allowed to settle for initial gravity-based separation of oil residues and water.

2.7.3.7.3 Closed Drain System

The closed drain system is designed to collect hydrocarbon liquids drained from pressurised topsides equipment. Closed drains go to the second stage separator for reprocessing, with the PW or FPSO cargo off-specification storage tanks used as a back-up.

2.7.3.7.4 Bilges

The FPSO bilge system consists of scupper drains to drain oily water from engine room equipment and tank drip trays. Oily water that collects in the bilge wells is pumped to the bilge holding tank, which is periodically pumped to the dirty slops tank.

2.7.3.8 Chemicals

2.7.3.8.1 HUC Phase chemicals

The estimated maximum volume and storage location of chemicals present on the FPSO during the HUC phase are detailed in Table 2-21.

Table 2-21: HUC Phase chemicals

Inventory	Location	Maximum Volume (m^3)
MGO	Storage tanks in engine room	9,137
Helifuel	Module M50	16
Water clarifier, oxygen scavenger, scale inhibitor, sodium hypochlorite, corrosion inhibitor, ammonia and pH Buffer (if required)	Chemical Injection Package (M71) Seawater Anti-Fouling Generation Package (M50) Balance of Plant (M92)	Variable
Methanol (stored)	Hull lean and rich methanol tanks	16,657
MEG	Hull storage tank	6,247
Gas cylinders – oxygen / acetylene	Oxygen and acetylene rooms	Variable
Propane bottles	Flare area for flare pilot ignition and contingency fuel for GTG startup	Variable
Lube oils / hydraulic oils	Within equipment packages / HPUs	Variable
Paints, coatings, adhesives, degreasers, detergents	Paint / chemical store	Variable
Refrigerant gas (R134a)	HVAC systems Engine Casing	300kg

2.7.3.8.2 Production Chemicals

Various production chemicals are injected in the FPSO topsides and subsea systems. Typically, these include biocide, water clarifier, oxygen scavenger, scale inhibitor, sodium hypochlorite and corrosion inhibitor, which will pass into the PW treatment and disposal unit (refer Section 2.7.2.6) and be discharged with the PW.

Bulk chemicals are delivered to the FPSO in transportable containers (such as intermediate bulk containers approximately 3 m^3 volume) by support vessels. The transportable containers are lifted onto the topsides and stored in bunded laydown areas. Chemicals are transferred from containers, as required, to the FPSO storage tanks (Table 2-18) through dedicated transfer lines. The chemicals are pumped from the storage tanks to injection points by injection pumps.

Ammonia solution, with a concentration of approximately 15%, will be delivered in an IBC and transferred via ammonia unloading pump to the 1000 L ammonia container installed on the ammonia dosing skid. It is then transferred to a dilution tank for dilution to 1.5% prior to injection to maintain acidity control of the condensed water used in the combined cycle power plant (refer Section 2.7.3.1).

For topsides hydrate management, methanol is bunkered to the FPSO. Methanol storage tanks are provided in the FPSO hull (Table 2-18), one for lean methanol with 6,179 m^3 (98% of methanol storage tank capacity) and the other for rich methanol with 10,324 m^3 (98% of methanol storage tank capacity), in order to meet 21 days' capacity, assuming abnormal operation where topsides methanol regeneration is not operational. A methanol regeneration system is incorporated into the FPSO design. Trace methanol will pass into the PW treatment and disposal unit (refer Section 2.7.2.6) and be discharged with the PW.

MEG is bunkered to the FPSO. One lean MEG tank is located in the FPSO hull, with 6,179 m³ (98% of lean MEG storage tank capacity). MEG is injected into subsea infrastructure for hydrate inhibition during well start-up and shutdown, along with well testing activities.

The Activity uses an insulate and blowdown philosophy following unplanned shutdowns, which involves subsea injection of MEG in addition to flaring during shutdown (as required) and start-up, to warm the flowlines to prevent hydrate formation. MEG is not recovered and will pass through into the PW treatment and disposal unit and be discharged with the PW.

Other production chemicals may be used as required and will be selected in accordance with the Santos chemical assessment process (refer Section 2.7.3.8.4) and managed at the FPSO.

2.7.3.8.3 Other Chemicals

The maximum volume and storage location of other chemicals associated with FPSO operations are provided in Table 2-18 and Figure 2-12.

During operation, mean volumes for MGO, MEG and methanol would be much lower than the maximum storage volumes presented in Table 2-22.

Table 2-22: Operations Phase chemicals

Inventory	Location	Maximum Volume (m^3)
MGO	Storage tanks in engine room	9,137
Helifuel	Module M50	16
Biocide, water clarifier, oxygen scavenger, scale inhibitor, sodium hypochlorite, corrosion inhibitor, ammonia	Chemical Injection Package (Module M71) Seawater Anti-Fouling Generation Package (Module M50) Power generation package (Modules M90 & M91) Balance of Plant (Module M92)	Variable
Methanol (stored)	Hull lean and rich methanol tanks	16,657
MEG	Hull storage tank	6,247
Oxygen / acetylene cylinders	Oxygen and acetylene rooms	Variable
Propane cylinders	Flare area for flare pilot ignition Module M90/91 (gas turbines)	Variable
Lube oils / hydraulic oils	Within equipment packages / HPUs	Variable
Paints, coatings, adhesives, degreasers, detergents	Oil / grease store	Variable
Firefighting foam (non-persistent and PFAS/PFOS free free)	Firefighting systems	Variable
Refrigerant gas (R134a)	HVAC systems Engine Casing	300kg
Calibration Gas	Module M61 (Metering skid)	Variable

Radioactive sources are encased in fixed density gauges onboard the vessel (inside the separators).

Laboratory chemicals are used in low quantities and stored in the laboratory. Laboratory chemicals are sent onshore for disposal.

Chemicals will be selected in accordance with the Santos chemical assessment process (refer Section 2.7.3.8.4) and managed at the FPSO.

2.7.3.8.4 Chemical Assessments

A risk-based approach to select chemical products ranked under the Offshore Chemical Notification Scheme (OCNS) is applied to those chemicals used and discharged to the marine environment. This scheme lists and ranks all chemicals used in exploration, exploitation and associated offshore processing of petroleum on the United Kingdom Continental Shelf. Chemicals are ranked according to their calculated hazard quotients (HQ) by the chemical hazard assessment and risk management (CHARM) mathematical model, which uses aquatic toxicity, biodegradation and bioaccumulation data (CHARM Implementation Network, 2005). The HQ is

converted to a colour banding, with gold and silver colour bands representing the least environmentally hazardous chemicals.

Table 2-23: OCNS chemical hazard and risk management hazard quotient ranking

Minimum HQ value	Maximum HQ value	Colour banding	Hazard
>0	<1	Gold	Lowest
≥1	<30	Silver	
≥30	<100	White	
≥100	<300	Blue	
≥300	<1,000	Orange	
≥1,000		Purple	Highest

Chemicals not amenable to the CHARM model (i.e. inorganic substances, hydraulic fluids or chemicals used only in pipelines) are assigned an OCNS grouping based on the worst-case ecotoxicity data, with Group E and D representing the least hazard potential (Table 2-24).

Table 2-24: Initial Offshore Chemical Notification Scheme grouping

Initial grouping	A	B	C	D	E
Result for aquatic-toxicity data (ppm)	<1	≥1 to 10	>10 to 100	>100 to 1000	>1,000
Result for sediment-toxicity data (ppm)	<10	≥10 to 100	>100 to 1000	>1000 to 10,000	>10,000

Note: Aquatic toxicity refers to the Skeletonema costatum EC_{50}, Acartia tonsa LC_{50}, and Scophthalmus maximus (juvenile turbot) LC_{50} toxicity tests. Sediment toxicity refers to the Corophium volutator LC_{50} test.
Source: Centre for Environment, Fisheries, Aquaculture Science (CEFAS), 2022

Subsea chemicals accepted are CHARM ranked Gold/Silver, or non-CHARM ranked E/D chemicals for use and discharge without a detailed environmental risk assessment. The same applies to chemicals that are on the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) Pose Little or No Risk to the Environment (PLONOR) List. The PLONOR List, agreed upon by the OSPAR Convention, contains a list of substances that will pose little or no risk to the environment in offshore waters. If chemicals do not have a CHARM/non-CHARM ranking under the OCNS, chemicals are assigned a pseudo-ranking on the available aquatic toxicity, biodegradation accumulation data (refer ecotoxicity assessment, biodegradation assessment and bioaccumulation assessment below). A risk assessment, informed by the pseudo-ranking, is conducted for non-OCNS listed chemicals to provide technical justification for their use and to show that their use is assessed for environmental acceptability for discharge to the marine environment.

Ecotoxicity assessment

Table 2-24 and Table 2-25 act as guidance in assessing the ecotoxicity of chemicals during the investigation of potential alternatives. Table 2-24 is used by CEFAS to group a chemical based on ecotoxicity results, with 'A' representing the highest toxicity/risk to environment and 'E' the lowest risk. Table 2-25 shows classifications and categories of toxicity against aquatic toxicity results.

Table 2-25: Acute aquatic species toxicity grouping

Category	Species	LC_{50}, EC_{50} and ErC_{50} criteria
Acute 1 Hazard statement – Very toxic to aquatic life	Fish	LC_{50} (96hr) ≤ 1 mg/L
	Crustacea	EC_{50} (48hr) ≤ 1 mg/L
	Algae, other aquatic plant species	ErC_{50} (72 or 96hr) ≤ 1 mg/L
Acute 2 – Hazard statement – Toxic to aquatic life	Fish	LC_{50} (96hr) >1 mg/L but ≤10 mg/L
	Crustacea	EC_{50} (48hr) >1 mg/L but ≤10 mg/L
	Algae, other aquatic plant species	ErC_{50} (72 or 96hr) >1 mg/L but ≤10 mg/L
Acute 3 – Hazard statement – Harmful to aquatic life	Fish	LC_{50} (96hr) >10 mg/L but ≤100 mg/L
	Crustacea	EC_{50} (48hr) >10 mg/L but ≤100 mg/L
	Algae, other aquatic plant species	ErC_{50} (72 or 96hr) >10 mg/L but ≤100 mg/L

Source: United Nations (2023)

Biodegradation Assessment

The biodegradation of chemicals is assessed using the CEFAS biodegradation criteria, which aligns with the categorisation outlined in the United Nations Globally Harmonised System Annex 9 Guidance on Hazards to the Aquatic Environment (UN, 2023). The below is used as a guide when investigating potential chemical alternatives. CEFAS categorises biodegradation into these groups:

- readily biodegradable: results of >60% biodegradation in 28 days (OECD 306, 301B – F method), >70% in 28 days (OECD 301A, 301E) to an OSPAR harmonised offshore chemical notification format (HOCNF) accepted ready biodegradation protocol
- inherently biodegradable: results of >20% and <60% (<70%) to an OSPAR HOCNF accepted ready biodegradation protocol
- not biodegradable: results from OSPAR HOCNF accepted ready biodegradation protocol or inherent biodegradation protocol are <20%, or half-life derived from aquatic simulation tests indicate persistence.

Bioaccumulation Assessment

The bioaccumulation of chemicals is assessed using the CEFAS bioaccumulation criteria, which aligns with the categorisation outlined in the Globally Harmonised Annex 9 Guidance on Hazards to the Aquatic Environment (UN, 2023). The preference is to select chemicals that are not bioaccumulative.

The guides used by CEFAS are:

- non-bioaccumulative: Log Pow <3, or BCF ≤100, the molecular weight is ≥700
- bioaccumulative: Log Pow ≥3, or BCF >100, the molecular weight is <700, or if the conclusion of a weight-of-evidence expert judgement under OSPAR Agreement 2008-5 is negative.

2.7.3.9 Waste Storage and Disposal

Solid and liquid wastes produced on the FPSO are segregated, stored and transferred to the mainland for final treatment and disposal at licenced waste disposal facilities if they cannot be treated and disposed of through the FPSO systems (such as hydrocarbon wastes and produced water) or onboard disposal systems.

Waste storage includes a range of facilities such as covered waste skips and onboard dedicated holding tanks or drums. Hazardous wastes such as paint wastes, oily rags and mercury-contaminated wastes are segregated from other waste streams. All waste materials offloaded are documented and tracked (Section 8.4.3.1.4, 8.4.3.2.4 and 8.4.3.3.4).

2.7.3.9.1 Putrescible Waste and Sewage Treatment

The volume of putrescible waste (food waste) and sewage is directly proportional to the persons on board (POB) of the FPSO. Putrescible waste and sewage are treated on the FPSO before discharge to the marine environment (refer Section 0). The FPSO includes two 100% sewage treatment systems to provide full operational redundancy.

2.7.3.9.2 Mercury Waste Management

Elemental mercury is naturally present in the Barossa production fluids and will be processed on the FPSO (described in Section 2.7.2). It is not possible to avoid production of mercury, and an export mercury limit is included in the export gas specification requirements to ensure that Barossa gas can be suitably processed by the existing DLNG facilities.

Mercury will be removed from the process gas stream by decanting in order to meet the specifications. This process involves provision of mercury decanting-pots, at the lowest points of the low-temperature separator (LTS) where mercury is known to accumulate, resulting in a relatively pure elemental mercury waste stream for disposal. Most mercury is expected to be removed in the first stage LTS and a very small amount in the second-stage LTS. It is predicted that 99.5% of mercury is removed across the two LTS stages (Genesis Energies, 2021).

Elemental mercury will be transferred from the mercury decanting-pots to specialised International Maritime Dangerous Goods-approved mercury containers (QC80s) of 80 L in size – noting these containers can only be filled to 95% by International Maritime Dangerous Goods requirements, meaning a useable volume of 76 L – by specialist mercury contractors for transporting to shore for treatment and disposal. Based on the 268.1 gram/hour (Basis of Design maximum production rate), each mercury decanting-pot at the first stage mercury collection point would need to be disposed of every five to seven months (based on an approximately mercury production of 4,244 kg/year or 167 L/year). All process wastes will initially be treated as mercury contaminated until demonstrated otherwise.

Samples of maintenance wastes with suspected mercury contamination, will be analysed either at the FPSO laboratory or sent to an onshore laboratory for analysis, as required.

2.7.3.10 Fire and Gas Detection and Firefighting Equipment

Fire and gas detection, foam (for firefighting, non-persistent and perfluoroalkyl and polyfluoroalkyl substances (PFAS) / perfluoro octane sulfonate (PFOS) free) and firefighting systems are available on the FPSO for emergency purposes. Routine and contingency testing of the systems and the foams is undertaken and is critical for emergency response preparedness.

2.7.4 Floating Production, Storage and Offloading Facility Operational Support Activities

2.7.4.1 Offtake Operations

Offtake tankers are third-party vessels. They are vetted against agreed criteria and Oil Companies International Marine Forum Guidelines and in accordance with the Santos Marine Assurance Standard (refer Section 8.3.2.5) before acceptance for offtake operations. A tanker will only be accepted by Santos for offloading if it passes the vetting assessment.

Once accepted for offloading, the tanker must comply with the requirements of the Barossa Terminal Handbook (refer Section 8.3.2.5) which contains procedures that are to be adhered to. It provides information necessary for the safe berthing of the offtake tankers, the safe connection of the floating offtake hose and documentation relating to the transfer of cargo as well as outlining who has responsibility for activities and who has authority. Approach to the facility must first be approved by the Barossa Offshore Installation Manager (OIM) and the Santos Marine Superintendent has authority for the offtake operations.

A support vessel will assist the offtake tanker during the approach, berthing and connection operations as well as in maintaining alignment and a safe distance from the FPSO during mooring. It will always remain connected to the offtake tanker when the offtake tanker is in the PSZ. Daylight berthing is only permitted.

The offtake hose is stored on a hose reel on the port side of the FPSO. The hose has an active emergency release coupling that allows for remote disconnection. Communication checks are performed, and the hose is connected, communication remains continuous between the FPSO and offtake tanker during offloading.

Condensate offtake operations occur depending on production rates (approximately once every three months). Offloading of up to 650,000 bbl or 103,000 m^3 ±5% parcels by tandem arrangement is to occur typically within 24 to 72 hours, although the offtake volumes and durations may vary depending on operational constraints. Offloading is monitored by the FPSO CCR and the offtake tanker CCR. Continuous surveillance and observations will be made including sharing of information regarding volume transferred and received. The support vessel will assist in disconnect.

During offtake operations, seawater may be taken onboard into segregated seawater ballast tanks to maintain FPSO stability and hull stresses within acceptable limits. Offtake tankers will be required to de-ballast during the offtake operations (refer Section 7.2). The use of tankers with double hulls and fully segregated ballast tanks is a requirement of the vetting process as well as a MARPOL requirement that is monitored by way of regular statutory inspections.

Offtake tankers may be fuelled by heavy fuel oil (HFO).

Offtake tanker operations are considered a Petroleum Activity under the Offshore Petroleum and Greenhouse Gas Storage Act and within the scope of this EP when the tanker is under Santos' navigational control in OA1, when the offtake tanker is connected to the FPSO and while undertaking a condensate offtake.

Rates during initial start-up will result in an extended period before the first offload occurs, which isn't expected to occur until after commencement of steady state operations.

2.7.4.2 Refuelling

Marine gas oil (MGO) is bunkered onboard the FPSO from support vessels and stored in diesel tanks located within the FPSO hull.

Jet-A1 is transferred and stored onboard the FPSO in portable tanks (intermediate bulk container (IBC) tote tanks) for refuelling helicopters (maximum volume 16 m^3).

2.7.5 Floating Production, Storage and Offloading Facility Emergency Systems

2.7.5.1 Floating Production, Storage and Offloading Facility Emergency Shutdown

The objective of the emergency shutdown system is to protect personnel, environment and the FPSO from the effects of accidental or uncontrolled hydrocarbon leakages, fires or other incidents requiring emergency shutdown of the FPSO. Depending on the level of emergency shutdown initiated, the safe mode may consist of closing the subsea valves, including subsea isolation valves, wellhead valves and downhole safety valves with a structured hierarchy of main emergency shutdowns. This ranges from full abandon FPSO shutdown to a total process shut down.

2.7.5.2 Emergency Pressure Relief Systems and Blowdown

Emergency pressure relief systems are provided on the FPSO to ensure the pressure in the system does not exceed the design pressure and to eliminate the possibility of loss of containment due to overpressure. The blowdown system ensures the topsides hydrocarbon inventory can be safely relieved to the flare system, either automatically in an emergency or manually as part of operational requirements.

The topside hydrocarbon processing systems have pressure safety valves sized to meet the design requirements. The pressure safety valves are routed to either the HP or LP flare system.

The risers can be individually depressurised manually, promptly following any unplanned shutdown scenario.

2.8 Support and Campaign Vessel Operations

In this EP support and campaign vessels undertaking activities are referred to as vessels. Vessels are vetted to ensure appropriateness for the required activities and typically fall into the two categories of:

- support vessels (Section 2.8.1) – for day-to-day operation and routine IMMR activities
- campaign vessels (Section 2.8.2) – for specific campaign activities, such as hook-up and commissioning and non-routine IMMR including LWI.

No planned anchoring of support and campaign vessels will occur in the OAs for this Activity.

2.8.1 Support Vessels

Support vessels will make regular trips between OA1, and Darwin Port and these activities include:

- transportation of equipment, materials, stores, fuel (MGO) and chemicals to the FPSO.
- backload of any equipment, waste and materials from the FPSO.
- launching ROVs for IMMR activities.
- offtake operations support (Section 2.7.4.1).

Anticipated, typical support vessel parameters are provided in Table 2-26:

Table 2-26: Typical support vessel parameters

Parameter	Description
Draft (typical)	5.2 m (typical)
Gross tonnage	3,708 t
Hull	Steel hull
Fuel type	Marine diesel
Total fuel volume	700 m³
Volume of largest fuel tank	350 m³
Persons on board	6-10

Support vessels will typically be on a dedicated charter servicing the Activity. Support vessels will use dynamic positioning (DP) mode when operating in the OAs.

2.8.2 Campaign vessels

FPSO arrival, hook-up and cold-commissioning activities (Section 2.5) and IMMR activities including environmental monitoring (Section 2.9) may require campaign-specific vessels. These may be chosen specifically for the technical requirements of the work required. Typically, these vessels will be of similar parameters to those shown in Table 2-27.

A temporary 500 m radius exclusion zone will be established around campaign vessels during operations. Campaign vessels are typically locally sourced from the North West Shelf (NWS) region; however, they may be sourced from Southeast (SE) Asia if required. Campaign vessels will use dynamic positioning (DP) mode when operating in the OAs. Other vessels utilised may include LWIV and uncrewed surface vessels (USV) depending on the type of activity required. Environmental monitoring activities would typically be undertaken using smaller vessels.

Table 2-27: Typical campaign vessel parameters

Parameter	Description
Draft (typical)	8 m (typical)
Gross tonnage	8,000
Hull	Steel hull
Fuel type	Marine diesel
Total fuel volume	1,200 m^3
Volume of largest fuel tank	700 m^3
Persons on board	100

2.8.2.1 Light Well Intervention Vessel

A LWIV may be used for riserless well intervention. LWIVs are dynamically positioned subsea support vessels and equipped with a main crane, auxiliary crane, moonpool and ROV hangars, in addition to a helideck and personnel accommodation for approximately 90 persons on board (POB), similar in size to campaign vessels (Table 2-27). The LWIV will use diesel-powered generators for power generation. LWIV refuelling within the Operational Area is not a planned activity.

The LWIV will display navigational lighting and external lighting, as required for safe operations, and will operate on a 24-hour basis. Potable water, primarily for accommodation and associated domestic areas, will be generated on the LWIV using a reverse osmosis (RO) plant. This process will produce brine, which is diluted and discharged to the marine environment. Cooling water may be discharged to the sea also.

The LWIV will also discharge deck drainage from open drainage areas, bilge water from closed drainage areas, putrescible water and treated sewage, and grey waste. Solid hazardous and non-hazardous wastes are transported to shore for disposal.

2.8.2.2 Uncrewed Surface Vessels

Remotely operated uncrewed surface vessels (USV) may be used to support campaign activities, FPSO supply activities and perform work using the launched ROV, as required. The USV may be in field concurrently with other support or campaign vessels, or independently. The USV would be operated remotely by a Vessel Master from a remote operations centre and a support vessel would be available in Darwin should any assistance be required. Figure 2-15 shows a representative large USV, Reach Remote 1 (23.9 m long, 8 m wide). They are typically fitted with lights, radars, an emergency anchor, loudspeaker, night vision, 360º camera, very high frequency (VHF) radio and hold position using DP. Refer to Table 2-28 for typical large USV parameters.

Figure 2-15: Reach Remote, as an example of a representative USV

Table 2-28: Typical large USV parameters

Parameter	Description
Draft (typical)	5.5 m
Gross tonnage	230 t
Volume of largest fuel tank	74 m^3

USVs are regulated by AMSA using the same regulations that are applicable to crewed vessels, given the broad definitions of 'vessel' in the *Navigation Act 2012* and the *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* are very broad. That is, the operator of the vessel has to maintain compliance with AMSA regulations for navigation, surveying and crewing requirements. AMSA's approach policy related to the use of autonomous vessels is available on their website: Autonomous vessels in Australia | Australian Maritime Safety Authority.

2.8.3 Vessel Operations

Vessels are selected and on-boarded in accordance with the Offshore Marine Assurance Procedure to ensure contracted vessels are operated, maintained and crewed in accordance with industry standards (for example, Marine Orders) and regulatory requirements (this EP) and the relevant Santos procedures mentioned in this EP. All required audits and inspections will assess compliance with the laws of the international shipping industry, which include safety and environmental management requirements, and maritime legislation including International Convention for the Prevention of Pollution from Ships 1973 as modified by the Protocol of 1987 (MARPOL) and other IMO standards.

The vessels will display navigational lighting and external lighting, as required for safe operations. Lighting levels will be determined primarily by operational safety and navigational requirements under relevant legislation, specifically the *Navigation Act 2012* and relevant Marine Orders. The vessels will be lit to maintain operational safety on a 24-hour basis.

Operational discharge streams from vessels are in accordance with relevant Marine Orders, and include:

- deck drainage
- macerated food waste and treated sewage
- bilge water
- cooling water
- desalination plant effluent (brine) and backwash water discharge
- ballast water.

Further details about the above discharge streams from campaign vessels including LWIV and USV are included in Section 0.

2.8.4 Helicopter Support

Helicopters are used primarily for crew change and typically operate out of Darwin, with multiple return trips on a weekly basis to the FPSO, depending on operational requirements. Crew changes may also be required during the IMMR scopes (defined in Section 2.9), depending on the scope. Helicopters will be required to refuel on the FPSO.

2.8.5 Unmanned Aerial Vehicle Operations

The exterior of the FPSO may be inspected using unmanned aerial vehicles. Unmanned aerial vehicles may also be used to conduct aerial surveys within the OAs. They are autonomous aircraft that will use the FPSO or a vessel as a launch platform to execute surveys and inspections.

2.8.6 Remotely Operated Vehicle and Autonomous Underwater Vehicle Operations

Activities such as surveys, commissioning, operation and IMMR including environmental monitoring (refer Section 2.9) may be supported by ROVs. The ROV can be fitted with various tools and camera systems that can be used to capture permanent records of the operations and immediate surrounding environment. The size of the vessel required to deploy an ROV, or autonomous underwater vehicle (AUV) depends on the size of the ROV or AUV and the launch and recovery system. The AUV or ROV is typically deployed from a vessel using a crane or an A-frame and is recovered using a winch or net. In some instances, the ROV may be placed on the seabed. USV's will also be supported by an electric ROV. Compared to a typical ROV, it is lighter, smaller and does not have a hydraulic fluid reservoir.

2.9 Subsea Inspection, Monitoring, Maintenance and Repair Activities

IMMR is typically conducted by ROVs or AUVs from one or more vessels that have DP capabilities. Divers may be used for operations on the rare occasion ROVs or AUVs cannot be used (e.g. on the STP mooring buoy when either connected or disconnected from the FPSO). Details of IMMR activities, including typical equipment required, and associated discharges are presented in Table 2-29.

IMMR typically includes:

- general visual inspection (GVI) and close visual inspection (CVI) of subsea infrastructure and equipment, including the Barossa GEP.
- cathodic protection (CP) surveys, including readings and GVI to determine condition of anodes.
- geophysical and infrastructure surveys, including:
    - multibeam echo sounder (MBES), which uses sound pulses to establish the seabed profile, position or shape of subsea infrastructure. Most modern MBES systems work by transmitting a broad acoustic pulse from a hull-, pole- or ROV-mounted transducer.
    - side scan sonar (SSS), which detects debris and other obstructions on the seafloor using a towed transducer that transmits high-frequency acoustic pulses.

Maintenance activities may include replacement, maintenance and repair of subsea equipment components (see Section 2.9.2 and Table 2-19) – and non-routine maintenance, undertaken in accordance with corrective work orders.

Marine survey vessels, campaign, USV or other support vessels may be used for activities outlined in Section 2.8.

It is through implementing the IMMR regime set out in this section that Santos will meet its obligations under the Offshore Petroleum and Greenhouse Gas Storage Act (s.572(2)) to '*maintain in good condition and repair all structures that are, and all equipment and other property that is:*

a) in the title area

b) used in connection with the operations.

2.9.1 Inspection Methods

2.9.1.1 Visual Inspection

External visual inspections of subsea infrastructure may be undertaken, typically using an ROV. General visual inspections can be used to confirm the results of other inspection methods, and aid in the planning of maintenance and repair activities.

Close visual inspections of subsea infrastructure system may be undertaken by divers where ROVs or AUVs cannot be used. Due to the relative complexity (based on health and safety risk) and cost of implementing diving operations in comparison with alternative methods (e.g., ROV), other inspection methods are preferred.

2.9.1.2 Cathodic Protection Survey

CP surveys may be performed on the external surface of subsea infrastructure using the following methods (or combination of it):

- Contact CP survey, which includes a ROV holding a CP probe and then connected to the exposed pipe steel substrate (e.g. on the field joint / girth weld area, where there is no concrete weight coating) or the probe connected to the exposed anode substrate.
- Field gradient CP survey (contactless survey), which includes a ROV holding a CP probe around 0.2 - 0.5 m above the pipeline, to measure the potential field gradient along the pipeline length without contacting the pipeline.

2.9.1.3 Marine Growth Removal

Removal of marine growth is typically only required for inspection purposes and is conducted at localised areas using high pressure water cleaning or brushing or a combination of these:

- Water jetting – conducted by ROV, water is pressurised to above hydrostatic pressure. Generally, water-jetting activities are through small-diameter water jets that act locally on the pipe and structure. Wash-out or induced currents are typically not experienced during this activity due to the nature of the operation.
- Soaking – an approved chemical is used to soak infrastructure to remove calcareous deposits if mechanical removal means are ineffective.
- Mechanical brushing – typically a coarse brush is applied to the pipeline or structure on a localised area only.

2.9.1.4 Subsea infrastructure inspection frequencies

Initial ‘first in service’ inspections will be performed nominally during the first one to two years of operations and, after that, at the intervals required on the basis of a risk-based inspection program. The objective of the first in service inspections shall be to provide operational performance information.

To determine IMMR frequency, the risk assessment may include:

- a threat assessment to determine threats to integrity in operation
- historical IMMR information acquired through inspection, monitoring and repair for similar assets
- nominal inspection frequencies set within the IMMR Plan.

GVI or CVI and CP nominal frequencies are provided in the Barossa Project Integrity Management Plan – Subsea and the Barossa Project Pipeline Integrity Management Plan (PIMP) (for the Offshore GEP). Nominal initial inspection and monitoring frequencies range from three to five years, or as needed. The findings of the IMMR campaigns will be used to inform the future frequencies of the IMMR activities. When an IMMR activity occurs, the expected duration may be seven to 30 days depending on whether maintenance and repairs are required. Additional unplanned external or internal inspections may be performed after significant external events (such as extreme weather, sea conditions, seismic activity, third-party interactions), integrity assessments or other triggers that indicate further inspection is required.

2.9.2 Maintenance and Repairs

Anomalies identified during planned inspections and condition monitoring are reviewed, risk assessed, and managed. The risk is mitigated by actions such as repair, re-rating, upgrade, or monitoring, as appropriate.

Urgent repairs (e.g., in the event of damage requiring precautionary shutdown) are addressed in the Emergency Repair Strategy for Subsea Pipelines. The strategy outlines various repair options available in the event of a Barossa GEP leak, rupture, or severe mechanical damage, including information on aspects such as material, equipment, and potential support requirements, and repair contractors and timescales (including mobilisation) associated with various repair options. An Emergency Pipeline Repair Reference Manual for Subsea Pipelines will be used to inform required repair work.

The Barossa Project PIMP identifies that non-urgent repairs can be made at opportune times (e.g., during facility shutdowns). Non-urgent repairs are subject to the Operational Risk Management Procedure. If a change to the Activity to that described in this EP is required as an outcome of the risk assessment, then the Santos Management of Change (MoC) Procedure will be applied.

Maintenance and repair of the pipeline may consist of the following activities:

- Excavation of the sediment around the Barossa GEP to establish the extent of any damage, and to provide appropriate access for repairs to be carried out. Typically, a jetting tool or air-lifting tool operated by a ROV or divers would be used to remove sand and rocks from around the Barossa GEP and to excavate beneath the pipeline, as required;
- Removal of concrete weight coating (CWC) and corrosion coating by ROV, divers, or specially designed CWC removal tools, using high pressure water jets or hydraulic saws;
- Free span correction using water jetting, or placement of gravel/rocks, concrete mattresses or grout bags using a ROV from a support vessel;
- In the event of a minor repair (where positive pressure has been maintained within the Barossa GEP and there has not been an ingress of seawater), a clamp repair (diver or diverless clamp) may be implemented. If a minor repair is required, the seabed around the Barossa GEP may need to be excavated to enable access for the clamp. Alternatively, the pipeline may be lifted, and grout-bags placed underneath. The pipeline may also be brought to the surface for the clamp repair;
- In the unlikely event of a major loss of containment where the contents of the line have been released and seawater ingress has occurred, removal of seawater and debris, such as marine growth and sand, that may exacerbate Barossa GEP corrosion is required. This would likely involve pushing the ingress seawater out of the Barossa GEP at the location of the breach, by pig trains being sent from both the DLNG and offshore ends of the pipeline to meet near the breach and force the pipeline contents and debris out of the pipeline. The pig train would be pushed by either an inert gas (e.g. nitrogen), UV treated seawater, or chemically treated seawater (dosed with biocide, corrosion inhibitor and an oxygen scavenger); and
- In the case where a major pipeline repair is required, the damaged section will be removed using divers or ROV cutting tools, and a prefabricated pipe repair spool would be installed, typically connected to the pipeline by use of either diver or diverless connectors.(Once the pipeline has been repaired a hydrotest will be performed, this will use treated seawater injected at DLNG towards the FPSO, with the hydrotest water being discharged at the FPSO when the GEP is depressurised. The GEP is then dewatered and reconditioned ready for the reintroduction of hydrocarbons. Dewatering is performed using a series of pigs separated by inhibited MEG and pushed with dry nitrogen, the pigs would be pushed from DLNG with the treated seawater and MEG being discharged at the FPSO (137,000m^3 of treated seawater and 600 m^3 of inhibited MEG may be released at the FPSO PLET). The pipeline will then be filled with nitrogen in preparation for recommissioning. Treated seawater (the same treatment would apply to MEG) is seawater conditioned with a hydrotest mixture such as Hydrosure, Roemex Hydro 3 or similar product that is ranked as Gold through the Offshore Chemical Notification Scheme (OCNS) or has a pseudo-ranking of Gold based on aquatic toxicity, biodegradation and bioaccumulation data. Treated seawater is typically a mixture of biocides (to prevent biofouling on the internal surfaces), an oxygen scavenger and corrosion inhibitor (to control corrosion of the pipeline) and a sometimes a dye (allows for leaks to be detected through visual inspections).

2.9.3 In Line Inspection Contingency

In-line inspection (ILI) via pigging for the GEP is not a planned activity but may be undertaken in the case where it is suspected that the pipeline integrity has been compromised due to a pipeline feed gas dew point excursion or other unplanned event.

Internal inspection of the GEP is performed using an ILI tool (tool) equipped with Magnetic Flux Leakage (MFL) measurement technology (or other alternative technology) capable of measuring the GEP wall thickness and detecting significant anomalies. This tool is used to inspect the GEP by pushing the tool between the riser base assembly at the Barossa Field to the DLNG. Bi-directional cleaning/gauging tools are used as part of the ILI

campaign prior to sending the ILI tool, to check for internal restrictions within the pipeline and to clean the pipeline.

The tool will be deployed via a temporary subsea pig launcher, which will be temporarily installed and connected to the riser base.

It is expected that up to 5 m^3 of treated seawater or MEG would be used per run. The pig and any treated seawater / MEG will be received at the DLNG (which is out of scope of this EP). The connection and disconnection of the pig launcher may result in the release of 125 m^3 of MEG.

2.9.4 Stuck In Line Inspection Tool Contingency

If an in-line inspection tool gets stuck or damaged in the GEP during the ILI campaign, it will be:

a) forced out using a high seal pig or a train of high seal pigs (which may be separated by treated seawater or MEG), resulting in a discharge at the DLNG; or

b) pushed back to the subsea receiver at the riser base (reverse flow), which may result in an unplanned event of flaring gas at Barossa FPSO; or

c) removed by sectional removal/ replacement of the GEP (Section 2.9.2).

Table 2-29: Subsea and seabed inspection, monitoring, maintenance and repair activities and equipment; and associated discharges

Activity	Equipment	Associated Discharges (approximate)
Subsea infrastructure inspection and cleaning typically includes: • Inspection of subsea infrastructure, moorings and FPSO hull • Post-cyclone survey (if required) • Marine growth removed during cleaning (refer Section 2.9.1.3) • Non-contact and contact CP checks, including field gradient survey technology and laser scanning • Non-destructive testing • Water jetting	• Vessel(s) • ROV and tooling • AUV • Remotely operated USV (typically with ROV) • Mechanical brushing • Chemical soaking and acid injection equipment • Ultra-high-definition phototropic equipment • SSS • MBES imaging sonar • Water jetting equipment	Discharges released to the marine environment includes: • inorganic and organic acids (2,000 L per operation) (such as citric acid) used to soak marine growth • marine growth (up to 25m^3 per campaign) removed from subsea infrastructure No gas discharges.
Replacement, maintenance and repair of subsea equipment components typically includes: • Installation or retrieval of hatches from FPSO hull • Subsea control system testing and repair • Repair or replacement of flowlines and umbilicals or risers • Replacement of subsea components: choke insert, subsea control module, flying lead, electronic actuator, etc • Subsea valve operation and testing following component replacement • Water jetting • Mechanical brushing • Non-contact and contact CP checks • Running tools for hardware	• Vessel(s) • ROV and tooling • AUV use • Remotely operated USV (typically with ROV) • Diver visual inspection • SSS • MBES imaging sonar • Acid injection equipment • Chemical use (e.g., MEG, non-toxic dye, water-based hydraulic control fluid, residual hydrocarbon production fluids) • Treated seawater with MEG, biocide, oxygen scavenger, corrosion inhibitor and non-toxic dye	Discharges released to the marine environment includes: • Inorganic and organic acids (2,000 L per operation) used to soak marine growth • Non-toxic dye (<5 L per operation) • Water-based hydraulic control fluid (<100L/day) • Residual hydrocarbon production fluids (<1L per campaign) • Treated seawater with MEG, biocide, oxygen scavenger, corrosion inhibitor and non-toxic dye (worst case up to 10m^3) • Residual hydrocarbon and inert gas (<1L per campaign)

Activity	Equipment	Associated Discharges (approximate)
replacement • Non-destructive testing • Marine growth removal (water jetting and acid soak) • Marine growth removal (acid soak)		• marine growth (up to 25m^3 per campaign) removed from subsea infrastructure
Stabilisation of subsea infrastructure with use of remediations typically includes: • Placement of gravel, grout bags and/or concrete mattresses on specific areas of the subsea infrastructure showing scour or movement; may also be used as subsea markers • Localised seabed excavation around structures	• Vessel(s) • Gravel and grout bags, mattress • ROV and tooling • Water jetting equipment	No gas or liquid discharges Seabed disturbance / sand movement with no associated discharges.
Barossa GEP subsea pig launch (contingency activity) typically includes: • Installation of a subsea pig launcher and connection to the riser base manifold followed by In Line Inspection pigging to shore • Marine growth removal (acid soak)	• Vessel(s) • ROV and tooling • Operation of subsea ROV operated valves • Pigs and pig launcher	Discharges to the marine environment includes: • Inorganic and organic acids (2,000 L per operation) used to soak marine growth • marine growth removed from subsea infrastructure • MEG (125 m^3) and hydrocarbon gas (approximately 400m^3) during connection and disconnection of pig launcher

Activity	Equipment	Associated Discharges (approximate)
Subsea infrastructure (including sections of the Barossa GEP) repair and replacement (contingency activity) typically includes: • Repair or replacement of a section of the Barossa GEP • Placement of infrastructure on the seabed. • ROV and tooling – concrete coating removal, weld seam removal, marine growth removal end preparation, water jetting, mechanical brushing, non-contact and contact CP checks, non-destructive testing • ROV survey either side and nearby seabed • Cutting of the damaged infrastructure using ROV operated tooling • Installation and connection of ROV operated pipe clamps or joins • Installation of the new spool piece • Stabilisation and span rectifications, such as sediment relocation, gravel and grout bags and concrete mattresses use, if required.	• Vessel(s) • ROV and tooling • Pipe lift frames and installation aids • SSS • MBES imaging sonar • Remotely operated USV (typically with ROV) • Chemical use (e.g., MEG, Non-toxic dye, Water-based hydraulic control fluid, Residual hydrocarbon production fluids) • Treated seawater with MEG, biocide, oxygen scavenger, corrosion inhibitor and non-toxic dyePipe lift frames and installation aid.s	Discharges to the marine environment includes: • Marine growth, concrete coating, anti-corrosion coating, metal swarf/fillings removed from pipeline released to the environment Gas and liquid discharges may include: • Minor release of hydrocarbon / residual hydrocarbon (<1 L) • Inert gas (<1 L) • Water-based hydraulic control fluid (<100L) • Treated seawater consisting of MEG, biocide, Oxygen scavenger, corrosion inhibitor and non-toxic dye (see worst-case below) Worst-case discharge of treated seawater (approximately 137,000 m^3) would be complete free flooding of the Barossa GEP due to a significant breach. The pipeline would then be flooded with treated seawater and flooding pigs from both ends, towards the failure location, to protect the Barossa GEP from corrosion.
Installation of temporary or permanent subsea instruments and retrieval of data from subsea monitoring instrumentation typically includes: • ROV installation of temporary or permanent instruments to measure e.g. pipe displacement and strain, or vibration. • ROV deployed to interrogate and retrieve data from instruments • ROV deployed to retrieve subsea instruments, recover data and re-deploy • ROV deployed for seabed sampling • Marine growth removal (water jetting and acid soak) • Mechanical brushing	• Vessel(s) • ROV and tooling	Discharges to the marine environment includes: • Inorganic and organic acids (2,000 L per operation) used to soak marine growth • marine growth (up to 25m^3 per campaign) removed from subsea infrastructure

2.9.5 Environmental monitoring activities

Environmental monitoring activities, such as sampling of seabed material (i.e. sediment), water sampling, or investigation/sampling of biological material (i.e., marine growth) for environmental studies may be undertaken to increase Santos' understanding of the environmental impacts and risks as part of planning activities for decommissioning.

Planned environmental monitoring activities associated with produced water management will occur in OA1. Sediment sampling may also be undertaken in OA1 and OA2 to characterise sediment and understand baseline conditions in the unlikely event of a loss of containment. Analytes could include total organic carbon,

particle sizes, major cations, trace metals, and types of bacteria. Sediment sampling activities will be performed using routine sampling techniques and equipment from a vessel, such as using a dual van Veen grab sampler shown in Figure 2-16.

Figure 2-16: Example of a dual van Veen grab sampler

2.10 Floating Production, Storage and Offloading Facility Demobilisation

The FPSO is designed to remain on station for the 25 year design life of the facility and is designed to withstand 10,000 year cyclonic metocean conditions. There is no planned drydocking expected over the design life of the facility. The STP buoy remains submerged if the FPSO leaves the field and is suspended at approximately 40 m below the sea surface.

3. Description of the Environment

Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)R 2023) requirements
Section 21. Environmental assessment
Description of the environment 21(2) The environment plan must: • describe the existing environment that may be affected by the activity • include details of the relevant values and sensitivities (if any) of that environment. *Note: The definition of environment in section 5 includes its social, economic and cultural features.* 21(3) Without limiting paragraph (2)(b), relevant values and sensitivities may include any of the following: • the world heritage values of a declared World Heritage property; • the National Heritage values of a National Heritage place; • the ecological character of a declared Ramsar wetland; • the presence of a listed threatened species or listed threatened ecological community; • the presence of a listed migratory species; • any values and sensitivities that exist in, or in relation to, part or all of: • a Commonwealth marine area; or • Commonwealth land.

This section describes the key physical, biological, socio-economic, and cultural features of the existing environment that may be affected by the Activity. The description applies to the operational areas (OAs) and any areas surrounding the OAs that may be affected by the Activity. In this Environment Plan (EP), the area that may be affected by the impacts and risks of the Activity is described as the environment that may be affected (EMBA). In the case of a hydrocarbon spill, the affected areas are categorized as the low exposure value area (LEVA) and the moderate exposure value area (MEVA), which also define the modelled EMBA. Consideration of matters of national environmental significance (protected under Part 3 of the EPBC Act) present in the EMBA are addressed in relevant parts of Section 3.4 and Section 3.5.

This section also includes details of the values and sensitivities pertaining to the EMBA. Detailed descriptions of these values and sensitivities are provided in the sections below. The results were informed by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protected matters reports (all matters potentially relevant to section 21 (3)), stated values in the Marine Bioregional Plans for the North Marine Region (NMR) and the North-West Marine Region (NWMR) (CoA, 2012a, b), EPBC Act protected matters reports (Appendix E), information obtained through consultation and the Barossa environmental studies detailed in Table 3-1. Publicly available information was also sourced, regarding the Indonesian and Timor-Leste coast, as the EMBA extends into some coastal waters of these two countries.

These values and sensitivities have been identified for the purposes of environmental assessment, identifying potential environmental consequences, and developing spill response plans. More information about the reasons why these exposure values have been included and how their application in defining areas relates to impact and risk assessment and spill response planning is provided in Sections 6 and 7.

Environmental Studies

The environmental studies in Table 3-1 have been undertaken in support of the Activity to characterise the existing marine environment within and surrounding operational area 1 (OA1) and operational area 2 (OA2). The studies have involved collecting detailed baseline data to capture seasonal variability in the area. In addition to providing specific data and information across the area, the studies collected data that has been used to validate the hydrodynamic model developed by RPS, which is used in the credible hydrocarbon spill modelling (Section 7.6 and 7.7).

Figure 5-2 of the Barossa Area Development Offshore Project Proposal (OPP) (ConocoPhillips, 2018) shows the locations of the sampling sites and includes benthic towed video transects, benthic habitat, sediment, infauna and water quality sampling in the immediate vicinity of the OAs.

Baseline studies were preceded by early engagement with key agencies, such as Australian Institute of Marine Science (AIMS) and were informed by a comprehensive literature review and gap analysis. The studies considered when developing this EP are summarised in Table 3-1. Further detail and copies of the studies are

provided in Section 5, Appendix C and Appendix D of the Barossa Area Development OPP (ConocoPhillips, 2018).

Table 3-1: Summary of Barossa environmental studies

Study Type/Name	Description of study	Reference
OPP studies		
Metocean data collection	Collection of metocean data on the surface and through the water column from July 2014 to March 2015, within and in the vicinity of the Barossa field, such as current, conductivity, wave and wind data.	Fugro, 2015
Water quality survey	Collection of baseline data on physical and chemical components of water quality in the vicinity of the Barossa field. The surveys were completed in June 2014, January 2015 and April 2015.	Jacobs, 2014, 2015a, 2015b
Sediment quality and infauna survey	Collection of baseline data on sediment quality and infauna communities in the vicinity of the Barossa field.	Jacobs, 2015c
Benthic habitat survey	Collection of baseline data to characterise topographic features, benthic habitats and macrofaunal communities in the vicinity of the Barossa field location and surrounding areas, including around Evans Shoal, Tassie Shoal and Lynedoch Bank, through use of a specialised remotely operated vehicle (ROV).	Jacobs, 2016a
Underwater noise survey	Collection of baseline data about ambient underwater noise (physical, biological and anthropogenic sources) at three locations from July 2014 to July 2015 within the vicinity of the Barossa field and surrounding areas.	JASCO Applied Sciences, 2016
Shoals and shelf survey 2015: • benthic habitats • fish communities	A seabed biodiversity survey of three shoals to the west of the Barossa field (Evans, Tassie and Blackwood) and two mid-continental shelf regions relevant to the potential Barossa Gas Export Pipeline (GEP) route. The survey was undertaken in September/October 2015 by AIMS and involved characterising the seabed habitats, associated biota and fish communities (shoals only).	Heyward *et al*., 2017
Environment Plan studies		
Oceanic Shoals Marine Park benthic habitat and fish diversity assessment	A seabed and fish biodiversity survey conducted between September and October 2017 by AIMS. The survey focused on six key sites inside and outside of the Oceanic Shoals Marine Park, including in the Habitat Protection Zone and Shepparton Shoal. The objective was to incorporate this new data to update the predictive habitat model and perform statistical comparison of the proportion and spatial diversity of habitats within and outside the Oceanic Shoals Marine Park.	Radford *et al*., 2019
Barossa GEP pre-lay geophysical survey	This report presents the results from a recent geophysical survey performed along the Barossa GEP route and provides a comprehensive assessment of the seafloor and shallow geological features along the Barossa GEP, including the identification of any hazardous debris.	Fugro Australia Marine, 2022
Environmental literature review and gap analysis	Collection and collation of all publicly available information pertaining to the marine environment within the vicinity of the Barossa field and gap analysis to determine whether there is sufficient information to inform an environmental impact assessment and any future regulatory approvals for a potential full field development.	Jacobs SKM, 2014
Hydrodynamic model validation study	Data from the metocean study and derived through the deployment of drifter buoys in the vicinity of the Barossa field and surrounding areas was used to validate the underlying hydrodynamic model used to develop the spill and discharge models.	RPS APASA, 2015
Geophysical survey	This survey undertook a preliminary geophysical survey of the offshore development area and potential pipeline routes.	Fugro, 2016
Geophysical survey report	This report provides the results from a geophysical survey carried out in the Barossa Project Infield Area. It provides comprehensive details regarding the seafloor and shallow geological features in the infield project area (including the drilling Operational Area).	DOF Subsea, 2018

Study Type/Name	Description of study	Reference
Tiwi Islands sensitivity mapping	Development of sensitivity mapping to assist with spill planning in the vicinity of the Tiwi Islands. Data was gathered based on desktop review of existing information and through direct engagements with Tiwi Island traditional owners via the Tiwi Land Council (TLC). The report was prepared at the request of ConocoPhillips during preparation of the Barossa Gas Export Pipeline Installation EP.	Jacobs, 2019
Maritime Heritage Assessment for OA1	A maritime archaeological assessment for the Offshore Development Infield Infrastructure to identify potential maritime archaeological sites which are defined as wrecks (ship or aircraft) and associated material, dumped material, maritime infrastructure, and associated deposits on or under the seabed.	Cosmos Archaeology 2023
Maritime Heritage Assessment for the Barossa GEP portion of OA2	A maritime archaeological assessment along the Barossa GEP route to identify potential maritime archaeological sites which are defined as wrecks (ship or aircraft) and associated material, dumped material, maritime infrastructure, and associated deposits on or under the seabed.	Cosmos Archaeology 2022
Maritime heritage assessment for the Darwin Pipeline Duplication (DPD) portion of OA2	A maritime archaeological assessment along the DPD route to identify potential maritime archaeological sites which are defined as wrecks (ship or aircraft) and associated material, dumped material, maritime infrastructure, and associated deposits on or under the seabed.	Cosmos Archaeology 2022
Tiwi Island Turtle Activity Report	This desktop report reviews publicly available literature and research relating to marine turtle activity occurring on, and around, the Tiwi Islands of northern Australia. A total of 19 satellite telemetry studies between 1994-2023 which tracked turtles passing through or foraging in waters near the Tiwi Islands were included in the review.	Pendoley, 2023
Benthic survey for Barossa DPD route	Collection of baseline information on the benthic habitats, sediment composition (including contaminant concentrations), macroinvertebrate (infaunal) assemblages, and water quality along the DPD route.	RPS, 2023a
Underwater cultural heritage (UCH) assessment of the route of the Barossa GEP	An independent expert assessment by Dr Brendan Corrigan for the purpose of identifying UCH places along the route of the Barossa GEP west and northwest of the Tiwi Islands ('Corrigan Report'). The Corrigan Report assessment included consideration of detailed expert reports on archaeology and sedimentology along the Barossa GEP route conducted by Wessex Archaeology and Dr Posamentier.	Corrigan, 2023
Maritime Archaeological assessment	Archaeological report focusing on the Late Pleistocene and Holocene depositional and erosional history of the Arafura Sea along the Barossa GEP corridor.	Wessex Archaeology, 2023
Ethnographic survey of the DPD section constructed in Commonwealth waters	An independent expert assessment by Dr Brendan Corrigan for the purpose of identifying spiritual and cultural values relevant to the construction of the DPD pipeline route (including 23 km of the route in Commonwealth waters). The document is available on the Santos website at https://www.santos.com/wp-content/uploads/2024/09/First-Nations-spiritual-and-cultural-values-in-relation-to-the-Darwin-Pipeline-Duplication-Project.pdf.	Corrigan, 2024
Archaeological survey of the DPD section constructed in Commonwealth waters	An independent expert assessment by Dr Jodie Benton for the purpose of identifying any underwater cultural heritage places along the DPD pipeline route (including 23 km of the route in Commonwealth waters). The document is available on the Santos website at https://www.santos.com/wp-content/uploads/2024/09/Desktop-First-Nations-Archaeological-Assessment-Summary-Report-Darwin-Pipeline-Duplication-Project-KP0-31.pdf.	Ozark, 2024

3.1 Environment that May Be Affected (EMBA)

This section describes the key physical, ecological, socio-economic and cultural features of the existing environment that may be affected by the Activity and covers:

- OA1 – floating production, storage, and offloading (FPSO) and subsea infrastructure
- OA2 – pipeline; and
- any areas surrounding the OAs that may be affected by the Activity.

In this document the area that may be affected by the impacts and risks of the Activity is described as the EMBA, or in the case of a hydrocarbon spill, LEVA (which also defines the modelled EMBA), MEVA and high exposure value area (HEVA). The EMBA and MEVA are shown in Figure 3-1.

3.1.1 Determining the EMBA

Stochastic hydrocarbon dispersion and fate modelling, applied to the worst-case spill scenario for the Activity was undertaken to determine the conservative EMBA (in this case also the LEVA) and the MEVA (refer to Section 7.6 and Section 7.7). The EMBA is generated by modelling and represents the greatest geographical extent that could be affected by 300 individual hydrocarbon spill scenarios occurring simultaneously across the full range of seasonal conditions.

Areas potentially contacted by hydrocarbons were determined using stochastic modelling which overlayed 300 individual hypothetical spill simulations from a hydrocarbon spill into a single map, with each simulation subject to a different set of metocean conditions drawn from historical records. Stochastic modelling compensates for the uncertainty associated with any single hydrocarbon spill event such that risk assessment and spill response planning are more robust and conservative by covering a wide range of possible scenarios.

Modelling considers key physical and chemical phases of hydrocarbons that pose differing environmental and socio-economic risks, being surface, entrained, dissolved aromatic and shoreline accumulated hydrocarbons. Defining the areas that may be affected by spilled hydrocarbons depends on the concentrations of the hydrocarbons on the sea surface, in the water column and on the shoreline.

Hydrocarbon exposure threshold values defined by the National Offshore Petroleum Safety and Environment Management Authority (NOPSEMA, 2019) (Section 7.7.4) for each of these phases were applied to the stochastic modelling outputs to determine the areas affected by the HEVA, the MEVA and the LEVA. The MEVA and HEVA represent areas wherein contact with hydrocarbons may result in harmful impacts to biota with the MEVA being the more conservative, encompassing the maximum extent of biological impact. The LEVA represents the maximum extent of possible contact with hydrocarbons within the depth range between 0-10 m and reflects the range of socio-economic considerations for spill response planning and scientific monitoring. For this reason, the LEVA has been used to define the modelled EMBA.

Importantly, in terms of impacts to environmental values and sensitivities, the extent of a particular impact and risk may not be relevant to the full extent of the modelled EMBA, therefore, the MEVA and HEVA are also referred to where relevant in this EP. The EMBA was determined based on combining the worst-case credible spill scenarios of a release of heavy fuel oil (HFO) from the offtake tanker caused by a vessel collision, a release of condensate from the FPSO or offtake tanker from a vessel collision, a release of marine gas oil (MGO) from the FPSO from a vessel collision and a release of marine diesel oil (MDO) from an inspection, maintenance, monitoring and repair (IMMR) vessel collision. A ‘best fit’ line is drawn around the outermost limits of the low exposure value contours resulting in a highly conservative EMBA. The MEVA and EMBA areas are shown in Figure 3-1 and further information about the reasons why these exposure values have been selected and how their application in defining areas relates to impact and risk assessment and spill response planning is provided in Section 7.7.12, Section 7.7.4 and Section 7.7.5.

Determining the EMBA for the purposes of assessing all values and sensitivities potentially affected by the impacts and risks of the Activity was not limited to the area defined by the modelled EMBA. Values and sensitivities outside but proximal to the modelled EMBA were also considered.

Wherever the abbreviation ‘EMBA’ is used subsequently in the EP, this refers to the modelled EMBA (LEVA).

It should be noted that an actual spill event is more accurately represented by only one of the 300 simulations from the modelling, meaning a much smaller geographical area would be affected in the event of an actual spill; and the EMBA does not take account of spill response mitigations which would reduce the extent of an unplanned spill. Modelling of a single simulation, representative of a single spill event, is termed deterministic modelling. This is discussed further in Section 7.7.5 and applied in the risk assessment where relevant.

The primary purpose of the EMBA is to assist with spill response planning and preparedness in the unlikely event of a hydrocarbon spill. The EMBA provides a conservative basis for assessing the range of potential socio-economic impacts and establishes a planning area for scientific monitoring during an unplanned spill event.

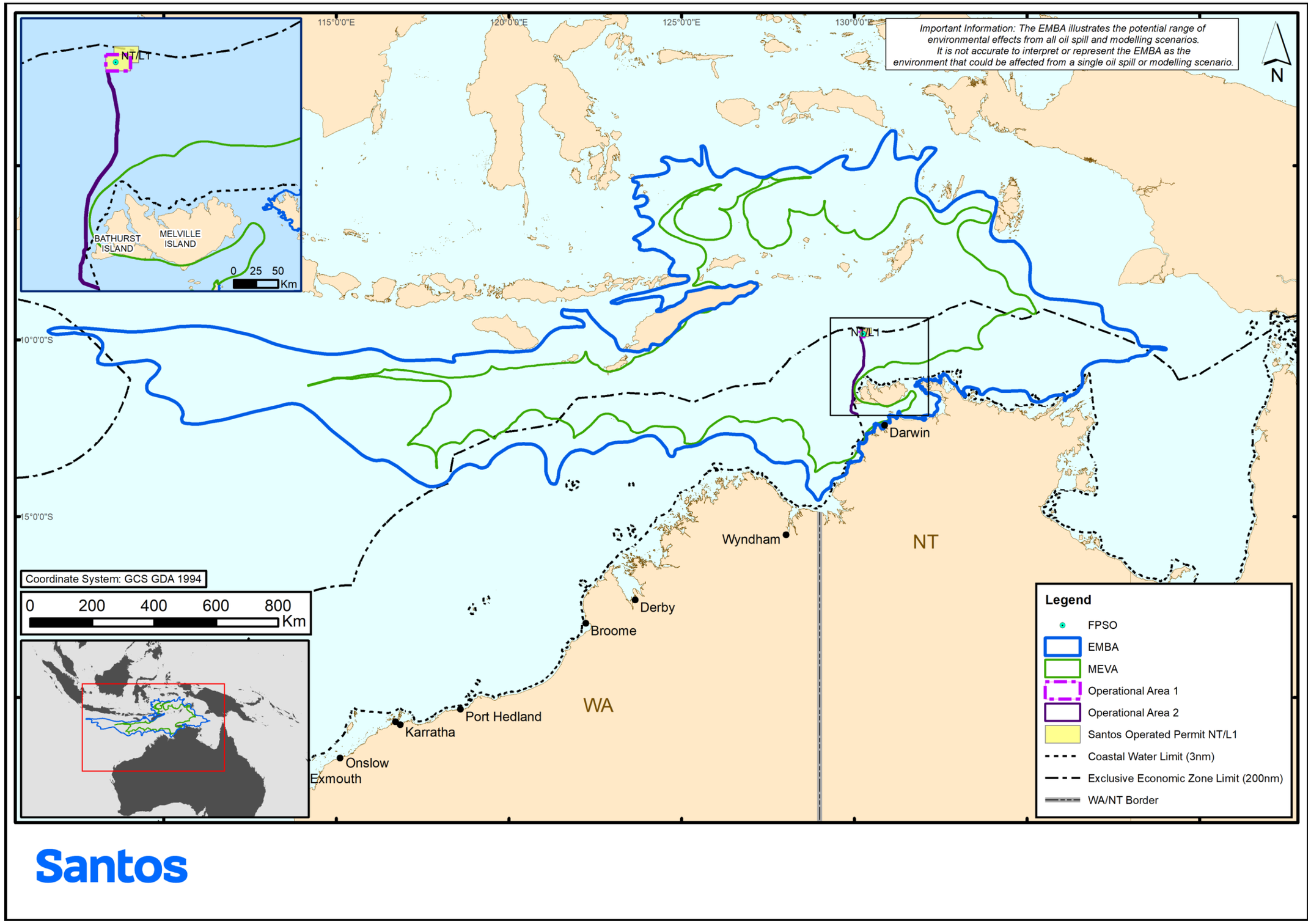


Figure 3-1: Operational Areas, MEVA and EMBA

3.2 Existing Environment

3.2.1 Regional Setting

Four provincial bioregions occur within the Australian waters of the EMBA (Figure 3-2), based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) version 4.0 (v. 4.0). Provincial bioregions are largely classified based on biological and physical information, including the distribution of demersal fishes, marine plants and invertebrates, sea floor geomorphology and sediments, and oceanographic data (IMCRA v. 4.0). Bioregions within international waters of the EMBA have not been formally classified, however habitats within these waters are described utilising published scientific literature and studies.

The OAs are located within the NMR, which encompasses approximately 625,689 km² of Commonwealth waters from west Cape York Peninsula to the Northern Territory (NT)/ Western Australia (WA) border (CoA, 2008, 2012a) (Figure 3-2). The EMBA intersects with both the NMR and the NWMR, as well as international waters. The MEVA is within the NMR with the majority in international waters. The HEVA is within the NMR and international waters equally. Provincial bioregions relevant to the EMBA described further in Section 3.2.1.1.

The key physical characteristics of the NMR include (CoA, 2012a):

- a wide continental shelf, with water depths averaging less than 70 m and ranging from approximately 10 m to a maximum known depth of 357 m
- currents driven predominantly by strong winds and tides and a monsoonal climate and complex weather patterns
- Van Diemen Rise, which forms part of a key ecological feature (KEF) (Section 3.5.5.9) and includes a range of geomorphic features, such as shelves, shoals, banks, terraces and valleys like the Malita Shelf Valley, which provides a significant connection between the Joseph Bonaparte Gulf and the Timor Trough
- a series of shallow calcium carbonate-based canyons (approximately 80 to 100 m deep and 20 km wide) in the northern section of the region that lead into the Arafura Depression, which consists mainly of calcium carbonate–based sediments (carbonate sand and subfossil shell fragments)
- the Arafura Shelf, which forms part of a KEF (Section 3.5.5.8) and is up to 350 km wide and has an average water depth of 50 to 80 m, and is characterised by features such as canyons and terraces
- cultural features including Sea Country (Section 3.7).

The key physical characteristics of the NWMR include:

- the Indonesian Throughflow, a low-salinity water mass that is one of the major elements of the global transfer of heat and water between oceans and which plays a key role in initiating the Leeuwin Current
- extensive areas of continental shelf and slope, plateaux and terraces, including the Sahul Shelf
- coral reefs, including Ashmore, Hibernia, Scott, Seringapatam, all of which have a high diversity of corals and associated fish and other species
- cultural features including Sea Country (Section 3.7).

The EMBA overlaps international waters of southwest Indonesia and Timor-Leste and, in the event of a worst-case hydrocarbon spill, residual entrained hydrocarbons may reach the coastlines of Indonesia and Timor-Leste. These international waters (belonging to Indonesia and Timor-Leste) are broadly comparable to the Australian oceanic waters within the EMBA, with no remarkable variation in water quality parameters or significant variation in sea state conditions expected. Areas of the Lesser Sunda Ecoregion found within the EMBA encompass the chain of islands and surrounding waters from Bali, Indonesia to Timor-Leste. The EMBA also overlaps a small portion of the southern boundary of the Coral Triangle on the south coast of Timor-Leste and West Timor. The Coral Triangle is located in southeast Asia and the Pacific, and encompasses the tropical marine waters of Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor-Leste. It is considered to be the planet's richest centre of marine life and coral diversity (Cross *et al.*, 2014).

The EMBA also includes coastal waters and shoreline habitats in WA, the NT, Indonesia and Timor-Leste. Protected areas outside but in close proximity to the EMBA, such as Scott Reef Nature Reserve to the southwest of the EMBA, have also been included in in this EP to ensure conservatism.

3.2.1.1 Provincial Bioregions

Based on the IMCRA, v. 4.0, the provincial bioregions relevant to the OAs, MEVA and the EMBA are provided in Table 3-2 and Figure 3-2. Both OAs are situated within the Timor Transition bioregion of the NMR (Department of the Environment and Heritage, 2006) that primarily features shelf slope and plateau to the west, and canyon and ridge to the east. It includes the Arafura Shelf, which is recognised as a KEF (Section 3.5.5.8). In addition, part of OA2 is also situated within the Northwest Shelf Transition bioregion.

Table 3-2: Integrated Marine and Coastal Regionalisation of Australia provincial bioregions relevant to the Activity

Bioregion	OA1	OA2	MEVA	EMBA
Northern Shelf Province	✗	✗	✓	✓
Northwest Shelf Transition	✗	✓	✓	✓
Timor Province	✗	✗	✓	✓
Timor Transition	✓	✓	✓	✓

3.2.2 Geographical Extent

OA1 is located in Australian Commonwealth waters, approximately 285 km north of Darwin and approximately 130 km north of the Tiwi Islands. OA2 is approximately 285 km in length and runs from OA1 to the point where the Barossa GEP crosses the Commonwealth/ NT waters boundary. The relative distances of key islands and mainland from the closest point in OA1 and OA2 are provided in Table 2-4, Section 2.2.1.

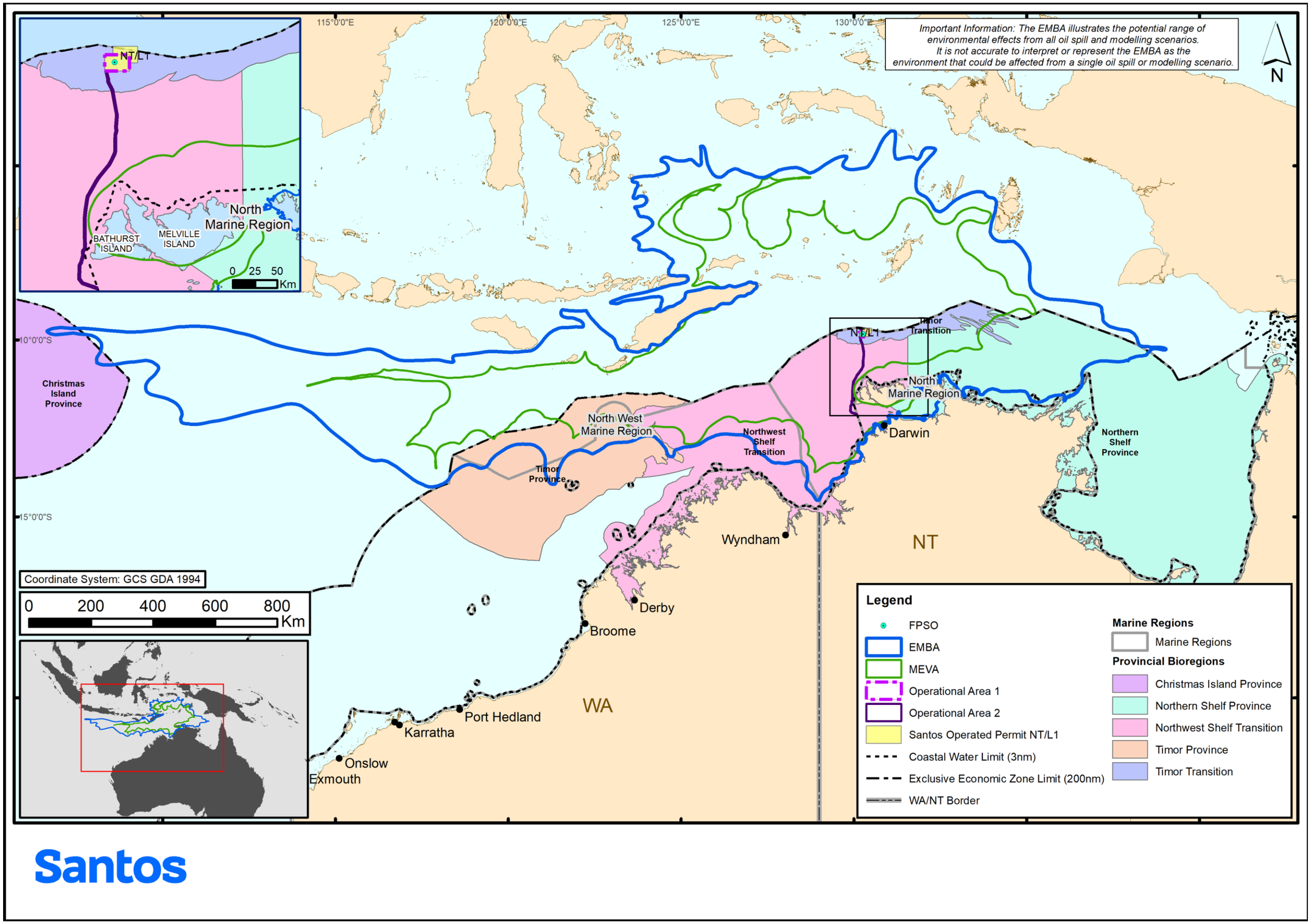


Figure 3-2: IMCRA v 4.0 provincial bioregions, MEVA and EMBA

3.3 Physical Environment

3.3.1 Geomorphology

About 550 to 160 million years ago, the northern and western parts of Australia formed part of the northern margin of Gondwana. About 300 million years ago, crustal stretching, rifting and breakup, initiated the development of an extensive basin where sediments were deposited (Baker *et al.*, 2008 in CoA, 2012a). About 135 million years ago the continent broke up, resulting in the separation of greater India and Australia.

3.3.2 Climate

Meteorological data for the region, recorded at the Bureau of Meteorology (BoM) weather station at Melville Island (the closest metrological station to OA1), shows a small seasonal variation in air temperatures. The mean maximum summer and winter air temperatures range between 33.9 °C in October and 31.3 °C in July (BoM, 2025). The average tropical cyclone frequency for the Timor and Arafura seas region is one cyclone per year, which occur mostly between November and April (BoM, 2025).

Waters in the northern extent of the EMBA predominantly lie in the arid tropics. Monsoonal conditions usually occur from October to March (wet season), with cooler and drier conditions prevailing from April to September (dry season) (CoA, 2012a).

3.3.3 Oceanography

3.3.3.1 Regional Current System

The Barossa Project is located within the influence of the Indonesian Throughflow, a large-scale current system characterised as a series of migrating gyres and connecting jets that are steered by the continental shelf. As these gyres migrate through the area, large spatial variations in the speed and direction of currents will occur at a given location over time. The Holloway current, which flows southwest and close to the coastline, intensifies during April to July due to increased wind forcing.

A comprehensive description of the circulation patterns of the Northwest Shelf and Bonaparte Gulf is provided in a review by Condie & Andrewartha (2008).

3.3.3.2 Current and Tides

Tidal activity is typically dominated by semi-diurnal tides, with two daily high tides and two daily low tides. The highest astronomical tide recorded at Tassie Shoal (about 75 km west of the OA1) is 1.4 m above mean sea level (MSL) and the lowest astronomical tide is 1.8 m below MSL (Consulting Environmental Engineers, 2002). The mean tidal range is 2.2 m at spring tides and 0.3 m at neaps (Consulting Environmental Engineers, 2002). Measurements of ocean currents at Tassie Shoal show water movement is strongly tidal, with typical speeds in the range of 0.1 to 0.4 m/s and peak speeds up to 0.8 m/s (Consulting Environmental Engineers, 2002).

Water movement in the EMBA is influenced by wind and tidal activity and less by ocean currents. Smaller-scale surface currents reflect seasonal wind activity, flowing easterly to north easterly during the wet season and west to southwest during the dry season (Heyward *et al.*, 1997). Local wind-driven surface currents can reach speeds of 0.6 metres per second (m/s) during monsoonal wind surges, although more typical speeds are in the range of 0.2 to 0.3 m/s (Heyward *et al.*, 1997). Average current speed in OA1 has been measured to range from 0.22 m/s at the near surface to 0.14 m/s at 210 m below MSL (Fugro, 2015).

3.3.3.3 Waves

Waves in the EMBA are expected to be composed of locally generated sea waves in response to local wind activity and swell waves created by distant wind activity. Wave height is generally between 0.6 and 0.8 m, coming from the west in the wet season and from the east in the dry season. Cyclones and tropical storms can greatly increase wave heights by up to 8 m in the outer Timor Sea during the cyclone season (Przeslawski *et al.*, 2011).

The wave climate offshore of the north-west shelf of Australia is normally dominated by the passage of storms over the southern Indian Ocean (Fugro, 2015). However, between October and March, the wave climate is controlled by the south-westerly monsoon winds. This combination of wind directions may lead to concurrent swells approaching from different directions. The sea wave climate also reflects the seasonal wind regime, with waves predominantly from the south-west in summer and from the east in winter.

3.3.3.4 Water Temperature

Surface water temperatures in OA1 generally range between 27 and 30 °C while temperatures above the seabed range between 11 and 13 °C (Jacobs, 2016a). Sea temperatures in the upper water column near OA1 were recorded as reaching a maximum of 30.9 °C in summer and a minimum of 24.7 °C in spring (Fugro, 2015). The minimum sea temperature of 10.6 °C was recorded near the seabed (within the permit area) at 253 m below MSL in spring. Mean temperatures ranged from 28.1 °C at 34 m below MSL (summer) to 12.6°C at 253 m below MSL (summer) (Fugro, 2015). Water temperatures within the EMBA and OA2 are expected to be broadly within the ranges of those observed in OA1.

3.3.3.5 Water Quality

MEVA and EMBA

Water quality in the Northwest Shelf Transition provincial bioregion is influenced predominantly by the Indonesian Throughflow, which brings warm, low salinity, oligotrophic (low in nutrients) waters into the region from Indonesia (CoA, 2012a). Offshore waters are generally clear, with the euphotic zone extending down to 100 m across the shelf (CoA, 2012a). Localised upwellings of cooler and higher nutrient content waters occur throughout the Northwest Shelf Transition provincial bioregion; however, the influence and extent of these upwellings are mostly unknown (CoA, 2012a).

Operational Area 1

Water quality was sampled at several sites within OA1 across three water quality surveys undertaken during the northern Australian winter, summer and autumn seasons from June 2014 to 2015 (Jacobs, 2014, 2015a, 2015b). At each of the sites, dissolved oxygen, salinity, temperature, turbidity, total suspended solids, pH, chlorophyll and hydrocarbons were measured. Key conclusions from water quality surveys include:

- the depth of the autumn thermocline was similar to winter but deeper than summer
- summer, autumn and winter conditions were similar for concentrations of certain nutrients and certain metals, increasing with depth associated with decomposition of organic matter
- generally, nutrients were below Australian and New Zealand Environment and Conservation Council and Agricultural and Resource Management Council of Australia and New Zealand (ANZECC & ARMCANZ) (2000) trigger values for marine tropical waters in the surface water of all sites but above trigger values in the mid water and bottom water of the deepest sites
- while most metal concentrations were below the ANZECC & ARMCANZ (2000) guidelines, copper concentrations were occasionally slightly above the ANZECC & ARMCANZ (2000) guideline for 99% species protection of 0.3 µg
- total recoverable hydrocarbons and benzene, toluene, xylenes and naphthalene were below the laboratory reporting limits at all sites and depths for each season (Jacobs, 2017, 2015b). There was little difference in the hydrocarbon profiles between sites, indicating a lack of hydrocarbons in the areas sampled (Jacobs, 2015b).

Operational Area 2

Environmental baseline studies along the Barossa GEP route corridor (which encompasses OA2) and nearby marine environment were undertaken. They included surveys of water quality (Jacobs, 2014, 2015a, 2015b). Sixteen sampling sites were positioned to provide coverage of the pipeline corridor, at areas of regional interest such as shoals and banks and within the Oceanic Shoals Marine Park reserve zones. Sites were located in the northern section of the pipeline corridor (five sites, labelled 1 to 5), in the central corridor (seven sites, labelled 6 to 9 and 14 to 16) and the southern corridor (four sites, labelled 10 to 13). Sampling was undertaken in July to August 2017, which falls within the tropical dry season (northern Australian winter).

At each site, physico-chemical profiles of the water column were obtained for dissolved oxygen, salinity, temperature, turbidity, pH, chlorophyll a, hydrocarbons and plankton. Water samples were collected at each site from two depths — near-surface (0 to 5 m) and near-bottom (within 5 m of the seabed) — for analysing nutrients, metals and metalloids, hydrocarbons and naturally occurring radioactive materials. Key conclusions from water quality surveys include:

- there was no obvious thermal stratification of the water column, probably due to the shallow nature of the sites and the time of year of the sampling. During winter, atmospheric cooling at the sea surface produces convective overturning of water and strong, continual winds, which cause the depth of the thermocline to be greater
- turbidity was a big factor in terms of affecting concentrations of nutrients and metals in the water column. Turbidity levels appeared to depend upon the location of the site in relation to the Tiwi Islands, with the northern- and southern-most sites having low turbidity and the site closest to the islands having

high turbidity, particularly in the bottom water. Higher concentrations of total nutrients (total nitrogen and total phosphorus) and total metals (particularly aluminium) were associated with high turbidity

- nitrate and nitrite concentrations were generally above the ANZECC & ARMCANZ (2000) trigger values for marine tropical waters and were highest in the bottom water when dissolved oxygen levels were low. Nitrate and nitrite and orthophosphate concentrations were high in the surface and bottom water of sites close to the Tiwi Islands
- total recoverable hydrocarbons and benzene, toluene, xylenes and naphthalene were below the laboratory reporting limits at all sites and depths for each season. There was little difference in the hydrocarbon profiles between sites, indicating a lack of hydrocarbons in the areas sampled
- of the marine zooplankton captured in the plankton net during this survey, organisms from the Classes Ancantharia and Copepoda were in the highest abundance and were consistently present at every site.

3.3.3.6 Sediment Quality

MEVA and EMBA

The dominant sediments within the offshore NMR are very soft to soft silts, sandy silts and very loose to loose silty sands with variable shell content and sand fraction ranging from fine to coarse (CoA, 2012a). Between the described isolated features of the Northwest Shelf Transition provincial bioregion are large extents of soft substrate (Przeslawski *et al.*, 2011).

Operational Area 1

Sediment quality was sampled at several sites within OA1 for analysing nutrients, metals and metalloids, hydrocarbons, naturally occurring radioactive materials, particle size distribution and infaunal community composition (Jacobs, 2015c). Key findings of the study include:

- of all the metals and metalloids tested, only cobalt and nickel were recorded above the ANZECC & ARMCANZ (2000) Interim Sediment Quality Guideline
- hydrocarbons were below the laboratory reporting limits at all sites
- the sites sampled were considered indicative of the benthic infaunal communities that are likely to occur in the study area
- sediments in OA1 consisted of fine and unlayered sediment through the upper layer, with slightly coarser material at the surface. Bioturbation was also evident in OA1 in the form of burrows and feeding voids.

Operational Area 2

Sediment quality was sampled at several sites within OA2 for analysing nutrients, metals and metalloids, hydrocarbons, naturally occurring radioactive materials, particle size distribution and infaunal community composition (Fugro, 2016; Jacobs, 2017). Key findings of the study include:

- generally, finer sediments (higher percentages of clay and silt) were located at sites in the northern corridor compared to the coarser gravelly sands in the south. This is likely to be related to the prevailing current direction, which flows along a south-eastward to north-westward axis near the seabed
- generally, sites in the northern section of the corridor had higher metal concentrations than those in the southern section and were likely to be associated with finer sediments
- the highest concentrations of nitrogen and organic carbon were associated with sediments with a higher percentage of fine particles
- the relationship between coarse sediments, high infaunal abundances and species richness has been previously identified in the NWS and there did appear to be an increase in faunal abundance from north to south.

3.3.4 Air Quality

Within the offshore and remote areas of the OAs and EMBA, there are no permanent sources of air pollution. Therefore, the air quality of this region of the EMBA is expected to be pristine, with only localised and temporary anthropogenic influences (such as from energy industry and shipping activity). Along the pipeline route, air quality will likely vary as it approaches land.

3.3.5 Shoals and Banks

A number of shoals and banks occur within the EMBA (Figure 3-3 & Figure 3-4). Numerous surveys have been conducted at these shoals and banks over the last 30 years (e.g. Heyward *et al.,* 1997; Heyward *et al.,* 2010; Heyward *et al.,* 2011; Heyward *et al.,* 2017).

Evans Shoal, Tassie Shoal and Lynedoch Bank are the nearest shoals and banks to OA1. The nearest shoals and banks to OA2 include Goodrich Bank, Marie Shoal and Shepparton Shoal shown in Figure 3-3Figure 3-3: Shoals and banks - Map 1. The shoals and banks that are further away from the OAs while still in the EMBA are shown in Figure 3-4.

The shoals and banks within the EMBA share a tropical marine biota similar to that of emergent reef such as Ashmore Reef, Cartier Island, Seringapatam Reef and Scott Reef (Heyward *et al.*, 2017). AIMS' analysis of benthic communities showed that neighbouring shoals and banks frequently share about >80% of benthic community composition, but vary in abundance, with a high level of interconnectivity where larval recruitment can connect these ecosystems (Heyward *et al.,* 2017). Interconnectivity is thought to be facilitated by the short distance between shoals (5 km to 20 km), the high number of shoals across the region (150 across the Sahul Shelf area of the Timor Sea) and current speeds (20 km to 30 km/day in mild weather) (Heyward *et al.,* 2017).

Section 3.3.5.1 presents a summary of the results from the Barossa shoals and banks studies (summarised in Table 3-5), which included a benthic habitat survey of Evans Shoal, Tassie Shoal, Lynedoch Bank and Goodrich Bank and habitat modelling at Marie Shoal and Shepparton Shoal.

The distances to the nearest shoals and banks from OA1 are provided in Table 3-3 and the distances from OA2 are provided in Table 3-4.

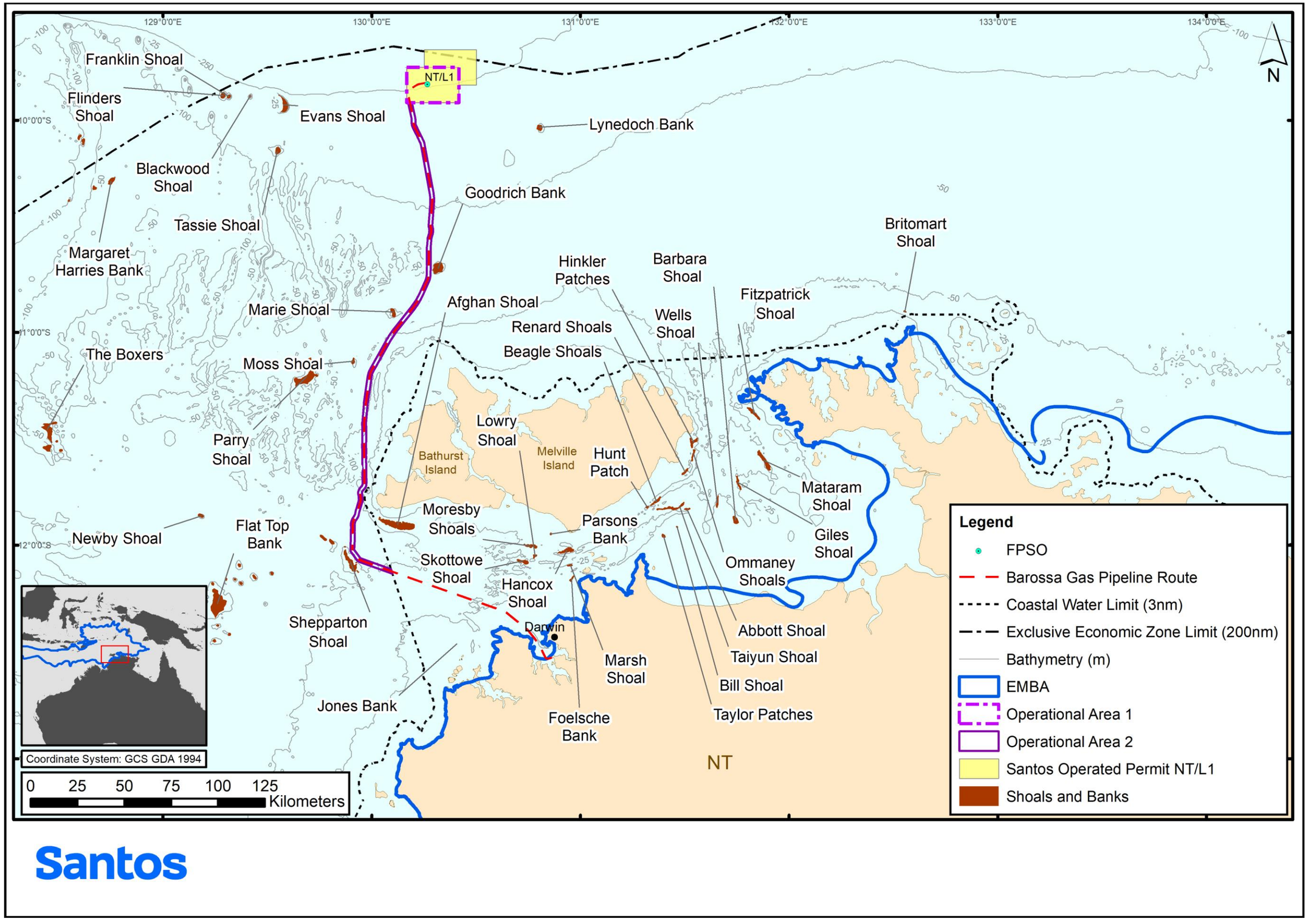
Table 3-3: Distances to the nearest shoals and banks from operational area 1

Geomorphic feature	Approximate Water depth (m).	Approximate distance/direction from OA1
Lynedoch Bank	10 to 30	45 km ESE
Evans Shoal	13 to 50	62 km W
Tassie Shoal	11 to 20	70 km SW
Blackwood Shoal	15 to 50	82 km W
Franklin Shoal	10 to 30	92 km W
Flinders Shoal	7 to 30	95 km W
Margaret Harries Bank	17 to 30	158 km SW
Sunrise Bank	33 to 50	218 km W

Table 3-4: Distances to the nearest shoals and banks to operational area 2

Geomorphic feature	Approximate Water depth (m)	Approximate distance/direction from OA2
Shepparton Shoal	10 to 40	0.843 km S
Goodrich Bank	15 to 50	0.984 km E
Marie Shoal	15 to 50	3.2 km W
Moss Shoal	20 to 60	8.7 km W
Afghan Shoal	30 to 50	19 km S
Parry Shoal	10 to 30	26 km W
Flat Top Bank	60 to 70	40 km WSW
Jones Bank	10	50 km SE
Skottowe Shoal	20 to 30	65 km E
Moresby Shoals	20	70 km E
Lowry Shoal	20	74 km E
Newby Shoal	30 to 70	78 km ESE
Parsons Bank	10 to 20	85 km ENE
Hancox Shoal	10 to 30	87 km E
Foelsche Bank	10	92 km E

Geomorphic feature	Approximate Water depth (m)	Approximate distance/direction from OA2
Marsh Shoal	10 to 20	92 km E
Beagle Shoals	20 to30	142 km ENE
Taiyun Shoal	20 to30	145 km ENE
Bill Shoal	20	154 km ENE
Abbott Shoal	20	160 km ENE
The Boxers	40 to100	160 km NW
Renard Shoals	20	163 km ENE
Ommaney Shoals	20	170 km ENE
Wells Shoal	20 to30	176 km ENE
Barbara Shoal	20	185 km E
Giles Shoal	20 to 30	190 km ENE
Mataram Shoal	20 to 40	205 km ENE
Fitzpatrick Shoal	30 to 40	210 km ENE
Howland Shoals	10	217 km SW
Britomart Shoal	29 to 31	249 km E
Deep Shoal 2	110 to130	266 km W
Echo Shoals	25 to 250	335 km W
Van Cloon-Deep Shoals	25 to 55	379 km W
Gale Bank	35 to 65	417 km W
Sahul Banks	25 to 500	476 km W
Eugene McDermott Shoal	20 to 105	588 km W
Westen Sahul Bank Shoals	25 to 250	599 km W
Vulcan Shoals	25 to 160	614 km W
Barracouta Shoals	20 to 175	639 km W
Fantome Shoals	7 to 20	650 km W
Woodbine Bank	15 to 110	691 km W
Johnson Bank	15 to 25	705 km W



Santos

Figure 3-3: Shoals and banks - Map 1

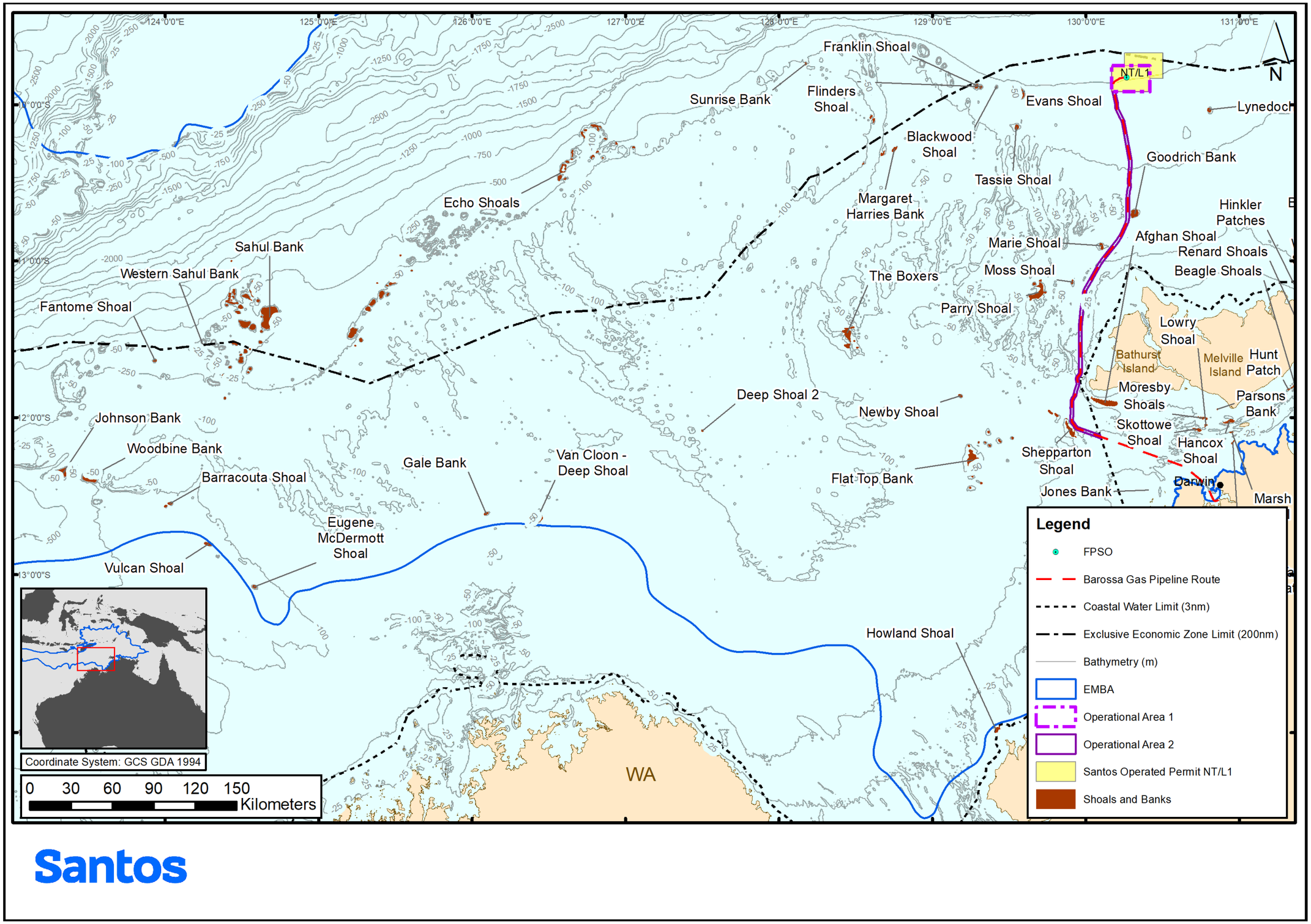


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Figure 3-4: Shoals and banks - Map 2

3.3.5.1 Summary of the Results from the Barossa Shoals and Banks Studies

Evans Shoal, Tassie Shoal and Lynedoch Bank were surveyed as part of the environmental baseline studies program (Jacobs, 2016a). There was a high degree of similarity between the surveyed sites, based on the consistent diversity observed in habitat features and biota present. One exception to this was the eastern slope of Evans Shoal, which showed a higher degree of similarity to a scarp feature (Jacobs, 2016a). This may be due to depth or greater exposure to predominant currents and weather.

In general, the reef flat at Evans Shoal was characterised by sand and algae-covered rubble with communities dominated by hard corals, soft corals, various algae and sponges which were present in varying degrees of diversity and abundance (Jacobs, 2016a; Heyward *et al.,* 2017). The plateaus of Evans Shoal and Tassie Shoal also had extensive areas of sand and rubble (Heyward *et al.,* 2017). Gorgonians and sea whips often dominated the reef crest, whereas the hard substrate of the slope predominantly supported sponges and filter feeders (such as gorgonians, feather stars and sea whips). Filter feeders became more prevalent on rocky outcrops beyond about 60 m depth (Heyward *et al.,* 2017). Of particular note were the northern and southern slopes of Evans Shoal as these supported large areas of dense plate coral (at 40 to 50 m water depth) and dense sub-massive coral (northern slope at about 47 m water depth) (Jacobs, 2016a).

Heyward *et al.,* (2017) also recorded areas of medium to high-density foliaceous coral at Evans Shoal and Tassie Shoal and noted that this habitat was very similar to that observed further west in the Sahul Shoals and within the deeper lagoon at Scott Reef. Overall coral cover of about 9% was observed at both Evans and Tassie Shoals (Heyward *et al.,* 2017). Single large bommies of the coral *Pavona clavus* are features on both Evans and Tassie Shoal (Jacobs, 2016a).

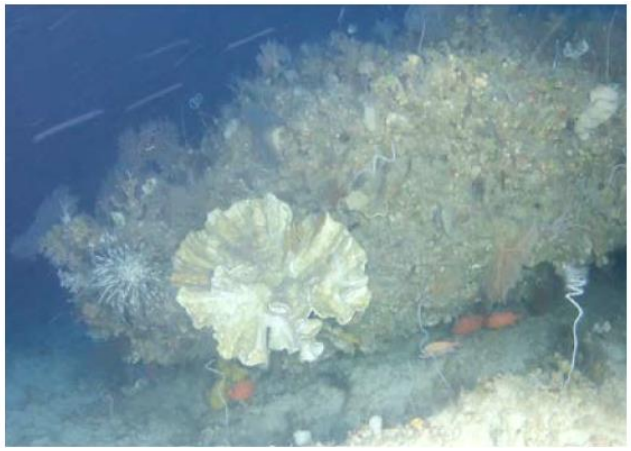
Heyward *et al.,* (2017) noted the seabed habitats at the shoals were broadly consistent with those observed from studies across the region. They also noted that while there were many similarities between the shoals in the region, there were differences – likely influenced by the broader physical environment. For example, the status of the benthic communities on each shoal may reflect different disturbance events (e.g. cyclone/storm damage and coral bleaching) and recruitment histories due to variations in biological connectivity (Heyward *et al.,* 2017).

The shoal slopes supported a diverse range of fish species typical of reef-fish assemblages as well as pelagic species. Species richness in the fish community was influenced most by the calcareous reef composition of the substrata, and the percentage cover of hard coral on this substratum type (Heyward *et al.,* 2017). Therefore, species richness decreased with depth as seabeds exhibited bare substrata. AIMS has conducted a detailed characterisation of the fish communities at Evans Shoal and Tassie Shoal (see Table 3-5).

Table 3-5 presents a summary of the results from the marine studies and mapping for Evans Shoal, Tassie Shoal Lynedoch Bank, Goodrich Bank, Marie Shoal and Shepparton Shoal.

Table 3-5: Summary of the results from the marine studies program

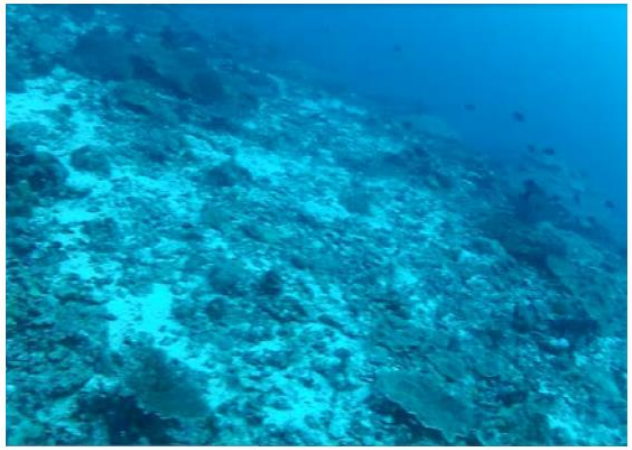
Shoal/bank	Description
Evans Shoal	Evans Shoal, located about 62 km to the west of OA1, is a flat-topped shoal that reaches a plateau at about 18 to 28 m below the sea surface. The infauna communities were reasonably diverse and abundant (3 to 63 individuals representing 3 to 42 taxa in the coarser sediments), with the species present being dominated by molluscs (e.g. Laevidentaliidae), crustaceans (e.g. tanaids, amphipods, isopods, callianassids) and annelid worms (e.g. syllids, *Nematonereis* species, lumbrinerids) (Jacobs, 2016a). The coarser sediments at Evans Shoal supported higher species diversity and abundance. The relationship between coarse sediments, high infaunal abundances and species richness has been previously identified in the northwest shelf with Huang *et al.*, (2013) noting that greater species richness and total abundance were associated with coarse-grained, heterogeneous sediments (Jacobs, 2016a). The key benthic habitats and dominant fish species observed are discussed below (Jacobs, 2016b). **Reef flat (centre of the shoal)** The transect was located at a water depth of about 28 m. The substrate was predominantly sand with patchy mixed beds of filter feeders (e.g. sponges and soft corals) and macroalgae. Hard corals were observed at a small bommie (Jacobs, 2016a). Heyward *et al.,* (2017) noted that hard corals were generally sparse or absent across large areas of the plateau, but their density increased towards the outer edges of the plateau. Several taxa of fish were observed, including species from families Labridae, (wrasse), Pomacanthidae (damselfish and clownfish), Acanthuridae (surgeonfishes, tangs and unicornfishes), Zanclidae (Moorish idols), Balistidae (triggerfishes) and Monacanthidae (leatherjacket). **Southern slope** Transects on this slope began on the reef flat in 18 m water depth. While the substrate of the reef flat was dominated by sand and rubble, some areas supported high-density coral cover (mostly plate and branching forms but also soft corals) and *Halimeda* species (calcareous algae). A diverse assemblage of reef-fish occurred in these areas and whitetip reef sharks were also observed. The reef crest of the shoal (about 32 m deep) was dominated by plate coral, whereas the upper slope was dominated by sand. As water depth increased the substrate changed from being dominated by plate corals (about 42 m depth) to macroalgae with scattered sponges and sea cucumbers (about 55 m depth).

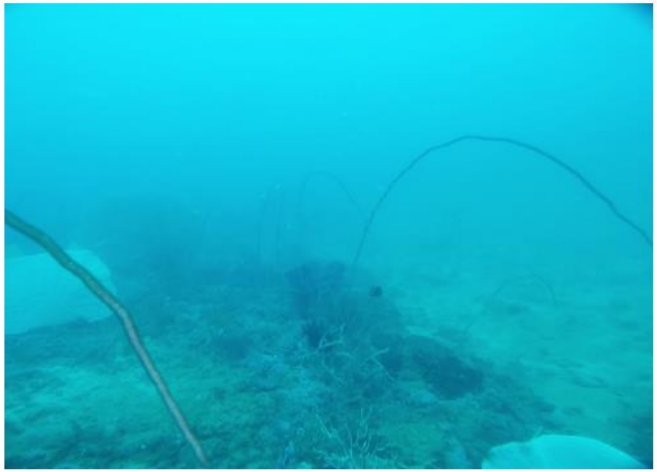
Shoal/bank	Description
	 Eastern slope Transects on this slope began at about 83 m water depth. The reef flat was characterised by sandy substrate with occasional small macroalgae. Silvertip sharks were observed in this habitat. The crest of the shoal (about 88 m deep) supported a rocky overhang with various types of filter feeders. The slope was dominated by steep rock faces and rocky overhangs with small sandy ledges that supported filter feeders (such as gorgonians, feather stars, sea whips and sponges) and reef-fish.  **Northern slope** Transects on the northern slope began at about 45 m water depth. The reef flat on this slope alternated between areas dominated by plate coral, sub-massive coral and macroalgae (including *Halimeda* species) with sponges. Whitetip reef sharks and one tawny nurse shark were observed on the reef flat, as were individuals from the fish families Labridae, Pomacentridae and Pomacanthidae. Small discrete piles of rubble were also observed and were likely to be triggerfish nests. The crest of the shoal (about 80 m deep) was colonised by sponges, filter feeders and algae. The reef slope was characterised by rocky substrate with small sand-covered ledges and supported communities dominated by sponges and filter feeders (such as gorgonians, feather stars, sea whips and sponges). One moray eel

Shoal/bank	Description
	(*Muraenidae*) and various species of fish (families Chaetodontidae (butterflyfish), Carangidae (queenfishes, runners, scads and trevallies), Caesionidae (fusiliers), Serranidae (groupers and reef cod) and Holocentridae (squirrelfish) were observed in the rocky overhangs of the reef slope.
Tassie Shoal	Tassie Shoal, located about 70 km to the west of OA1, is a flat-topped shoal that reaches a plateau at about 14 to 15 m below the sea surface. The infauna communities were reasonably diverse and abundant (12 to 33 individuals representing 12 to 24 taxa), with species present being dominated by syllid polychaetes, tanaid crustaceans, foraminifera, brittlestars and fibularid echinoderms (urchins) (Jacobs, 2016a). The key benthic habitats and dominant fish species associated with the shoal are discussed below (Jacobs, 2016a). **Reef flat** The reef flat was sampled at two sites at a water depth of about 15 m. The substrate consisted of sand, rubble and patchy reef structure. The reef structure was dominated by massive, sub-massive, plate and branching coral forms, and the hard substrate supported a range of sea whips, soft corals, *Halimeda* species, turf algae and sponges. Feather stars, large clams and a decapod crustacean were also recorded. A diverse range of tropical fish species were sighted including representatives from the families Labridae, Pomacentridae, Zanclidae, Pomacanthidae and Acanthuridae. Two whitetip reef sharks were also observed.

Shoal/bank	Description
	Eastern slope The transect began in about 28 m water depth. The reef crest was dominated by hard coral, soft coral and sponges, but also supported *Halimeda* species. Schools of fish (acanthurids and carangids) and sea snakes were observed on both the reef flat and upper slope. The top of the reef slope (30 to 50 m) was dominated by sponges and soft corals, such as gorgonians and sea whips. The substrate became dominated by sand and rock at about 50 m and began to flatten out and become dominated by sand around 70 m. A sea snake and a whitetip reef shark were observed at the bottom of the reef slope (about 48 m).
Lynedoch Bank	Lynedoch Bank, located about 45 km to the south-east of OA1, is a flat-topped bank which reaches a plateau at about 14 to 16 m below the sea surface. The infauna communities were reasonably diverse and abundant (56 individuals representing 39 taxa) with species present being dominated by nematodes, tanaid crustaceans, and polychaetes (tube-dwelling onuphids and chaetopterids, and lumbrinerids), brittlestars (ophiuroids) and mud shrimp (callianassids) (Jacobs, 2016a). The key benthic habitats and fish communities of the shoal are discussed below (Jacobs, 2016b). **Reef flat (centre of the shoal)** The reef flat was sampled at two sites at a water depth of about 16 m. The reef flat was dominated by sand and rubble with hard corals (mostly branching, massive and sub-massive), sponges, soft coral and *Halimeda* species present. Small reef-fish were common (including individuals from the families Chaetodontidae, Labridae and Zanclidae) with whitetip reef sharks, a sea snake and a moray eel also observed.

Shoal/bank	Description
	Eastern slope The transect began on the reef flat in about 26 m water depth, which was observed to be similar to that described above. The reef sloped gently to a depth of about 85 m and was characterised by a sand and rubble substrate. There was a noticeable low abundance of fish, sharks and other motile biota.

Shoal/bank	Description
	Western slope The reef flat was characterised by sand and rubble with hard corals (mostly branching, encrusting and massive forms), sponges and *Halimeda* species present. Small triggerfish (Balistidae) were common, with sharks (most likely silvertip and whitetip reef sharks) and a sea snake also observed. The reef crest (about 40 m water depth) and the slope were dominated by sand and rubble, with occasional sponges, sea stars, sea cucumbers, and reef-fish (Pomacanthidae). The slope flattened out at about 70 m deep and became dominated by sand. 
Goodrich Bank	Goodrich Bank is located approximately 984 m to the OA2. Surveys of two mid-shelf locations adjacent to Goodrich Bank and Cape Helvetius were undertaken in 2015 (Heyward *et al.,* 2017). During the survey these areas were found to be turbid and had large areas of bare seabed with patchy areas of filter feeder habitat and limited areas of consolidated substrate (Heyward *et al.,* 2017). Sponges were found to be the dominant fauna, which is consistent with other turbid sites in the region (Heyward *et al.,* 2017). Hard coral was only encountered in the shallowest survey transects at 30 m.
Marie Shoal	Marie Shoal is located approximately 3.2 km to the OA2. While no specific studies have been conducted at Marie Shoal, given its proximity to Goodrich Bank, and what is known about the general nature of shoals in the region (Heyward *et al.,* 2017), Marie Shoal is expected to have similar benthic habitat and characteristics to Goodrich Bank. This view is supported by the habitat mapping by AIMS (Heyward *et al.,* 2017) which presents filter feeder communities at both Marie Shoal and Goodrich Bank.

Shoal/bank	Description
Shepparton Shoal	Shepparton Shoal is located approximately 843 m to the OA2. Shepparton Shoal is relatively shallow (approximately 30 m deep) and differed from most other sites surveyed by having up to medium density filter-feeder communities (see photo for example of habitat type) predicted over most (86%) of the shoal (Radford *et al*., 2019). No hard or soft corals, or *Halimeda* communities were recorded and areas not supporting non-photic filter feeders were expected to comprise bare substrates (Radford *et al*., 2019). Fish were not surveyed at this site, but given the depths and habitat types present can be expected to be dominated by bony fishes, likely including stripey snapper (*Lutjanus carponotatus*), rockcod (*Epinephelus* spp), sandperch (*Parapercis* spp), threadfin bream (*Pentapodus emeryii*) surgeonfish (*Acanthurus* spp) and angelfish (*Chaetodontoplus duboulayi*). 

3.3.6 Offshore Reefs and Islands

Table 3-6 summarises the offshore reefs and islands within the EMBA. Extensive offshore reefs and islands are not present within OA1 or OA2 (Jacobs, 2016a; Fugro, 2016; DOF, 2018; Fugro Australia Marine, 2022). Offshore reefs include diverse coral and seagrass habitats, and benthic and fish communities. A number of these reefs and islands also have designated biological important areas (BIAs), where aggregations of individuals of a species are known to display biologically important behaviour such as breeding, foraging, resting or migration.

Table 3-6: Summary of the offshore reefs and islands within the EMBA

Offshore reef/ island	Description
Ashmore Reef	Ashmore Reef is located about 800 km to the south-west of the OA1 and is protected by the Commonwealth-managed Ashmore Reef Marine Park (Section 3.5.4.1.1). Ashmore Reef is also a designated Ramsar wetland of international significance (Section 3.5.2.1). The reef is a large platform reef of 227 km^2, consisting of an atoll-like structure with three low, vegetated islands, numerous banks of shifting sand and two large lagoon areas. The surrounding reef consists of a well-developed reef crest – most prominent on the south and east sides – and a broad reef flat that can be up to 3 km across. Along the edge of this reef flat area are large areas of drying sand that become exposed at low tide, particularly along the southern side. Water depth within the lagoon is highly variable, ranging from extremely shallow around the sand banks and up to 45 m in the deeper areas. The three islands located within the lagoon – West Island, East Island and Middle Island – are mostly flat, being composed of coarse sand with a few areas of exposed beach rock and limestone outcrops (Clarke, 2016). Five species of seagrass have been reported at Ashmore Reef, with *Thalassia hemprichii* being the dominant species (Pike & Leach, 1997; Skewes *et al.,* 1999b; Brown & Skewes, 2005). The total area of seagrass at Ashmore Reef in 1999 was estimated to be 470 ha (Skewes *et al.,* 1999b). However, much of this was very sparse cover and there were only 220 ha of seagrass with a greater than 10% cover (Brown & Skewes, 2005). Seagrass grew in a sparse, patchy distribution across the sand flats, but had a higher coverage on the reef flat area, where it extended to within 100 m of the reef crest. The area of greatest cover and diversity was in the west and south-west areas of the reef on the inner reef flat (Brown & Skewes, 2005). These seagrass meadows support a small but significant population of dugongs estimated at around 100 individuals in all age classes from calves to adults (Hale & Butcher, 2013). The diversity of fish at Ashmore Reef is higher than other comparable reefs in the NMR bioregion with more than 760 species recorded (Russell *et al.,* 2005; Kospartov *et al.,* 2006). The majority of fish species are shallow water, benthic taxa that typically inhabit depths down to 100 m and are widely distributed throughout the Indo-West Pacific (Russell *et al.,* 2005). The most species rich groups are gobies (Gobiidae), damselfishes (Pomacentridae), wrasses (Labridae), cardinal fishes (Apogonidae), moray eels (Muraenidae), butterflyfishes (Chaetodontidae), and rockcods and groupers (Serranidae) (Allen, 1989; Russell *et al.,* 2005). Macroalgae at Ashmore Reef are estimated to cover more than 2000 ha, mostly on the reef slope and crest areas (Hale & Butcher, 2013). The algal community is dominated by turf and coralline algae, with fleshy macroalgae comprising typically less than 10% of total algal cover (Skewes *et al.,* 1999b).
Cartier Island	Cartier Island is located about 780 km to the southwest of OA1. The island and surrounding reefs are protected by the Cartier Island Marine Park (Section 3.5.4.1.2). Cartier Island is an unvegetated sand cay surrounded by mature reef flats; it sits at the centre of a reef platform that rises steeply from the seabed. The island is composed of coarse sand and is stabilised by patches of beach rock around its perimeter. The island supports large populations of nesting marine turtles and is a designated nesting BIA for the green turtle (Section 3.5.6).
Hibernia Reef	Hibernia Reef is located about 740 km to the southwest of OA1 and is situated about 40 km north-east of Ashmore Reef and 60 km north-west of Cartier Island. Hibernia Reef consists of an approximately oval-shaped reef that tapers to a point on the western side. The reef covers an area of about 11.5 km^2 and has no permanent land, but large areas of the reef can become exposed at low tide. Hibernia Reef is also characterised by a deep central lagoon and drying sand flats.
Seringapatam Reef	Seringapatam Reef is located about 1000 km to the southwest of OA1 and is a remote atoll. It covers an area of about 55 km^2 and encloses a lagoon which has a relatively consistent depth of about 20 m (maximum depth of 30 m) (Heyward *et al.,* 2013). The lagoon is connected to the ocean by a narrow passage in the north-east part of the reef. Seringapatam Reef is recognised as a KEF (Section 3.5.5.3). Seringapatam Reef is a regionally important scleractinian coral reef as it has a high biodiversity comparable to Ningaloo Reef. Results from a Western Australian Museum (WAM) survey in 2006 noted 159 species of scleractinian corals with a hard coral cover of about 16% (WAM, 2009). The dominant benthic habitats of the reef were observed to include hard and soft corals (Heyward *et al.,* 2013 cited in ConocoPhillips, 2018). Several baseline studies were conducted at Seringapatam Reef in 2013, as part of interests in the Greater Poseidon Field in the Browse Basin. The dominant benthic habitats of the reef were observed to include turf algae, macroalgae, hard and soft corals, algae and filter feeders (e.g., sponges, gorgonians, hydroids and seapens) (Heyward *et al.,* 2013).

Offshore reef/ island	Description
	Seringapatam Reef was found to have a seagrass cover of 2 ha out of 5,519 ha (0.04%) composed of *Thalassia hemprichii* and *Halophila ovalis* in approximately equal quantities (Skewes *et al.,* 1999a). This finding contrasts with a more recent survey where only one species of seagrass (*Halophila decipiens*) was recorded at Seringapatam (Huisman *et al.,* 2009).
Scott Reef	Scott Reef is located about 1000 km to the southwest of OA1 and includes North Scott Reef and South Scott Reef. North Scott Reef is an annular reef, about 17 km long and 16 km wide, enclosing a shallow lagoon (up to 20 m deep) that is connected to the ocean by passages in the northeast and southwest (Gilmour *et al.,* 2013; Woodside, 2014). South Scott Reef is a crescent-shaped reef that is about 20 km wide. The lagoon at South Scott Reef ranges in depth (20 to 70 m) and supports significant benthic communities such as hard and soft corals. Sandy Islet, to the north of South Scott Reef, represents the only sandy shoreline habitat at Scott Reef and is a significant nesting site for green turtles, predominantly during the summer months (Gilmour *et al.,* 2013). Light penetration at Scott Reef is high due to low turbidity. Light penetration depths to the deeper part of South Reef Lagoon are in excess of 50 m with corals able to survive at depths of up to 70 m (Woodside Energy Limited *et al.,*2010). Scott Reef is recognised as a KEF (Section 3.5.5.3) and Commonwealth Heritage Place (Section 3.5.3). Scott Reef supports five species of seagrass (URS, 2006), with *Thalassia hemprichii* most abundant (Skewes *et al.,* 1999a; URS, 2006). The highly energetic environment and significant tidal exposure of Scott Reef restricts the area of habitats potentially suitable for seagrass establishment to a small proportion of the total area, resulting in low abundance (Skewes *et al.,* 1999a; URS 2006). Surveys at Scott and Seringapatam reefs (described above) recorded more than 100 species of marine algae (Huisman *et al.,*2009). The marine algal community was similar between reefs and also similar to the Rowley Shoals. Algae found at these offshore atolls forms a small subset of the Indo-Pacific algal flora, with virtually all of the species identified thus far having been previously collected from north-western Australia or from localities further north. Although further research is necessary, at present there is nothing to suggest that the macroalgal communities of these offshore atolls are unique within the Indo-Pacific (Huisman *et al.,* 2009). Scott Reef has enormous habitat diversity and is considered a hot spot for fish, with five endemic species (CoA, 2012a). The reef has biogeographic significance due to the presence of species which are at or close to the limits of their geographic ranges, including fish known previously only from Indonesian waters such as cardinalfish, azure damselfish (*Chrysoptera hemicyanea*), comb-tooth blenny (*Escnius schroederi*) and several Gobiids (CoA, 2012a). Coral communities at Scott Reef occur across shallow (< 30 m) and deep (> 30 m) habitats, with 306 species from 60 genera and 14 families having been identified (Gilmour *et al.,* 2009). Coral communities varied from shallow to deep water with 295 species recorded from shallow water environments and 51 species from deep water. Eleven species were only found in deep water environments. Of the corals recorded, none were endemic to Scott Reef (Gilmour *et al.,* 2009) and all were predominantly widespread Indo-Pacific species.
Tiwi Islands	The Tiwi Islands are situated about 80 km north of Darwin and are comprised of Melville Island, Bathurst Island and nine smaller uninhabited islands off the northern and southern shores. The islands are approximately 130 km south of OA1 and 7 km to the east of OA2. The islands cover an area of about 8,320 km^2 and support a number of important habitats, including extensive stands of mangroves, tidal mudflats, sandy beaches, seagrass meadows and fringing reef habitats (INPEX, 2010). Many species found on the islands are not recorded anywhere else in the NT, primarily due to their isolation and climatic extremes (high rainfall) (NRETAS, 2009a). The Tiwi Islands are Aboriginal freehold land owned by the Tiwi Aboriginal Land Trust (NRETAS, 2009a). The Tiwi Islands, and the small islands nearby, support important nesting sites for marine turtles, internationally significant seabird rookeries, and some major aggregations of migratory shorebirds. The sandy beaches on the Tiwi Islands, specifically the west coast of Bathurst Island and the north coast of Melville Island, are particularly important for marine turtle nesting. Nesting is dominated by flatback and olive ridley turtles (Chatto & Baker, 2008). However, green and hawksbill turtles also nest on the Tiwi Islands. Significant numbers of olive ridley turtles are known to nest on the beaches of Seagull Island and the north-west coast of Melville Island (Chatto & Baker, 2008). A number of BIAs for turtles are found along the coastlines of the Tiwi Islands (Section 3.5.6). Five seabird breeding colonies have been reported on small offshore islands surrounding Melville and Bathurst islands (Chatto, 2001) that range in size from two to more than 30,000 birds (Chatto 2001). The colony on Seagull Island, off the north-west tip of Melville Island, supports a breeding BIA of about 60,000 crested terns (Woinarski *et al.,* 2003a). This is thought to be the largest breeding colony of this species and is considered an internationally significant colony (> 1% global population) (NRETAS, 2009a). A 20 km buffer has been designated around the BIA as a foraging zone for the crested terns (see Section 3.5.6). The breeding period for the crested tern is from March to July, with most eggs being laid between late April and early June (Chatto, 2001). In general, colonial seabird breeding in the NT occurs throughout most of the year, though mostly between May and November (Chatto, 2001). The extensive areas of tidal flats, particularly on the south-east of Melville Island, have also been noted as providing important wading and feeding habitats for shorebirds. The highest total count

Offshore reef/ island	Description
	at this site was 40,000 shorebirds in 1993 with the most common species being great knots (Chatto, 2003). Other species recorded in high numbers include red-necked stints, greater and lesser sand plovers and bar-tailed godwits (Chatto, 2003). The north coast of the Tiwi Islands is recognised as a key site for the conservation of dugongs (PWSNT, 2003), as the shallow waters contain a significant seagrass habitat (Figure 3-13). See Section 3.4.3.1.1 for a further discussion of the presence of dugongs near the Tiwi Islands.
Vernon Islands Vernon Islands	The Vernon Islands are situated in the Clarence Strait in the Northern Territory, between Gunn Point on the Australian mainland and Cape Gambier on Melville Island. The island group comprises three major islands, a large reef, and numerous smaller reefs (including Harris Reef) and sand islands. These low-lying islands have a maximum height of 4 meters above sea level and feature sandy beaches with accessible inland areas via small creeks through mangrove thickets. Much of the surrounding area, including reefs, becomes exposed during low tide (Graham, 2008). The region experiences strong internal circulation and complex currents, particularly during monsoon conditions, due to minimal oceanic interaction (Smit *et al*., 2000). The islands are fringed with mangroves, mudflats, and rocks. In clearer waters, hard corals like Acropora and Montipora are common, alongside extensive coralline algal terraces (IMCRATG, 1998). The islands' marine environment includes diverse mangrove forests, rich reef systems, rocky shelves, seagrass, and algal beds (Tiwi Land Council, 2013). Coral reefs, an important habitat, are widespread, with deep "Blue Holes" supporting high species diversity. The endemic anemone fish *Amphiprion* spp. is also present (Tiwi Land Council, 2013). Satellite-tracking data from dugongs tagged as part of the INPEX Ichthys Project baseline surveys observed that dugongs around the Vernon Islands (Whiting *et al*., 2009). Additionally, there is a 60 km flatback turtle internesting buffer between Melville Island and the Vernon Islands. Culturally, the Vernon Islands hold significance for the Tiwi, Larrakia, and Wulna peoples. The Tiwi used the islands as staging posts for travel, hunting dugong and turtle, and believe their ancestor Mudunkala created the Tiwi Islands and the surrounding waters, including Clarence Strait (Graham, 2008). The Vernon Islands remain a vital spiritual, hunting, and fishing area. In 1978, a claim was lodged under the *Aboriginal Land Rights (Northern Territory) Act 1976* for the Vernon Islands. The case went to hearing in 2008 and 2009, resulting in the acceptance of the Tiwi claim. The Aboriginal Land Commissioner mandated an agreement on a conservation management regime between the NT Government and the Tiwi Land Council.

3.3.7 Other Seabed Features of Interest

3.3.7.1 Seamounts

Environmental baseline studies have included sampling sites at several seamounts in the broader vicinity of the Barossa development (within 9 to 18 km to the west of OA1). The seamounts are generally raised up from the seabed to water depths between 50 and 80 m and are characterised by predominantly sand and rubble (Jacobs, 2016a). The hard substrate of the seamount slopes support epibenthic communities dominated by sponges and filter feeders such as gorgonians (e.g. sea whips, sea fans and soft corals) and feather stars. Other epibenthic species observed included holothurians (sea cucumbers), sea fans and algae (Jacobs, 2016a).

Triggerfish nesting areas were apparent at the seamounts. The triggerfish (family Balistidae) appeared to make depressions in the sand and rubble at the top of the southernmost seamount surveyed, as they were observed in and around these depressions (Jacobs, 2016a). At a seamount about 18 km west of OA1, small discrete piles of rubble have accumulated that also may have been fish nests or as the result of tidal/current movement. These piles were also observed on the northern slope of Evans Shoal. The seamounts also appeared to support schools of fish (predominantly from the families Lutjanidae, Carangidae and Caesionidae, and including larvae or juveniles) both near the top of the seamount and at depth.

Four grey nurse sharks were observed at one of the seamounts in about 130 to 160 m water depth. This was considered unusual as neither the east nor west coast populations are known to extend that far north and are generally associated with shallower, more coastal waters (DoEE, 2017e).

Seamounts are likely to be observed sporadically across the wider EMBA and support epibenthic communities, such as sponges and filter feeders and schools of fish.

3.3.7.2 Scarps

The Barossa environmental baseline studies program included sampling sites at two scarps, 10 km to the south of OA1, which were in water depths ranging between 160 and 190 m. The substrate of the scarps was similar and characterised by a hard bedrock pavement at the top, with a rocky profile along the ridge and sand habitats at the base (Jacobs, 2016a). The scarps provided habitat for gorgonians (e.g. sea whips), feather stars and other filter feeders, sponges, and hydroid/bryozoan turf. A deep-water snapper species (possibly goldband snapper) was also observed in a rocky overhang at the base of the slope and small silver fish and one ray were observed on the sand flat at one of the scarps (Jacobs, 2016a).

Scarps are likely to be observed sporadically across the wider EMBA and support epibenthic communities, such as sponges and filter feeders and schools of fish.

3.3.8 Bathymetry and Seabed

Operational Area 1

Based on the extensive baseline studies (refer Table 3-5), the seabed within OA1 is generally flat and located on a plain feature that is devoid of any significant bathymetric features. The water depths in OA1 are between approximately 220 m to 280 m. The seabed was interpreted to comprise predominantly fine clayey sand and generally lack hard substrate (Fugro, 2016). The only relic seabed features observed were slight undulating sand waves (less than 25 cm in height) and widespread bioturbation (as in, burrows, mounds and tracks) (Jacobs, 2016a).

In general, the benthic habitats observed in OA1 were typical of those expected in offshore environments and were consistent with studies conducted both in areas with similar features and comparable geographic location (Jacobs, 2016c). See Section 3.4.1 for further details on the benthic habitats observed in the OA1.

OA1 occurs within the bounds of the Shelf Break and Slope of the Arafura Shelf KEF (Section 3.5.5.8). The ecological values associated with this unique seafloor feature (i.e. patch reefs and hard substrate pinnacles) were not observed during the surveys (Jacobs, 2016a).

Operational Area 2

Three geophysical surveys have been undertaken over the Barossa pipeline route and are relevant to OA2 (Fugro, 2016, DOF Subsea, 2018 and Fugro, 2022).

Based on the extensive baseline studies (refer Table 3-5), the water depths in OA2 are between approximately 254 m and 36 m. The northern section of OA2 has smooth to moderate slopes of fine to medium sands and silts and clay, with pockmarks and occasional outcrops. The southern section of OA2 has areas of highly irregular relief, smooth sandy and silty seabed (with megaripples and sandwaves), and rock and reef outcrops with coarse sediments (sand, gravel and shells).

Sediments along much of the OA2 are characterised by sand (0.063 mm to 2 mm) and gravel-sized (2 mm to 64 mm) particles, likely dominated by carbonates from weathering of hard substrate or biogenic production (DOF Subsea, 2018; Jacobs, 2017; Fugro, 2022). The relatively low portion of fine sediments may be the result of tidal currents winnowing fine sediments, which may also account for the naturally high levels of turbidity observed near the seabed. Laboratory analysis of sediment samples collected by Jacobs (2017) indicated most resuspended sediments would be deposited within 12 hours or less, with sediments from half of all sites expected to have more than 90% deposition in less than an hour (Jacobs, 2017).

Seabed feature observations are reported in kilometres relative to the distance from the northern to the southern end of the pipeline route corridor (referred to as KPs or Kilometre Points) and are summarised below (Table 3-7). Approximately 30 km of OA2 lies within the Oceanic Shoals Marine Park Multiple Use Zone, and approximately 31.5 km lies within the Habitat Protection Zone (refer Section 3.5.4.2.1). Water depth ranges from about 240 m to approximately 50 m towards the southern end of the OA2.

Table 3-7: Summary of seabed features along OA2

KP	Seabed feature observations
Offshore Barossa GEP KP0 to KP60	The pipeline route starts in 254 m of water and is essentially flat for the first 5 km. Between KP34.3 and KP41.8 the seabed is typically flat and featureless, the exception being a channel that crosses the route at KP39.8. A large sandwave field occurs between KP41.8 and KP50.75.
Offshore Barossa GEP KP60 to KP110	The route shallows from 101 m depth at KP70.7 to 73.5 m at KP87.7 before rising again to 78.6 m at KP109. Isolated and clustered pockmarks occur throughout the area. Habitat between KP70 and KP108, within the Van Diemen Rise KEF and Oceanic Shoals Marine Park, consists of burrowers and crinoids with a small outcrop of filter feeders at KP80. Between KP100 and KP110, the pipeline passes adjacent to Goodrich Bank. Goodrich Bank typically consists of coarse sandy substrate and sparse filter feeders (further described in Section 3.3.5).
Offshore Barossa GEP KP110 to KP165	The seabed is typically smooth and featureless except for numerous pockmarks and a large area of small depressions (attributed to biological activity) which occurs between KP1110 and KP122.5. At KP135, the pipeline passes about 2.3 km to the east of Marie Shoal. Between KP145 and KP175 it passes through the Habitat Protection Zone of the Oceanic Shoals Marine Park.
Offshore Barossa GEP KP165 to KP210	The seabed is typically smooth and featureless with large sandwaves and megaripples.
Offshore Barossa GEP KP210 to KP262	The seabed is dominated by a series of ridges and plateaus formed from harder material. Hard grounds occur as low- to high-relief topography which includes specific areas of outcrop. The AIMS habitat model (further described in Section 3.5.4.2.1) predicts outcrops of hard corals and filter feeders adjacent to the pipeline route between KP210 and KP235. Heyward *et al.* (2017) reports macroscopic biota was generally sparse but low to medium-density filter-feeder habitats were encountered. Sponges tended to dominate the filter-feeder habitats with various small to medium-sized soft corals contributing less biomass. In all cases these communities were associated with small-scale patches and consolidated substrate, either sandy pavement or minor rocky outcrops. Between KP247 and KP252 the pipeline re-enters the Van Diemen Rise KEF (see Section 3.5.5.9).
Nearshore Barossa GEP KP0 to KP23	The seabed is characterised as silty, shelly sand with very sparse (<1%) epibiota (mainly soft corals and crinoids). This section does not overlap any KEF.

EMBA

Notable features within the EMBA include the Bonaparte Depression, a 45,000 km^2 geomorphic basin and the Arafura Shelf, which is characterised by continental shelf, canyons, terraces, the Arafura Sill and the Arafura Depression (CoA, 2012a).

Most of the EMBA is expected to consist of flat, featureless seabed, as observed in the geophysical surveys undertaken in OA1 and OA2. Areas of the EMBA also include a range of geological features, including shelves, canyons, terraces, plateaus, valleys, pinnacles, reefs, banks and shoals (CoA, 2012a, 2012b).

Major geological features have been identified within the EMBA, including nine KEFs (described in Section 3.5.4.4). Notable reef and shoal habitats within the EMBA include those around Evans Shoal, Tassie Shoal, Lynedoch Bank, Ashmore Reef, Cartier Island, Hibernia Reef, Seringapatam Reef and Scott Reef (see Sections 3.3.5 and 3.3.6). Evans Shoal, Tassie Shoal and Lynedoch Bank, within the EMBA have been the

subject of field-based surveys (see a summary of the results in Section 3.3.5.1). Section 3.4.1 further details the benthic habitats in the EMBA.

Table 3-8 summarises the benthic and shoreline habitats within the OAs and EMBA, which are discussed further in Section 3.4.1.

The OAs and EMBA overlap several KEFs that include values relating to their seabed features. These are discussed in more detail in Section 3.5.4.4.

Table 3-8: Habitats associated with EMBA receptors within operational areas 1 and 2 and the MEVA

Category	Receptor	OA1 Presencee	OA2 Presence	MEVA	Northwest Transition	Northwest Shelf Transition	Timor Province	Timor Transition	Cocos (Keeling) Islands
Benthic habitats	Coral reefs	✗	✗	✓	✓	✓	✓	✗	✗
	Seagrass	✗	✗	✓	✓	✓	✓	✗	✗
	Macroalgae	✗	✓	✓	✓	✓	✓	✓	✗
	Non-coral benthic invertebrates	✓	✓	✓	✓	✓	✓	✓	✓
Shoreline habitats	Mangroves	✗	✗	✓	✗	✓	✓	✗	✗
	Intertidal platforms	✗	✗	✓	✓	✓	✗	✗	✗
	Sandy beaches	✗	✗	✓	✗	✓	✓	✗	✗
	Rocky shorelines	✗	✗	✓	✓	✓	✗	✗	✗

3.4 Ecological Environment

3.4.1 Benthic Habitats and Communities

Benthic habitats predominantly refer to communities consisting of marine plants, such as seagrass and macroalgae, or invertebrates such as reef-building corals.

Previous surveys in the Timor Sea indicate that between 50 and 200 m depth, the benthos consists mostly of soft, easily re-suspended sediments (Heyward *et al.,* 1997; URS, 2005, 2007). The diversity and coverage of epibenthos is low and organisms present are predominantly sponges, gorgonians and soft corals (Heyward *et al.,* 1997; URS, 2005, 2007).

The seabed features of regional interest nearest to OA1 (Evans Shoal, Tassie Shoal and Lynedoch Bank) and OA2 (Goodrich Bank, Marie Shoal and Shepparton Shoal) were subject of benthic habitats and communities surveys and mapping (refer to Section 3.3.5).

Heyward *et al.,* (2017) developed a spatial predictive benthic habitat model of the Oceanic Shoals Marine Park, where a portion of OA2 overlaps. This was part of the Australian National Environmental Science Program to determine the spatial heterogeneity of the benthic environment and key classes of organisms within the reserve. The outputs of this model are detailed in Section 3.5.4.2.1

See the sections below for a broad description of the benthic communities within the EMBA, with reference to the observations made during the relevant surveys and studies presented in Table 3-1.

Benthic Communities

Benthic macrofauna groups observed near OA1 include octocorals (particularly sea pens) and motile decapod crustaceans (mostly prawns and squat lobsters), which were recorded in relatively low numbers. Other biota observed included anemones, starfish, brittle star and soft corals (Jacobs, 2016a).

The frequent bioturbations (burrows, mounds and tracks) observed suggest several burrow-living decapods (such as prawns) may be present (Jacobs, 2016a). These species are more active at dawn, dusk or at night in habitats lacking cover and hence, are less likely to be recorded during daylight surveys (Jacobs, 2016a).

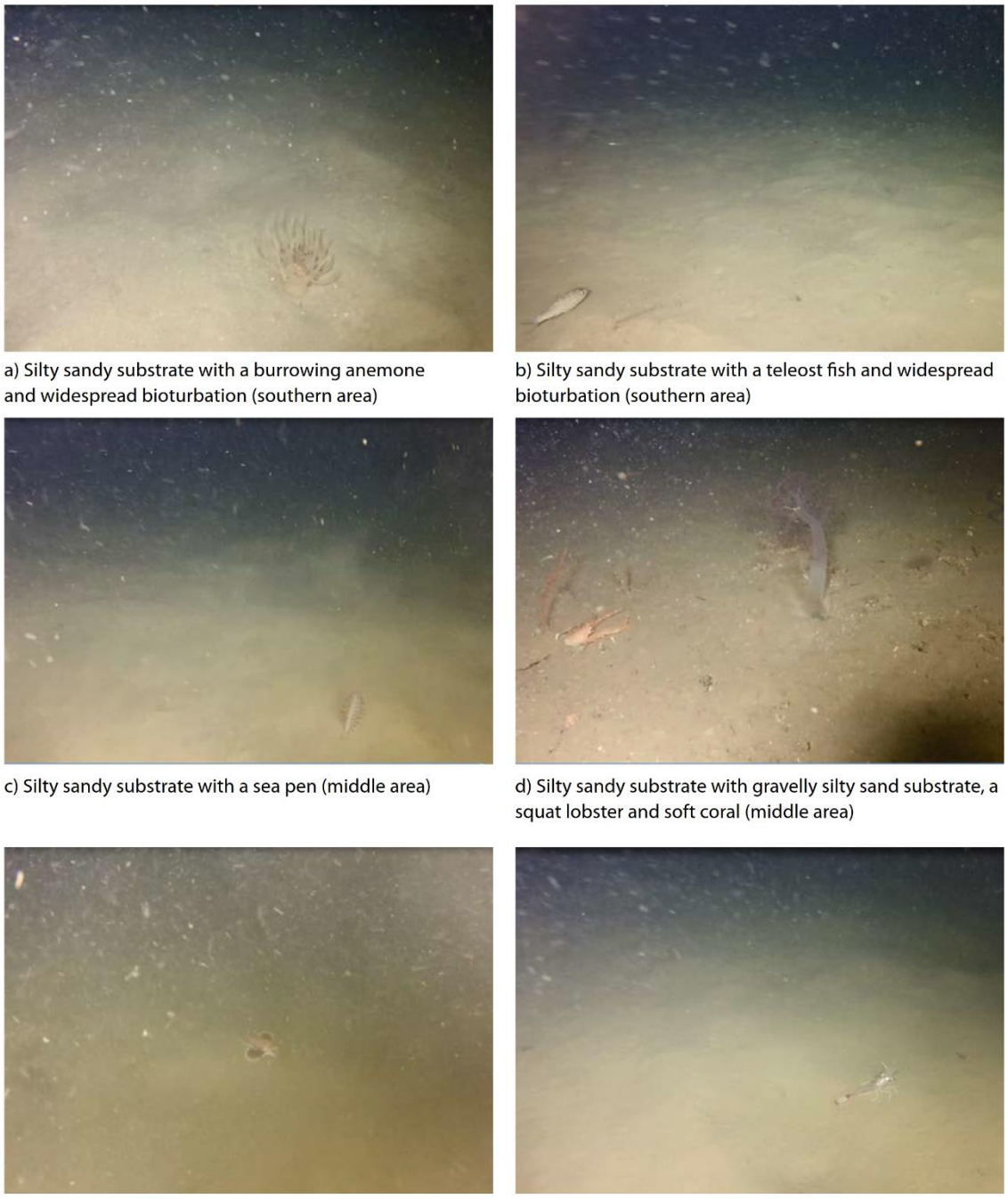
Infaunal communities near OA1 were characterised by burrowing taxa and demersal fish, namely foraminifera (an amoeboid protist), nematodes, *Bregmaceros* sp. (codlets), tube forming Onuphid polychaetes and the superb nutshell, *Ennucula superba*. The communities were characterised by low abundance (five to 15 individuals) and species diversity (five to nine taxa). The most common phyla within the infaunal communities were Annelida (total of eight individuals across the sampling sites), Mollusca and Foraminifera (total of seven individuals) and Crustacea (total of six individuals). Due to the lack of hard substrate, the associated epibenthos was expected to be sparse (Jacobs, 2016a).

The deep-water benthic characteristics of OA1 are broadly consistent with the results of similar surveys in offshore areas of the region (Jacobs, 2016a).

OA1 occurs within the bounds of the Shelf Break and Slope of the Arafura Shelf (KEF) (Section 3.5.5.8). The ecological values associated with this unique seafloor feature (i.e. patch reefs and hard substrate pinnacles) were not observed during the surveys (Jacobs, 2016a).

See Figure 3-5 for some images that represent the benthic habitats and macrofauna near OA1.

Three geophysical surveys have been undertaken over OA2 (Fugro, 2016; DOF Subsea, 2018; Fugro, 2022). A summary of the benthic communities observed have been included in Table 3-7.



a) Silty sandy substrate with a burrowing anemone and widespread bioturbation (southern area)

b) Silty sandy substrate with a teleost fish and widespread bioturbation (southern area)

c) Silty sandy substrate with a sea pen (middle area)

d) Silty sandy substrate with gravelly silty sand substrate, a squat lobster and soft coral (middle area)

e) Silty sandy substrate with a teleost (gurnard) (northern area)

f) Silty sandy substrate with a prawn (northern area)

Figure 3-5: Representative images of benthic habitats and macrofauna near the permit area (Jacobs, 2016a)

3.4.1.1 Coral Reefs

Extensive coral communities are not present within the OA1 or OA2 (Jacobs, 2016a, 2017; Fugro, 2016; DOF Subsea, 2018; Fugro, 2022). Within the EMBA the following coral reefs are present:

- Ashmore Reef
- Hibernia Reef
- Cartier Island
- Seringapatam Reef

- Scott Reef [4]
- Tiwi Islands
- shallower waters adjacent to the Indonesia and Timor-Leste coastlines.

Shoals and banks within the EMBA (identified in Section 3.3.5) are also likely or have been observed to have coral reefs present. The coral reef communities found on the Tiwi islands, Scott Reef, Ashmore Reef and Cartier Island have been further described in Table 3-6.

In addition, more than 150 shoal/bank features occur across the Carbonate Banks and Terrace System of the Sahul Shelf KEF (Section 3.5.5.5). The hard substrate of these banks is thought to support diverse organisms including sessile benthic invertebrates, such as sponges, soft and hard corals, gorgonians, bryozoans, ascidians and associated reef fish and elasmobranchs (Brewer *et al.,* 2007).

Coral reef communities within the EMBA are expected to be widespread in shallower waters adjacent to the coastlines of Indonesia and Timor-Leste. The EMBA overlaps a small portion of the southern boundary of the Coral Triangle, on the south coast of Timor-Leste and West Timor. The Coral Triangle is located in southeast Asia and the Pacific, and encompasses the tropical marine waters of Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor-Leste. It is considered to be a globally significant centre of marine life and coral diversity (Cross *et al.,* 2014)

Corals are both primary producers and filter feeders and thus play a role in the provision of food to marine fauna and in nutrient recycling to support ecosystem functioning (CALM & MPRA, 2005a). The distribution of corals in the area is governed by the availability of hard substrate for attachment and light availability. Corals create settlement substrate and shelter for marine flora and fauna. Studies have shown that declines in the abundance, or even marked changes in species composition of corals, has a marked impact on the biodiversity and productivity of coral reef habitats (Pratchett *et al.,* 2008). As part of the reef-building process, scleractinian corals are important for the protection of coastlines through accumulation and cementation of sediments and dissipation of wave energy (CALM & MPRA, 2005a).

3.4.1.2 Seagrasses

Seagrass communities are not present within the OA1 or OA2 (Jacobs, 2016a, 2017; Fugro, 2016; DOF Subsea, 2018; Fugro, 2022). Within the EMBA the following receptors have seagrass communities:

- Ashmore Reef
- South Scott Reef [4]
- Seringapatam Reef
- Tiwi Islands
- Lesser Sunda Ecoregion with Indonesian and Timor-Leste coastlines.

The above receptors have been described in Sections 3.3.5 and 3.3.6.

Seagrasses are biologically important for four reasons:

- sources of primary production
- habitat for juvenile and adult fauna such as invertebrates and fish
- a food resource
- their ability to attenuate water movement and trap sediment (Masini *et al.,* 2009).

More than 30 species of seagrasses have been recorded within Australian waters. Seagrasses inhabit a variety of substrates from mud to rock but occur most extensively on soft substrates. Seagrass meadows of note within the EMBA include those around the Tiwi Islands – these provide significant habitat to a number of species, including dugongs.

Seagrass habitats are widely distributed across the Lesser Sunda Ecoregion and within Indonesian waters the lower intertidal and upper subtidal zones are considered important areas for the growth of seagrass (Hutumo & Moosa, 2005). Pioneering vegetation in the intertidal zone is dominated by *Halophila ovalis* and *Halodule pinifolia* while *Thalassodendron ciliatum* dominate the lower subtidal zones (Hutumo & Moosa, 2005). Data from the United Nations Environment Program (UNEP) World Conservation Monitoring Centre has identified

[4] *Protected areas outside but in close proximity to the modelled EMBA such as Scott Reef Nature Reserve (inclusive of Scott Reef and Seringapatam Reef) to the southwest, have been included in this document.*

the southwest and west Lombok, Savu and the south coast of Timor-Leste as potential areas of importance for seagrass (DeVantier *et al.,* 2008).

3.4.1.3 Plankton

Plankton abundance and distribution is patchy, dynamic and strongly linked to localised and seasonal productivity (Evans *et al.,* 2016). Fluctuations in abundance and distribution occur both vertically and horizontally in response to tidal cycles, seasonal variation (light, water temperature and chemistry, currents and nutrients) and cyclonic events. As a key indicator for ecosystem health and change, plankton distribution and abundance has been measured for more than a century in Australia (Richardson *et al.,* 2005). The compilation of this data has been made publicly available and was used in the *Australia State of the Environment 2016* report (Jackson *et al.,* 2017) to nationally assess marine ecosystem health. According to their findings, warming ocean temperatures have extended the distribution of tropical phytoplankton species (which have a lower productivity) further south, resulting in a decline in primary productivity in oceanic waters north of 35°C, especially the North West Shelf (Evans *et al.,* 2016). Trends in primary productivity across Australia are variable, with the southwest of Australia experiencing an increase in productivity and northern Australia experiencing no change between 2002 and 2016 (Evans *et al.,* 2016).

During the marine studies program, phytoplankton and zooplankton species were sampled along 300 m-long surface water transect tows during three field surveys (June 2014, January 2015 and April 2015) using plankton nets (Jacobs, 2016a). Four of the sites were near the OA1 (only three of which were sampled in winter), three were at Evans Shoal (with only two sampled in winter), three were at Tassie Shoal (only one sampled in winter) and two were at Lynedoch Bank (autumn and summer only).

Phytoplankton assemblage composition was relatively similar across the seasons. Diatoms (Bacillariophyceae), blue-green algae (Cyanobacteria) and dinoflagellates (Dinophyceae) were recorded in all seasons, cryptomonads (Crytophyceae) in two seasons (summer and autumn), and silcoflatellates (Dictoyochophyceae) and green algae (Chlorophyceae) in only a single season (winter and autumn respectively) (Jacobs, 2016a).

Blue-green algae were the most abundant phytoplankton assemblage. They were recorded in about 87% of the transect tows and had a mean abundance of 74%. *Trichodesmium erythraneum* (a blue-green alga) was the most abundant phytoplankton species at the majority of sites during each season (Jacobs, 2016a).

The zooplankton assemblage composition was relatively similar across the season, with summer and winter being most similar (Jacobs, 2016a). The summer survey recorded the most diverse assemblage (14 classes of organisms), while autumn was the least diverse (either class) (Jacobs, 2016a).

3.4.2 Shoreline Habitats

Shoreline habitats are defined as those habitats that are adjacent to the water along the mainland and of islands that occur above the lowest astronomical tide (LAT) and most often in the intertidal zone. The shorelines relevant to the EMBA are those of the Tiwi Islands, Indonesia and Timor-Leste, Scott Reef, Ashmore Reef, and Cartier Island.

3.4.2.1 Mangroves

Within the EMBA the following receptors have mangrove habitat present:

- Tiwi Islands
- NT coastline and coastal islands
- Indonesian and Timor-Leste coastlines.

Along the shoreline of the Tiwi Islands mangroves are predominantly within tidal creeks and not exposed along the shoreline. Mangroves occupy a relatively small area of the Timor-Leste and Indonesian coastlines (Alongi, 2013).

Mangroves are common and widely distributed along coastlines of the NT (Chatto & Baker, 2008), and extensive mangals occur at many, if not most, of the tidal flats, estuaries and tidal creeks along the mainland coast and on islands that fall within the EMBA.

Mangroves are important primary producers and have several ecological and economic values. For example, they play a key role in reducing coastal erosion by stabilising sediment with their complex root systems (Kathireson & Bingham 2001). They are recognised for their capacity to help protect coastal areas from the damaging effects of erosion during storms and storm surge. Mangroves are important in the filtration of runoff from land, which helps maintain water clarity for the coral reefs that are often found offshore in tropical locations (NOAA, 2014). Indonesia has the largest total mangrove coverage of any country, with at least 31,890 km^2. This is slightly more than 20% of the global mangrove forest coverage (UNESCO, 2020). On the

other hand, mangroves in Timor-Leste are not so abundant. There are some fringing mangroves restricted to coastal lagoons and estuaries, due to the otherwise high-energy beaches, which are not suitable for natural mangrove establishment.

The muddy sediments that occur in mangrove forests are home to a variety of epibenthic, infaunal and meiofaunal invertebrates (Kathireson & Bingham 2001). Crustaceans known to inhabit the mud in mangrove systems include fiddler crabs, mud crabs, shrimps and barnacles. Within the water channels of the mangrove systems, various finfish are found from the smaller fish such as gobies and mudskippers (which are restricted to life in the mangroves) through to larger fish such as barramundi (*Lates calcarifer*) and the mangrove jack (*Lutjanus argentimaculatus).* Mangroves and their associated invertebrate-rich mudflats are an important habitat for migratory shorebirds from the northern hemisphere, as well as some avifauna that are restricted to mangroves as their sole habitat (Garnet & Crowley 2000).

The habitats and communities found on the Tiwi islands have been further described in Table 3-6.

3.4.2.2 Intertidal Mud/ Sand Flats

Within the EMBA the following receptors have intertidal mud/sandflats present:

- Tiwi Islands
- NT coastline and coastal islands
- South Scott Reef [5]
- Ashmore Reef
- Cartier Island
- Indonesian and Timor-Leste coastlines.

The Tiwi Islands have been identified as containing tidal flats. While their extent is not well documented, they are thought to be closely related to the mangrove habitats of the islands (Conoco Phillips, 2019).

Due to the large tidal ranges, intertidal flats are common along the NT coastline and often extensive at low tide, frequently occurring adjacent to, or in conjunction with, mangrove communities in the EMBA. Duke *et al.* (2010) indicates that intertidal mud/sand flats occur along >75% of the shore within the Darwin Harbour region and >66% of the coast between Mandorah and Point Blaze.

Intertidal mudflats form when fine sediment carried by rivers and the ocean is deposited in a low-energy environment. Intertidal mudflats are highly productive components of shelf ecosystems, responsible for recycling organic matter and nutrients through microbial activity. This microbial activity helps stabilise organic fluxes by reducing seasonal variation in primary productivity which ensures a more constant food supply. Intertidal sand and mudflats support a wide range of benthic infauna and epifauna which graze on microscopic algae and microbenthos, such as bivalves, molluscs, polycheate worms and crustaceans (Zell, 2007).

Ashmore Reef has intertidal sand flats and these, combined with shingle and pebble shores meet the definition of Ramsar wetland type E which is unique for the bioregion (Hale and Butcher, 2013). Back reef sands are characterised by intertidal and sub-tidal sands and comprise 40% of the Ashmore Reef. Ashmore Reef Nature Reserve also contains mud flats which meet the definition of Ramsar wetland type G, unique for the bioregion (Hale and Butcher, 2013).

Cartier Island is characterised as having sand flat habitats, which are specifically identified as supporting species such as turtles, stingrays, echinoderms, molluscs and crustaceans (Commonwealth of Australia, 2002)

The high abundance of invertebrates found in intertidal sand and mudflats provides an important food source for finfish and shellfish which swim over the area at high tide. Mudflats have also been shown to be significant nursery areas for flatfish. During low tide, these intertidal areas are also important foraging areas for indigenous and migratory shorebirds.

The habitats and communities found on the Tiwi islands, Scott Reef, Ashmore Reef and Cartier Island have been further described in Table 3-6.

Although no specific areas of intertidal mud or sand flats have been identified for international waters, the southern coasts of the islands that make up the Lesser Sunda Ecoregion of Indonesia and Timor-Leste do contain numerous estuarine habitats. These estuaries are likely to contain intertidal and tidal sand and mud flats that support a range of benthic invertebrate species that in turn attract other species such as birds and

[5] *Protected areas outside but in close proximity to the modelled EMBA such as Scott Reef Nature Reserve (inclusive of Scott Reef and Seringapatam Reef) to the southwest, have been included in this document.*

fish. Such estuaries in the Lesser Sunda Ecoregion are typically mangrove lined. Within the Lesser Sunda Ecoregion, the following areas are recognised as containing estuarine habitat (Wilson *et al*. 2011):

- Lombok
- Sumba
- Central south and central north coasts of Sumbawa
- North-east coast of Flores
- South-west coast of Timor-Leste.

The Irebere Estuary, located on the south-eastern coast, Tilomar located on the southern coast and Nino Konis Santana located on the eastern coast of Timor-Leste has been recognised as an Important Bird Area (Birdlife International 2018).

Several National Parks in the Ecoregion also contain estuarine habitats (likely to include intertidal sand and mud flats), including Karimunjawa National Park.

3.4.2.3 Sandy beaches

Within the EMBA the following receptors have sandy beaches present:

- Tiwi Islands.
- NT coastline and coastal islands.
- Scott Reef [5].
- Ashmore Reef.
- Cartier Island.
- Indonesian and Timor-Leste coastlines.

The sandy beaches on the Tiwi Islands (specifically the west coast of Bathurst Island and the north coast of Melville Island) are important areas for marine turtles, with nesting dominated by flatback and olive ridley turtles (peak nesting in March to May) (Chatto & Baker, 2008).

Northern territory sandy beaches intersected by the EMBA include part of the extensive stretches along northern Fog Bay up to Point Paterson, at Point Blaze and on many of the coastal islands which support turtle nesting (Chatto & Baker, 2008).

Sandy beaches at Ashmore Reef and Cartier Island are critical habitats, supporting nesting turtles and shorebirds, including resting areas during their migration. Scott Reef has one sandy shoreline habitat located north of South Scott Reef called Sandy Islet. Sandy Islet is significant for breeding green turtles, which nest here during the summer months (Gilmour *et al.,* 2013).

The southern coastlines of the Lesser Sunda Ecoregion of Indonesia and Timor-Leste islands are known to contain sandy beaches consisting of soft black sand, formed by volcanic activity. Within this region, a number of important sites for turtle nesting beaches have been identified (Huffard *et al.,* 2012).

Sandy beaches are those areas within the intertidal zone where unconsolidated sediment has been deposited (and eroded) by wave and tidal action. Sandy beaches can vary from low- to high-energy zones, the energy experienced influences the beach profile due to varying rates of erosion and accretion.

Sandy beaches provide habitat to a variety of burrowing invertebrates and subsequently provide foraging grounds for shorebirds (Garnet & Crowley, 2000). The number of species and densities of benthic macroinvertebrates that occur in the sand are typically inversely correlated with sediment grain-size and exposure to wave action and positively correlated with sedimentary organic content and the amount of detached and attached macrophytes (Wildsmith *et al.,* 2005). However, the distributions of these faunas among habitats will also reflect differences in the suite of environmental variables that characterise those habitats (Wildsmith *et al.,* 2005).

Sandy habitats are important for both resident and migratory seabirds and shorebirds (see Section 3.4.3.4). While sand flats and beaches generally support fewer species and numbers of birds than mudflats of similar size; some species such as the beach thick knee (*Esacus giganteus*), a crab eater, are commonly associated with sandy beaches (Garnet & Crowley, 2000). Sandy beaches can also provide an important habitat for turtle nesting and breeding (see Section 3.4.3.3.1).

The habitats and communities found on the Tiwi islands, Scott Reef, Ashmore Reef and Cartier Island have been further described in Table 3-6.

3.4.2.4 Rocky shorelines

Within the EMBA the following receptors have rocky shorelines present:

- Tiwi Islands
- NT coastline and coastal islands
- Indonesian and Timor-Leste coastlines.

Rocky shores can include pebble/cobble, boulders and rocky limestone cliffs (often at the landward edge of reef platforms). Rocky outcrops typically consist of hard bedrock, but some of the coastline has characteristic karst cliffs with an undercut notch. Rocky shorelines can vary from habitats where there is bedrock protruding from soft sediments to cliff-like structures that form headlands. Rocky shorelines are an important foraging area for seabirds and habitat for invertebrates found in the intertidal splash zone (Morton & Britton 2003).

Rocky shores occur along approximately 12% of the coastline in the Darwin Harbour and approximately 30% of the mainland coast between Mandorah and Point Blaze (Duke *et al*., 2010), as well as a number of coastal islands

3.4.3 Threatened and migratory fauna

Table 3-9 lists the threatened and migratory fauna within the OAs and EMBA as identified from the EPBC Act protected matters reports (Appendix E). Table 3-9 also lists the threatened species protected under the *Territory Parks and Wildlife Conservation Act 1976* (NT) (TPWC Act) that have the potential to occur within the EMBA.

For each species identified, the extent of the likely presence is listed in Table 3-9 and described in Sections 3.4.3.1 to Section 3.4.3.4.

An additional three species, the grey nurse shark (*Carcharias taurus*; EPBC-listed Vulnerable), Omura's whale (*Balaenoptera omurai*; not EPBC-listed) and the turtle-headed sea snake (*Emydocephalus annulatus*; EPBC-listed Marine), have been included in this EP as they were reported as occurring within or near the OAs during surveys as part of the Barossa Marine Studies Program. The OAs are overlapped by the East Asian-Australasian Flyway for migratory shorebirds that visit the mudflats of the Kimberley region to feed before migrating to the Arctic. The EMBA also overlaps the spawning grounds for southern bluefin tuna, listed as conservation dependent under the EPBC Act.

Note that terrestrial species (such as terrestrial mammals, reptiles and bird species) that appear in the EPBC Act protected matters report for the EMBA and do not have habitats along shorelines, are not relevant to the Activity impacts and risks have been excluded from Table 3-9.

Table 3-9: Threatened and migratory fauna that may be present in the operational areas and EMBA identified by EPBC Act protected matters reports

Marine Fauna				OA1		OA2		MEVA		EMBA		BIA
Common name	**Scientific name**	**EPBC Act 1999**	**Territory Parks and Wildlife Conservation Act 1976**	**May be present**	**Particular values or sensitivities**	**May be present**	**Particular values or sensitivities**	**May be present**	**Particular values or sensitivities**	**May be present**	**Particular values or sensitivities**	**May be present**
Sharks, rays and sawfishes												
Dwarf sawfish	*Pristis clavata*	Migratory, Vulnerable	Vulnerable	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	✓	species or species habitat known to occur within area	None – no BIA identified
Freshwater sawfish	*Pristis pristis*	Migratory, Vulnerable	Vulnerable	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	None
Giant manta ray	*Mobula birostris*	Migratory	-	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	None – no BIA identified
Great white shark	*Carcharodon carcharias*	Migratory, Vulnerable	-	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	None – no BIA identified
Green sawfish	*Pristis zijsron*	Migratory, Vulnerable	Vulnerable	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA identified
Grey nurse shark	*Carcharias taurus*	Vulnerable	-	✓	Not reported in the protected matters report for OA1, however reported as occurring within or near OA1 as part of the Barossa marine studies program	✓	Species or species habitat may occur within area. Reported as occurring within or near the OAs as part of the Barossa marine studies program	✓	Reported as occurring within or near the OAs as part of the Barossa marine studies program	✓	Reported as occurring within or near the OAs as part of the Barossa marine studies program	None – no BIA identified
Longfin mako	*Isurus paucus*	Migratory	-	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	None – no BIA identified
Narrow sawfish	*Anoxypristis cuspidate*	Migratory	-	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur in the area	✓	Species or species habitat known to occur within area	None – no BIA identified
Northern river shark	*Glyphis garricki*	Endangered	-	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Breeding known to occur within area	None – no BIA identified
Oceanic whitetip shark	*Carcharhinus longimanus*	Migratory	-	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	species or species habitat may occur within area	None – no BIA identified
Reef manta ray	*Mobula alfredi*	Migratory	-	✗	N/A	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	None – no BIA identified
Scalloped hammerhead	*Sphyrna lewini*	Conservation Dependent	-	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA identified
Shortfin mako	*Isurus oxyrinchus*	Migratory	-	✗	N/A	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	None – no BIA identified
Speartooth shark	*Glyphis glyphis*	Critically Endangered	Vulnerable	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur in the area	✓	Species or species habitat known to occur within area	None – no BIA identified
Whale shark	*Rhincodon typus*	Migratory, Vulnerable	Data deficient	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Foraging, feeding or related behaviour known to occur within area.	✓	species or species habitat may occur within area.	Yes – see Section 3.5.6
Other fish												
Southern bluefin tuna	*Thunnus maccoyii*	Conservation Dependent	-	✗	N/A	✗	N/A	✗	N/A	✓	Not reported in the protected matters	None – no BIA identified

Marine Fauna				OA1		OA2		MEVA		EMBA		BIA
Common name	Scientific name	EPBC Act 1999	Territory Parks and Wildlife Conservation Act 1976	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present
											report, however spawning area known to occur within the area	
Marine mammals												
Australian Humpback Dolphin	*Sousa sahulensis*	Migratory	-	✗	N/A	✓	Species or species habitat likely to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area.	Yes – see Section 3.5.6
Australian snubfin dolphin	*Orcaella heinsohni*	Migratory	-	✗	N/A	✓	Species or species habitat may occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area.	Yes – see Section 3.5.6
Bryde's whale	*Balaenoptera edeni*	Migratory	-	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	None-no BIA identified
Dugong	*Dugong dugon*	Migratory	-	✗	N/A	✓	Species or species habitat known to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area	Yes – see Section 3.5.6
Fin whale	*Balaenoptera physalus*	Migratory, Vulnerable	-	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Foraging, feeding or related behaviour likely to occur within area.	None – no BIA defined
Humpback whale	*Megaptera novaeangliae*	Migratory	-	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	None – no BIA defined
Killer whale, orca	*Orcinus orca*	Migratory	-	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	None – no BIA defined
Pygmy blue whale	*Balaenoptera musculus brevicauda*	Migratory, Endangered	-	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Migration route known to occur within area	✓	Migration route known to occur within area	Yes – see Section 3.5.6
Sei whale	*Balaenoptera borealis*	Migratory, Vulnerable	-	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Foraging, feeding or related behaviour likely to occur within area.	None – no BIA defined
Sperm whale	*Physeter macrocephalus*	Migratory	-	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	None – no BIA defined
Spotted bottlenose dolphin	*Tursiops aduncus (*Arafura/Timor Sea populations*)*	Migratory	-	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	Yes – see Section 3.5.6
Marine turtles												
Flatback turtle	*Natator depressus*	Vulnerable Migratory Listed Marine	-	✓	Species or species habitat known to occur within area	✓	Congregation or aggregation known to occur within area.	✓	Breeding known to occur within area	✓	Breeding known to occur within area	Yes – see Section 3.5.6
Green turtle	*Chelonia mydas*	Vulnerable Migratory Listed Marine	-	✓	Species or species habitat known to occur within area	✓	Congregation or aggregation known to occur within area.	✓	Breeding known to occur within area	✓	Breeding known to occur within area	Yes – see Section 3.5.6
Hawksbill turtle	*Eretmochelys imbricata*	Vulnerable Migratory Listed Marine	Vulnerable	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	Foraging, feeding or related behaviour known to occur within area	✓	Breeding known to occur within area	Yes – see Section 3.5.6
Leatherback turtle	*Dermochelys coriacea*	Endangered Migratory Listed Marine	Critically endangered	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	Foraging, feeding or related behaviour known to occur within area	Yes – see Section 3.5.6
Loggerhead turtle	*Caretta caretta*	Endangered Migratory Listed Marine	Vulnerable	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	Foraging, feeding, or related behaviour known to occur within area	✓	Foraging, feeding, or related behaviour known	Yes – See Section 3.5.6

Marine Fauna				OA1		OA2		MEVA		EMBA		BIA
Common name	Scientific name	EPBC Act 1999	Territory Parks and Wildlife Conservation Act 1976	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present
											to occur within area	
Olive ridley turtle	*Lepidochelys olivacea*	Endangered Migratory Listed Marine	Vulnerable	✓	Species or species habitat likely to occur within area	✓	Congregation or aggregation known to occur within area.	✓	Breeding known to occur within area	✓	Breeding known to occur within area	Yes – See Section 3.5.6
Sea snakes												
Dusky sea snake	*Aipysurus fuscus*	Endangered Listed marine	-	✗	N/A	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined
Leaf-scaled sea snake	*Aipysurus foliosquama*	Critically Endangered Listed Marine	-	✗	N/A	✗	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	None – no BIA defined
Short-nosed sea snake	*Aipysurus apraefrontalis*	Critically Endangered Listed Marine	-	✗	N/A	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined
Lizards												
Arafura Snake-eyed Skink	Cryptoblepharus gurrmul	Endangered	Endangered	✗	N/A	✗	N/A	✗	N/A	✓	Species or species habitat known to occur within area.	None- no BIA identified
Crocodiles												
Salt-water crocodile	*Crocodylus porosus*	Migratory Listed Marine	-	✗	N/A	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	None – no BIA defined
Birds												
Abbott's booby	*Papasula abbotti*	Endangered Listed Marine	-	✗	N/A	✗	NA	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	None – no BIA defined
Asian dowitcher	*Limnodromus semipalmatus*	Vulnerable Migratory	-	✗	N/A	✗	N/A	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined
Australian lesser noddy	*Anous tenuirostris melanops*	Vulnerable Listed Marine Migratory	-	✗	N/A	✗	N/A	✓	Breeding known to occur within area	✓	Breeding known to occur within area	None – no BIA defined
Australian painted snipe	*Rostratula australis*	Endangered Listed Marine	Endangered	✗	N/A	✗	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	None – no BIA defined
Bar-tailed godwit	*Limosa lapponica*	Migratory	-	✗	N/A	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined
Black-eared cuckoo	*Chalcites osculans*	Migratory	-	✗	N/A	✗	NA	✗	NA	✓	Species or species habitat known to occur within area overfly marine area	None – no BIA defined
Black tailed godwit	*Limosa limosa*	Endangered	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Bridled tern	*Onychoprion anaethetus*	Migratory	-	✗	N/A	✗	N/A	✗	NA	✓	Breeding known to occur within area	Yes – See Section 3.5.6
Broad-billed sandpiper	*Limicola falcinellus*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Brown booby	*Sula leucogaster*	Migratory	-	✗	N/A	✗	N/A	✓	Breeding known to occur within area	✓	Breeding known to occur within area	Yes – See Section 3.5.6
Caspian tern	*Hydroprogne caspia*	Migratory	-	✗	N/A	✗	N/A	✗	NA	✓	Breeding known to occur within area	None – no BIA defined
Christmas Island frigatebird	*Fregata andrewsi*	Endangered Migratory	Endangered	✗	N/A	✗	NA	✗	NA	✓	Foraging, feeding or related behaviour known to occur within area	None – no BIA defined
Christmas Island white-tailed tropicbird	*Phaethon lepturus fulvus*	Endangered Migratory	-	✗	N/A	✗	NA	✓	Foraging, feeding or related behaviour likely to occur within area.	✓	Foraging, feeding or related behaviour likely to occur within area.	None – no BIA defined

Marine Fauna				OA1		OA2		MEVA		EMBA		BIA
Common name	Scientific name	EPBC Act 1999	Territory Parks and Wildlife Conservation Act 1976	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present
Common greenshank	*Tringa nebularia*	Endangered Migratory	-	✗	N/A	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area overfly marine area	None-no BIA identified
Common noddy	*Anous stolidus*	Migratory	-	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area	None – no BIA defined
Common sandpiper	*Actitis hypoleucos*	Migratory	-	✓	Species or species habitat may occur within area.	✓	Species or species habitat may occur within area.	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined
Curlew sandpiper	*Calidris ferruginea*	Critically endangered Listed Marine Migratory	Critically endangered	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined
Eastern curlew	*Numenius madagascariensis*	Critically Endangered Listed Marine Migratory	Critically endangered	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined

Marine Fauna				OA1		OA2		MEVA		EMBA		BIA
Common name	Scientific name	EPBC Act 1999	Territory Parks and Wildlife Conservation Act 1976	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present
Fork-tailed swift	*Apus pacificus*	Migratory	-	✗	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	None – no BIA defined
Great frigatebird	*Fregata minor*	Migratory	-	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	Breeding known to occur within area	None – no BIA defined
Great knot	*Calidris tenuirostris*	Vulnerable Migratory	Endangered	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Greater crested tern	*Thalasseus bergii*	Migratory	-	✗	N/A	✗	NA	✓	Breeding likely to occur within area	✓	Breeding known to occur within area	Yes – See Section 3.5.6
Greater sand plover	*Charadrius leschenaultii*	Vulnerable Listed Marine Migratory	Vulnerable	✗	N/A	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined
Grey plover	*Pluvialis squatarola*	Vulnerable Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area overfly marine area	None – no BIA defined
Grey-tailed tattler	*Tringa brevipes*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Lesser crested tern	*Thalasseus bengalensis as Sterna bengalensis*	Migratory	-	✗	N/A	✗	NA	✓	Breeding likely to occur within area	✓	Breeding known to occur within area	Yes – See Section 3.5.6
Lesser frigatebird	*Fregata ariel*	Migratory	-	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area	None – no BIA defined
Lesser sand plover	*Charadrius mongolus*	Endangered Migratory	Endangered	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Little curlew	*Numenius minutus*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Little ringed plover	*Charadrius dubius*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Little tern	*Sternula albifrons*	Migratory	-	✗	N/A	✗	N/A	✓	Breeding known to occur within area	✓	Breeding known to occur within area	Yes – see Section 3.5.6
Long-toed stint	*Calidris subminuta*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Marsh sandpiper	*Tringa stagnatilis*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area overfly marine area	None-no BIA identified
Masked booby	*Sula dactylatra*	Migratory	-	✗	N/A	✗	N/A	✗	NA	✓	Breeding known to occur within area	None-no BIA identified
Northern Siberian bar-tailed godwit	*Limosa lapponica menzbieri*	Endangered Listed Marine Migratory	Vulnerable	✗	N/A	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined
Nunivak bar-tailed godwit	*Limosa lapponica baueri*	Migratory, Endangered	-	✗	N/A	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined
Oriental pratincole	*Glareola maldivarum*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Oriental plover	*Charadrius veredus*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Oriental reed-warbler	*Acrocephalus orientalis*	Migratory	-	✗	NA	✗	NA	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined
Osprey	*Pandion haliaetus*	Migratory	-	✗	N/A	✗	N/A	✓	Species or species habitat known to occur within area	✓	Breeding known to occur within area	None – no BIA defined
Pacific golden plover	*Pluvialis fulva*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Partridge Pigeon (eastern)	*Geophaps smithii smithii*	Vulnerable	-	✗	N/A	✗	NA	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined
Pectoral sandpiper	*Calidris melanotos*	Migratory	-	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area overfly marine area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined

Marine Fauna				OA1		OA2		MEVA		EMBA		BIA
Common name	Scientific name	EPBC Act 1999	Territory Parks and Wildlife Conservation Act 1976	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present
Pin-tailed snipe	*Gallinago stenura*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting likely to occur within area	✓	Roosting likely to occur within area	None – no BIA defined
Red-footed booby	*Sula sula*	Migratory	-	✗	N/A	✗	N/A	✓	Breeding known to occur within area	✓	Breeding known to occur within area	Yes – see Section 3.5.6
Red knot	*Calidris canutus*	Vulnerable Listed Marine Migratory	Endangered	✓	Species or species habitat may occur within area overfly marine area.	✓	Species or species habitat may occur within area overfly marine area.	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined
Red-necked stint	*Calidris ruficollis*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Red-tailed tropicbird	*Phaethon rubricauda*	Migratory	-	✗	N/A	✗	N/A	✓	Breeding known to occur within area	✓	Breeding known to occur within area	None – no BIA defined
Red-tailed Tropicbird (Indian Ocean	*Phaethon rubricauda westralis*	Endangered	-	✗	N/A	✗	NA	✗	NA	✓	Breeding known to occur within area	None – no BIA defined
Roseate tern	*Sterna dougallii*	Migratory	-	✗	N/A	✗	N/A	✓	Breeding likely to occur within area	✓	Breeding known to occur within area	Yes – see Section 3.5.6
Ruddy turnstone	*Arenaria interpres*	Vulnerable Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Rufous Fantail	*Rhipidura rufifrons*	Migratory	-	✗	N/A	✗	NA	✓	Breeding known to occur within area	✓	Species or species habitat may occur within area overfly marine area	None – no BIA defined
Sanderling	*Calidris alba*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Sharp-tailed sandpiper	*Calidris acuminata*	Vulnerable Migratory	-	✓	Species or species habitat may occur within area.	✓	Species or species habitat may occur within area.	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Streaked shearwater	*Calonectris leucomelas*	Migratory	-	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	None – no BIA defined
Swinhoe's snipe	*Gallinago megala*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Terek sandpiper	*Xenus cinereus*	Vulnerable Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None-no BIA identified
Wandering tattler	*Tringa incana*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
Wedge-tailed shearwater	*Ardenna pacifica*	Migratory	-	✗	NA	✗	NA	✓	Breeding known to occur within area	✓	Breeding known to occur within area	None – no BIA defined
Whimbrel	*Numenius phaeopus*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area	None – no BIA defined
White-tailed tropicbird	*Phaethon lepturus*	Migratory	-	✓	Species or species habitat may occur within area	✓	Species or species habitat may to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area	None – no BIA defined
Wood sandpiper	*Tringa glareola*	Migratory	-	✗	N/A	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area overfly marine area	None-no BIA identified

3.4.3.1 Fish

3.4.3.1.1 Sharks, Rays, and Sawfishes

Threatened and/or migratory shark, ray, and sawfish species under the EPBC Act within the OAs and EMBA have been identified in Table 3-9. These species are summarised below. The only species with a BIA within the EMBA is the whale shark (Table 3-9).

While not identified in the Protected Matters Search Tool (PMST), the grey nurse shark (*Carcharias taurus*) was observed during the marine studies program at a seamount of about 18 km to the west of OA1 (see Section 3.3.7.1). A description of this species has therefore been included below.

Dwarf Sawfish

The Australian distribution of the dwarf sawfish *(Pristis clavata*) is considered to extend across northern Australia and along the Kimberley and Pilbara coasts (Last & Stevens 2009; Stevens *et al.,* 2005). However, most of the dwarf sawfish recorded in WA and the NT have been from the shallow estuarine waters of the Kimberley region which are believed to be nursery (pupping) areas, with immature juveniles remaining in these areas up until three years of age (Thorburn *et al.,* 2008). Adults are known to seasonally migrate back into inshore waters (Peverell, 2007), although it is unclear how far offshore the adults travel – given captures in offshore surveys are very uncommon. The range of the species is restricted to brackish and salt water (Thorburn *et al.,* 2008).

Based on the habitat preferences of dwarf sawfish, it is considered highly unlikely the species occurs within the deeper offshore waters of the OA1 and the EMBA. However, they may be found within the southern end of OA2 and coastal habitats encompassed by the EMBA.

Freshwater/ Largetooth and Green Sawfish

Sawfishes generally inhabit inshore coastal, estuarine, and riverine environments. The freshwater sawfish or largetooth sawfish (*Pristis pristis*) has been recorded in north-west Australia from rivers (including isolated waterholes), estuaries and marine environments (Stevens *et al.,* 2005). Newborns and juveniles primarily occur in the freshwater reaches of rivers and in estuaries, while most adult freshwater sawfish have been recorded in marine and estuarine environments (Peverell, 2005; Thorburn *et al.,* 2007). It is believed that mature freshwater sawfish enter fewer saline waters during the wet season to give birth (Peverell, 2005) and freshwater river reaches play an important role as nursery areas (DoE, 2014a).

The green sawfish (*Pristis zijsron*) has predominantly been recorded in inshore coastal areas, including estuaries and river mouths with a soft substrate, although there have been records of sawfish offshore in depths up to 70 m (Stevens *et al.*, 2005). This species does not occupy freshwater habitats (DoE,2014a).

Short-term tracking has shown that green sawfish appear to have limited movements that are tidally influenced. They are likely to occupy a restricted range of only a few square kilometres within the coastal fringe, having a strong association with mangroves and adjacent mudflats (Stevens *et al.,* 2008). Sawfishes feed close to the benthos on a variety of teleost fishes and benthic invertebrates, including cephalopods, crustaceans, and molluscs (Compagno & Last, 1999; Last & Stevens, 2009; Pogonoski *et al.,* 2002; Thorburn *et al.,* 2007, 2008).

Based on the habitat preferences of freshwater and green sawfish, it is considered highly unlikely that freshwater and green sawfish would occur within the deeper offshore waters of OA1 and EMBA. However, they may be found within the southern end of OA2, and coastal habitats encompassed by the EMBA.

Giant Manta ray /Reef Manta ray

The giant manta ray (*Mobula birostris*) appears to be a seasonal visitor to coastal or offshore sites. Giant manta rays are often seen aggregating to feed, mate or clean. Sightings of these giant rays are often seasonal or sporadic but in a few locations their presence is a more common occurrence. This species is not regularly encountered in large numbers and, unlike some other rays, do not often appear in large schools (>30 individuals) when feeding. Overall, they are encountered with far less frequency than the smaller manta species, despite having a larger distribution across the globe (IUCN, 2019).

The giant manta ray occurs in tropical, sub-tropical and temperate waters of the Atlantic, Pacific, and Indian oceans. They are commonly sighted along productive coastlines with regular upwelling, oceanic island groups and particularly offshore pinnacles and seamounts. The giant manta ray is commonly encountered on shallow reefs while being cleaned or is sighted feeding at the surface inshore and offshore. It is also occasionally observed in sandy bottom areas and seagrass beds (IUCN 2019).

The reef manta ray (*Mobula alfredi*) has a circumtropical and sub-tropical distribution, existing in the Pacific, Atlantic and Indian oceans. Within this broad range, however, actual populations appear to be sparsely distributed and highly fragmented. This is likely due to the specific resource and habitat needs of this species.

Overall population size is unknown, but subpopulations appear, in most cases, to be small (about 100 to 2000 individuals). A proportion of the individuals in some populations undertake significant coastal migrations (IUCN, 2019).

Based on the habitat preferences of these rays and the location OA1 (i.e. deep offshore marine environment with no significant benthic features), it is considered highly unlikely they would occur in significant numbers, although individuals might transit through the area. However, the species may be found within the southern extent of OA2 given its proximity to coastal areas, as well as coastal waters of the EMBA.

Great White Shark

In Australia, great white sharks (*Carcharodon carcharias)* have been recorded from central Queensland (QLD) around the south coast to northwest WA but may occur further north on both coasts (Last & Stevens, 2009). They are widely but not evenly distributed in Australian waters and are considered uncommon to rare compared with most other large sharks (CITES, 2004).

Great white sharks can be found from close inshore around rocky reefs, surf beaches and shallow coastal bays to outer continental shelf and slope areas (Pogonoski *et al.,* 2002). They also make open ocean excursions and can cross ocean basins (for instance from South Africa to the western coast of Australia and from the eastern coast of Australia to New Zealand). Great white sharks are often found in regions with high prey density, such as pinniped colonies (DEWHA, 2009a)

Grey Nurse Shark

The grey nurse shark (*Carcharias taurus*) was observed during the marine studies program at a seamount of about 18 km to the west of OA1 (see Section 3.3.7.1) and is therefore likely to be present within the EMBA. The grey nurse shark has also been recorded by Momigliano and Jaiteh (2015) at oceanic coral reefs in the Timor Sea. In Australia, the grey nurse shark is now restricted to two populations: one on the east coast from southern QLD to southern NSW and the other mostly from the south-west coast of WA but also up as far as the Northwest Shelf (DEWHA, 2012b; Pogonoski *et al.,* 2002). The east and west coast populations are genetically different, with low frequency of immigrant exchange among each of these populations (Ahonen *et al.,* 2009).

While it is thought that grey nurse sharks have a high degree of site fidelity, grey nurse sharks have been observed to move between different habitats and localities, exhibiting migratory characteristics (Bansemer and Bennett, 2011). In certain areas grey nurse sharks are vulnerable to localised pressure due to high endemism. The status of the west coast population is poorly understood although they are reported to remain widely distributed along the WA coast and are still regularly encountered, albeit with low and indeterminate frequency (Chidlow *et al.,* 2006).

Grey nurse sharks are often observed hovering motionless just above the seabed, in or near deep sandy-bottomed gutters or rocky caves, and near inshore rocky reefs and islands (Pollard *et al.,* 1996). The species has been recorded at varying depths, but it is generally found between 15 and 40 m (Otway & Parker, 2000). Grey nurse sharks have also been recorded in the surf zone, around coral reefs, and to depths of around 200 m on the continental shelf (Pollard *et al.,* 1996). Grey nurse sharks feed primarily on a variety of teleost and elasmobranch fishes and some cephalopods (Gelsleichter *et al.*; 1999; Smale, 2005).

Given a grey nurse shark has been observed during the marine studies program at a seamount of about 18 km to the west of OA1 and species have also been observed by Momigliano and Jaiteh (2015) at oceanic coral reefs in the Timor Sea, it is likely the species will be present in the EMBA, around reefs, banks, and seamounts. Given the lack of suitable habitat for grey nurse shark in OA1 and OA2, it is likely the species would be transiting only if present in these areas.

Narrow Sawfish

Narrow sawfish (*Anoxypristis cuspidata*) have been recorded in inshore marine or brackish waters in water depths up to 40 m (GBRPMA 2012). While limited information is available on the narrow sawfish, it is thought that the species preferred habitat is on or near the seabed in shallow coastal waters and estuaries (GBRPMA 2012). The distribution of the species in Australian waters is unknown, however, it is most common in the Gulf of Carpentaria with southward ranges extending to Broad Sound (QLD) and the Pilbara coast (WA) (GBRPMA 2012). Pupping is understood to coincide with the wet season (DSEWPaC 2012a).

Based on the habitat preferences of freshwater and green sawfish, it is considered highly unlikely that dwarf sawfish would occur within the deeper offshore waters of OA1 and EMBA. However, they may be found within the southern end of OA2, and coastal habitats encompassed by the EMBA.

Sightings of the great white shark within OA1 and OA2 are not expected to be common. Their presence is likely to be limited to infrequent individuals transiting through the EMBA.

Northern River Shark

The northern river shark (*Glyphis garricki*) is one of the rarest species of shark in the world. Adults have only been recorded in marine habitats, whereas neonates, juveniles and subadults have been recorded in freshwater, estuarine and marine environments.

The associated recovery plan (*Sawfish and river sharks multispecies recovery plan*, CoA 2015b) cites observations of adults and juveniles in marine waters north of Derby, WA. Pupping and juvenile sharks are known to occur in Cambridge Gulf and pupping is also identified as likely to occur in King Sound. Under the recovery plan, all areas where aggregations of individuals have been recorded as displaying biologically important behaviours (e.g., breeding, foraging, resting, or migrating) are considered critical to the survival of the species unless population data suggests otherwise. It is possible that individuals may be encountered in low numbers within OA1, OA2 and EMBA.

Oceanic Whitetip Shark

The oceanic whitetip shark (*Carcharhinus longimanus*) is widespread throughout tropical and subtropical waters of the world (30° N to 35° S) (IUCN, 2019). They are an oceanic and pelagic species that regularly occur in waters of 18 to 28°C, usually >20°C (IUCN, 2019). Within Australian waters, they are found from Cape Leeuwin (WA) through parts of the NT, down the east coast of QLD and New South Wales (NSW) to Sydney (Last & Stevens, 2009). They are usually found in surface waters, though can reach depths of >180 m. They have occasionally been recorded inshore but are more typically found offshore or around oceanic islands and areas with narrow continental shelves (Last & Stevens, 1994). It is possible that individuals may be encountered in low numbers within the OA1, OA2 and EMBA.

Scalloped Hammerhead

The scalloped hammerhead (*Sphyrna lewini)* has a circum-global distribution in tropical and subtropical waters. It shows a strong genetic population structuring across ocean basins as it rarely ventures into or across deep ocean waters but ranges quite widely over shallow coastal shelf waters. Consequently, there is very little structuring from the eastern to western extends within Australia and it is likely to be shared stock with Indonesia (DCCEEW, 2023a).

Within Australian waters the scalloped hammerhead extends from NSW, around the north of the continent and then south into WA to approximately Geographe Bay, although it is rarely recorded south of the Houtman Abrolhos islands. Based on the wide distribution range of the species, individuals may be present within the EMBA. As the species range extends to water depths of 275 m, it is possible that individuals may occur within OA1, however, large numbers are not expected.

Shortfin Mako and Longfin Mako Sharks

The longfin mako (*Isurus paucus*) is a widely distributed but rarely encountered oceanic shark that ranges from Geraldton in WA and around the north coast, to at least Port Stephens in NSW (DSEWPaC, 2012a). The shortfin mako (*Isurus oxyrinchus*) is an oceanic and pelagic species, although they are occasionally seen inshore. They are found throughout temperate seas but are rarely found in waters colder than 16°C.

The shortfin mako is not known to be found in OA1 and uncommon in OA2. The longfin species are not expected to be common within OA1 or OA2, however both may be found within the EMBA.

Speartooth Shark

The speartooth shark (*Glyphis glyphis)* is a medium-sized shark found in tidal rivers and estuaries in the NT and QLD (DCCEEW, 2023a). The species is capable of living in both freshwater and seawater, tending to use tropical river systems as primary habitat (Stevens *et al.,* 2005). It has been recorded in tidal rivers and estuaries with turbid waters with fine muddy substrates in temperatures ranging from 27 to 33 °C (Pillans *et al.*, 2009).

There are three distinct geographical locations where the speartooth shark is known to occur, with only one of these areas close to the EMBA: the Van Diemen Gulf (about 20 km from the boundary of the EMBA). In the NT, the speartooth shark has been recorded in the Adelaide River, South, East and West Alligator Rivers, Murganella Creek and Marrakai Creek (DoE, 2014b). Records from the Adelaide River indicate that the species inhabits the upper reaches of the river system (Ward & Larson, 2012). This estuarine species is known to travel between freshwater and marine environments; therefore individuals may be encountered in low numbers within the EMBA

Whale Shark

The whale shark is the largest of all fish, reaching up to 18 m (Chen *et al.,* 1997; Compagno, 2001) and is a migratory species with worldwide geographical ranges between 30º N and 35º S (Last & Stevens, 2009). The species is oceanic but often forms aggregations in coastal waters at sites throughout the tropics. Typically, these aggregations are seasonal and often coincide with specific productivity events that are a focus of feeding

for the animals (Meekan *et al.,* 2009). For example, whale sharks aggregate to feed on dense swarms of copepods in Baja California (Clark and Nelson, 1997), fish spawn off Belize (Heyman *et al.,* 2001) and red crab larvae at Christmas Island (Meekan *et al.,* 2009) (outside the EMBA).

One of the best-known aggregation sites for whale sharks occurs along the central and north-west coast of WA from March to July, focused on Ningaloo Reef in the Exmouth region. The small size and general absence of female whale sharks from Ningaloo Reef suggests that the region may be important for feeding rather than breeding (Norman & Stevens, 2007). The timing of this aggregation coincides with a pulse in seasonal productivity that results in large abundances of tropical krill (Meekan *et al.,* 2006; Jarman & Wilson, 2004). At Ningaloo Reef, whale sharks are often found swimming close to the reef front, within a few kilometres of the shore and in water of less than 50 m. A tourist industry based on snorkelling with the sharks in this area has developed during the past 15 years and is now estimated to be worth over $4 million annually to the local economy of the Ningaloo region.

Whale sharks are known to be highly migratory with migrations of 13,000 km being recorded (Eckert & Stewart, 2001). Research on the migration patterns of whale sharks in the western Indian Ocean, and isolated and infrequent observations of individuals, indicate that a small number of the WA population migrate through the Northwest Shelf. Wilson *et al.,* (2006) tagged 19 whale sharks in 2003 and 2004, with long-term movement patterns successfully recorded from six individuals. All travelled north-east into the Indian Ocean after departing Ningaloo Reef, with one tracked to Ashmore Reef and another to Scott Reef. Whale sharks are occasionally observed from Santos' offshore oil and gas facilities on the Northwest Shelf (e.g. at Santos Harriet A and Stag platforms). In general, migration along the northern WA coastline broadly follows the 200 m isobath and typically occurs between July and November (DoE, 2015).

Due to their widespread distribution and highly migratory nature, whale sharks may occur in very low numbers within the OA1, OA2 and EMBA.

3.4.3.1.2 Other Fish

The EMBA supports offshore pelagic and demersal fish assemblages which are typical of those found in the NMR and NWMR. The threatened and/or migratory fish species under the EPBC Act that has been identified as potentially present in the EMBA is the southern bluefin tuna (*Thunnus maccoyii*), which is classified as conservation dependent.

Southern Bluefin Tuna

The southern bluefin tuna is regarded as a highly migratory species and occurs globally in waters between 30°S and 50°S. In Australia, southern bluefin tuna range from northern WA around the southern region of the continent into northern NSW. Spawning occurs near the surface in warmer waters (at least 24°C) during August–April, peaking in October–February (Honda *et al.,* 2010). The single known spawning ground for the species is located in the Indian Ocean between Java and northern WA, which intersects the region surrounding the proposed development. However, the habitat of the southern bluefin tuna does not overlap with the OAs and thus presence of the species is expected to be limited to the EMBA.

3.4.3.2 Marine Mammals

Threatened and/or migratory marine mammal species under the EPBC Act, that may occur within the OAs and EMBA have been identified in Table 3-9. These species are summarised below. Marine mammal BIAs are discussed in Section 3.5.6.

Australian Humpback Dolphin

Australian humpback dolphins (*Sousa sahulensis*) are found in tropical/subtropical waters of the Sahul Shelf from northern Australia to the southern waters of the island of New Guinea (Jefferson and Rosenbaum, 2014). They typically are found in small groups near estuaries, deep channels, rocky reefs, in sheltered bays, open ocean and occasionally in surf zones. At present, there is no range-wide estimate of the abundance of Australian humpback dolphins. Additionally, monitoring to estimate abundance is currently underway at several new locations in WA, NT and QLD. Overall, available abundance estimates indicate that Australian humpback dolphins occur in small populations averaging 54–89 individuals and 0.1–0.19 individuals per km² (Parra & Cagnazzi 2016). Threats to Australian humpback dolphins include habitat destruction and degradation from urban and coastal developments, noise pollution, boating activities, particularly close to population centres, and incidental capture in shark nets, trawl nets, drift nets and ghost nets. Overfishing of prey species and illegal killing are also threats (DCCEEW, 2023a). Australian humpback dolphins are most likely to be present in OA2 and shallower parts of the EMBA.

Australian Snubfin Dolphin

The Australian snubfin dolphin (*Orcaella heinsohni*) is known to occur within tropical NT coastal waters off northern Australia, extending north from Broome in WA to the Brisbane River in QLD (DCCEEW, 2023a). Surveys have indicated that the species is typically found in protected shallow nearshore waters, generally less

than 20 m deep, adjacent to river and creek mouths and close to seagrass beds (DCCEEW, 2023a). The majority of recordings are from river and creek mouths, and occasionally upstream tidal rivers, in waters of less than 10 m depth (CoA, 2012a). Data also suggests this species occurs in small, localised populations (DSEWPaC, 2012a).

Given this species' preference for nearshore waters and apparent high site fidelity, individuals may transit through the south of the EMBA on rare occasion and around the Tiwi Islands and in shallower waters OA2 in low numbers. Given the depths of OA1 the species is unlikely to be present.

Bryde's Whale

The Bryde's whale (*Balaenoptera edeni)* is found all year round in tropical and temperate waters (Kato, 2002). Two forms are recognised: inshore and offshore Bryde's whales. It appears that the inshore form is restricted to the 200 m depth isobar, while the offshore form is found in deeper waters of 500 to 1,000 m (DCCEEW, 2023a). Both forms are expected to be found in zones of upwelling where they feed on shrimp-like crustaceans (Bannister *et al.,* 1996). Little is known about the population abundance of Bryde's whale, the location of exact breeding and calving grounds and large-scale migration patterns (DCCEEW, 2023a). It is suggested, however, that the offshore form migrates seasonally, heading towards warmer tropical waters during the winter.

A few individuals of Bryde's whale were detected in the noise monitoring study for the Barossa marine studies program (Table 3-1). Further detail and copies of the studies are provided in Section 5, Appendix C and Appendix D of the Barossa Area Development OPP (ConocoPhillips, 2018). From January to early October (JASCO, 2016). McPherson *et al.,* (2015) commented that the presence of Bryde's whales would be expected based on the findings of several studies which noted the species' occurrence in the Timor Sea and surrounding waters. It is likely the individuals detected were the inshore form of the species. As such, it is possible the Bryde's whales may occasionally transit through the EMBA, OA1 and OA2; however, they are not expected to be present in significant numbers.

Dugong

Dugongs (*Dugong dugon*) are large herbivorous marine mammals (up to 3 m) that feed off seagrass and generally inhabit coastal areas. Dugong feeding aggregations tend to occur in large seagrass meadows within wide and shallow protected bays, shallow mangrove channels and in the lee of large inshore islands. Dugongs spend most of their time in the neritic zone within shallow tidal and subtidal seagrass meadows, and generally remain within an area of tens of kilometres (CoA, 2012b). Nevertheless, dugongs are known to migrate between seagrass habitats (hundreds of kilometres) (Sheppard *et al.,* 2006) and have been observed in water depths of up to 37 m (CoA, 2012b). Satellite-tracking data from dugongs tagged as part of the INPEX Ichthys Project baseline surveys observed that dugongs around the Vernon Islands, south of Melville Island, spent time in Darwin Harbour and around the Tiwi Islands (INPEX, 2010). Routine sightings occur in various locations along the NT coastline, including within Darwin Harbour and to the south of Melville Island (within the EMBA). The species is also found in Timor specifically in Taman buru bena, Teluk kupang marine tourism park, Menipo nature tourism park and Maubesi mangrove forest nature reserve.

As presented in Section 3.5.6, BIAs for foraging, breeding, calving, and nursing are identified at Ashmore Reef, which is located within the region surrounding development. However, as the dugong's dietary preference is seagrass, the species will occur within shallow waters, such as those surrounding the Tiwi Islands. A well-known major dugong aggregation of about 4400 individuals occurs in waters seaward (within about 50 km) of the Tiwi Islands and ranks in the top eight of dugong populations in the world. Dugongs are known to occur in OA2 and the shallower coastal waters of the EMBA, but not in OA1.

Fin whale

Fin whales (*Balaenoptera physalus*) have a worldwide distribution generally in deeper waters, with oceanic migrations between warm water breeding grounds and cold-water feeding grounds.

The fin whale distribution in Australia is not clear due to the sparsity of sightings. Information is known primarily from stranding events and whaling records. Fin whales have been observed in South Australian waters between November and May but their presence in NT waters is unknown (DCCEEW, 2023a).

There are no known mating or calving areas in Australian waters. However, it is possible that individual fin whales may pass through OA1 and the EMBA in low numbers, but not OA2.

Humpback whale

Humpback whales *(Megaptera novaeangliae*) have a wide distribution, with recordings throughout Australian Antarctic waters and offshore from all Australian states/territories (Bannister *et al.,* 1996). They occur throughout Australian waters as two genetically distinct populations on the east and west coasts. Both populations' distributions are influenced by migratory pathways and aggregation areas for resting, breeding and calving. In the west, humpback whales migrate north to breeding grounds in Camden Sound of the west Kimberley between May and November, with a peak period between late July and early August, after feeding in

Antarctic waters during the summer months (Jenner et at., 2001). Calving typically occurs between June and early September, within nearer shelf waters of the Camden Sound (DCCEEW, 2023a). The whale's southern migration runs between August and November, with females and calves being the last to leave the breeding grounds.

Relatively few humpback whales have been known to travel north of their calving grounds in Camden Sound (Jenner *et al.,* 2001). No humpback whales were recorded during the 12 months of noise monitoring undertaken as part of the Barossa marine studies program (see Table 3-1) (JASCO Applied Sciences, 2016; McPherson *et al.,* 2015). The species is considered unlikely to occur within OA1 but may occur in OA2 and the EMBA.

Killer whale

The killer whale (*Orcinus orca*) has a widespread global distribution and has been recorded in waters of all Australian states/territories (Bannister *et al.,* 1996). Killer whales are commonly found in cold, deeper waters but they have been observed along the continental shelf and in shallower coastal areas. They are also more likely to be observed around seal colonies, with the closest significant seal colony to the EMBA being at the Abrolhos Islands (about 2500 km southwest of the EMBA). While killer whales are known to undertake seasonal migrations and follow regular migratory routes, little is known about these movements (DCCEEW, 2023a). The species is unlikely to be present in OA1, OA2 or the EMBA given the water temperatures and lack of important habitat.

Pygmy Blue Whale

Two subspecies of blue whale are recorded in Australian waters: the southern (or true) blue whale (*Balaenoptera musculus intermedia*) and the pygmy blue whale (*Balaenoptera musculus brevicauda*). Southern blue whales are believed to occur in waters south of 60°S and pygmy blue whales occur in waters north of 55°S (i.e. not in the Antarctic). By this definition all blue whales in waters from Busselton, WA, to the NT border are assumed to be pygmy blue whales, so only this subspecies is discussed below.

Pygmy blue whales have a southern hemisphere distribution, migrating from tropical water breeding grounds in winter to temperate and polar water feeding grounds in summer (Bannister *et al.,* 1996, Double *et al.,* 2014). The WA migration path takes pygmy blue whales down the WA coast to coastal upwelling areas along southern Australia (Gill, 2002) and south at least as far as the Antarctic convergence zone (Gedamke *et al.,* 2007).

A noise monitoring study conducted as part of the Barossa marine studies program (Table 3-1) recorded pygmy blue whales moving in a northward direction in August 2014 and between late-May to early July 2015 (JASCO, 2016). It was estimated that the whales were anywhere from 5 to 80 km from OA1. The detections were recorded over 400 km north-east of the migration BIA for the species. No detections of the species were made during the period of their southward migration. Telemetry data collected from tagged pygmy blue whales indicates their migration patterns, highlighting a journey from the coastal waters of Western Australia to the surrounding marine regions of Indonesia (Sahri *et al*. 2022).

Generally, blue whales appear to travel as individuals or in small groups based on acoustic data. For example, analysis of pygmy blue whale calls from noise loggers deployed around Scott Reef (2006 to 2009) for the Woodside Browse project showed that 78% of the calls were from lone whales, 18% were from two whales and 4% were from three or more whales (McCauley, 2011; Woodside, 2014).

Possible foraging areas for pygmy blue whales within the EMBA include Scott Reef off the northern coast of Western Australia (CoA (2015a), and along the Timor Trough (Burton *et al*. 2023; Ferreira *et al*. (2024). These areas are likely to provide important feeding grounds for the species, supporting their migratory and ecological needs. The steep gradient features in this location tend to stimulate upwelling and thus increased productivity (seasonally variable) (ConocoPhillips, 2018). There are no known breeding areas of significance to blue whales in the EMBA.

As presented in Section 3.5.6, a migration BIA is located along the continental shelf edge off the WA coastline, extending offshore near Scott Reef and into Indonesian waters. The foraging BIA encompasses the Scott Reef area and the distribution BIA covers the full extent of the known range for the species. Neither of the BIAs overlap with OA1. However, based on the monitoring by JASCO (2016), pygmy blue whales may be temporarily present in OA1 as they migrate through the area on their northern migration. The species is unlikely to be present in OA2 given the water depths.

Sei Whale

Sei whales (*Balaenoptera borealis)* have a worldwide oceanic distribution, ranging from polar to tropical waters. Sei whales tend to be found further offshore than other species of large whales (Bannister *et al.,* 1996), the species typically occurs in oceanic basins and continental slopes (Prieto *et al.,* 2012). Records of the species occurring on the continental shelf (< 200 m water depth) are uncommon in all Australian waters (Bannister *et al.,* 1996).

Sei whales move between Australian waters and Antarctic feeding areas; however, they are only infrequently recorded in Australian waters (Bannister *et al.,* 1996) and their movement and distribution in Australian waters is not well known (DCCEEW, 2023a). It is possible that individual sei whales may be present in low numbers within the northern part of the EMBA and OA1, and unlikely to be encountered in OA2.

Sperm Whale

Sperm whales (*Physeter macrocephalus*) are distributed worldwide in deep waters (> 200 m) off continental shelves and sometimes near shelf edges, averaging 20 to 30 nautical miles offshore (Bannister *et al.,* 1996). The sperm whale is known to migrate northwards in winter and southwards in summer; however, detailed information on the distribution of sperm whales is not available for the timing of migrations. There are no sperm whale BIAs within OA1, OA2 and the EMBA. Sperm whales are unlikely to be present in the OA1, OA2 or the EMBA, given water depths and the distance from key areas in WA.

Spotted Bottlenose Dolphin (Indo-pacific Bottlenose Dolphin)

There are four known subpopulations of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*), of which the Arafura/Timor Seas population was identified as potentially occurring within OA1 and EMBA. The species occurs in NT open coastal waters, primarily within the continental shelf and around oceanic islands. The species forages in a wider range of habitats and within deeper waters than most dolphin species but is generally restricted to water depths of less than 200 m (DSEWPaC, 2012). The Arafura/Timor Sea Indo-Pacific bottlenose population is considered migratory; however, their movement patterns are considered highly variable, with some individuals displaying year-round residency in a small area and others undertaking long-range movements and migrations (DCCEEW, 2023a).

There is a breeding/calving BIA located in Darwin Harbour for the Indo-Pacific bottlenose dolphin that overlaps the EMBA (Table 3-16). Given spotted bottlenose dolphin use relatively deeper waters and potentially travel large distances, it is likely this species will also transit through other parts of the EMBA and may occasionally transit the EMBA.

3.4.3.3 Marine Reptiles

Threatened and/or migratory marine reptile species under the EPBC Act likely to occur within the OAs and EMBA have been identified in Table 3-9. These species are summarised below. Marine reptile BIAs and habitat critical areas are discussed in Section 3.5.6.

3.4.3.3.1 Marine Turtles

Marine turtles are long-lived, air-breathing, diving, marine reptiles that spend most of their life cycle in the ocean, with females spending a brief period on sandy beaches to nest and lay eggs. Following emergence from nests, hatchlings also spend a very short period on land as they crawl across the beach to the ocean and swim offshore. All marine turtle species share a very similar life cycle pattern comprised of three behavioural phases:

1. Migration: During the breeding period, males and females will migrate to mating areas, which may or may not be close to the nesting beach.
2. Inter-nesting: Females will spend several months at the nesting area, laying multiple clutches of eggs. Between nesting events, females will move to inter-nesting areas while they wait for the next clutch of eggs to form.
3. Foraging: After mating (males) or once their last clutch of eggs is laid (females), marine turtles migrate back to their remote foraging areas, where they build up their fat reserves before the next breeding migration. Most females will not nest in consecutive years (Miller 1996).

Considering these three behavioural phases, at any point in time, marine turtles may be present in an area either as residents on semi-permanent foraging grounds, as migrants moving between foraging sites and nesting areas, or as breeding animals that have migrated from their foraging ground to their nesting area, where females will remain as temporary residents for up to three months laying multiple clutches of eggs.

Six species of marine turtle use the waters and nest on sandy beaches in and around the EMBA. These are the green turtle (*Chelonia mydas*), flatback turtle (*Natator depressus*), hawksbill turtle (*Eretmochelys imbricata*), loggerhead turtle (*Caretta caretta*), olive ridley turtle (*Lepidochelys olivacea)* and leatherback turtle (*Dermochelys coriacea*) (Table 3-9).

These six species of marine turtle are in the EPBC Act's list of threatened species as either 'endangered' or 'vulnerable' and all six species are also listed as 'migratory'. The hawksbill turtle, loggerhead turtle and leatherback turtle are also protected under the TPWC Act.

See Table 3-10 for a summary of the different habitat types that marine turtle species use during their various life stages.

Table 3-10: Summary of habitat types for the life stages of the six marine turtle species in the EMBA as identified by EPBC Act protected matters reports

Life stage		Green turtle	Flatback turtle	Hawksbill turtle	Loggerhead turtle	Olive ridley turtle	Leatherback turtle
Post-hatchling		Open ocean pelagic habitats (poorly studied for Australian populations)	Coastal waters (poorly studied for Australian populations)	Open ocean pelagic habitats (poorly studied for Australian populations)	Pelagic (poorly studied for Australian populations)	Pelagic (poorly studied for Australian populations)	Pelagic (no data for Australian populations)
Adult	Mating	Offshore from nesting beaches.	Shallow waters offshore from nesting beaches.	Offshore from nesting beaches.	Expected to occur either enroute or adjacent to nesting beaches.	Not recorded within the North and Northwest marine bioregions.	Not recorded within the North and Northwest marine bioregions.
	Nesting	Typically, high-energy, steeply sloped beaches with deep sand and deep-water approach.	Typically, low-energy beaches that are narrow with a low to moderate slope. Beach approach obstructed by broad intertidal mud or limestone platforms.	Typically beaches close to nearshore coral reefs and sediment comprised of coarse sand and coral rubble.	Generally, prefer high-energy, relatively narrow, steeply sloped, coarse-grained beaches.	Not recorded within the North and Northwest marine bioregions.	Not recorded within the North and Northwest marine bioregions.
	Inter-nesting	Shallow coastal waters within several kms of nesting beach. Inter-nesting buffers of 20 km identified around all nesting habitats.	Shallow nearshore waters within 5 to 60 km of nesting beach. Inter-nesting buffers of 40 to 60 km identified around all nesting habitats.	Shallow coastal waters within several kms of nesting beach. Inter-nesting buffers of 20 km identified around all nesting habitats.	Shallow coastal waters within several kms of nesting beach. Inter-nesting buffers of 20 km identified around all nesting habitats.	Not recorded within the North and Northwest marine bioregions. Inter-nesting buffers of 20 km identified around all nesting habitats.	Not recorded within the North and Northwest marine bioregions.
	Foraging	Neritic habitats associated with seagrass and algae, and mangrove habitats.	Turbid, shallow inshore waters, subtidal, soft-bottomed habitats of the continental shelf.	Subtidal and intertidal coral and rocky reef habitats of the continental shelf.	Subtidal and intertidal coral and rocky reefs, seagrass, and deeper soft-bottomed habitats of the continental shelf.	Many feeds within continental shelf waters, however it is not known if others are pelagic, as with the east Pacific population.	Mostly pelagic but will forage close to shore and over continental shelf in temperate waters.

Marine Turtles local to the Tiwi Islands

In 2023, a desktop study (Pendoley, 2023) was commissioned on marine turtle activity occurring on, and around, the Tiwi Islands, utilising publicly available literature and research including:

- spatial data of marine turtle satellite telemetry studies on and around the Tiwi Islands; and
- information on beach-based studies occurring on the Tiwi Islands.

This section summarises the findings from that study.

The highest number of turtle tracks were recorded on the west coast beaches of Bathurst Island (flatback dominated), the northwestern tip of Melville Island (flatback and olive ridley dominated), and on Seagull Island (olive ridley dominated) (Figure 3-6; Chatto & Baker 2008). Seagull Island is estimated to support 1001–5000 nesting female olive ridleys per year and the northwestern tip of Melville Island, known as Imalu (Cape van Dieman), is estimated to support a nesting population of 501–1000 olive ridleys and 11–100 flatback turtles per year (Queensland Government, 2021; Whiting *et al.,* 2007).

Pendoley (2023) identified that the waters surrounding the Tiwi Islands are traversed by marine turtles nesting in other areas of northern Australia, including olive ridleys from the Wessel Islands, flatback turtles from WA, QLD and the NT, green turtles from WA and from Groote Eylandt, and loggerhead turtles from WA (Table 3-11). Collectively, this data indicates that marine turtle migratory pathways are largely restricted to the waters inside of the 100 m depth contour (i.e., waters less than 100 m deep). Migration pathways often followed the mainland coastline or north-east or western coastlines of the Tiwi Islands.

The turtle foraging areas and migration pathways summarised by Pendoley (2023) did not overlap with OA1 located approximately 130 km north of the Tiwi Islands; however, their east-west migration pathways passed over OA2 immediately north of the Tiwi's. OA2 also overlapped with waters identified as critical habitat for flatback and olive ridley turtles nesting on the Tiwi's. Olive ridley foraging habitat occurred further east and west in the Arafura and Timor Sea areas, and in the Bonaparte Gulf and the Gulf of Carpentaria. In comparison, foraging habitat for green and loggerheads was largely restricted to shallow nearshore waters while flatbacks were found in deeper water approximately 100 km northwest of the Tiwi's.

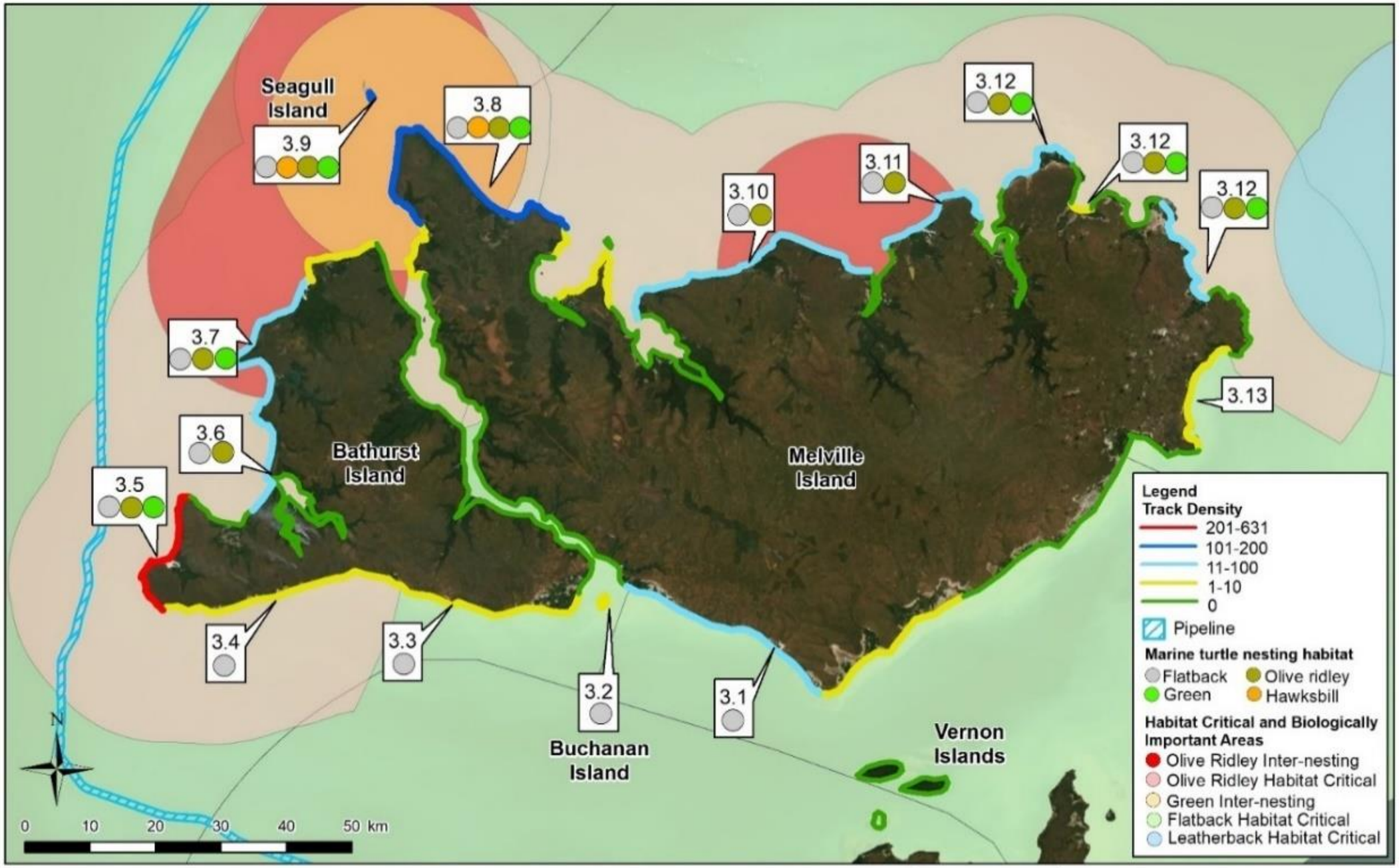
Table 3-11: Summary usage of Tiwi Island beaches and waters

Category	Use of Tiwi Islands beaches and waters					
	Nesting	Inter-nesting	Migration	Foraging	Overlap with OA2	Overlap with OA1
Olive ridley	Yes	Yes	Yes	Unknown	Yes (migration)	No
Flatback	Yes	Yes	Yes	Yes (WA, NT nesting stocks)	Yes (migration)	No
Green	Yes	Yes*	Yes	Yes (WA, Scott Reef, NW Shelf, Ashmore stock, NT stocks)	Yes (migration)	No
Hawksbill	Yes	Yes*	Yes	Unknown	Unknown	Unknown
Loggerhead	No	No	Yes	Yes	Yes (migration)	No
Leatherback	No	No	Unknown	Unknown	Unknown	Unknown

** = assumed based on nesting*

Four of the six species of marine turtle that occur in Australian waters are commonly recorded nesting on beaches in the NT, including the flatback turtle, green turtle, hawksbill turtle and olive ridley turtle (Chatto & Baker 2008). On-ground and aerial surveys conducted over a 15-year period identified twelve key nesting areas in the NT that were considered of international or national importance to marine turtles, and two of these significant nesting areas occur on the Tiwi Islands. These two latter sites are the beaches along the northern coastline of Melville Island and southwest of Bathurst Island (Chatto & Baker 2008). The two most abundant species to nest on the Tiwi Islands are the flatback turtle and olive ridley turtle (Chatto & Baker 2008).

The beaches along the southwest and southern coast of Bathurst Island are largely used by flatback turtles for nesting (Chatto & Baker 2008), while the northern sections of Bathurst and Melville Islands are dominated by a combination of flatback and olive ridley nesting (Chatto & Baker 2008). Low levels of green turtle nesting have also been confirmed on the Tiwi Islands (Segments 3.5, 3.7 – 3.9, 3.12 in Figure 3-6; Chatto & Baker 2008; Whiting *et al.,* 2007), and hawksbill turtles have been confirmed nesting on Seagull Island and on the northwestern tip of Melville Island (Segment 3.8 and 3.9 in Figure 3-6; Chatto & Baker 2008).



Data sources: Chatto, R. & Baker, B. (2008) The distribution and status of marine turtle nesting in the Northern Territory. Parks and Wildlife Service, Department of Natural Resources, Environment, The Arts and Sport, Northern Territory Government, Palmerston; Habitat critical to the survival of marine turtles in Australian waters. COPYRIGHT Commonwealth of Australia, Australian Government Department of Climate Change, Energy, the Environment and Water, 2020; Biologically Important Areas of Regionally Significant Marine Species. COPYRIGHT Commonwealth Energy, the Environment and Water, 2015.

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PENDOLEY ENVIRONMENTAL

Figure 3-6: Marine turtle nesting beaches on the Tiwi Islands and confirmed nesting species (Pendoley, 2023)-

Table 3-12 presents the annual activity calendar for olive ridley and flatback turtles nesting on the Tiwi Islands (Whiting *et al.,* 2007; CoA, 2017) and timing of foraging and migration for all species recorded migrating through or foraging in the waters surrounding the Tiwi Islands. The light grey within Table 3-12 presents year-round low level, dispersed activity; dark grey: peak months for each activity. Foraging occurs year-round for all species. The timing of green turtle and hawksbill turtle nesting and hatching on the Tiwi Islands is unknown due to the low number of records for these species (see Table 3-12 footnote*).

Table 3-12: Annual activity calendar for olive ridley and flatback turtles nesting on the Tiwi Islands timing of foraging and migration for all species recorded migrating through or foraging in the waters surrounding the Tiwi Islands

Species/Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flatback – Arafura Sea stock												
Nesting/inter-nesting												
Hatchling emergence												
foraging												
Olive Ridley – Northern Territory stock												
Nesting/inter-nesting												
Hatchling emergence												
Foraging												
Green – Cobourg genetic stock												
Nesting/inter-nesting*												
Hatchling emergence*												
Foraging												
Green – Gulf of Carpentaria stock												
Nesting/inter-nesting*												
Hatchling emergence*												
Foraging												
Hawksbill – North East Arnhem Land stock **NE Arnhem**												
Nesting /inter-nesting*												
Hatchling emergence*												
Foraging												
Green, flatback, olive ridley, loggerhead and hawksbill turtles from NT, WA and Qld migrating through Tiwi waters to and from nesting sites												
Migrating turtles												

**The peak nesting and hatching time for green and hawksbill turtles on the Tiwi Island's is currently unknown. The information presented here is based on the timing of nesting and hatching reported in the Recovery Plan for the green turtle Cobourg and Gulf of Carpentaria genetic stocks (Commonwealth of Australia, 2017) and the hawksbill turtle north-east Arnhem Land genetic stock (Hoenner et al., 2015; Commonwealth of Australia, 2017) and may be indicative of Tiwi Island nesting turtle activities.*

Further information on the marine turtle species found on the Tiwi Islands and within the EMBA are described below.

Flatback Turtle

The flatback turtle (*Natator depressus*) has an Australasian distribution, with all recorded nesting beaches occurring within tropical to subtropical Australian waters. The management of the flatback turtle in Australia is broken up into five stocks around Australia: eastern QLD, the Arafura Sea, Cape Domett, southwest Kimberley and the Pilbara (CoA, 2017).

As described in the Section above, flatback turtles nesting within the NT are all from the Arafura Sea breeding stock (genetic stock). The long-term trend of this stock is unknown (CoA, 2017). Studies undertaken by Chatto

& Baker (2008) along sections of coastline in the NT, including the Tiwi Islands, estimate that high numbers of flatback turtles nest within four segments of the Tiwi Islands coastline (Segments 3.5, 3.8, 3.9, 3.12; Figure 3-6). Flatback turtles nest at low numbers year-round in the NT, however, there are recognised windows of peak nesting activity from June to September (Chatto & Baker 2008; CoA, 2017) (Table 3-12). After nesting, flatback turtles typically forage in waters < 50 m deep and within 66 km from shore (Whittock *et al.,* 2016). Their main diet comprises sea pens, jellyfish, soft corals, and holothurians (Limpus 2007).

To date there is no evidence to indicate flatback turtles swim out into deep offshore waters, such as those of OA1, during the inter-nesting period (Pendoley, 2023). The seabed characteristics off Cape Fourcroy at the southwestern tip of Bathurst Island (i.e. narrow continental shelf, steep seabed slope and relatively high current speeds) are not typical of flatback-turtle internesting habitat and consequently the species is unlikely to internest in the OA1 but is expected to be present in OA2 and the EMBA.

Green Turtle

Green turtles (*Chelonia mydas*) have not been recorded nesting in the Bonaparte or Van Diemen bioregions, except for two significant nesting sites: Black/Smith Point and Lawson Island, which are east of the Tiwi Islands and near Cobourg Peninsula and outside of the EMBA (Chatto & Baker, 2008). BIAs for green turtles occur on the north coast of the Tiwi Islands (within the EMBA) and an internesting buffer has been defined 20 km from the Tiwi Islands, with internesting expected between October and April.

In northern and eastern Australia, fluctuations in green turtle nesting numbers have been linked the Southern Oscillation Index (Limpus & Nicholls, 1994; Limpus & Nicholls, 1988) and sea surface temperatures (Solow *et al.,* 2002). On average, the re-migration period for female green turtles is about five years. In the NT nesting sites occur mostly from the western end of Melville Island to near the border with QLD. The Cobourg Peninsula genetic stock of green turtles is the closest to those found within the EMBA on the Tiwi Islands. The nesting period for these is between October and April, with the peak nesting period occurring between December and January.

While primarily herbivorous, feeding mainly in shallow benthic habitats on seagrass and/or algae, green turtles are also known to feed on sponges, jellyfish, and mangroves (Limpus, 2008). Green turtles are unlikely to forage or dwell within deeper offshore waters due to the water depths; however, they may occasionally migrate through it.

Although there is little information on the nesting behaviour of green and hawksbill turtles on the Tiwi Islands, studies around northwestern Australia have shown that both species occupy shallow waters (<9 m deep) during their internesting period (Ferreira *et al.,* 2020; Fossette *et al.,* 2021). After nesting, green turtles move to discrete foraging areas in shallow waters (median depth 9 m; Ferreira *et al.,* 2020) and typically feed on seagrass, algae, and terrestrial plant material, including mangrove leaves and propagules (Pendoley & Fitzpatrick, 1999; Esteban *et al.,* 2020).

Given the preferred habitat of the green turtle, they are likely to be present within the EMBA, mainly within the inshore/coastal areas of the Tiwi Islands and reef areas. Individuals may traverse OA1 during long migrations or between shallower shoals which may present suitable foraging habitat. Given the species presence on the north coast of the Tiwi Islands, individuals are likely to traverse OA2 during migration or between suitable foraging habitats associated with shoals and banks (Table 3-11).

Hawksbill Turtle

Hawksbill turtles (*Eretmochelys imbricata*) have a global distribution throughout tropical and subtropical marine waters. In WA they are concentrated on the North West Shelf (Dampier Archipelago) (Limpus, 2009), which is one of the largest hawksbill populations remaining in the world. There is a second major population of hawksbill turtles in Australia, which is genetically isolated from the North West Shelf population: this is located along the NT coast and northeastern QLD.

In the NT, nesting occurs on islands rather than on mainland beaches. In particular, NT nesting sites are concentrated around northeastern Arnhem land and Groote Eylandt (outside the EMBA). Within the EMBA, nesting is known to occur at Ashmore Reef. Although Scott Reef has been described as a nesting beach for hawksbill turtles, this is based on the tagging and re-capture of a single hawksbill at this location (Guinea, 2009). In the NT nesting is reported to occur from July to December (Chatto, 1997, 1998). Adults tend to forage in tropical tidal and subtidal coral and rocky reef habitat where they feed on an omnivorous diet of sponges, algae, jelly fish and cephalopods (DSEWPaC, 2012b).

Hawksbill turtles are unlikely to occur within OA1 given the water depths. Individuals may be present in OA2 and the EMBA, given their preference to forage around areas such as the shoals through the Oceanic Shoals Marine Park. The species may nest at Scott Reef and Ashmore Reef, 1000 and 800 km to the west of OA1 respectively.

Leatherback Turtle

The leatherback turtle *(Dermochelys coriacea*) has the widest distribution of any marine turtle and can be found from tropical to temperate waters throughout the world. There are no major leatherback turtle centres of nesting activity that have been recorded in Australia, although scattered isolated nesting (one to three nests per year) occurs in southern QLD and the NT (Limpus & McLachlin 1994).

Turtles have been observed south of the Northwest Shelf area and in open waters (>200 m deep) (Limpus, 2009). Due to the lack of nesting sites around Australian coastal waters, it is presumed that leatherback turtles observed in Australian waters are migrating from neighbouring countries to access feeding grounds in Australia (Limpus, 2009).

Leatherback turtles have not been recorded nesting on the Tiwi Islands, but they have been observed in nearby waters (Chatto & Baker 2008; Limpus 2009). Leatherback turtles were recorded nesting at Cobourg Peninsula in 1996 and 2004 (Chatto & Baker 2008), and as a result, a 20 km inter-nesting buffer was established around all of the sandy beaches from Cobourg Peninsula to Cape Arnhem representing habitat critical to the survival of leatherback turtles. Additionally, observations of leatherback turtles have also been recorded in waters north of Melville Island, where individuals were captured in trawl fisheries (Limpus 2009).

The species may be observed within the OA1, OA2 and EMBA in low numbers given they have been observed in deeper waters. Isolated nesting may occur around the north coast of Melville Island, within the EMBA, however there is presently no record of this occurring.

Loggerhead Turtle

The loggerhead turtle (*Caretta caretta*) has a worldwide distribution, living and breeding in subtropical to tropical locations (Limpus, 2008). Breeding aggregations in Australia occur on both the east coast (QLD and NSW) and the west. The annual nesting population in WA is thought to be 3,000 females annually (Baldwin *et al.,* 2003), and this is considered to support the third-largest population in the world (Limpus, 2008). Loggerhead turtles have one genetic breeding stock within WA (CoA, 2017).

Loggerhead turtles are known to forage in the Oceanic Shoals Marine Park, the Arafura Sea, and the Gulf of Carpentaria; however, they have not been observed breeding in the region (CoA, 2012b). Loggerheads found within the EMBA are most likely to come from the WA population, which nest in the areas of Dirk Hartog Island, Murion Islands, Gnaraloo Bay, and the Ningaloo coast in November–May (outside the EMBA) (CoA, 2017).

Loggerhead turtles have not been recorded nesting on the Tiwi Islands, but they have been observed in nearby waters (Chatto & Baker 2008; Limpus 2009). They typically forage in waters < 50 m deep, and at higher latitudes, the depth that they dive to forage decreases (likely in response to the distribution of their prey; Eckert 2006).

Transient individuals may pass through the EMBA, OA1 and OA2 on longdistance migration or while foraging.

Olive Ridley Turtle

The olive ridley turtle (*Lepidochelys olivacea*) is known to nest on the Tiwi Islands, within the EMBA, specifically on the west coast of Bathurst Island and the north coast of Melville Island. Olive ridely turtles are also known to nest in Timor specifically in Taman buru bena, Teluk kupang marine tourism park, Menipo nature tourism park and Maubesi mangrove forest nature reserve.

-In comparison to the wider geographical region, which reports approximately 1000 nests/year (Indonesia), 100's nests/year (Myanmar and Brunei) and <50 nests/year (Papua New Guinea, Malaysia, Thailand, and Vietnam), the Tiwi rookeries support thousands of olive ridley nests per year (Jensen *et al.,* 2013). The greatest concentration of olive ridley turtles has been recorded around the northwest tip of Melville Island, on Seagull Island off the northwest coast of the Tiwi Islands, and from Lethbridge Bay to Brenton Bay on Melville Island (Segments 3.8, 3.9, and 3.11, respectively; Figure 3-6) (Chatto & Baker 2008). The nesting season for the species extends from February to November, with the peak nesting period occurring between April and May (Whiting *et al.,* 2007) (Table 3-12). After nesting, female olive ridley turtles migrate to foraging grounds, which occur across a broad range of habitats that include nearshore shallow waters, deeper waters along the continental shelf, and shelf slope habitats where they forage at or near the substrate (Whiting *et al.,* 2007).

Satellite tracking on a small sample of these turtles in and around the Tiwi Island region found the individuals remained close to shore (waters depths typically less than 55 m deep) and within 37 km of the nesting beach during the inter-nesting interval (Whiting *et al.,* 2007; Whiting *et al.,* 2005). Inter-nesting olive ridley turtles are therefore expected to be in the shallow waters around the Tiwi Islands and within the shallower regions of the EMBA, however unlikely to occur within OA1, given the water depths and location from nesting beaches.

3.4.3.3.2 Sea Snakes

Sea snakes are essentially tropical in distribution. Several key aggregation/feeding areas for sea snakes are known within the EMBA, described below.

Sea snakes are typically distributed in shallow inshore regions and the Tiwi Islands, which provide suitable seabed habitat and clear waters. However, they are also found further offshore at atolls, including the shoals/banks in the Timor Sea (Guinea, 2013b).

Most sea snakes are observed in water depths ranging between 10 and 50 m (RPS, 2010) and generally have shallow, benthic feeding patterns. Some species are known to dive deeper than this, but non-pelagic species seldom, if ever, dive deeper than 100 m (Heatwole, 1975). Very few species are known to inhabit deep pelagic environments, such as the environments occurring in OA1, given they are air-breathing (Guinea, 2006).

Distribution and movements of sea snakes are largely species-dependent with some species, such as the pelagic yellow-bellied sea snake, known to travel large distances, while others, such as the olive sea snake, usually reside in a particular area.

Sea snake species residing on reefs do not actively disperse or migrate between reefs. Sea snakes are found to be present year-round at most reefs on the Sahul Shelf (Guinea, 2013).

For those sea snake species that do migrate between reefs, within their broader home range, migration is thought to be influenced by ocean current. However, no studies have been undertaken to date on the migrations of open water sea snake species to determine their home ranges. Reef-dwelling Sea snakes appear to have very small home ranges (Guinea, 2013).

Research trawls indicate that sea snakes move to the southern shallow regions of the Gulf of Carpentaria in the summer months and into deeper waters at other times of the year (Redfield *et al.,* 1978).

Sea snakes are known to breed in shallow embayments along the NT coastline around December to February, except for the spine-bellied sea snake which breeds during June to August (DSEWPaC, 2012a).

Several species of sea snakes were observed at Evans Shoal, Tassie Shoal, Lynedoch Bank, and a seamount to the north-west of OA1 during the Barossa marine surveys. Several opportunistic sightings (species unknown) were also made during surveys in open offshore waters in the Timor Sea. The individuals able to be identified were the olive sea snake and turtle-headed sea snake (Jacobs, 2016a). Tassie Shoal and five surrounding shoals identified these same two species of sea snake at the surface and foraging on the seabed (ConocoPhillips, 2016). Based on the known distribution, habitat preference and sightings made during the various surveys, sea snakes are considered likely to transit OA1, OA2 and the EMBA.

Three species of sea snakes listed as threatened under the EPBC Act were identified in the PMST as being within the EMBA (Appendix E):

- Dusky sea snake (*Aipysurus fuscus*)
- leaf-scaled sea snake (*Aipysurus foliosquama*).
- short-nosed sea snake (*Aipysurus apraefrontalis*)

Dusky sea snake

The dusky sea snake (*Aipysurus fuscus*) is a moderately short and stout sea snake. Dorsal colouring (on the upper surface) of the species is generally dark brown or purplish-brown with more faint cross-bands on the flanks (DCCEEW, 2023a). The species inhabits inner coral reef lagoons and occurs amongst corals and on a substrate of sand at depths of less than 10 m (DCCEEW, 2023a). In Australia the dusky sea snake is restricted to the reefs of the Sahul Shelf in Western Australia, in particular Ashmore and Hibernia, within the EMBA.

The dusky sea snake may occur within the EMBA.

Leaf-scaled sea snake

The leaf-scaled sea snake *(Aipysurus foliosquama)* occurs in shallow water (less than 10 m deep) in the protected parts of the reef flat, adjacent to living coral and on coral substrates (DCCEEW, 2023a). The species is found only on the reefs of the Sahul Shelf in WA, especially on Ashmore and Hibernia reefs (Minton & Heatwole, 1975). The leaf-scaled sea snake forages by searching in fish burrows on the reef flat (DCCEEW, 2023a).

The leaf-scaled sea snake may occur within the EMBA.

Short-nosed sea snake

The short-nosed sea snake (*Aipysurus apraefrontalis*) is a small snake that is fully aquatic and endemic to WA. It has been recorded from Exmouth Gulf, WA, to the reefs of the Sahul Shelf, in the eastern Indian Ocean. This species is believed to show strong site fidelity to shallow coral reef habitats in less than 10 m of water, with most specimens having been collected from Ashmore and Hibernia reefs (Guinea & Whiting, 2005).

The species prefers the reef flats or shallow waters along the outer reef edge in water depths to 10 m. The species has been observed during daylight hours, resting beneath small coral overhangs or coral heads in 1 to 2 m of water. Guinea and Whiting (2005) reported that very few short-nosed sea snakes moved even as far as

50 m away from the reef flat and were therefore unlikely to be found in high numbers in offshore, deeper waters.

The short-nosed sea snake may occur within the EMBA.

3.4.3.3.3 Lizards

Arafura snake-eyed skink

The Arafura snake-eyed skink (*Cryptoblepharus gurrmul*) is a small slender, relatively long limbed, shallow headed species of snake-eyed skink. The Arafura Snake-eyed Skink is endemic to the Northern Territory (NT), where it is known only from three islands: North Goulburn Island (36km^2), and two small (about 2 km^2) islands, New Year Island and Oxley Island, north-east of Croker Island. Brief searches on nearby islands have failed to detect the species. This agile and fast-moving terrestrial species is locally common in littoral habitats, including beach sands, rocks, and coral rubble, on the three islands. Arafura Snake-eyed Skinks forage amongst rocks in the intertidal zone, and retreat to fringing vegetation when confronted by an incoming tide. They feed on both terrestrial and small marine invertebrates, such as amphipods and polychaete worms (Northern Territory Government 2021).

The Arafura snake-eyed skink may occur in intertidal zones within the EMBA.

3.4.3.3.4 Saltwater Crocodile

The saltwater crocodile (*Crocodylus porosus*) is primarily found in inland waterways, tidal creeks, coastal floodplains and channels, billabongs, and swamps across northern Australia (DCCEEW, 2023a). It is also found in Timor specifically in Taman buru bena, Teluk kupang marine tourism park, Menipo nature tourism park and Maubesi mangrove forest nature reserve.

The species' recognised distribution extends from Rockhampton in QLD to King Sound in WA (DCCEEW, 2023a). There are no identified BIAs or EPBC-listed critical habitat within the NMR for saltwater crocodiles. In the NT, most breeding sites are found on riverbanks or floating rafts of vegetation.

Within the NMR, the saltwater crocodile's distribution is thought to have expanded since its protection in the early 1970s, with individuals occurring up to 150 km inland, further than any historical records or knowledge (CoA, 2012b). Although the species is considered recovered and no longer threatened, it is recognised that strict regulation is required to avoid the population becoming depleted again (DCCEEW, 2023a). Nesting occurs in freshwater swamps that have little tidal movement between December and March, with a peak period between January and February (CoA, 2012b). Given the crocodiles' preferred habitat, they may be present within the EMBA in inshore/coastal areas, but they are unlikely to occur within OA1 and OA2.

3.4.3.4 Birds

Threatened and/or migratory bird species under the EPBC Act within the OAs and EMBA have been identified in Table 3-9. These species are summarised below.

Marine waters and coastal areas in the EMBA contain key habitats that are important to birds, including offshore islands, sandy beaches, tidal flats, mangroves, and coastal and pelagic waters. These habitats support a variety of birds which utilise the area in different ways and at different times of the year (DSEWPaC 2012a). Birds can be broadly grouped according to their preferred foraging habitat as coastal/ terrestrial birds, seabirds, and shorebirds.

Coastal or terrestrial species inhabit the offshore islands and coastal areas of the mainland throughout the year. These species are either primarily terrestrial, or they may forage in coastal waters.

Seabirds include those species whose primary habitat and food source is derived from pelagic waters. These species spend the majority of their lives at sea, ranging over large distances to forage over the open ocean.

Shorebirds, including waders, inhabit the intertidal zone and adjacent areas. Some shorebird species, including oystercatchers are resident (Surman & Nicholson. 2013). Other shorebirds are migratory and include species that utilise the East Asian–Australasian Flyway, a migratory pathway, that traverses the EMBA, for millions of migratory shorebirds that travel from Northern Hemisphere breeding grounds to Southern Hemisphere resting and foraging areas.

Australia is a signatory to three international treaties with China, Japan, and the Republic of Korea to safeguard migratory bird species, predominantly shorebirds. To facilitate observance of the three agreements migratory shorebirds have been listed as specially protected under the EPBC Act. The EPBC Act Policy Statement 3.21 sets out criteria for determining the significance of sites to migratory shorebirds based on the number of migratory species and the proportion of a species population that is supported by the site (CoA, 2017). Site significance can be difficult to assess, particularly for ephemeral inland wetlands. These areas may be used rarely, depending on weather conditions, but still provide important habitat for migratory shorebird species.

Migratory shorebirds require a particular conservation approach due to their migration patterns that take them across international boundaries (Bamford *et al.,* 2008). These species and their habitats are sensitive to threats due to their high site fidelity, tendency to aggregate, high energy demands and the need for habitat networks containing both roosting and foraging sites (CoA, 2017). Migratory shorebirds are known to use networks of connected sites (also known as site complexes). They move within these networks depending on the time of day, availability of resources and environmental conditions at the site (CoA, 2017).

The *Wildlife conservation plan for migratory shorebirds* (CoA, 2015c) provides a framework to guide the conservation of migratory shorebirds and their habitat in Australia and, in recognition of their migratory habits, outlines national activities to support their appreciation and conservation throughout the East Asian-Australasian Flyway.

An examination of the Species Profile and Threats database (DCCEEW, 2023a) and *The Action Plan for Australian Birds* (Garnet *et al.*, 2011) showed that some listed bird species are not expected to occur in significant numbers within the marine and coastal environments of the EMBA due to their terrestrial or southern distributions. Hence, these species are not discussed further.

Red knot (New Siberian Islands and northeastern Siberia)

The red knot is a migratory shorebird, and the species includes five subspecies, including two found in Australia, *Calidris canutus piersmai* and *Calidris canutus rogersi*. The red knot breeds in Siberia and spends the non-breeding season in Australia and New Zealand. During the non-breeding season, the species spends the majority of its time on tidal mudflats or sandflats where they feed on intertidal invertebrates, especially shellfish (Garnet *et al.,* 2011).

The red knot is listed as having habitat that is known to occur within the EMBA. In particular, Ashmore Reef is known to be a significant site for shorebirds with a maximum of 55 red knot individuals counted in 2010 (Clarke, 2011).

Curlew sandpiper

Curlew sandpiper (*Calidris ferruginea*) is a migratory shorebird that breeds in north Siberia and spends the non-breeding season from western Africa to Australia (Bamford *et al.,* 2008). The curlew sandpiper occurs around coastal Australia and preferred habitats include coastal brackish lagoons, tidal mud and sand flats, estuaries, saltmarshes and less often inland. Their diet is mainly comprised of polychaete worms, molluscs and crustaceans (Higgins & Davies, 1996 in Garnet *et al.,* 2011).

The curlew sandpiper is listed as having habitat that is known to occur within the EMBA. Ashmore Reef is known to be a significant site for shorebirds with a maximum 850 curlew sandpiper individuals counted in 2010 (Clarke, 2011).

Greater Sand Plover, Large Sand Plover

The greater sand plover is a congener that breeds in China, Mongolia and Russia. The greater sand plover spends the non-breeding season along coasts from Japan through southeast Asia to Australasia (Bamford *et al.,* 2008). Non-breeding birds occur along all Australian coasts, especially in the north for the greater sand plover (DCCEEW, 2023a).

Non-breeding birds forage on beaches, saltmarshes, coastal bays and estuaries, and feed on marine invertebrates including molluscs, worms, crustaceans, and insects (Marchant & Higgins 1993 in Garnet *et al.,* 2011).

The greater sand plover is listed as having habitat known to occur within the EMBA. Ashmore Reef forms part of the East Asian-Australasian Flyway which represents the collective migration route for waterbirds between breeding and non-breeding areas (Hansen *et al.,* 2016).

Bar-tailed godwit (Northern Siberian subspecies)

Northern Siberian bar-tailed godwit (*Limosa lapponica manzbieri*) is a migratory shorebird that breeds in Siberia and migrates to the coast of Australia for the non-breeding season (Bamford *et al.,* 2008). The northern Siberian occurs along the coast of northwestern Australia and is found on muddy coastlines, estuaries, inlets, mangrove-fringed lagoons, and sheltered bays, feeding on annelids, bivalves and crustaceans (Higgins & Davies, 1996 in Garnet *et al.,* 2011).

The bar-tailed godwit is listed as having habitat that is known to occur within the EMBA. Ashmore Reef is known to be a significant site for shorebirds with a maximum of eight bar-tailed godwit individuals counted in 2010 (Clarke, 2011).

Eastern curlew

The eastern curlew (*Numenius madagascariensis)* is a migratory shorebird that breeds in Siberia, Kamchatka and Mongolia and migrates to coastal East Asia and Australia. The South Korean Yellow Sea is an important

staging post for this species. Non-breeding birds occur around coastal Australia, are more common in the north and have disappeared or become much rarer at many sites along the south coast (Garnet, 2011).

Non-breeding birds are present at estuaries, mangroves, saltmarshes, and intertidal flats, particularly those with extensive seagrass (Zosteraceae), where they feed on marine invertebrates, especially crabs and small molluscs (Higgins & Davies, 1996 in Garnet, 2011).

The eastern curlew is listed as having habitat that is known to occur within the EMBA. Ashmore Reef is known to be a site for shorebirds with a maximum of four eastern curlew individuals counted in 2010 (Clarke, 2011).

Asian dowitcher

The Asian dowitcher (*Limnodromus semipalmatus*; Vulnerable, Migratory) is a large, distinctive wader with a long neck, long legs, and a long, straight, snipe-like bill (DCCEEW, 2024f). In Australia, this bird is only a regular visitor to coastal areas between Broome and Port Hedland and the Port McArthur tidal wetlands in the Gulf of Carpentaria, arriving from August (DCCEEW, 2024f). It roosts in sheltered coastal environments such as estuarine and intertidal mudflats, lagoons, creeks and saltworks, and feeds on inter-tidal mudflats (DCCEEW, 2024f). Only a small proportion of the non-breeding population arrive in Australia, occasionally recorded in the Northern Territory and rarely in western and eastern Australia (DCCEEW, 2024f). In the NT, the Asian dowitcher is found in Darwin and Arnhem Land (DCCEEW, 2024f). No sites of international significance are listed in the NT for this species (Birdlife Australia, 2020). The Asian dowitcher typically leaves north-west Australia by the end of April to return to northern hemisphere breeding grounds (DCCEEW, 2024f). The species may occasionally be seasonally present within the intertidal zones and shorelines within the EMBA.

Australian painted snipe

The Australian painted snipe (*Rostratula australis*; Endangered) is a wading bird that has been recorded in wetlands of all Australian states, most frequently recorded in the Murray-Darling Basin and in smaller numbers and less frequently at scattered locations in WA and NT (DEPWS, 2021a). The most northerly breeding records are from near Derby and Taylor's Lagoon, near Broome and at Tarrabool Lake on the Barkly Tablelands. Although this species is only occasionally recorded in northern Australia, it has been recorded in northern WA and NT (DEPWS, 2021a). While this species generally inhabits shallow terrestrial freshwater and occasionally brackish wetlands and other waterlogged areas, the Australian painted snipe requires shallow wetlands with areas of bare wet mud and canopy cover nearby for breeding (DCCEEW, 2021a). Whilst the species may occur within the EMBA, it primarily inhabits freshwater wetlands outside of the EMBA.

Black-tailed godwit

Black-tailed godwits (*Limosa limosa*; Endangered, Migratory) are found in all states and territories of Australia during the non-breeding (austral summer) season, with coastal regions supporting the highest densities of the species. This bird usually first arrives in north-west Australia from late August, and most have departed the NT by mid April (DCCEEW, 2024e). The largest populations are found on the north coast between Darwin and Weipa (DCCEEW, 2024e). Roosting usually occurs in sheltered bays, estuaries, and lagoons with large intertidal mudflats and/or sandflats. Feeding habitat includes areas of mud or soft, wet sand within sandflats, intertidal mudflats, saltmarshes, and the beaches of oceanic coastlines, bays, and estuaries (DCCEEW, 2024e). Areas of importance to the species in the NT include Darwin Harbour, North Darwin (the Beagle Gulf coastline), Legune Wetlands and Milingimbi Coast, but none of these are considered to have international significance (Birdlife Australia, 2020). The species may occasionally be seasonally present within the intertidal zones and shorelines within the EMBA.

Common greenshank

The common greenshank (*Tringa nebularia*; Endangered, Migratory) is widespread in coastal regions, occurs in all types of wetlands and has the widest distribution of any shorebird in Australia (DCCEEW, 2024h). The species is sparsely scattered through most of the NT (DCCEEW, 2024h), with important areas in the Kakadu National Park, Milingimbi coast, and the southwest coastline of the Gulf of Carpentaria, but no sites of international significance in the NT (Birdlife Australia, 2020). The common greenshank roosts around wetlands, in shallow pools and puddles, or slightly elevated on rocks, sandbanks or small muddy islets (DCCEEW, 2024h). They occur in estuaries and mudflats, mangrove swamps and lagoons (DCCEEW, 2024h). During feeding, the birds pick from the surface (DCCEEW, 2024h) while wading in shallow water along the edge of tidal estuaries, muddy claypans, saltworks and saltpans (DCCEEW, 2024h). The species arrives in Australia from August, with most leaving by March and April, but some overwintering also occurs (DCCEEW, 2024h). The species may occasionally be seasonally present within the intertidal zones and shorelines within the EMBA.

Great knot

The great knot (*Calidris tenuirostris*; endangered, Migratory) is a medium-sized migratory shorebird with relatively short legs, a slender medium-length bill and a wingspan of about 58 cm (DCCEEW, 2024d). The species breeds in northeast Siberia and far northeast Russia and migrates along the East Asia-Australasian

Flyway to overwinter in the southern hemisphere (DCCEEW, 2024d). Most that reach Australia settle along the northern coastline between northwest WA and the Gulf of Carpentaria, but significant numbers reach eastern QLD and there are reports of great knots from most Australian coastal areas. The species is common in the NT from Darwin to the south-east Gulf of Carpentaria (DCCEEW, 2024d) with internationally significant numbers recorded in North Darwin (Beagle Gulf coastline) and the Milingimbi Coast (Birdlife Australia, 2020). It prefers sheltered coastal habitats with extensive tidal mudflats or sandflats, including estuaries, lagoons, inlets and bays. Great knots are gregarious and frequently occur in large flocks with other shorebirds (including red knots), especially when roosting during high tides. They specialise on feeding on bivalves but also consume other marine invertebrates. Prey are captured on or just below the surface of wet mud or sand (Garnet *et al*., 2011). The species is likely to present at roosting sites on shorelines within the EMBA and may seasonally fly over the offshore waters.

Grey plover

Grey plovers (*Pluvialis squatarola*; Vulnerable; Migratory) have been recorded along the coast in all states of Australia, with small numbers regularly recorded in the NT (DCCEEW, 2024g). Migrating birds arrive in northern Australia between August and October with many continuing their migration to southern regions. Plovers which have remained along the northern coastline for the non-breeding season leave between February and April (DCCEEW, 2024g). Some non-breeding individuals may stay in Australia. The species usually roosts in sheltered, sandy areas including unvegetated sandbanks or sand-spits, or other sheltered environments such as estuaries or lagoons, and are often seen in small numbers on mangrove mudflats (DCCEEW, 2024g). Kakadu National Park, Milingimbi coast, and the southwest coastline of the Gulf of Carpentaria have been identified as areas of importance to this species in the NT, but they do not represent sites of international significance (Birdlife Australia, 2020). In Australia, grey plovers feed by pecking and probing for worms, molluscs, and crustaceans mostly in mud or soft, wet sand of sandflats, intertidal mudflats, saltmarshes, and beaches (DCCEEW, 2024g). The species is likely to present at roosting sites on shorelines within the EMBA and may seasonally fly over the offshore waters.

Lesser sand plover

The lesser sand plover (*Charadrius mongolus*: Endangered, Migratory) is a small to medium sized shorebird with a short stout bill and short grey legs. The lesser sand plover breeds in central Asia and eastern Russia. Two subspecies occur in Australia as seasonal migrants: *Charadrius mongolus mongolus* and *Charadrius mongolus. stegmanni*. In Australia, *Charadrius mongolus stegmanni* is more common in northern Australia, while *Charadrius mongolus. mongolus* is more common in eastern Australia (DCCEEW, 2024j). After breeding during the northern summer on mountain steppes and tundras of inland eastern Russia (*Charadrius mongolus. mongolus*) or sand dunes, shingle and other open habitats of eastern Siberia (*Charadrius mongolus. stegmanni*), those that overwinter in Australia migrate southwards along the East Asian-Australasian flyway. These non-breeding birds occur almost exclusively along the coast, where they forage on sheltered intertidal mudflats and sandflats, sandy beaches, estuaries and mangroves. Inland saline wetlands close to the coast are also used occasionally. They feed on marine worms, molluscs, crustaceans, and insects, which are captured on or just below the surface of sand or mud. The species is likely to present at roosting sites on shorelines within the EMBA.

Nunivak bar-tailed godwit

Nunivak bar-tailed godwit (*Limosa lapponica baueri*; endangered, Migratory) breeds in west Alaska and northeast Siberia and overwinters mostly in northern and eastern Australia and New Zealand. In the NT, bar-tailed godwits have been reported along almost the entire coastline, including all major islands (DCCEEW, 2024k). After breeding during the northern summer on the arctic tundras of western, migration southwards along the East Asian-Australasian Flyway to overwinter in Australasia. During this non-breeding season (the austral summer), godwits in the NT usually congregate in flocks near the coast. They forage on intertidal mudflats or in shallow water, feeding on worms, molluscs, and crustaceans (DCCEEW, 2024k). The species is likely to be seasonally present within the intertidal zones and shorelines within the EMBA.

Sharp-tailed sandpiper

The sharp tailed sandpiper (*Calidris acuminata*; Vulnerable, Migratory) is a small-medium size wader that is widely distributed throughout Australia (DCCEEW, 2024l). The majority (>90%) of the non-breeding population migrates to Australia (DCCEEW, 2024l). They arrive in Australia from mid-August/early September with most birds then moving slowly south to southeast Australia (DCCEEW, 2024l). In the NT, the species mostly occurs in the northern coastal regions (DCCEEW, 2024l), with Darwin Harbour, North Darwin (Beagle Gulf coastline), Kakadu National Park, the Legune Wetlands, Milingimbi coast and Nhulunbuy (Gove Peninsula) considered to be important areas (Birdlife Australia, 2020). Internationally significant numbers have been recorded at Kakadu National Park and Milingimbi coast (Birdlife Australia, 2020). Sharp tailed sandpipers often roost at the edges of wetlands, on wet open mud or sand, in shallow water, or in short sparse grass or saltmarsh, but also occasionally on sandy beaches, stony shores or rocks (DCCEEW, 2024l). They typically feed on seeds, worms, molluscs, crustaceans and insects (DCCEEW, 2024l), foraging at the edge of the water of wetlands or

intertidal mudflats, either on bare wet mud or sand, or in shallow water (DCCEEW, 2024l). The species is likely to be seasonally present within the intertidal zones and shorelines within the EMBA.

Terek sandpiper

The terek sandpiper (*Xenus cinereus*; Vulnerable, Migratory) is primarily a coastal species, more common in northern and eastern parts of Australia than southern regions (DCCEEW, 2024i). It is one of the commoner shorebird species in tropical mangrove-lined estuaries, often occurring in small numbers among much larger flocks of other migratory shorebirds (DCCEEW, 2024i). They feed primarily on crustaceans and insects, in the supralittoral or upper littoral zone, where a film of water covers the sand, but may also forage in the lower littoral zone on exposed rock platforms (DCCEEW, 2024i). In the NT, widespread records occur from Darwin, north to Melville Island, and east to the western section of the Gulf of Carpentaria, around Gove Peninsula, Groote Eylandt, Sir Edward Pellew Island and the mouth of the McArthur River (DCCEEW, 2024i). Important areas are considered to include Darwin Harbour, North Darwin (Beagle Gulf coastline), Kakadu National Park, the Legune Wetlands and Milingimbi Coast, with the Kakadu and Milingimbi Coast identified to have international significance (Birdlife Australia, 2020). The preferred roosting habitat for this bird is in or among mangroves (DCCEEW, 2024i). Terek sandpipers migrate south from their Arctic breeding grounds, passing through the Torres Strait and arriving around Cairns and Darwin in August. Most individuals visiting Australia seem to remain on the north coast, leaving by late April (DCCEEW, 2024i). The species is likely to be seasonally present within the intertidal zones and shorelines within the EMBA.

Australian lesser noddy

This Australian lesser noddy (*Anous tenuirostris melanops*) is usually found only around its breeding islands in the Houtman Abrolhos Islands in WA (Storr *et al.,* 1986), south of the EMBA. The Australian lesser noddy occupies coral-limestone islands that are densely fringed with white mangrove *Avicennia marina*, and it occasionally occurs on shingle or sandy beaches (Higgins & Davies 1996 in DCCEEW, 2023a). This species is thought to be sedentary or resident, staying near to its breeding islands in the non-breeding season. It may leave nesting islands for short periods during the non-breeding season, and probably forages widely (Higgins & Davies, 1996 in DCCEEW, 2023a).

Breeding apparently occurs only on Morley, Wooded and Pelsaert Islands at the Houtman Abrolhos Islands (Higgins and Davies, 1996 in DCCEEW, 2023a). Mangrove stands support about 68,000 breeding pairs spread over the three islands (Surman & Nicholson, 2006). Breeding may also occur on Ashmore Reef (Stokes & Hinchey, 1990). The breeding season extends from mid-August to early April (Higgins & Davies, 1996 in DCCEEW, 2023a). The Australian lesser noddy is known to breed within the EMBA.

Abbott's booby

Currently, Abbott's booby (*Papasula abbotti*) is only known to breed on Christmas Island and to forage in the waters surrounding the island and south-east Asia (TSSC, 2020). Within Christmas Island, most nests are found in the tall plateau forest on the central and western areas of the island, and in the upper terrace forest of the northern coast.

While this species may over-fly waters of the EMBA from time-to-time in transit or for foraging, they do not use the area for breeding or resting, no critical nesting or feeding areas have been identified within the EMBA.

Christmas Island White-tailed Tropicbird, Golden Bosunbird

The Christmas Island white-tailed tropicbird (*Phaethon lepturus fulvus*) is only known to breed on Christmas Island and to forage and roost over the Indian Ocean (DCCEEW, 2023a). The species is widely distributed across Christmas Island and has been recorded south and southeast of the Island. The Christmas Island white-tailed tropicbird predominantly occurs north of 18ºS but may occur up to about 1500km off the coast of Christmas Island at the edge of the North West continental shelf in WA at 21ºS (DCCEEW, 2023a).

While this species may over-fly waters of the area surrounding the development from time-to-time in transit or for foraging, they do not use the area for breeding or resting, no critical nesting or feeding areas have been identified within the EMBA.

3.4.4 Conservation Management Plans

To protect, maintain and enhance recovery of certain threatened species and ecological communities, DCCEEW may prepare conservation management plans in the form of conservation advice or recovery plans. Recovery plans set out the necessary research and management actions to stop the decline of listed threatened species and support their recovery. Table 3-13 summarises the actions relevant to the Activity, with more information about the requirements of the relevant plans of management (including recovery plans, conservation advice and wildlife conservation plans for marine fauna) and demonstrates where this EP considers those management requirements.

Further assessment of the Activity's consistency with actions and objectives set within the plans is provided throughout Sections 6 and 7.

3.4.4.1 Conservation Advice

When a native species or ecological community is listed as threatened under the EPBC Act, conservation advice is developed to assist its recovery. Conservation advice provides guidance on immediate recovery and threat abatement activities that can be undertaken to ensure the conservation of a newly listed species or ecological community.

3.4.4.2 Recovery Plans

The Australian Government Minister for the Environment may make or adopt and implement recovery plans for threatened fauna, threatened flora (other than conservation dependent species) and threatened ecological communities listed under the EPBC Act. Recovery plans set out the research and management actions necessary to stop the decline of, and support the recovery of, listed threatened species or threatened ecological communities. The aim of a recovery plan is to maximise the long-term survival in the wild of a threatened species or ecological community.

The EP summarises the actions relevant to the Activity with more information on the specific requirements of the relevant plans of management (including conservation advice, recovery plans and management plans for marine fauna) that would be applicable and demonstrates where current management requirements have been considered.

Table 3-13: Relevant threats identified in recovery plans, conservation advice and wildlife conservation plans for species that occur or may occur within the operational areas and environment that may be affected

Receptor	Species	Recovery plan/conservation advice/wildlife conservation plan	Threats/strategies identified as relevant to the Activity	Addressed (where relevant) in EP section
All	All vertebrate fauna	Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (CoA, 2018)	Marine debris	7.1 Release of solid objects
Fish	All sawfish and river sharks	Sawfish and River Sharks Multispecies Recovery Plan (CoA, 2015b)	Habitat degradation or modification	6.5 Seabed and benthic habitat disturbance 0 Operational Discharges 0 Produced Water Discharges 7.1 Release of solid objects 7.2 Introduction of Invasive Species 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Marine debris	7.1 Release of solid objects
	Dwarf sawfish	Approved Conservation Advice for *Pristis clavata* (dwarf sawfish) (DEWHA, 2009b)	Habitat degradation and modification	6.5 Seabed and benthic habitat disturbance 0 Operational Discharges 0 Produced Water Discharges 7.1 Release of solid objects 7.2 Introduction of Invasive Species 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Green sawfish	Approved Conservation Advice for Green Sawfish (DEWHA, 2008a)	Habitat degradation and modification	6.5 Seabed and benthic habitat disturbance 0 Operational Discharges 0 Produced Water Discharges 7.1 Release of solid objects 7.2 Introduction of Invasive Species 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Freshwater sawfish	Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a)	Habitat degradation and modification	6.5 Seabed and benthic habitat disturbance 0 Operational Discharges 0 Produced Water Discharges 7.1 Release of solid objects 7.2 Introduction of Invasive Species 0 Minor Releases (surface and subsea)

Receptor	Species	Recovery plan/conservation advice/wildlife conservation plan	Threats/strategies identified as relevant to the Activity	Addressed (where relevant) in EP section
				7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Marine debris	7.1 Release of solid objects
	Northern river shark	Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c)	Habitat degradation and modification	6.5 Seabed and benthic habitat disturbance 0 Operational Discharges 0 Produced Water Discharges 7.1 Release of solid objects 7.2 Introduction of Invasive Species 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7Unplanned Liquid Hydrocarbon Release Scenarios
			Marine debris	7.1 Release of solid objects
	Great white shark	Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013)	Ecosystem effects as a result of habitat modification and climate change	6.3 Greenhouse Gas Emissions 6.5 Seabed and benthic habitat disturbance 0 Operational Discharges 0 Produced Water Discharges 7.1 Release of solid objects 7.2 Introduction of Invasive Species 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Grey nurse shark	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (CoA, 2014)	Pollution and disease	0 Operational Discharges 0 Produced Water Discharges 7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Ecosystem effects as a result of habitat modification and climate change	6.3 Greenhouse Gas Emissions 6.5 Seabed and benthic habitat disturbance 0 Operational Discharges 0 Produced Water Discharges 7.1 Release of solid objects 7.2 Introduction of Invasive Species 0 Minor Releases (surface and subsea)

Receptor	Species	Recovery plan/conservation advice/wildlife conservation plan	Threats/strategies identified as relevant to the Activity	Addressed (where relevant) in EP section
				7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Speartooth shark	Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b)	Habitat degradation and modification	6.5 Seabed and benthic habitat disturbance 0 Operational Discharges 0 Produced Water Discharges 7.1 Release of solid objects 7.2 Introduction of Invasive Species 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Marine debris	7.1 Release of solid objects
	Whale shark	Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a)	Boat strike	7.3 Marine Fauna Interaction
			Habitat disruption from mineral exploration, production and transportation	6.5 Seabed and benthic habitat disturbance 0 Operational Discharges 0 Produced Water Discharges 7.1 Release of solid objects 7.2 Introduction of Invasive Species 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions
			Marine debris	7.1 Release of solid objects
Mammals	Blue whale (includes pygmy blue whale)	Conservation Management Plan for the Blue Whale - *A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999* 2015–2025 (CoA, 2015a)	Noise interference	6.1 Noise Emissions
			Climate variability and change	6.3 Greenhouse Gas Emissions
			Vessel disturbance	7.3 Marine Fauna Interaction
			Marine debris	7.1 Release of solid objects
			Acute and chronic chemical discharge	0 Operational Discharges 0 Produced Water Discharges 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Fin whale	Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b)	Pollution (persistent toxic pollutants)	0 Operational Discharges 0

Receptor	Species	Recovery plan/conservation advice/wildlife conservation plan	Threats/strategies identified as relevant to the Activity	Addressed (where relevant) in EP section
				Produced Water Discharges 7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate and oceanographic variability and change	6.3 Greenhouse Gas Emissions
			Anthropogenic noise and acoustic disturbance	6.1 Noise Emissions
			Vessel strike	7.3 Marine Fauna Interaction
	Sei whale	Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c)	Pollution (persistent toxic pollutants)	0 Operational Discharges 0 Produced Water Discharges 7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate and oceanographic variability and change	6.3 Greenhouse Gas Emissions
			Vessel strike	7.3 Marine Fauna Interaction
			Anthropogenic noise and acoustic disturbance	6.1 Noise Emissions
Reptiles	All marine turtles	National Light Pollution Guidelines for Wildlife (DCCEEW, 2023h)	Light pollution	6.2 Light Emissions
			Climate change and variability	6.3 Greenhouse Gas Emissions
		Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017)	Marine debris	7.1 Release of solid objects
			Chemical and terrestrial discharge	0 Operational Discharges 0 Produced Water Discharges 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Light pollution	6.2 Light Emissions
			Vessel disturbance	7.3 Marine Fauna Interaction
	Leatherback turtle	Commonwealth Conservation Advice on *Dermochelys coriacea* (DEWHA, 2008b)	Vessel strike	7.3 Marine Fauna Interaction
			Marine debris	7.1 Release of solid objects
			Climate change	6.3 Greenhouse Gas Emissions
	Arafura snake-eyed skink	Approved Conservation Advice *Cryptoblepharus gurrmul* (Arafura snake-eyed skink) (TSSC, 2018)	Climate change	6.3 Greenhouse Gas Emissions
	Dusky sea snake	Approved Conservation Advice for *Aipysurus fuscus* (dusky sea snake) (DCCEEW, 2024p).	Degradation of reef habitat, primarily as a result of coral bleaching and extreme weather events	6.3 Greenhouse Gas Emissions
			Anthropogenic noise	6.1 Noise Emissions
			Climate change	6.3 Greenhouse Gas Emissions

Receptor	Species	Recovery plan/conservation advice/wildlife conservation plan	Threats/strategies identified as relevant to the Activity	Addressed (where relevant) in EP section
			Oil pollution	7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Short-nosed sea snake	Approved Conservation Advice on *Aipysurus apraefrontalis* (Short-nosed sea snake) (DSEWPaC, 2011a)	Degradation of reef habitat, primarily as a result of coral bleaching (primary threat)	6.3 Greenhouse Gas Emissions
	Leaf-scaled sea snake	Approved Conservation Advice on *Aipysurus foliosquama* (Leaf-scaled sea snake) (DSEWPaC, 2011b)	Degradation of reef habitat, primarily as a result of coral bleaching (primary threat)	6.3 Greenhouse Gas Emissions
Birds	All seabirds and shorebirds	National Light Pollution Guidelines for Wildlife (DCCEEW, 2023h)	Light pollution	6.2 Light Emissions
			Climate change and variability	6.3 Greenhouse Gas Emissions
	Seabirds	Wildlife Conservation Plan for Seabirds (CoA, 2020)	Habitat loss or modification	7.1 Release of solid object 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Anthropogenic disturbance	6.2 Light Emissions 7.3 Marine Fauna Interaction
			Climate change	6.3 Greenhouse Gas Emissions
			Invasive species	7.2Introduction of Invasive Species
			Pollution (marine debris, light, water)	6.2 Light Emissions 7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Migratory shorebirds	Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c)	Habitat loss and degradation	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Anthropogenic disturbance	6.2 Light Emissions 7.3 Marine Fauna Interaction
			Climate change and variability	6.3 Greenhouse Gas Emissions
	Asian dowitcher	Approved Conservation Advice for *Limnodromus semipalmatus* (Asian dowitcher) (DCCEEW, 2024f)	Habitat loss, degradation, and fragmentation	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Chronic and acute pollution	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions

Receptor	Species	Recovery plan/conservation advice/wildlife conservation plan	Threats/strategies identified as relevant to the Activity	Addressed (where relevant) in EP section
	Black tailed godwit	Approved Conservation Advice for *Limosa limosa* (Black-tailed godwit) (DCCEEW, 2024e)	Habitat degradation, loss, or disturbance	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions
			Chronic and acute pollution	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Common greenshank	Approved Conservation Advice for *Tringa nebularia* (common greenshank) (DCCEEW, 2024h)	Habitat loss, degradation, and fragmentation	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions
			Chronic and acute pollution	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Curlew sandpiper	Approved Conservation Advice for *Calidris ferruginea* (Curlew Sandpiper) (DCCEEW, 2023d)	Habitat degradation or modification (oil pollution)	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Chronic and acute pollution	0 Operational Discharges 0 Produced Water Discharges 7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Eastern curlew	Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew) (DCCEEW, 2023e)	Habitat loss or disturbance	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios

Receptor	Species	Recovery plan/conservation advice/wildlife conservation plan	Threats/strategies identified as relevant to the Activity	Addressed (where relevant) in EP section
	Great knot	Approved Conservation Advice for *Calidris tenuirostris* (great knot) (DCCEEW, 2024d)	Habitat loss, degradation, and fragmentation	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions
			Chronic and acute pollution	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Greater sand plover	Approved Conservation Advice for *Charadrius leschenaultii* (greater sand plover) (DCCEEW, 2023f)	Habitat loss, fragmentation, and degradation	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions
			Chronic and acute pollution	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Grey plover	Approved Conservation Advice for *Pluvialis squatarola* (grey plover) (DCCEEW, 2024g)	Habitat loss, fragmentation, and degradation	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions
			Chronic and acute pollution	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Nunivak bar-tailed godwit	Approved Conservation Advice for *Limosa lapponica baueri* (Alaskan bar-tailed godwit) (DCCEEW, 2024k)	Habitat loss, fragmentation, and degradation	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions
			Chronic and acute pollution	7.1 Release of solid objects

Receptor	Species	Recovery plan/conservation advice/wildlife conservation plan	Threats/strategies identified as relevant to the Activity	Addressed (where relevant) in EP section
				0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Red knot	Approved Conservation Advice for *Calidris canutus* (red knot) (DCCEEW, 2024m)	Habitat loss or disturbance	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions
			Chronic and acute pollution	0 Operational Discharges 0 Produced Water Discharges 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Red tailed tropicbird (Indian ocean)	Approved Conservation Advice for *Phaethon rubricauda westralis* (Indian Ocean red-tailed tropicbird) (DCCEEW, 2023g)	Climate change	6.3 Greenhouse Gas Emissions
	Ruddy turnstone	Approved Conservation Advice for *Arenaria interpres* (ruddy turnstone) (DCCEEW, 2024m)	Habitat loss, fragmentation, and degradation	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Chronic and acute pollution	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions
	Sharp-tailed sandpiper	Approved Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW, 2024l)	Habitat loss, fragmentation, and degradation	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions
			Chronic and acute pollution	0 Operational Discharges 0 Produced Water Discharges 7.1 Release of solid objects

Receptor	Species	Recovery plan/conservation advice/wildlife conservation plan	Threats/strategies identified as relevant to the Activity	Addressed (where relevant) in EP section
				0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Terek sandpiper	Approved Conservation Advice for *Xenus cinereus* (terek sandpiper) (DCCEEW, 2024i)	Habitat loss, fragmentation, and degradation	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions
			Chronic and acute pollution	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Northern Siberian bartailed godwit	Conservation Advice *Limosa lapponica menzbieri* (Yakutian bar-tailed godwit (northern Siberian)) (DCCEEW, 2024o)	Habitat degradation,loss, or disturbance	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Abbott's booby	Conservation Advice for the Abbott's Booby *Papasula abbotti* (TSSC, 2020a)	Habitat degradation or modification	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change – severe storm events and prey depletion	6.3 Greenhouse Gas Emissions
			Marine debris	7.1 Release of solid objects
	Christmas Island frigatebird	Conservation Advice for the Christmas Island Frigatebird *Fregata andrewsi* (TSSC, 2020b)	Habitat disturbance	7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Australian lesser noddy	Conservation Advice for *Anous tenuirostris melanops* (Australian lesser noddy) (TSSC, 2015d)	Habitat degradation or modification	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
	Christmas Island whitetailed tropicbird	Conservation Advice for *Phaethon lepturus fulvus* (white-tailed tropicbird) (DoE, 2014d)	Habitat degradation or modification	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Oil spills and shipping activity near Christmas Island	7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios

Receptor	Species	Recovery plan/conservation advice/wildlife conservation plan	Threats/strategies identified as relevant to the Activity	Addressed (where relevant) in EP section
	Australian painted snipe	Approved Conservation Advice for *Rostratula australis* (DSEWPaC, 2013)	Habitat degradation, loss, and modification	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions
	Lesser sand plover	Conservation Advice for *Charadrius mongolus* Lesser Sand Plover (DCCEEW, 2024j)	Habitat degradation, loss, and modification	7.1 Release of solid objects 0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios
			Climate change	6.3 Greenhouse Gas Emissions
			Pollution/contamination impacts	0 Minor Releases (surface and subsea) 7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO 7.6 Subsea Release of Gaseous Hydrocarbon 7.7 Unplanned Liquid Hydrocarbon Release Scenarios

3.5 Protected Areas, KEFs and BIAs

Areas protected under the EPBC Act and key ecological features located within the OAs and EMBA are listed in Table 3-14 and illustrated in Figure 3-7 and Figure 3-9. Biologically Important Areas and habitat critical to the survival of EPBC Act-listed marine turtles addressed in Sections 3.5.5 and 3.5.6.

Note: protected areas that are terrestrial and not linked to the shoreline but occur in the EPBC PMST results for the EMBA have been excluded as they are not relevant to hydrocarbon spill scenarios assessed in Sections 7.6 and 7.7.

No threatened ecological communities are overlapped by the OAs or EMBA.

Table 3-14: Distance from operational areas 1 and 2 boundaries to protected areas and key ecological features within the environment that may be affected

Value/sensitivity name	OA1 presence	OA2 presence	MEVA	EMBA	Distance/ direction from OA1	Distance/ direction from OA2
Protected areas, protected under the EPBC Act.						
Australian Marine Parks						
Oceanic Shoals Marine Park	✗	✓	✓	✓	45 km S	Overlaps
Arafura Marine Park	✗	✗	✓	✓	240 km E	255 km E
Ashmore Reef Marine Park	✗	✗	✓	✓	795 km SW	720 km SW
Cartier Island Marine Park	✗	✗	✓	✓	770 km SW	685 km SW
Argo-Rowley Terrace	✗	✗	✗	✓	1250 km SW	1230 km SW
Arnhem	✗	✗	✗	✓	360 km SE	370 km E
Joseph Bonaparte Gulf	✗	✗	✓	✓	435 km S	185 km S
Wessel*	✗	✗	✗	✗	705 km SE	715 km E
Christmas Island Marine Park*	✗	✗	✗	✗	2318 km W	2278 km W
World Heritage Properties						
Kakadu National Park*	✗	✗	✗	✗	320 km SE	200 km E
Commonwealth heritage places						
Ashmore Reef National Nature Reserve	✗	✗	✓	✓	795 km SW	720 km SW
Scott Reef and Surrounds*	✗	✗	✗	✗	1002 km SE	890 km SE
Wetlands of international importance (Ramsar)						
Ashmore Reef National Nature Reserve	✗	✗	✓	✓	800 km SW	730 km W
Kakadu National Park*	✗	✗	✗	✗	320 km SE	200 km E
Cobourg Peninsula	✗	✗	✗	✓	215 km SE	200 km E
Wetlands of national importance**						
Cobourg Peninsula	✗	✗	✗	✓	215 km SE	200 km E
Ashmore Reef Marine Park	✗	✗	✗	✓	800 km SW	800 km SW
Daly-Reynolds Floodplain Estuary System	✗	✗	✗	✓	375 km S	145 km S
Finniss Floodplain and Fog Bay Systems	✗	✗	✓	✓	385 km S	150 km S
Kakadu National Park*	✗	✗	✗	✗	320 km SE	200 km E

Value/sensitivity name	OA1 presence	OA2 presence	MEVA	EMBA	Distance/ direction from OA1	Distance/ direction from OA2
Key ecological features						
North-west Marine Region						
Ancient coastline at 125 m depth contour	✗	✗	✗	✓	700 km SW	570 km SW
Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	✗	✗	✓	✓	765 km SW	685 km WSW
Continental slope demersal fish communities	✗	✗	✓	✓	775 km SW	675 km WSW
Carbonate bank and terrace system of the Sahul Shelf	✗	✗	✓	✓	50 km S	Overlaps
Seringapatam Reef and Commonwealth waters in the Scott Reef Complex	✗	✗	✗	✓	950 km SW	750 km WSW
North Marine Region						
Carbonate bank and terrace system of the Van Diemen Rise	✗	✓	✓	✓	330 km SW	200 km W
Pinnacles of the Bonaparte Basin	✗	✗	✓	✓	195 km SW	155 km SW
Shelf break and slope of the Arafura Shelf	✓	✓	✓	✓	Overlaps	Overlaps
Tributary canyons of the Arafura Depression	✗	✗	✓	✓	255 km NE	270 km NE
Gulf of Carpentaria basin	✗	✗	✗	✓	740 km SE	740 km SE

** Wessel Marine Park, Christmas Island Marine Park, Scott Reef and Kakadu National Park do not overlap with the EMBA but are in close proximity to the extent of the modelled EMBA and have been assessed as part of the 'environment that may be affected' by the Activity.*

*** Note, whilst a number of other wetlands of national importance were returned in the PMST search reports, on further review these were determined to not overlap the EMBA.*

3.5.1 World Heritage Properties

The EPBC PMST search results showed that Kakadu National Park, is a world heritage property of national environmental significance that is not within the EMBA, but approximately 800 m away and has been included to ensure conservatism. A description of this National Park is as below.

3.5.1.1 Kakadu National Park

Kakadu National Park is an ancient landscape of beauty and unique biodiversity. It covers an area of 19,180 km^2 within the Alligator Rivers region of the NT. It extends from the coast in the north to the southern hills and basins 150 km to the south, and 120 km from the Arnhem Land sandstone plateau in the east, through wooded lowlands to the western boundary.

The park was proclaimed under the *National Parks and Wildlife Conservation Act 1975 (*Cth*)* in three stages between 1979 and 1991 for the purposes of:

- the preservation of the area in its natural condition.
- the encouragement and regulation of the appropriate use, appreciation and enjoyment of the area by the public.

Kakadu National Park was first inscribed on the World Heritage list in 1981 and was subsequently expanded and re-inscribed in 1987 and again in 1992. The Koongarra area was added to the World Heritage Area in June 2011.

The park is home to a variety and concentration of wildlife, and many plants and animals are threatened or found nowhere else in the world. Nearly 1600 plant species have been recorded in Kakadu, including 15 species considered threatened. More than one third of Australia's bird fauna (271 species) and about one quarter of Australia's land mammals (77 species) are found in the park, along with 132 species of reptiles and

27 species of frogs. The region is the most species-rich in freshwater fish in Australia, and over 246 species of fish have been recorded in tidal and freshwater areas within the park. The park also plays a major role in protecting representative examples of ecosystems within the Arnhem Plateau and Pine Creek bioregions and contributing to the National Reserve System's network of protected areas across Australia.

3.5.2 Wetlands of National and International Importance (Ramsar)

The wetlands of national and international importance in the EMBA and MEVA are critical for biodiversity conservation and ecological balance. Wetlands of international importance are also referred to as Ramsar wetlands.

Within the MEVA, the internationally important Ashmore Reef, offers pristine coral ecosystems and serves as a breeding and feeding ground for marine species. Close to the MEVA, the Finniss Floodplain and Fog Bay Systems, recognised nationally, provide crucial habitats for many species, contributing significantly to regional biodiversity.

No other wetlands of international or national importance are located within the OAs or MEVA. However, several wetlands of international and national importance occur within the EMBA (Table 3-12). Figure 3-7 and Figure 3-8 show the Ramsar wetlands within the MEVA and EMBA, these have been further described below.

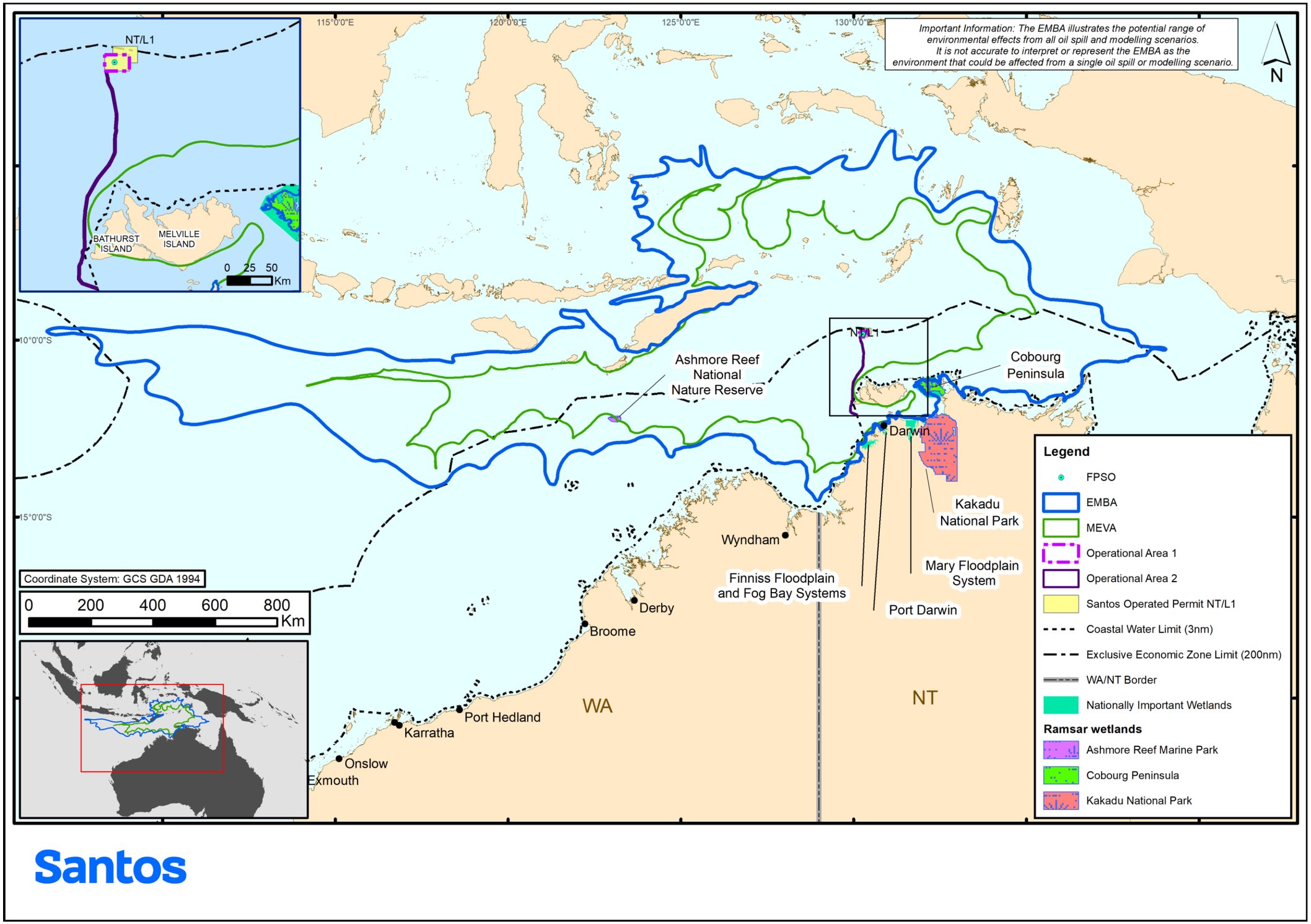

Figure 3-7: RAMSAR wetlands, MEVA and EMBA Map 1

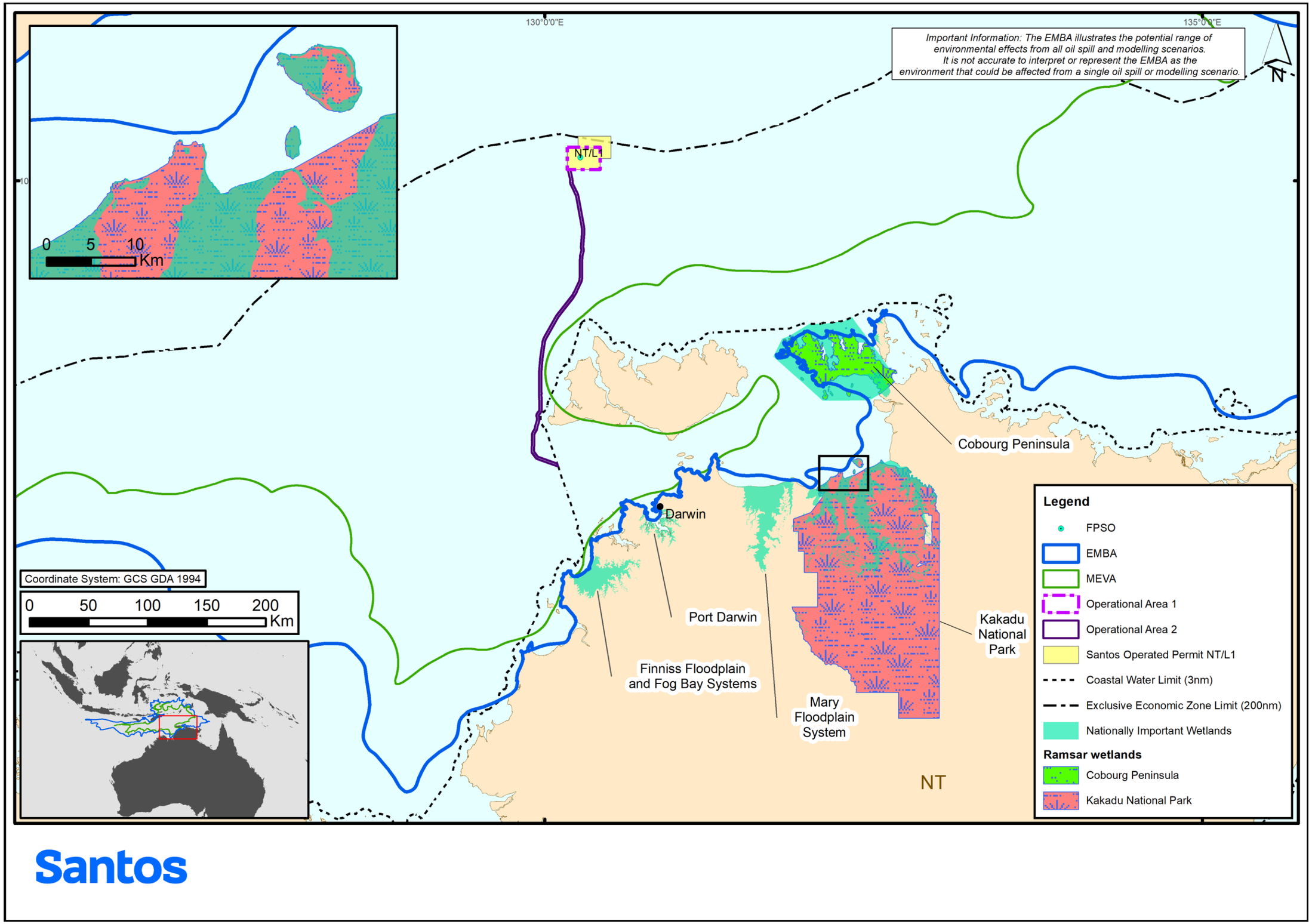

Figure 3-8: Ramsar wetlands, MEVA and EMBA Map 2

3.5.2.1 Wetlands of International Importance

Ashmore Reef

In addition to being listed as an Australian Marine Park (Section 3.5.4), Ashmore Reef has been designated a Ramsar wetland of international importance due to the importance of the islands in providing a resting place for migratory shorebirds and supporting large breeding colonies of seabirds (Hale & Butcher, 2013). The reserve provides a staging point for many migratory wading birds from October to November and March to April as part of the migration between Australia and the northern hemisphere (Commonwealth of Australia, 2002). Migratory shorebirds use the reserve's islands and sand cays as feeding and resting areas during their migration.

Ashmore Reef plays a primary role in the maintenance of biodiversity in reef systems in the region. The reserve supports 275 species of reef building coral, 13 species of sea cucumbers, and high numbers of mollusc species. There are over 760 fish species, 13 species of sea snake, 99 species of decapod crustacean and 47 species of waterbird listed as migratory under international treaties. It supports breeding of 20 species of waterbirds including the brown booby, lesser frigatebird, crested tern, bridled tern, sooty tern and common noddy. The Ramsar site is also important for feeding for green turtles, hawksbill turtle and loggerhead turtle and critical nesting and inter-nesting habitats for green and hawksbill turtles (CoA, 2002).

Ashmore Reef regularly supports more than 20,000 waterbirds and has been known to support more than 65,000 waterbirds. The Ramsar site regularly supports more than one per cent of at least six species of waterbird including the sooty tern, bar-tailed godwit, grey-tailed tattler, ruddy turnstone, sanderling and greater sand plover (CoA, 2002).

A summary of the habitats found at Ashmore Reef is presented in Section 3.3.6.

Cobourg Peninsula

The Cobourg Peninsula comprises both coastal and inland wetlands and was declared a Ramsar site in 1974. Important habitat for seabirds throughout the peninsula includes intertidal forested wetlands and mudflats, seasonal freshwater marshes and permanent freshwater pools. Four coral reefs are located within the Coburg Peninsula Ramsar site: Popham Creek, Kuper Point, Sandy Island No. 1, and Sandy Island No. 2 (AECOM, 2011). Garig Gunak Barlu National Park includes the marine waters surrounding the peninsula, but these are not included in the Ramsar site (BMT WBM, 2011). Orontes Reef is located just outside Cobourg Peninsula to the north. A total of 595 marine fish species from 117 families have been recorded from the Cobourg Peninsula area (BMT WBM 2011).

Bird species richness within the Cobourg Peninsula is high, with 236 bird species having been recorded including 89 waterbird species, 21 of which are migratory (BMT WBM, 2011). The Cobourg Peninsula supports habitat and conditions that are important for waterbird breeding. At least six seabird species are known to occupy the Cobourg Peninsula for breeding purposes, with notable breeding colonies found on sandy, coral rubble islands and headlands (BMT WBM 2011).

In addition to providing important habitat for seabirds, the Cobourg Peninsula is known to provide important nesting habitat for six marine turtle species including the green turtle (*Chelonia mydas*), flatback turtle (*Natator depressus*), leatherback turtle (*Dermochelys coriacea*), olive ridley turtle (*Lepidochelys olivacea*), hawksbill turtle (*Eretmochelys imbricate*), loggerhead turtle (*Caretta carets*). The dugong (*Dugong dugon*) is also known to forage within waters around the site. Additionally, a number of nationally threatened species are known to be present at this site.

Kakadu National Park

Kakadu National Park Ramsar site is composed of a diversity of coastal and inland wetland types that range from intertidal forested wetlands and mudflats to seasonal freshwater marshes and permanent freshwater pools. Ramsar topology identifies 13 coastal types and 15 inland types throughout Kakadu National Park. Hydrology, fire regimes and notable biological processes, with supporting processes including climate, tidal hydraulics, groundwater, water quality, geology and geomorphology are ecosystem processes present in Kakadu National Park habitats (BMT WBM, 2010).

The site also meets all nine Nomination Criteria of the Convention, recognising the representative wetland habitats of the site at a bioregional level, support of populations of vulnerable wetland species, its characteristics as a centre of endemism and high biodiversity including its diversity of habitats, support for key life-cycle functions such as waterbird breeding and refugia values, its importance for supporting substantial populations of waterbirds and fish diversity and fish nursery and spawning habitats and its support of at least one percent of the national population of several non-avian wetland species (BMT WBM, 2010). The Ramsar site is managed under the Kakadu National Park Management Plan 2016-2026 (DNP, 2016). Kakadu National Park is not within the EMBA but is approximately 800 m away therefore has been included to ensure conservatism.

3.5.2.2 Wetlands of National Importance

Cobourg Peninsula, Kakadu National Park and Ashmore Reef Marine Park hold the status of wetlands of national importance and wetlands of international importance. They are described in Section 3.5.2.1 above.

Daly-Reynolds Floodplain-Estuary System

The Daly-Reynolds Floodplain-Estuary System is a major floodplain-tidal wetland system with the largest catchment of any major freshwater floodplain system in the NT. It is a major breeding area for magpie goose (*Anseranas semipalmata*), herons and allies and saltwater crocodile (*Crocodylus porosus*); a major dry season refuge area for waterbirds and a significant migration stop-over area for shorebirds.

The Daly-Reynolds Floodplain-Estuary System supports 31 floodplain communities, more than 80 species of bird species of which 30 are listed under treaties Japan-Australia Migratory Bird Agreement and China-Australia Migratory Bird Agreement (JAMBA/CAMBA). It is also one of the most reliable areas in the NT for breeding large numbers of magpie goose. Very dense colonies of breeding magpie goose are located over most of the floodplain but especially around Elizabeth Downs Homestead and cover large areas (up to 4600 ha) of the floodplain. Maximum number of nests recorded was 94,896 in the wet season (1983-4). Also, at least ten breeding colonies of other waterbirds, supporting in total more than 40,000 adult birds. Species presents include the four white egrets *Egretta* spp., pied heron (*Ardea picata)*, rufous night heron (*Nycticorax novaehollandiae)*, Australian white ibis (*Threskiornis Molucca),* royal spoonbill (*Platalea regia)*, three cormorant species and the darter (*Anhinga melanogaster)*. Significant numbers of brolga (*Grus rubindicus)* use the site, especially in the dry season (DIWA, 2023).

In addition to providing important habitat for seabirds, it is also known to support six frog species and freshwater turtles; *Chelodina rugosa* and *Emydura victoriae* (DIWA, 2023).

Finniss Floodplain and Fog Bay Systems

The Finniss River Coastal floodplain is about 70 km south-west of Darwin. The Finniss River floodplain supports very large aggregations of waterbirds, including more than 1% of the world's populations of magpie geese and pied herons, and high densities of many other waterbird species. The floodplain supports important breeding activity by saltwater crocodiles, magpie geese, and other waterbirds, and three large waterbird breeding colonies are located in paperbark swamps on the floodplain. Five threatened birds and one threatened plant are reported from this site. The Finniss River supports a high density of saltwater crocodiles (Fukuda *et al.,* 2007, as cited in DIWA, 2023). Thirty-five species recorded from this site are listed under international conventions or bilateral agreements protecting migratory animals.

About 870 ha of mostly dry rainforest occurs at this site, especially in coastal areas near Stingray Head. Most of the rainforest occurs as small patches (100 ha).

Fog Bay is located about 65 km southwest of Darwin. The site includes the coastline of the Bay and associated tidal flats, and the chain of small islands to the north of Native Point. The mouth of the Finniss River bisects the site; to the north, the coastline is dominated by sandy beaches and grassy dunes, and to the south, the Bay comprises extensive intertidal mudflats backed by mangroves. The mudflats in this site gradually merge into the Finniss River coastal floodplain. Bare Sand Island and the southern portion of Fog Bay regularly support large numbers of migratory shorebirds during their non-breeding season, including internationally significant numbers of at least six species (greater sand plover, grey-tailed tattler, great knot, terek sandpiper and black-tailed godwit). The sandy beaches of Fog Bay and some of the nearby islands are significant for flatback turtle nesting, and the surrounding waters are important feeding areas for three other species of marine turtle (DIWA, 2023).

3.5.3 Commonwealth Heritage Places

The Commonwealth heritage places list comprises natural, Indigenous, and historic heritage places which are either entirely within a Commonwealth area, or outside the Australian jurisdiction and owned or leased by the Commonwealth or a Commonwealth Authority. The following subsections describe the Commonwealth heritage places within the EMBA (as identified in Table 3-14). Scott Reef and surrounds is not within the EMBA but is approximately 37km away and has been included to ensure conservatism.

3.5.3.1 Ashmore Reef National Nature Reserve

Ashmore Reef is a shelf edge atoll located in the Timor Sea approximately 840 km west of Darwin and 610 km north of Broome. The atoll is comprised of three low vegetated islands (West Island, East Island and Middle Island) which cover a total area of approximately 61 ha. The islands are surrounded by coral reefs and sandbanks, with the Ashmore Reef National Nature Reserve covering approximately 583 square km (CoA, 2002).

Ashmore Reef has heritage significance due to the history of human occupation and use of the islands that comprise the atoll. The islands are believed to have been visited by Indonesian fisherman from the island of Rotti since the early eighteenth century, as well as by Macassans and Bajo and people from the island of Ceram. The islands were used for fishing and as a staging point for voyages to the southern reefs along Australia's coast (CoA, 2002).

3.5.3.2 Scott Reef and Surrounds

Scott Reef is a large, emergent shelf atoll close to the EMBA. It is located on the edge of the broad continental shelf, about 300 km from mainland northwestern Australia (Figure 3-9). The listing comprises the areas of Scott Reef that are within Commonwealth waters to the 50 m bathymetric contour. This includes North Reef, an annular reef, 16.3 km long and 14.4 km wide and parts of the lagoon of South Reef, a crescent shaped reef 17 km across (DoE 2014d).

The place is regionally significant both because of its high representation of species not found in coastal waters off WA and for the unusual nature of its fauna which has affinities with the oceanic reef habitats of the Indo-West Pacific as well as the reefs of the Indonesian region (DoE 2014d).

3.5.4 Marine Parks

In agreement with the states and NT governments, the Australian government has committed to establish Commonwealth marine parks as a component of the National Representative System of Marine Protected Areas (DNP, 2012). In November 2012, the Commonwealth Marine Reserves Network was proclaimed with the purpose of protecting the biological diversity and sustainable use of the marine environment (DNP, 2012). Commonwealth marine reserves were renamed as Australian marine parks in October 2017. Six marine regions are included in the Australian Marine Parks Network, including the Coral Sea, the South-west, the Temperate East, the South-east, the North and the North-west. The remaining networks' 10-year management plans were approved and came into effect on 1 July 2018.

The EMBA overlaps several Australian marine parks and Territory/State marine parks, which are identified in Table 3-14 and shown in Figure 3-9. OA1 does not intercept any Australian marine parks or Territory/State marine parks, management areas or reserves. However, OA2 overlaps two zones of the Oceanic Shoals Marine Park: a 30 km section through the Multiple Use Zone; and 31.5 km through the Habitat Protection Zone (IV).

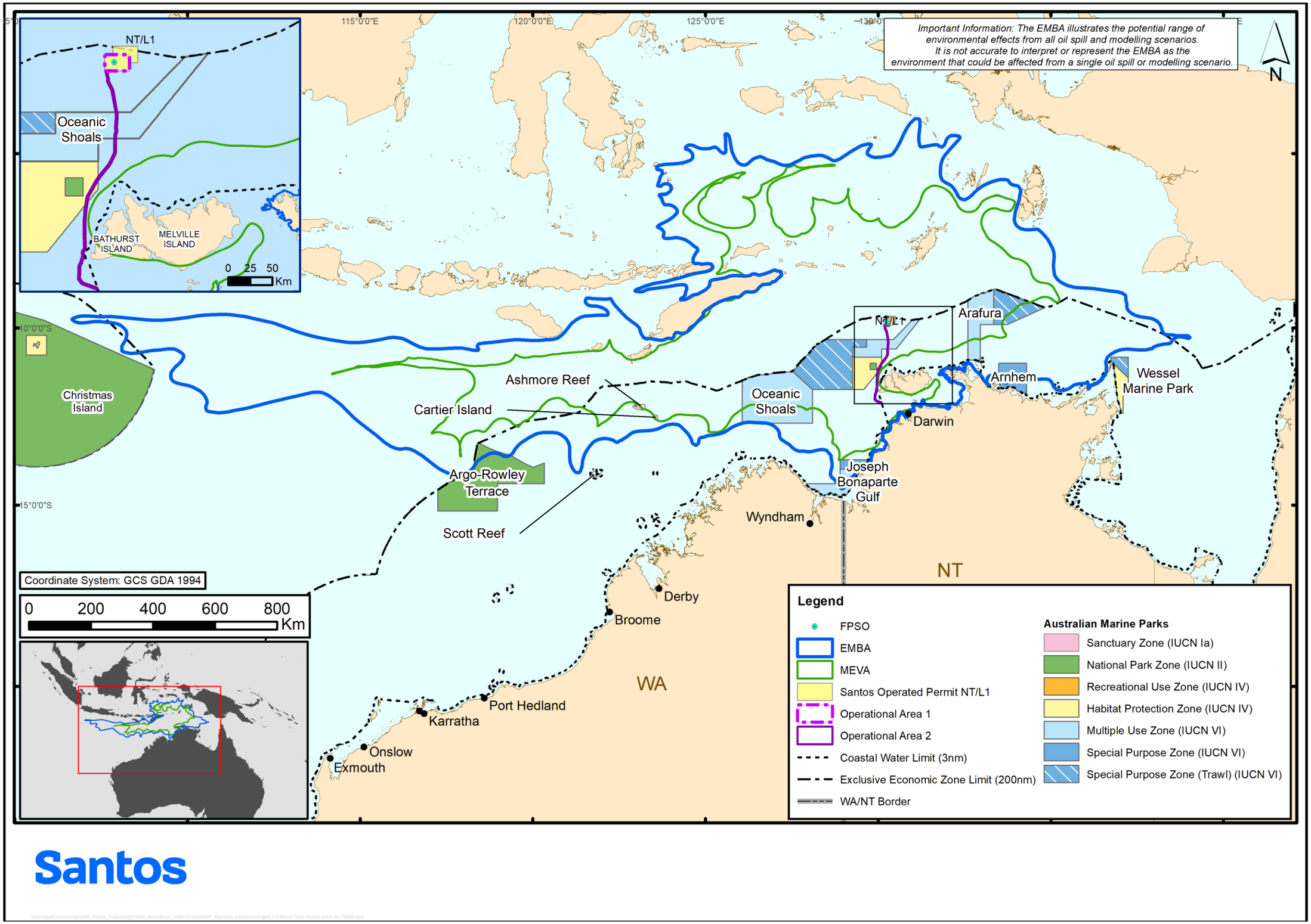

Figure 3-9: Marine Parks within and proximate to the MEVA and EMBA

Marine parks are divided into management zones (Figure 3-9) and managed in accordance with the North Marine Parks Network Management Plan (DNP, 2018a) and North-West Marine Parks Network Management Plan (DNP, 2018b), as are the four KEFs identified in the NMR and four KEFs identified in the NWMR. Table 3-15 presents prescriptions and conditions from the North-West and North Marine Parks Network management plans relevant to the Activity.

Construction and operation of the Barossa GEP, and the performance of other activities for the purposes of those operations, such as surveys, through a Habitat Protection Zone (IV) was authorised through the issue of a Commercial Activity Licence by the DNP in April 2019 (PA2018-00041-1, 5 April 2019) (refer Appendix C).

Table 3-15: Prescription and condition from the North-West and North Marine Parks Network management plans relevant to the activities in this environment plan

Prescription/ condition number	Prescription/condition	Relevant section of EP
North-West Marine Park Network Management Plan and North Marine Park Network Management Plan		
4.2.9.8	Actions required to respond to oil pollution incidents, including environmental monitoring and remediation, in connection with mining operations authorised under the OPGGS Act, may be conducted in all zones without an authorisation issued by [DNP], provided that the actions are taken in accordance with an environment plan that has been accepted by NOPSEMA, and [DNP] is notified in the event of oil pollution within a marine park, or where an oil spill response action must be taken within a marine park, so far as reasonably practicable, prior to response action being taken.	Section 4 (Relevant Persons consultation), reporting under Section 8.4 and the Barossa Production Operations OPEP

3.5.4.1 North-West Marine Parks Network

The North-West Marine Parks Network is aligned to the North-west Marine Region. The network covers 335,341 km^2 and includes 13 marine parks (DNP, 2018a). Its broad values include:

- natural values
- cultural values
- heritage values
- socio-economic values.

Further detail on each of the relevant marine parks are provided below.

3.5.4.1.1 Ashmore Reef Marine Park

The Ashmore Reef Marine Park (Sanctuary Zone – IUCN Category Ia; Recreational Use Zone – IUCN Category II) is within the EMBA and covers an area of about 583 km^2 (DNP, 2018a). It forms part of the North-West Marine Park Network. As the only oceanic reef in the north-east Indian Ocean with vegetated islands (East, Middle and West Islands), Ashmore is also the largest of three emergent, oceanic reefs in the region (DSEWPaC, 2012a). Both the Ashmore and Cartier islands fall under the legal memorandum of understanding between Indonesia and Australia, as both areas are located within Australia's external territory (DSEWPaC, 2012a).

Ashmore Reef Marine Park is located on Australia's North West Shelf in the Indian Ocean, about 840 km west of Darwin and 610 km north of Broome. The reserve includes two extensive lagoons, shifting sand flats and cays, seagrass meadows, a large reef flat covering an area of 239 km^2. Within the reserve are three small islands known as East, Middle and West Islands (DNP, 2018b).

Ashmore was designated a Ramsar wetland of international importance in 2003 (Section 3.5.1) due to the importance of its islands providing a resting place for migratory shorebirds and supporting large seabird breeding colonies.

The marine park protects the following conservation values (DNP, 2018a):

Ecosystems, habitats and communities associated with the North West Shelf, Timor Province and emergent oceanic reefs.

The island and reef habitats support:

- critical nesting and internesting habitat for green turtles (including one of three genetically distinct breeding populations in the North-west Marine Region); low level nesting activity by loggerhead turtles has also been recorded
- large and significant feeding populations of green, hawksbill and loggerhead turtles around the reefs (it is estimated that about 11,000 marine turtles feed in the area throughout the year)
- a small dugong population of less than 50 individuals that breed and feed around the reef. This population is thought to be genetically distinct from other Australian populations.
- a migratory pathway for pygmy blue whales (DNP, 2018a)
- some of the most important seabird rookeries on the North West Shelf including colonies of bridled terns, common noddies, brown boobies, eastern reef egrets, frigatebirds, tropicbirds, red-footed boobies, roseate terns, crested terns and lesser crested terns
- an important staging point/feeding area for many migratory shorebirds
- an internationally significant area for the abundance and diversity of sea snakes.

Two KEFs:

- Ashmore Reef and Cartier Island and surrounding Commonwealth waters
- Continental slope demersal fish communities (DNP, 2018b).

Cultural and heritage sites, including:

- Ashmore lagoon as a rest/staging area for traditional Indonesian fishers
- Indonesian artefacts
- grave sites
- Commonwealth heritage listing – Ashmore Reef.

The North-West Marine Parks Management Plan states for the Ashmore Reef Marine Park 'Sea country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years. At the commencement of this plan there is limited information about the cultural significance of this Marine Park.

Ashmore Reef and nearby islands and reefs are associated with benthic communities consisting predominantly of sand and coral rubble, with noteworthy hard coral, soft coral, algae and seagrasses (Heyward *et al.,* 2010; Skewes *et al.,* 1999a, 1999b). The reefs host similar benthic communities, with areas of relatively high live coral cover, although episodes of coral bleaching have been recorded (Heyward *et al.,* 2010). Benthic organisms that depend on photosynthesis such as seagrasses, macroalgae and zooxanthellate corals are typically restricted to shallower waters around the reefs. Data collected near Ashmore Reef indicates that corals are likely to spawn during March and April (Heyward *et al.,* 2010).

Soft sediments are widespread in the region, with sediment infauna communities in the region dominated by polychaetes and crustaceans. These taxa accounted for over 80% of benthic infauna sampled, both in terms of numbers of species and individual organisms.

Commercial tourism, recreation and scientific research are important socio-economic values of the marine park (DNP, 2018a).

3.5.4.1.2 Cartier Island Marine Park

The Cartier Island Marine Park (Sanctuary Zone – IUCN Category Ia) is within the EMBA, located about 45 km south-east of Ashmore Reef Marine Park and 610 km north of Broome, WA. Both the Ashmore Reef and Cartier Island marine parks are in Australia's external territory of Ashmore and Cartier Islands and are also within an area subject to a Memorandum of Understanding (MoU) between Indonesia and Australia, known as the MoU Box. The marine park covers an area of 172 km² and protects the following conservation values (DNP, 2018a):

- Ashmore Reef and Cartier Island and surrounding Commonwealth waters
- areas of enhanced productivity in an otherwise low-nutrient environment
- regional importance for feeding and breeding aggregations of birds and marine life
- continental slope demersal fish communities
- area of high diversity in demersal fish assemblages

- area of high diversity and abundance of hard and soft corals, gorgonians (sea fans), sponges and a range of encrusting organisms
- breeding and foraging habitat for seabirds
- inter-nesting, nesting and foraging habitat for marine turtles
- foraging habitat for whale sharks
- internationally significant for its abundance and diversity of sea snakes
- one known shipwreck listed under the *Underwater Cultural Heritage Act 2018* (Cth): the Ann Millicent (wrecked in 1888) (Section 3.6.7).

The North-West Marine Parks Management Plan states for the Cartier Island Marine Park 'Sea country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years. At the commencement of this plan there is limited information about the cultural significance of this Marine Park.

Scientific research is an important activity in the marine park (DNP, 2018a).

3.5.4.1.3 Argo-Rowley Terrace Marine Park

The Argo-Rowley Terrace Marine Park is within the EMBA. The marine park is approximately 270 kilometres northwest of Broome, WA. The marine park is adjacent to the Mermaid Reef Marine Park and the Western Australian Rowley Shoals Marine Park. The marine park covers an area of 146,003 km^2 and water depths between 220 m and 6000 m. The marine park was proclaimed under the EPBC Act on 14 December 2013 and renamed Argo-Rowley Terrace Marine Park on 9 October 2017. The marine park is assigned IUCN category VI and includes three zones assigned under this plan: National Park Zone (II), Multiple Use Zone (VI) and Special Purpose Zone (Trawl) (VI).

The marine park is the largest in the North-west Network, surrounding the existing Mermaid Reef Marine Park and reefs of the Western Australian Rowley Shoals Marine Park. It includes the deeper waters of the region and a range of seafloor features such as canyons on the slope between the Argo Abyssal Plain, Rowley Terrace, and Scott Plateau. These are believed to be up to 50 million years old and are associated with small, periodic upwellings that results in localised higher levels of biological productivity.

The Argo–Rowley Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Transition and Timor Province.

The marine park includes examples of ecosystems representative of:

- Northwest Transition—an area of shelf break, continental slope, and the majority of the Argo Abyssal Plain. Key topographic features include Mermaid, Clerke and Imperieuse Reefs which collectively are a biodiversity hotspot
- Timor Province—an area dominated by warm, nutrient-poor waters. Canyons are an important feature in this area of the marine park and are generally associated with high productivity and aggregations of marine life
- the KEFs of the marine park are:
    - canyons linking the Argo Abyssal Plain with the Scott Plateau, an area likely to result in upwelling of nutrient rich water and aggregations of marine life
- Mermaid Reef and Commonwealth waters surrounding Rowley Shoals—an area of enhanced productivity and high species richness, thought to be facilitated by internal wave action generated by internal tides.

The marine park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the marine park include resting and breeding habitat for seabirds and a migratory pathway for the pygmy blue whale.

Sea country (discussed further in Section 3.7.12) is valued for Indigenous cultural identity, health, and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years. At the commencement of this plan there is limited information about the cultural significance of this marine park.

Commercial fishing and mining are important socio-economic values of the marine park (DNP, 2018a).

3.5.4.2 North Marine Park Network

The North Park Network is aligned to the North Marine Region. The network covers 157,480 km^2 (DNP, 2018b). Broad values of this network include:

- natural values
- cultural values
- heritage values
- socio-economic values.

Further detail on the applicable Oceanic Shoals Marine Park is provided below.

3.5.4.2.1 Oceanic Shoals Marine Park

The Oceanic Shoals Marine Park encompasses 71,743 km^2, predominantly comprising a Multiple Use Zone (IUCN Category VI, 39,964 km^2) and a Special Purpose Zone for Trawling (IUCN VI, 24,444 km^2). The marine park also includes a National Park Zone (IUCN Category II, 406 km^2) and Habitat Protection Zone (Category IV, 6,929 km^2. The marine park protects the following conservation values (DNP, 2018b):

- important resting area for turtles between egg laying (internesting area) for the threatened flatback turtle and olive ridley turtle
- important foraging area for the threatened loggerhead turtle and olive ridley turtle
- examples of the ecosystems of two provincial bioregions: the Northwest Shelf Transition Province (which includes the Bonaparte, Oceanic Shoals and Tiwi meso-scale bioregions) and the Timor Transition Province.

KEFs represented in the park are:

- Carbonate bank and terrace system of the Van Diemen Rise (unique sea-floor feature)
- Carbonate bank and terrace system of the Sahul Shelf (unique sea-floor feature)
- Pinnacles of the Bonaparte Basin (enhanced productivity, unique sea-floor feature)
- shelf break and slope of the Arafura Shelf (unique sea-floor feature) (DNP, 2018b).

No heritage listings apply to the marine park. Commercial fishing and mining are important socio-economic values for the park (DNP, 2018b).

The North-West Marine Parks Management Plan states for the Oceanic Shoals Marine Park 'Sea country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years. At the commencement of this plan there is limited information about the cultural significance of this Marine Park.

Approximately 30 km of OA2 lies within the Oceanic Shoals Marine Park Multiple Use Zone, and approximately 31.5 km lies within the Habitat Protection Zone.

Benthic habitat model of the Oceanic Shoals Marine Park

Benthic habitat modelling (Heyward *et al.,* 2017; Radford *et al.*, 2019) and field surveys (Radford *et a.,* 2019) undertaken by AIMS within the Oceanic Shoals Marine Park, identify that benthic communities within the Oceanic Shoals Marine Park are broadly similar to benthic communities within the wider region. Unconsolidated sediments were the most common benthic habitat type within the Oceanic Shoals Marine Park, with sparse filter feeding assemblages being the second most common habitat type (Radford *et al.,* 2019). Benthic primary producers, such as corals, *Halimeda spp*. and macroalgae, were restricted to relatively shallow areas (<30 m) within the marine park and comprised a small portion of overall benthic habitats. Sparse to moderate density filter feeders, dominated by small sponges, were observed on areas of bare or sand covered pavement, with larger organisms observed on outcropping low-relief reef or rocks where the seabed slope changed around the edge of deeper channels. In general, epibenthic biota was sparse and initial observations suggest the dominant species present are consistent with what has been observed during other surveys of similarly turbid waters in the region; for example, Kelly & Prezlawski (2012).

AIMS also compared the proportion and diversity of habitats within OA2 against the habitats in the Oceanic Shoals Marine Park (Radford *et al.*, 2019). Statistical analysis revealed no significant difference between the proportion of habitats within OA2 inside and outside the park. Generally, the habitats in OA2 were a proportional subset of the habitats found in the marine park and thus, any habitat present within OA2 in the marine park, including the habitat protection zone, is well represented elsewhere in the marine park.

Fish diversity within the Oceanic Shoals is relatively low compared to other locations sampled in the Timor Sea (Radford *et al.*, 2019). This is likely to reflect the absence of complex or rugose benthic habitats, which have been shown to support higher species richness (Radford *et al.,* 2019). Analysis of baited remote underwater video systems (BRUVS) recordings within the Oceanic Shoals Marine Park highlighted the strong lineage between benthic habitats and fish assemblage characteristics. The unconsolidated sediments hosted pelagic or mobile demersal species that were not closely associated with benthic habitats, such as sharks and trevallies.

While relatively uncommon, commercially important demersal fishes such as snappers (Lutjanidae) and cod (Serranidae) were observed in filter feeder benthic habitats (Radford *et al.,* 2019).

3.5.4.2.2 Arafura Marine Park

The Arafura Marine Park covers 22,924 km^2 and is comprised of a Multiple Use Zone and Special Purpose Zone (Trawl). The marine park is almost wholly contained within the EMBA. It is located about 256 km from Darwin and extends to the outer edge of the Exclusive Economic Zone (EEZ) and the water depth ranges from 15 m to 500 m (DNP, 2018b).

The Arafura Marine Park has been deemed significant because '*it contains habitats, species and ecological communities associated with the Northern Shelf Province and Timor Transition. It includes one key ecological feature: the tributary canyons of the Arafura Depression (valued as a unique seafloor feature with ecological properties of regional significance). It is near to important wetland systems including the Cobourg Peninsula Ramsar site and provides important foraging habitat for seabirds'*

The Arafura Marine Park has both cultural and natural values. The natural values it protects include (DNP, 2018b):

- ecosystems representative of the Northern Shelf Province
- ecosystems representative of the Timor Transition
- BIAs for marine turtles
- BIAs for seabirds
- a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act.
- tributary canyons of the Arafura Depression KEF.

The sea country (discussed further in Section 3.7.12) of the marine park is part of the responsibility of the Yuwurrumu members of the Mandilarri-Ildugji, the Mangalara, the Murran, the Gadura-Minaga and the Ngaynjaharr clans. Sea country is valued for Indigenous cultural identity and Indigenous people have been sustainably using and managing their sea country, including that within the Arafura Marine Park, for tens of thousands of years (DNP, 2018b). For the purposes of consultation for this EP, Yuwurrumu members of Mandilarri-Ildugij, Mangalara, Murran, Gadura-Minaga and Ngaynjaharr clans have representation through the Cobourg Consultative Committee and the Mulurryud Consultative Committee.

3.5.4.2.3 Arnhem Marine Park

The Arnhem Marine Park covers an area of 7125 km² and water depth ranges from less than 15 m to 70 m. The marine park is entirely comprised of a Special Purpose Zone (VI) and the majority of the marine park is contained within the EMBA. It is located approximately 100 km southeast of Croker Island and 60 km southeast of the Arafura Marine Park. It extends from NT waters surrounding the Goulburn Islands, to the waters north of Maningrida (DNP, 2018b).

The Arnhem Marine Park has been deemed significant because "it contains habitats, species and ecological communities associated with the Northern Shelf Province. It includes dynamic habitats due to gently sloping shelf topped with a number of pinnacles, at depths ranging from 5 m to 30 m. It is near to important wetland systems including the Blyth-Cadell Floodplain and Boucaut Bay Nationally Important Wetland and provides important foraging habitat for seabirds" (DNP, 2018b).

The Arnhem Marine Park has both cultural and natural values.

The marine park protects the following natural values (DNP, 2018b):

- ecosystems representative of the Northern Shelf Province
- nutrient-rich coastal water contributing to high biological biodiversity
- BIAs for marine turtles
- BIAs for seabirds.

No heritage listings apply to the marine park. Commercial fishing, tourism and recreation (e.g. fishing) are important socio-economic values for the park (DNP, 2018b).

The North Marine Park Network Management Plan states for the Arnhem Marine Park that the coastal Aboriginal people of West Arnhem Land have responsibilities for sea country in the marine park. For the purposes of consultation for this EP, First Nations people of West Arnhem Land have representation through the Maningrida Regional Consultative Committee and the Goulburn Islands Consultative Committee. The North Marine Park Network Management Plan also states that this marine park 'contains sites which are registered

under Northern Territory *Aboriginal Sacred Sites Act 1989*. The Northern Land Council is the Native Title Representative Body for the NT's northern region.'

3.5.4.2.4 Joseph Bonaparte Gulf Marine Park

-The Joseph Bonaparte Gulf Marine Park (Figure 3-9) is located approximately 15 km west of Wadeye, NT, and approximately 90 km north of Wyndham, WA, in the Joseph Bonaparte Gulf. It is adjacent to the Western Australian North Kimberley Marine Park. The marine park covers an area of 8597 km² and water depth ranges between less than 15 m and 100 m. The marine park was proclaimed under the EPBC Act on 14 December 2013 and renamed Joseph Bonaparte Gulf Marine Park on 9 October 2017. The marine park is assigned IUCN category VI and includes two zones: Special Purpose Zone (VI) and Multiple Use Zone (VI).

The Joseph Bonaparte Gulf Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Transition bioregion (DNP, 2018b).

The marine park contains a number of prominent shallow seafloor features including an emergent reef system, shoals, and sand banks. It is near an important wetland system including the Ord River floodplain Ramsar site and provides connectivity between the nearshore and sea environments. The marine park includes habitats connecting to and complementing the adjacent Western Australian North Kimberley Marine Park (DNP, 2018b).

The marine park includes examples of ecosystems representative of the Northwest Shelf Transition, a dynamic environment influenced by strong tidal currents, monsoonal winds, cyclones and wind-generated waves. The large tidal ranges and wide intertidal zones near the marine park create a physically dynamic and turbid marine environment. The key ecological feature in the marine park is the carbonate bank and terrace system of the Sahul Shelf, characterised by terraces, banks, channels, and valleys supporting sponges, soft corals, sessile filter feeders, polychaetes, and ascidians. The marine park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. The BIAs within the marine park include foraging habitat for marine turtles and the Australian snubfin dolphin (DNP, 2018b). The park also supports large numbers of migratory shorebirds during the non-breeding season including internationally significant numbers of greater sand plover (*Charadrius leschenaultia),* grey-tailed tattler (*Tringa brevipes*), great knot (*Calidris tenuirostris*), terek sandpiper (*Xenus cinereus*) and black-tailed godwit *(Limosa limosa*).

No international, Commonwealth or national heritage listings apply to the marine park at commencement of this plan.

Tourism, commercial fishing, mining, and recreating are some of the important social and economic values of the marine park (DNP, 2018b).

Sea country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years. The Miriuwung, Gajerrong, Doolboong, Wardenybeng and Gija and Balangarra people have responsibilities for sea country in the Marine Park. They are represented by the following Prescribed Body Corporates: Miriuwung and Gajerrong Aboriginal Corporation, and Balanggarra Aboriginal Corporation. These corporations are the points of contact for their respective areas of sea country in the marine park. The Northern Land Council and the Kimberley Land Council are the Native Title Representative Bodies for the NT's northern region, and the Kimberley region. Further, for the purposes of consultation for this EP, the coastal peoples on the western coast of the NT, with potential interests and responsibilities in the marine park, have representation through the Djulidki Consultative Committee and the Kardu Lalingkin Consultative Committee.

3.5.4.2.5 Wessel Marine Park

The Wessel Marine Park is not within the EMBA but is approximately 8 km away and has been included for conservatism. Wessel Marine Park is located approximately 22 km east of Nhulunbuy, NT. It extends from NT waters adjacent to the tip of the Wessel Islands to NT waters adjacent to Cape Arnhem. The Marine Park covers an area of 5908 km² and water depths between 15 m and 70 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Wessel Marine Park on 9 October 2017. The marine park is assigned IUCN category IV and includes two zones assigned under this plan: Habitat Protection Zone (IV) and Special Purpose Zone (Trawl) (VI).

The marine park is adjacent to waters surrounding the Wessel Islands, both of which, are regarded as a biodiversity hotspot, supporting some of the most diverse and species-rich environments in the North Marine Region. A number of endemic species occur in the area, and nationally and internationally significant aggregations of migratory shorebirds, seabirds, marine turtles and a variety of unique sponge and coral communities.

The marine park includes examples of ecosystems representative of the Northern Shelf, a dynamic region with gently sloping shelf topped with a number of pinnacles at depths ranging from 5 m to 30 m. Tidal eddies induce localised upwellings and hotspots of productivity that correspond with aggregations of marine life within the marine park.

The key ecological feature in the marine park is the Gulf of Carpentaria basin, characterised by soft sediments that support abundant and diverse communities dominated by polychaetes, crustaceans, molluscs, and echinoderms, with pelagic fish species such as shark, snapper, tuna, and mackerel.

The marine park overlaps the Arafura Sill, which is a seafloor barrier that restricts movement of water into the Gulf of Carpentaria basin and forms a distinct biogeographical transition point for sessile invertebrate (e.g., sponges and corals) and fish species.

The marine park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the marine park include breeding habitat for seabirds and internesting and foraging habitat for marine turtles. Tourism, commercial fishing, mining, and recreational activities are some of the important social and economic values of the marine park (DNP, 2018b).

The North Marine Park Management Plan states that the Yolŋu people have responsibilities for sea country in the marine park, and that the marine park contains sites which are registered under NT *Aboriginal Sacred Sites Act 1989*. The Northern Land Council is the Native Title Representative Body for the NT's northern region. For the purposes of consultation for this EP in respect of functions, interests or activities which Santos understands may be affected by the activities the subject of this EP, Yolŋu language groups have representation through the Miyarrka and Ngoy Garmak Consultative Committees (see Table 4-9).

3.5.4.3 International Marine Parks

The EMBA also overlaps two international marine parks, one from Indonesia and one from Timor-Leste:

- Savu Sea (Laut Sawu) Marine National Park (MNP) (Indonesia)
- Nino Konis Santana National Park (Timor-Leste).

3.5.4.3.1 Savu Sea (Laut Sawa) MNP

The Savu Sea (Laut Sawu) Marine National Park (MNP) is located within the Lesser Sunda Ecoregion located to the south of the Coral Triangle and covers approximately 35,000 km^2 (UNEP-WCMC 2023a). It was established in 2009 and has an IUCN Category II status (UNEP-WCMC 2023a). The MNP is split into three management areas: the Pantar Strait Marine Protected Area, the Sumba Strait Marine Area, and the Tirosa-Batek Marine Area.

The Savu Sea MNP acts as a marine corridor and migratory pathway for marine fauna and is also an important upwelling zone in the Indo-Pacific region due to the presence of deep ocean trenches (Perdanahardja & Lionata 2017). The MNP area is a known migration route for several cetacean species, including the blue whale and sperm whale (Huffard *et al.,* 2012). Other cetacean species such as pygmy killer whales, melon-head whales, shortfinned pilot whales and numerous dolphin species (including Risso's dolphin, Fraser's dolphin, common dolphin, bottlenose dolphin and spinner dolphin) are known to frequent the MNP area (Coral Triangle Atlas, 2023). Several species of marine turtle, including the green turtle, hawksbill turtle and leatherback turtle have also been recorded in the MNP area (Huffard *et al.,* 2012).

The marine park area covers a range of habitats and species diversity, including:

- 532 corals species which include 11 endemic and sub endemic species
- 350 reef fish species
- Fifteen mangrove species are recorded that represented 9 families of mangrove.
- Ten seagrass species
- Deep-water habitats such as seamounts, deep-water canyons, straits (migratory corridors)
- Large persistent pelagic habitats
- Main migratory corridors and habitats for 14 whale species, seven dolphin's species, and dugong
- Habitats for five sea turtle species (green, leatherback, olive ridley, loggerhead, and flatback) as well as for large marine fauna such as sharks, napoleon, parrotfish and groupers (Savu Sea National Marine Conservation Area undated).

The Savu Sea MNP provides productive marine habitats that support large populations of fish and artisanal and commercial fisheries. It is estimated that 65% of the East Nusa Tenggara regional fisheries production comes from the Savu Sea (Perdanahardja & Lionata, 2017).

3.5.4.3.2 The Nino Konis Santana National Park

The EMBA also overlaps Nino Konis Santana National Park. The Nino Konis Santana National Park is also located within the Lesser Sunda Ecoregion, northeast side of Timor-Leste. Established in 2007, Nino Konis was the first national park created in the country and includes the entire eastern tip of Timor-Leste and the

waters offshore (UNEP-WCMC, 2023b). The Konis Santana National Park marine waters are characterised by a narrow reef flat (<60 m to approximately 1 km wide) that is dominated by seagrass in shallower water (approximately 2200 ha) and corals in deeper waters (approximately 2000 ha) (Amaral 2010). The national park is rich in marine biodiversity, including sharks, coral trout (*Plectropomus* species), and the highly threatened Napoleon wrasse (*Cheilinus undulatus*) as well as whales, dolphins, whale sharks, orcas and mantas (Erdmann and Mohan, 2013). It is home to a number of marine and terrestrial habitats that are listed at the national and global level and includes 55,600 ha of the Coral Triangle and 25 endemic bird species (Erdmann and Mohan, 2013). The area also has a high level of productivity due to strong ocean mixing, which raises both nutrient concentrations in the area and supports the high level of biodiversity.

The area contains a unique species of coral (*Montipora* spp.) that shows significant morphological differences from its closest congener, and is likely new to science, requiring additional taxonomic study (Erdmann and Mohan, 2013).

3.5.4.4 Indian Ocean Territories Marine Parks Network

Although the EMBA does not overlap with the Christmas Island Marine Park, the marine park is in proximity. The PMST results (Appendix E) identified that the EMBA "overlapped" the Marine Park, as the tool relies on polygons for the search. Section 3 (Data Sources) of the PMST (refer Appendix E) states, '*Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.)*.' The dimensions of the PMST search polygon (as set by the PMST) are such that the EMBA and the Marine Park both occur in the same search polygon, even though their respective coordinates do not overlap.

To ensure a conservative approach to evaluation of risks and impacts associated with the activity the Christmas Island Marine Park is described and associated potential impacts assessed.

The Indian Ocean Territories Marine Parks Network consists of two marine parks established by the Australian Government in March 2022. This network protects the unique marine environments surrounding Australia's remote external territories in the Indian Ocean: Christmas Island and the Cocos (Keeling) Islands.

3.5.4.4.1 Christmas Island Marine Park

The park covers 277,016 km^2 of the Indian Ocean surrounding Christmas Island – nearly the entirety of Australia's waters around this remote external territory. It protects a diversity of pelagic and seafloor features, with water depths ranging from 0 m to over 6,000 m (DNP, 2025).

The Christmas Island marine region supports high levels of species richness and diversity, including varieties of marine fauna found nowhere else in the world. The fringing coral reefs contain coral species from both Indian and Pacific Ocean bioregions, and over 680 species of fish have been recorded in the region. The overlap of these bioregions in this area has given rise to hybrid marine fish, including some endemic species (DNP, 2025).

The offshore deep-sea marine environment of the marine park is characterised by seamounts, ridges, abyssal plains and hadal (deep trough areas). The South Equatorial Current connects the Indian Ocean waters with the Indo-Pacific. The area is also influenced by tidal regimes, monsoonal climatic patterns and cyclones (DNP, 2025).

The marine environment supports some species that attract tourists and researchers to the island – these include unique seabirds, whale sharks, spinner dolphins and large pelagic fish. It also supports important biological processes, such as spawning of Christmas Island's famous red crabs. The marine park adjoins Christmas Island National Park, connecting and increasing protection across land and sea for species like Abbott's booby seabirds and land crabs, which require both environments for their survival (DNP, 2025).

The marine environment supports some species that attract tourists and researchers to the island – these include unique seabirds, whale sharks, spinner dolphins and large pelagic fish. It also supports important biological processes, such as spawning of Christmas Island's famous red crabs (*ketam merah*). The marine park adjoins Christmas Island National Park, connecting and increasing protection across land and sea for species like Abbott's booby seabirds and land crabs, which require both environments for their survival (DNP, 2025).

Christmas Island has a unique history that reflects its multicultural community. The customs, traditions and languages of the Chinese and Malay communities on Christmas Island contribute to the island's diverse culture. For over a century, these communities have continuously relied on the ocean environment for their livelihood and sustenance. The marine environment supports important sources of food that have sustained local communities since settlement. The marine environment provides a source of recreation and relaxation,

with residents and visitors drawn to the ocean for fishing, boating, kayaking, sailing, paddleboarding, snorkelling, scuba diving, free-diving, wildlife watching and swimming DNP, 2025).

Key pressures on Christmas Island Marine Park include climate and environmental change, marine debris and other pollution, marine invasive species and disease, coastal development and infrastructure, fishing pressure and recreational and tourism activities (DNP, 2025).

3.5.4.5 Garig Gunak Barlu Marine National Park

The EMBA intersects the perimeter of the Garig Gunak Barlu National Park, situated in the NT. It contains both the Cobourg Marine Park and the Cobourg Sanctuary. The sanctuary extends to low water mark and includes the intertidal zone and waters covering the peninsula. The marine park extends seaward from the low water mark. Collectively they encompass a diverse array of landscapes and marine environments BMT WBM (2011).

Garig Gunak Barlu is managed by the NT Parks and Wildlife Commission under the *Cobourg Peninsula Aboriginal Land, Sanctuary, and Marine Park Act 1981 (NT).* The park includes the Cobourg Peninsula, Burford Island, the Sir George Hope Islands, Mogogout Island, and Endyalgout Island, as well as the surrounding marine waters. The park is classified as an IUCN Category II protected area, which designates it as a national park focused on the protection of natural environments and the provision of recreational opportunities (PWSNT, 2011).

The park is notable for its rich biodiversity, supporting all six species of Australian marine turtle - green, hawksbill, flatback, leatherback, and olive ridley turtles. The surrounding ocean is inhabited by various shark species and cetaceans, while saltwater crocodiles are found near the coast. On land, the park is home to over 200 bird species and several mammal species (PWSNT, 2011).

The park features Multiple Use A and B zones, which allow for different levels of resource use, including commercial fishing activities. The Multiple Use A Zone permits more intensive fishing practices, such as prawn trawling and netting, while the Multiple Use B Zone supports commercial fishing under different regulations (PWSNT, 2011).

Critical to the park's management are the BIAs for marine turtles, seabirds, and dolphins. These BIAs provide essential habitats for nesting, feeding, and migratory pathways, particularly for flatback, green, and olive ridley turtles. Additionally, the park supports critical habitats for fish and crustacean species important to local fisheries BMT WBM (2011).

3.5.5 Key Ecological Features

Key ecological features (KEFs) are elements of the Commonwealth marine environment defined as important for either a region's biodiversity or its ecosystem function and integrity. KEFs meet one or more of the following criteria (DSEWPaC, 2012a):

- a species, group of species or a community with a regionally important ecological role
- a species, group of species or a community that is nationally or regionally important for biodiversity
- an area or habitat that is nationally or regionally important for:
  - enhanced or high biological productivity
  - aggregations of marine life
  - biodiversity and/or endemism
- a unique seafloor feature with ecological properties of regional significance.

The EMBA overlaps several KEFs, which are identified in Table 3-14 and shown in Figure 3-10. OA1 and OA2 occur within the bounds of the Shelf Break and Slope of the Arafura Shelf KEF. A portion of OA2 occurs over the Carbonate Bank and Terrace System of the Van Diemen Rise KEF (see Section 3.3.8). The ecological values associated with this unique seafloor feature (i.e. patch reefs and hard substrate pinnacles) were not observed during the baseline habitat surveys in the vicinity of the Barossa field (Jacobs, 2016a).

3.5.5.1 Ancient Coastline at 125 m Depth Contour

The shelf of the North-west Marine Region contains several terraces and steps which reflect changes in sea level that occurred over the last 100,000 years. The most prominent of these features occurs at a depth of 125 m as an escarpment along the North West Shelf and Sahul Shelf (DSEWPaC, 2012a), designated the 'Ancient coastline at 125 m depth contour' KEF. Where the ancient, submerged coastline provides areas of hard substrate it may contribute to higher biological diversity. Little detailed knowledge is available, but the hard substrate of the escarpment is likely to support sponges, crinoids, molluscs and echinoderms (DSEWPaC, 2012a). It is understood that changes in topography at these depths are critical points for the

generation of internal waves (Holloway *et al.,* 2001 cited in CoA, 2012a), playing a minor role in aiding localised upwelling or at least regional mixing associated with the seasonal changes in currents and winds. It is also believed that this prominent floor feature could be important as a migratory pathway for cetaceans and pelagic species such as the whale shark and humpback whale, as they move north and south between feeding and breeding grounds (CoA, 2012a).

Parts of the ancient coastline are thought to provide biologically important habitats in areas otherwise dominated by soft sediments. The topographic complexity of these escarpments may also facilitate vertical mixing of the water column providing a relatively nutrient-rich environment for species present on the escarpment (DSEWPaC, 2012a). This enhanced productivity could potentially be attracting baitfish, which in turn provide food for the migratory species. The pressures of potential concern on the biodiversity value of this feature generally include ocean acidification as a result of climate change (DSEWPaC, 2012a).

3.5.5.2 Continental Slope Demersal Fish Communities

The Australian continental slope provides important habitat for demersal fish communities, characterised by high endemism and species diversity. Specifically, the continental slope between North West Cape and the Montebello Trough is the most diverse slope bioregion in Australia with more than 500 fish species, 76 of which are endemic (Last *et al.,* 2005 in DSEWPaC, 2012a).

The continental slope KEF consists of two distinct community types, associated with the upper and mid slope, 225 to 500 m and 750 to 1000 m deep, respectively. The Timor Province and Northwest Transition bioregions are the second-richest areas for demersal fish across the entire continental slope (DSEWPaC 2012a). The bacteria and fauna that is present in the system on the continental slope are the basis for the food web for demersal fish and higher order consumers in the system. Further information on this system is lacking, though it has been suggested that it is a detritus-based system, where infauna and epifauna become prey for a range of teleost fish, molluscs and crustaceans (Brewer *et al.,* 2007). The higher order consumers supported by this system are likely to be carnivorous fish, deep water sharks, large squid and toothed whales (Brewer *et al.,* 2007). The pelagic production is known to be phytoplankton based, with hotspots located around oceanic reefs and islands (Brewer *et al.,* 2007).

It is believed that the loss of the benthic habitat along this continental shelf region would likely lead to a decline in the species diversity and endemism that this feature is associated with (DCCEEW, 2023a).

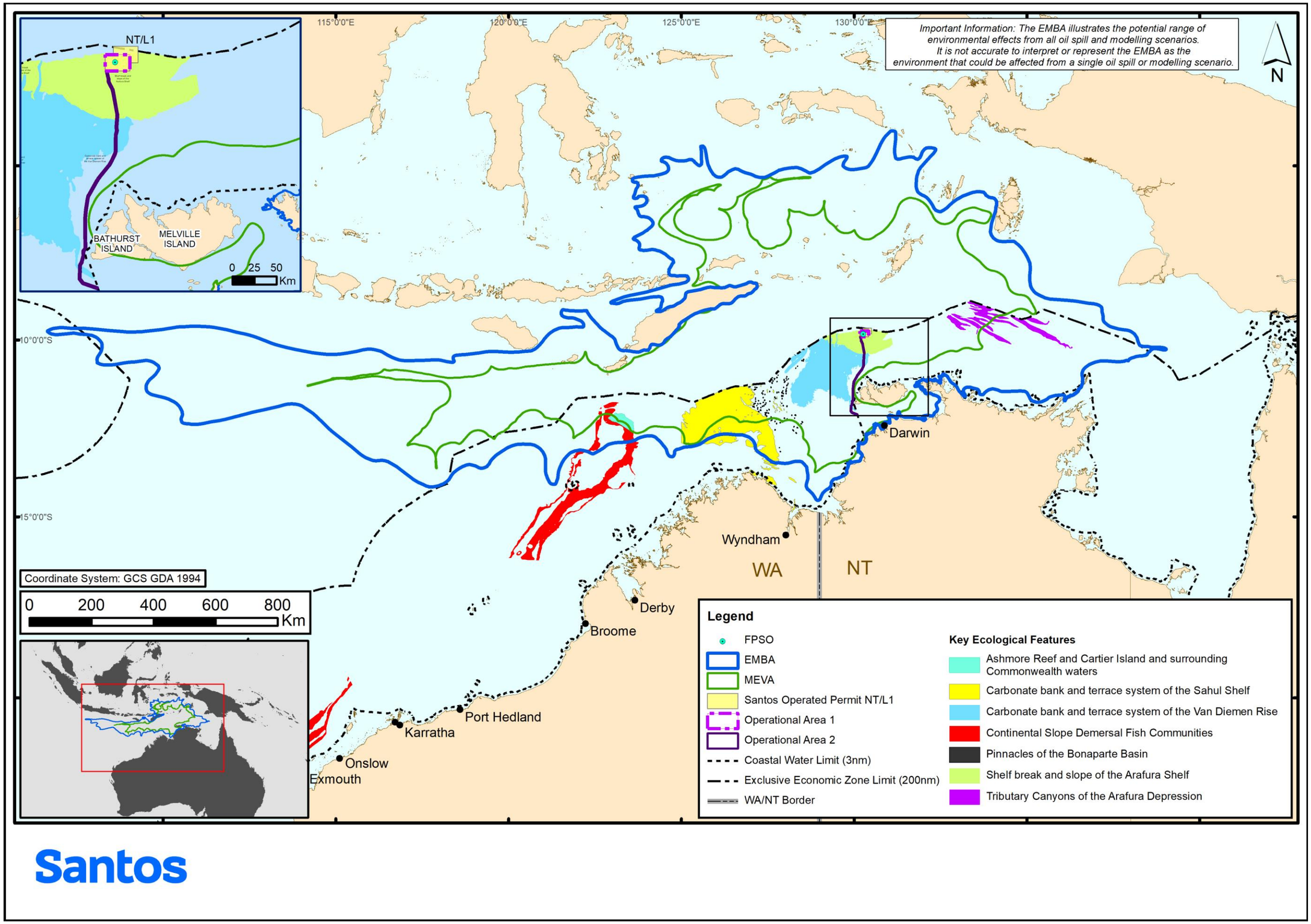

Figure 3-10: Key ecological features, MEVA and EMBA

3.5.5.3 Seringapatam Reef and Commonwealth waters in the Scott Reef Complex

Scott and Seringapatam reefs are part of a series of submerged reef platforms that rise steeply from the sea floor between the 300 and 700 m depth contours on the northwest continental slope in the Timor Province (Falkner *et al.,* 2009). Scott Reef consists of two separate reef formations, North Reef and South Reef. The total area of the KEF is about 2418 km². As two of the few offshore reefs in the northwest Austalia, they provide an important biophysical environment in the region.

Scott and Seringapatam reefs attract aggregations of marine life including humpback whales on their northerly migration, Bryde's whales, pygmy blue whales, Antarctic minke whales, dwarf minke whales, minke whales, dwarf sperm whales and spinner dolphins (Jenner *et al.,* 2008). Whale sharks and several species of sea snakes have also been recorded in this area (Donovan *et al.,* 2008). Green and hawksbill turtles' nest during the summer months on Sandy Islet on South Scott Reef. These species also internest and forage in the surrounding waters (Guinea, 2006). Scott Reef is a particularly biologically diverse system and includes more than 300 species of reef-building corals, about 400 mollusc species, 118 crustacean species, 117 echinoderm species and around 720 fish species. Corals and fish at Scott Reef have higher species diversity than the Rowley Shoals (Done *et al.,* 1994).

Scott Reef is listed as Commonwealth Heritage Places and is discussed in Section 3.5.3.2. A general description of Scott Reef and Seringapatam Reef is presented in Table 3-6.

3.5.5.4 Ashmore Reef and Cartier Island and surrounding Commonwealth waters

Ashmore Reef and Cartier Island are situated on the shallow upper slope of the Sahul Shelf, north of Scott and Seringapatam reefs. Rising from a depth of more than 100 m, the reef platform is at the edge of the North West Shelf and covers an area of 239 km². Ashmore Reef Marine Park (Section 3.5.4.1.1) encloses an area of about 583 km² of seabed (EA, 2002). Cartier Island lies about 350 km off Australia's Kimberley coast, 115 km south of the Indonesian island of Roti and 45 km southeast of Ashmore Reef Commonwealth Marine Reserve. Cartier Island Marine Park (Section 3.5.4.1.2) covers an area of 167 km² (EA, 2002). Species at Ashmore Reef and Cartier Island include more than 225 reef-building corals, 433 molluscs, 286 crustaceans, 192 echinoderms, and the most diverse variety of fish of any region in WA with 709 species (EA, 2002).

Sandy beaches provide important habitat for nesting green and hawksbill turtles throughout the year. Seagrass present at Ashmore Reef provides critical breeding (April–May) and foraging (throughout the year) habitat for a genetically distinct population of dugong with their range probably extending to other submerged shoals within the area (Whiting, 1999). The emergent habitat at Ashmore also provides important nesting sites for seabirds, many of which are migratory. Ashmore's islands are regarded as supporting some of the most important seabird rookeries on the North West Shelf seasonally, including up to 50,000 seabirds (26 species) and up to 2,000 waders (30 species, representing almost 70% of wader species that regularly migrate to Australia) (Milton, 2005).

A general description of Ashmore Reef and Cartier Island is presented in Table 3-6.

3.5.5.5 Carbonate Bank and Terrace System of the Sahul Shelf

The carbonate bank and terrace system of the Sahul Shelf is located in the western Joseph Bonaparte Gulf and to the north of Cape Bougainville and Cape Londonderry. The banks consist of a hard substrate and flat tops at depths of 150–300 m. Each bank occupies an area generally less than 10 km² and is separated from the next bank by narrow sinuous channels with depths up to 150 m. The origin of the banks is uncertain, though the area contains predictably high levels of productivity, in comparison to the generally low productivity of the region (DSEWPaC, 2012a).

The banks are foraging areas for loggerhead, olive ridley and flatback turtles and provide habitat for humpback whales, and green and freshwater sawfish (Donovan *et al.,* 2008 in DSEWPaC, 2012a). The banks may also be used by Australian snubfin dolphin, a migratory species occurring mostly on the northern extent of the Sahul Shelf. The hard substrate of the banks is thought to support diverse organisms including sessile benthic invertebrates such as sponges, soft and hard corals, gorgonians, bryozoans, ascidians and associated reef fish and elasmobranchs (Brewer *et al.,* 2007).

The carbonate banks and terrace system of the Sahul Shelf are considered to be regionally important because of their role in enhancing productivity relative to their surrounds (DSEWPaC, 2012a). Little is known about the banks, terraces and associated channels but they are believed to be areas of enhanced productivity and biodiversity due to the upwellings of cold nutrient-rich water at the heads of the channels and the availability of hard substrate (Brewer *et al.,* 2007).

3.5.5.6 Pinnacles of the Bonaparte Basin

The limestone pinnacles of the Bonaparte Basin are located in the mid-outer shelf of the western Joseph Bonaparte Gulf and comprise 61% of the limestone pinnacles in the Northwest Marine Region and 8% of the total limestone pinnacles found within the Australian Exclusive Economic Zone (Baker *et al.,* 2008). The pinnacles range from water depths of 30 to 80 m providing hard substrate in a relatively sparse soft sediment habitat for sessile species. The pinnacles are thought to be remnants of the calcareous shelf and coastal features from previous low sea-level stands and have been recorded up to 50 m in height and from 50 to 100 km long (Baker *et al.,* 2008, Heyward *et al.,* 1997).

The pinnacles of the Bonaparte Basin are regionally important because of their biodiversity value (unique sea-floor feature with ecological properties of regional significance), which apply to both the benthic and pelagic habitats (DSEWPaC, 2012a). Diverse communities of sessile benthic invertebrates, including hard and soft corals, sponges, whips, fans, bryozoans and aggregations of demersal fish species such as snappers, emperors and groupers, have been recorded (Brewer *et al.,* 2007). Foraging within the pinnacles by marine turtles has been reported and the area has also been suggested to be used by freshwater and green sawfish as well as humpback whales (Donovan *et al.,* 2008). The pinnacles have been recognised as a sponge biodiversity hotspot with greater diversity than that of the surrounding seafloor (NERP MBH, 2014).

3.5.5.7 Tributary canyons of the Arafura Depression

The tributary canyons of the Arafura Depression form an important ecological feature characterised by high nutrients from upwellings of deep ocean water, which enhance productivity of the area (CoA, 2012a). This is thought to occur as a result of movements of water through the canyons and surface water circulating as a result of monsoonal winds (Wilson, 2005).

The national and/or regional importance of the tributary canyons is associated with its high productivity, high levels of biodiversity and endemism. Surveys of the area identified around 245 macroscopic species including a variety of invertebrates and six small fish species (Wilson, 2005). The area also includes coral communities, predatory fish, whale sharks, sawfish and marine turtles (mostly olive ridley) (CoA, 2012a).

3.5.5.8 Shelf Break and Slope of the Arafura Shelf

The shelf break and slope of the Arafura Shelf is an important ecological feature that creates a unique seafloor which enhances biological productivity on the edge of the shelf and attracts feeding aggregations of pelagic marine organisms. The productivity of this area has been recognised as nationally and/or regionally important (Last *et al.,* 2005).

Although the ecosystem processes in this area are largely unknown, it is thought that the oceanographic processes associated with the Indonesian Throughflow current and monsoonal winds are a strong influence.

The physical characteristics of this shelf break and slope comprise of continental slope, patch reefs and hard substrate pinnacles (Harris *et al.,* 2005).

Phytoplankton and invertebrates have been sampled at this KEF and the primary production of phytoplankton is thought to be the basis for offshore food webs in the area (CoA, 2012b). Records show about 284 demersal fish species in the area (Last *et al.,* 2005) and other marine species that have been recorded include marine turtles, whale sharks and predatory fish species including sharks (CoA, 2012b).

Whilst OA1 occurs within the bounds of the ‘Shelf break and slope of the Arafura Shelf’ KEF, the ecological values associated with this unique seafloor feature (i.e., patch reefs and hard substrate pinnacles) were not observed during the Barossa marine studies program, nor are these topographically distinct features evident from the data derived from multiple surveys undertaken across this area (see Section 3.3.8).

3.5.5.9 Carbonate Bank and Terrace System of the Van Diemen Rise

The bank and terrace system of the Van Diemen Rise covers about 31,278 km^2 and forms part of the larger system associated with the Shaul Banks to the north and Londonderry Rise to the east. The value of this KEF is ‘unique seafloor feature with ecological properties of regional significance’ and it is considered important for its role in enhancing biodiversity and local productivity relative to its surrounds and for supporting relatively high species diversity. The feature is characterised by carbonate terrace, banks, channels, and valleys, with variability in water depth and substrate composition considered to contribute to the presence of unique ecosystems in the channels.

The carbonate banks and shoals found within the Van Diemen Rise make up 80% of the banks and shoals, 79% of the channels and valleys, and 63% of the terrace found across the North Marine Region. The carbonate banks and shoals rise from depths of 100 m to 200 m to within 10 m to 40 m of the sea surface (Anderson *et al.,* 2011).

A survey was undertaken in 2010 by Geoscience Australia and AIMS to map the seabed environments of the Van Diemen Rise (Anderson *et al.,* 2011). The survey involved towed-video transects at 77 sites to characterise the benthic habitats and epibenthos in the four geomorphic environments (banks, terraces, valleys and plains) within the Van Diemen Rise survey area of 784 km². The shallow banks sampled contained complex benthic features with diverse and often dense epibenthic assemblages. A total of 175 video characterisations were recorded from 13 bank sampling sites in the study area and sample from depths of 10.5 to 54.3 m (mean depth of 34 m). The sites were characterised by mostly low-lying rock outcrops that supported hard corals (18% occurrence) and octocorals (99% occurrence) along with smaller colonies of bryozoa and ascidians (Anderson *et al.,* 2011). The rocky outcrops were interspersed by small areas of coarse-grained soft sediments that were relatively barren and supported few organisms (Anderson *et al.,* 2011).

The feature provides habitat for a high diversity of sponges, soft corals and other sessile filter feeders; epifauna and infauna; and olive ridley turtles, sea snakes and sharks. Rich sponge gardens and octocorals have been identified on the eastern Joseph Bonaparte Gulf along the banks, ridges and some terraces. Plains in deep holes/valleys are characterised by scattered epifauna and infauna that include polychaetes and ascidians. Epibenthic communities, such as the sponges found in the channels, are likely to support fish and second-order consumers. Pelagic fish such as mackerel, red snapper and a genetically distinct population of gold band snapper are found in the Van Diemen Rise.

The Barossa GEP passes through the KEF twice, over a length of approximately 40 km within a northern portion of the KEF and approximately 10 km within a southern portion of the KEF (see Figure 3-10). This equates to a footprint of 3.3 hectares (0.033 km²) or 0.0001% of the total area of the KEF. Photographic observations taken during the geotechnical survey of OA2 showed bare sand on the seabed at all locations within the KEF and along the whole OA2. The closest sponge communities are located on Goodrich Bank (see Section 3.3.5); however, these were also sparsely distributed and found only in the shallow waters on top of the bank (Heyward *et al.,* 2017).

3.5.5.10 Gulf of Carpentaria

The Gulf of Carpentaria basin is located in the Northern Shelf Province provincial bioregion and is characterised by gently sloping soft sediments and water varying in depth from around 45 to 80 m. Sediment types differ across the basin, shelf sandy muds (less than 50% sand) are found on the western side, shelf muddy sands (50–80% sand) on the eastern side and relict sands and muddy sands dominate the sea floor of the southern basin. The waters in the Gulf of Carpentaria mix little with waters of the Arafura and Coral seas, so that they form a distinct semi-enclosed system with limited inputs from either oceanographic or terrestrial sources (CoA, 2012b).

The Gulf of Carpentaria is believed to be one of the few remaining near-pristine marine environments in the world (CoA, 2012b). Primary productivity in the Gulf of Carpentaria basin is mainly driven by cyanobacteria that fix nitrogen (Burford *et al.,* 2009) but is also strongly influenced by seasonal processes. The soft sediments of the basin are characterised by moderately abundant and diverse communities of infauna and mobile epifauna dominated by polychaetes, crustaceans, molluscs, and echinoderms. The Gulf of Carpentaria basin also supports assemblages of pelagic fish species including planktivorous and schooling fish, and top predators such as shark, snapper, tuna, and mackerel. The Gulf is also an important migratory route for seabirds, shore birds and marine turtles. During the monsoon, Gulf waters become stratified, resulting in the development of high concentrations of chlorophyll at depths of around 40 metres. In the dry season (April–October), strong southeast trade winds mix Gulf waters and resuspend nutrients generated from benthic microbial processes high in the euphotic zone. This results in primary productivity throughout the water column. Higher-order species including cetaceans and large pelagic fish prey on pelagic species that benefit from this productivity (Hosack & Dambacher 2011).

3.5.6 Biologically Important Areas and Habitat Critical

Table 3-16 and Figure 3-11 to Figure 3-21 show species BIAs in relation to the OAs, MEVA and EMBA. There are no BIAs within OA1. A flatback turtle internesting BIA overlaps OA2 (refer Figure 3-19).

BIAs are spatially defined areas where aggregations of individuals of a species are known to display biologically important behaviour such as breeding, foraging, resting or migration. BIAs are identified by DCCEEW; however, they have no legal status but are designed to support decision making under the EPBC Act. They are not designed to identify protected areas but may inform such processes.

Habitat critical to the survival of EPBC Act-listed marine turtles (habitat critical – HC) in relation to the OAs, MEVA and EMBA are presented in Table 3-17 and Figure 3-15 to Figure 3-20.

The beaches of the Tiwi Islands include:

- Nesting HC for the survival of olive ridley turtles from the NT Stock (Fitzsimmons & Limpus 2014) and a 20 km buffer applied across the waters adjacent to important nesting locations (i.e. those where > 10 nesting

females have been recorded) to represent their internesting habitat (i.e., the area within which turtles spend time offshore between successful nesting events). Overlaps OA2 (refer to Figure 3-15).

- Nesting HC for the flatback turtle from the Arafura Stock and a 60 km buffer applied immediately seaward of the nesting habitat to represent the inter-nesting habitat for this species (Figure 3-19). Northwest of Melville Island, a 20 km buffer has also been listed as a BIA for internesting green turtles. Overlaps OA2 (refer toFigure 3-17).

The EPBC Regulations require that 'habitat critical to the survival of the listed threatened species' is identified in recovery plans (see Section 3.4.4.2). BIAs may overlap these sites but may be identified for other purposes. DCCEEW states that the criteria used to identify 'habitat critical to the survival of the species' are more complex than those used to identify BIAs. Specifically, the *Sawfish and river sharks' multispecies recovery pla*n (DoEE, 2015) cites that '*all areas where aggregations of individuals have been recorded displaying biologically important behaviour such as breeding, foraging, resting or migrating, are considered critical to the survival of the species unless population survey data suggests otherwise'*.

Table 3-16: Biologically important areas identified in the OAs, MEVA and EMBA

Species	BIA	Presence in MEVA	Presence in EMBA	Distance/ direction from OA1	Distance/ direction from OA2
Fish, sharks, and rays					
Whale shark	Foraging	✓	✓	505 km SW	442 km W
Marine mammals					
Pygmy blue whale	Migration	✓	✓	173 km NW	188 km NNW
	Distribution*	✓	✓	57 km NWW	76 km NNW
	Foraging	✓	✓	973 SW	868 SW
Dugong	Foraging	✓	✓	827 SW	755 W
	Foraging (high density seagrass beds)	✓	✓	812 km SW	737 km W
	Nursing	✓	✓	827 km SW	755 km W
	Calving	✓	✓	827 km SW	755 km W
	Breeding	✓	✓	827 km SW	755 km W
Australian snubfin dolphin	Breeding	✓	✓	207.5 km SE	72.8 km E
Indo-Pacific humpback dolphin	Breeding	✓	✓	207 km SE	45 km SE
Indo-Pacific/ spotted bottlenose dolphin	Breeding	✓	✓	207 km SE	73 km SE
Marine reptiles					
Loggerhead turtle	Foraging	✓	✓	357 km SSW	190 km W
Green turtle	Internesting	✓	✓	118 km S	14 km E
	Internesting buffer	✓	✓	756 km SW	671 km SW
	Foraging	✓	✓	315 km SSW	84 km S
	Mating	✓	✓	821 km SW	748 km W
	Nesting	✓	✓	776 km SW	690 km W
Hawksbill turtle	Nesting	✓	✓	814 km SW	740 km W
	Internesting	✓	✓	243 km E	202 km SE
	Foraging	✓	✓	776 km SW	690 km W

Species	BIA	Presence in MEVA	Presence in EMBA	Distance/ direction from OA1	Distance/ direction from OA2
	Internesting buffer	✓	✓	795 km SW	721 km W
Flatback turtle	Internesting buffer	✓	✓	486 km SW	262 km SW
	Internesting	✓	✓	50 km S	Overlaps
	Foraging	✓	✓	357 km SW	190 km W
Leatherback turtle	Internesting	✓	✓	230 km SE	209 km E
Olive ridley turtle	Internesting	✓	✓	111 km S	5 km E
	Foraging	✓	✓	249 km SW	70 km S
Seabirds and shorebirds					
Brown booby	Breeding	✓	✓	770 km SW	695 km W
Bridled tern	Breeding	✓	✓	228 km SE	208 km E
Greater frigatebird	Breeding	✓	✓	707 km W	632 km W
Lesser crested tern	Breeding	✓	✓	789 km SW	715 km W
Crested tern	Breeding (high numbers)	✓	✓	111 km S	5 km E
	Breeding	✗	✓	223 km SE	203 km E
Lesser frigatebird	Breeding	✓	✓	525 km SW	371 km W
	Foraging	✗	✗	1120 km SE	1160 km E
Little tern	Resting	✓	✓	799 km SW	727 km W
Roseate tern	Breeding (high numbers)	✗	✓	280 km SE	265 km E
	Breeding	✓	✓	789 km SW	716 km W
Red-footed booby	Breeding	✓	✓	707 km SW	632 km W
Wedge-tailed shearwater	Breeding	✗	✓	713 km SW	637 km W
White-tailed tropic bird	Breeding	✓	✓	717 km SW	641 km W

Table 3-17: Marine turtle 'habitat critical' identified in the OAs, MEVA and EMBA

Species	Habitat critical area	Presence in MEVA	Presence in EMBA	Distance/ direction from OA1	Distance/ direction from OA2
Green turtle	Croker Island and McCluer Island groups plus Black Point to Smith Point, 20 km internesting buffer	✓	✓	210 km SE	187 km E
Hawksbill turtle	New Year Island 20 km internesting buffer	✓	✓	286 km SE	280 km E
Flatback turtle	Nesting HC Soldier Point to Pirlangimpi including Seagull Island. 60 km internesting buffer	✓	✓	72 km S	Overlaps
Olive ridley turtle	Nesting HC Soldier Point to Pirlangimpi, including Seagull Island 20 km internesting buffer	✓	✓	112 km S	896 E
	Nesting HC Brace Point to One Tree Point, including all offshore islands 20 km internesting buffer	✓	✓	112 km S	Overlaps

*The pygmy blue distribution range is not a designated BIA. There are no specific requirements associated with the distribution range described in the Conservation Management Plan for the Blue Whale.

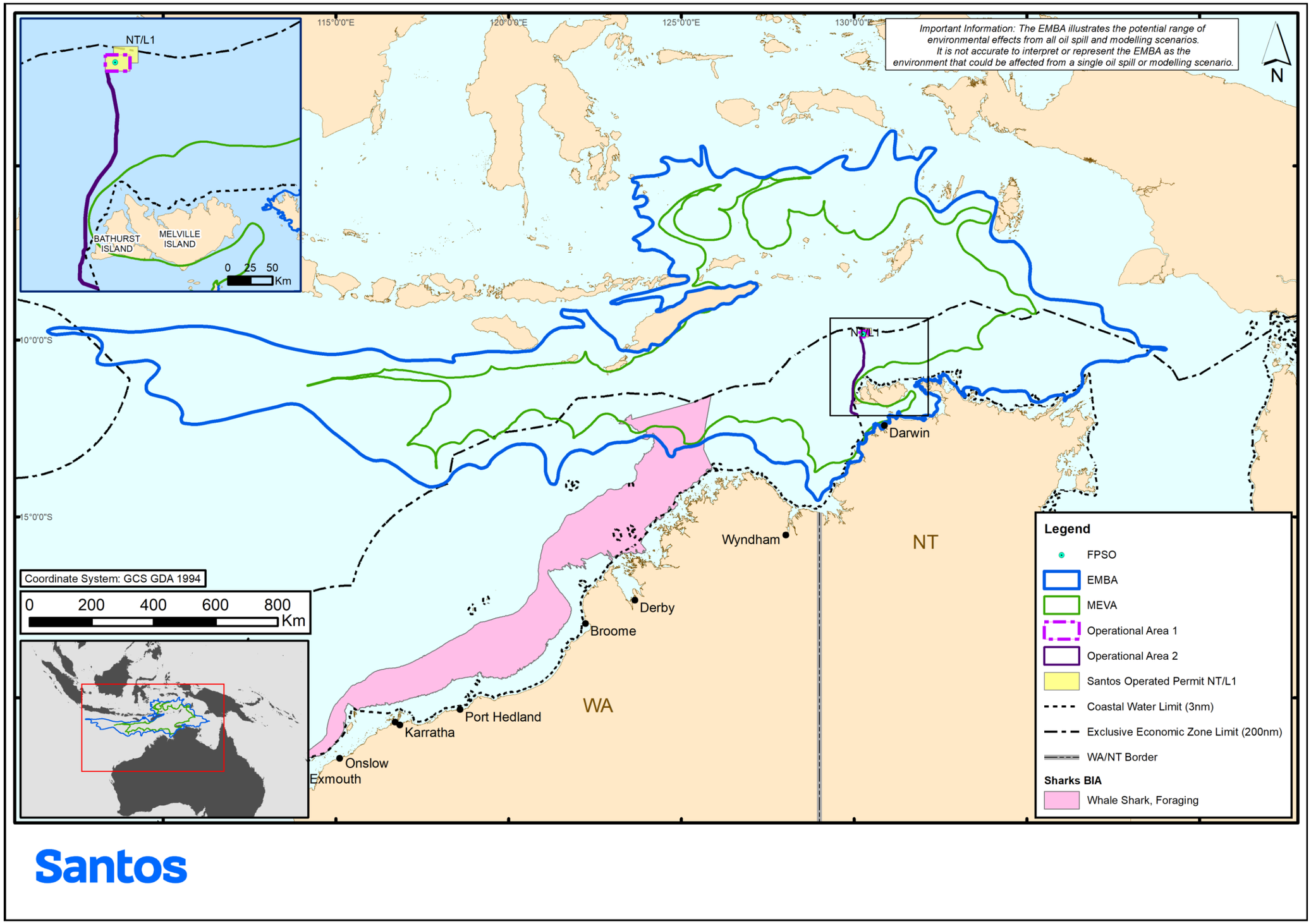

Figure 3-11: Whale shark biologically important areas, MEVA and EMBA

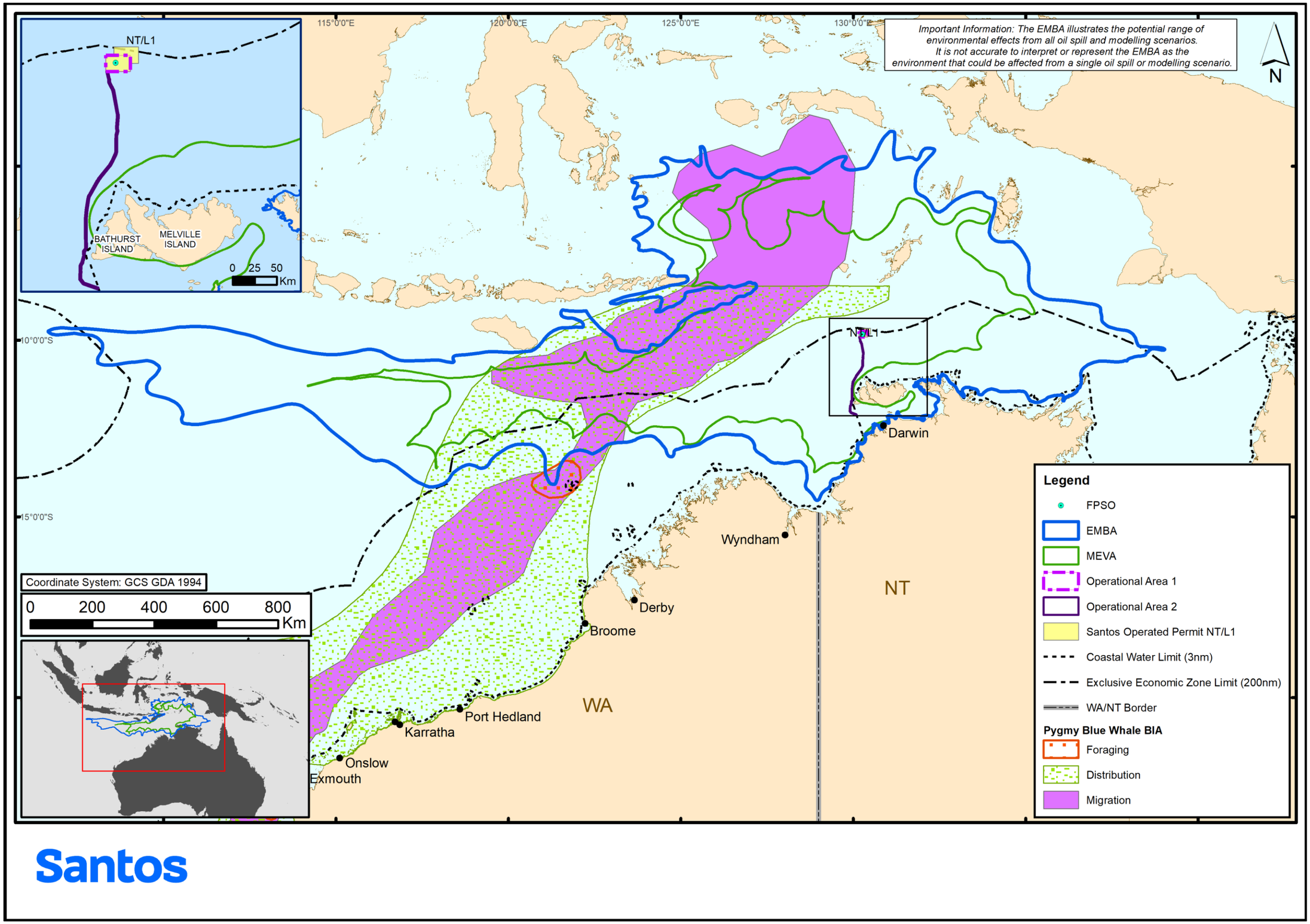

Figure 3-12: Pygmy blue whale biologically important areas, MEVA and EMBA

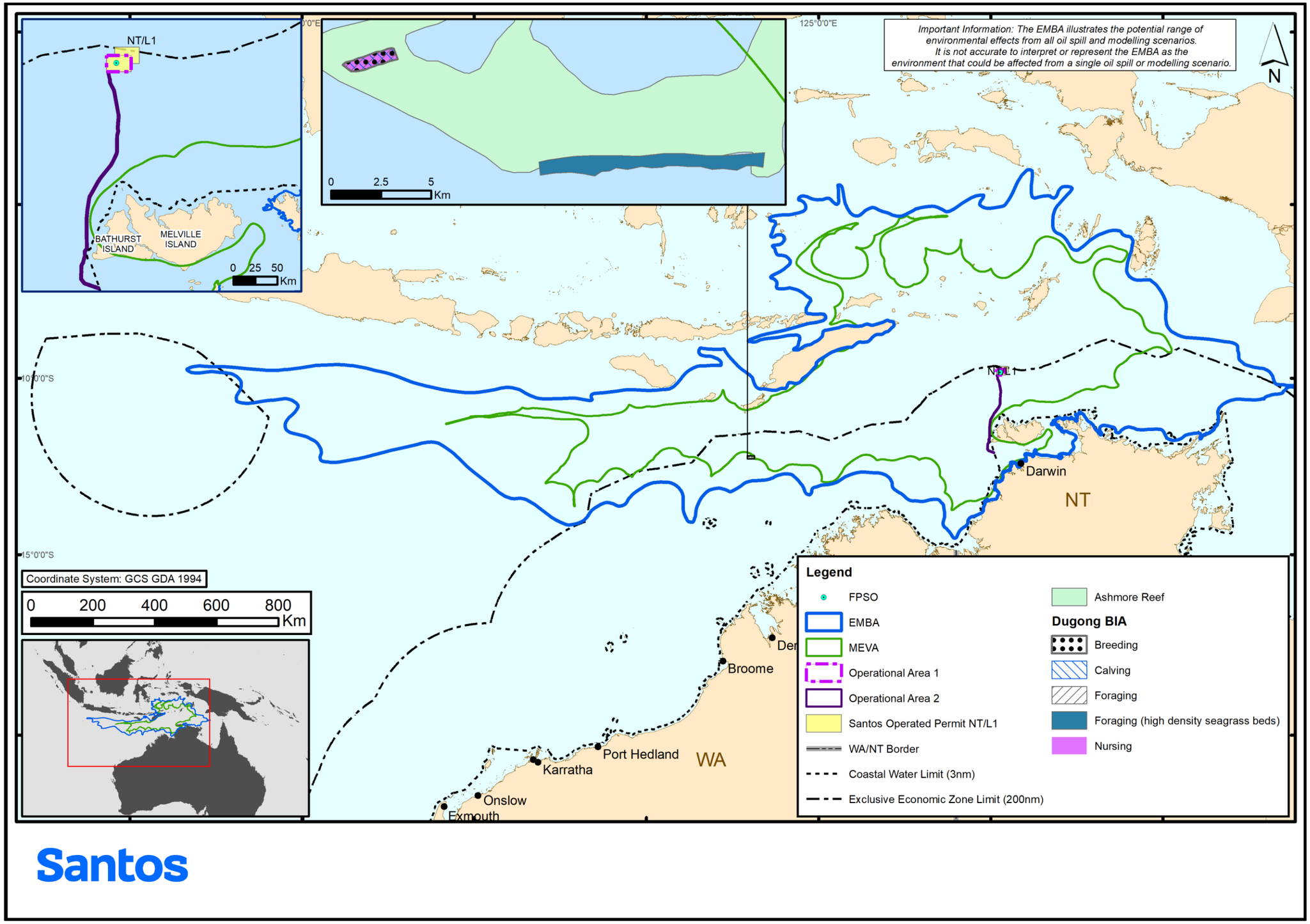

Figure 3-13: Dugong biologically important areas, MEVA and EMBA

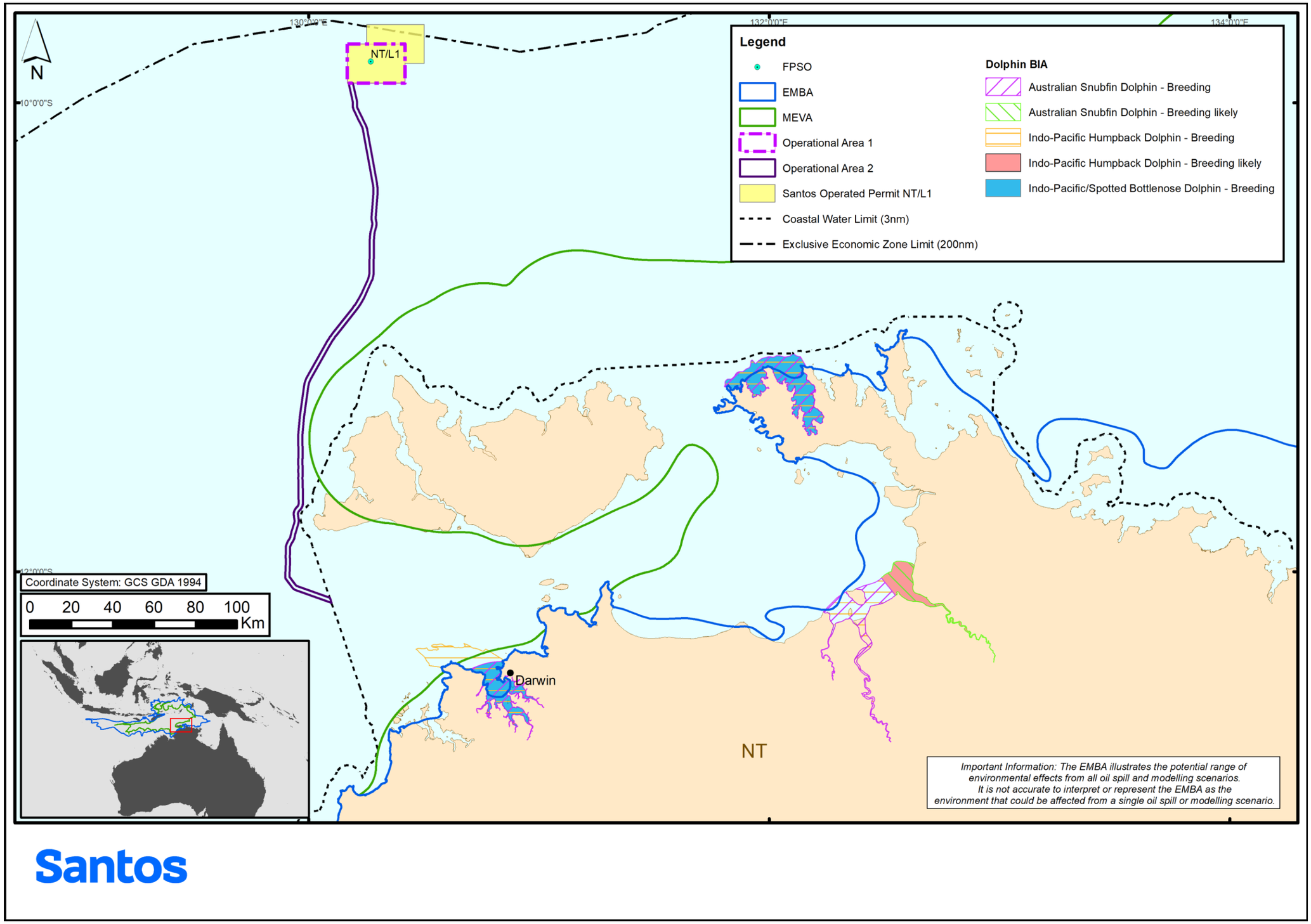

Figure 3-14: Dolphin biologically important areas, MEVA and EMBA

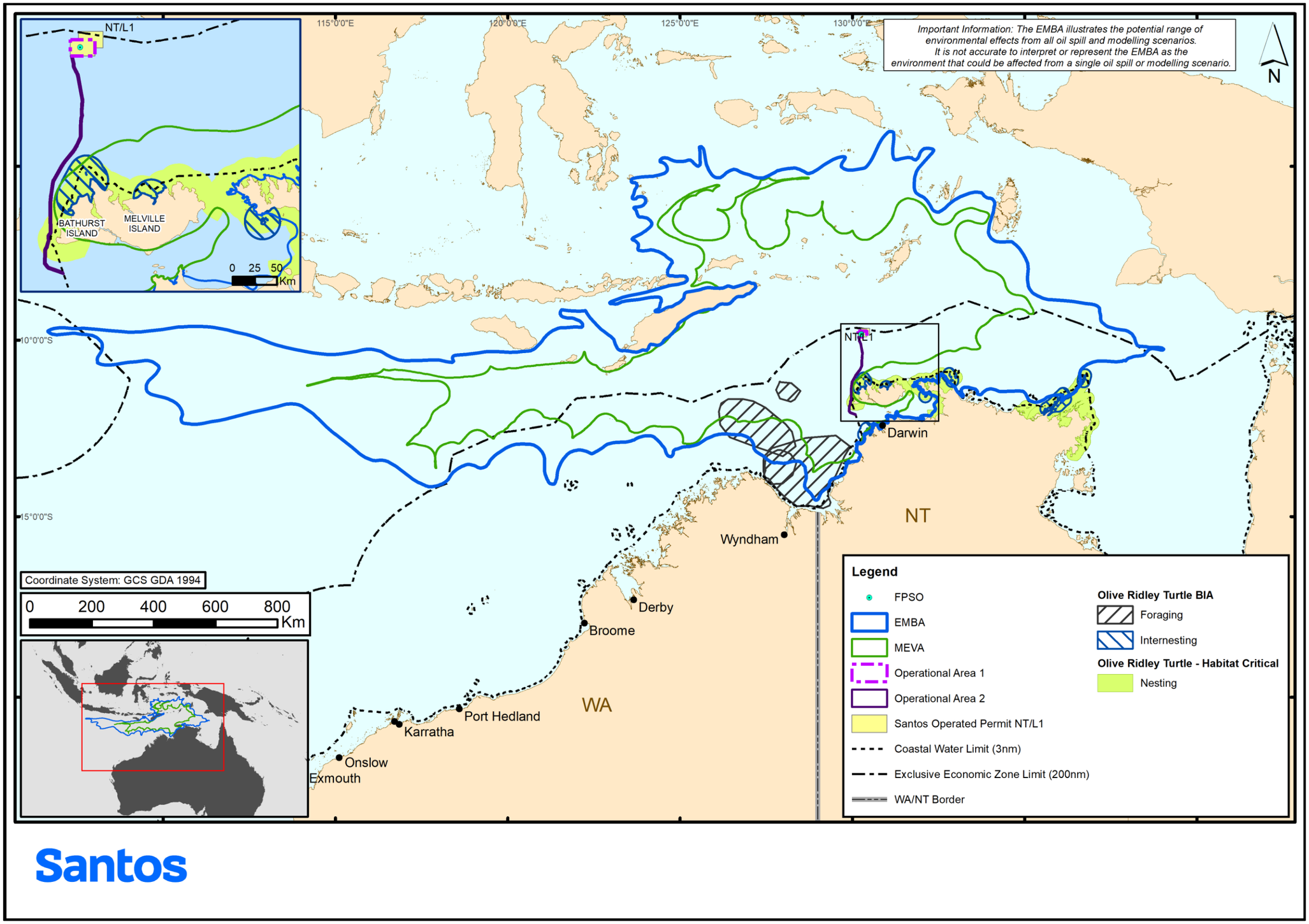

Figure 3-15: Olive ridley turtle biologically important areas, habitat critical, MEVA and EMBA

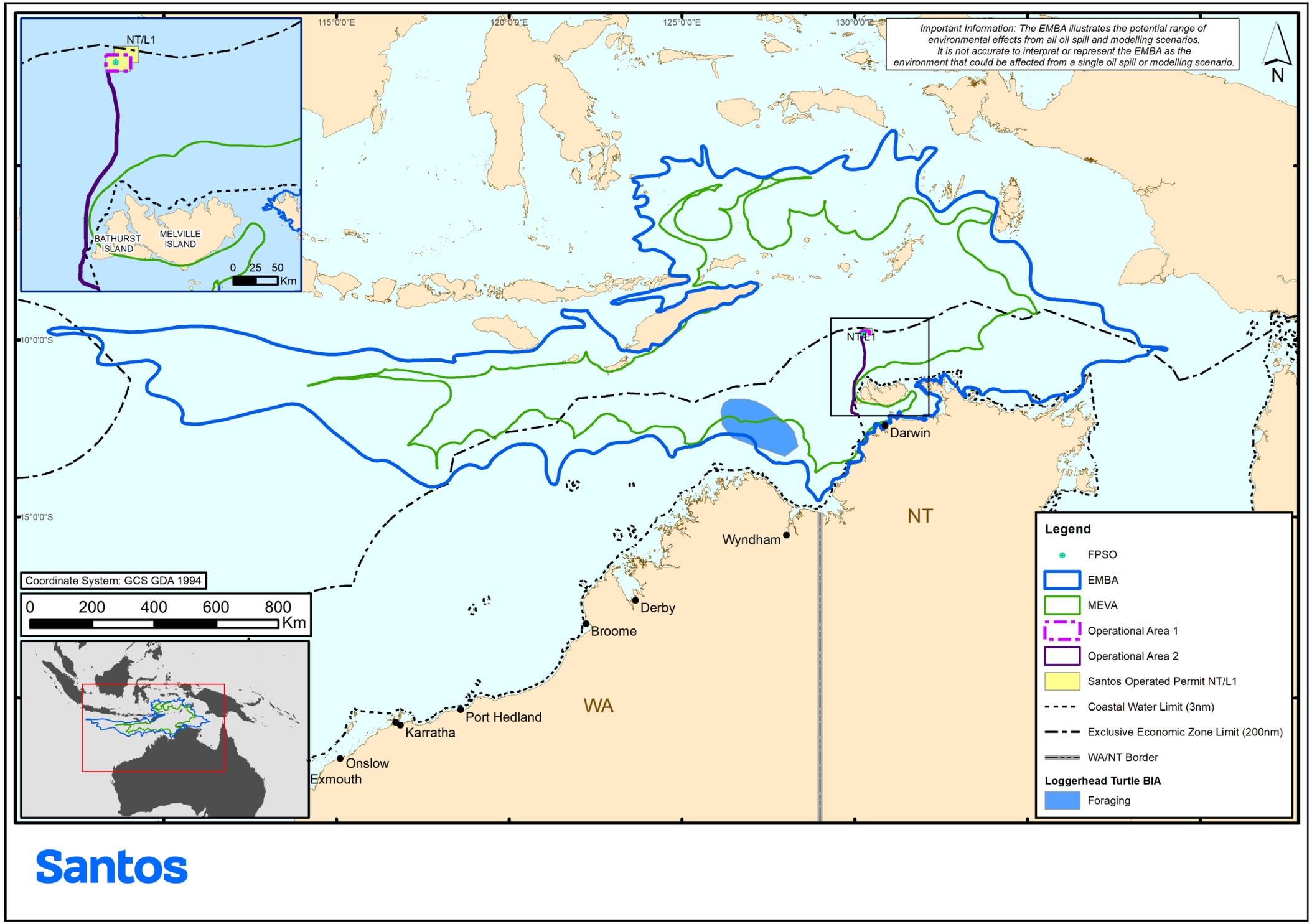

Figure 3-16: Loggerhead turtle biologically important areas, habitat critical, MEVA and EMBA

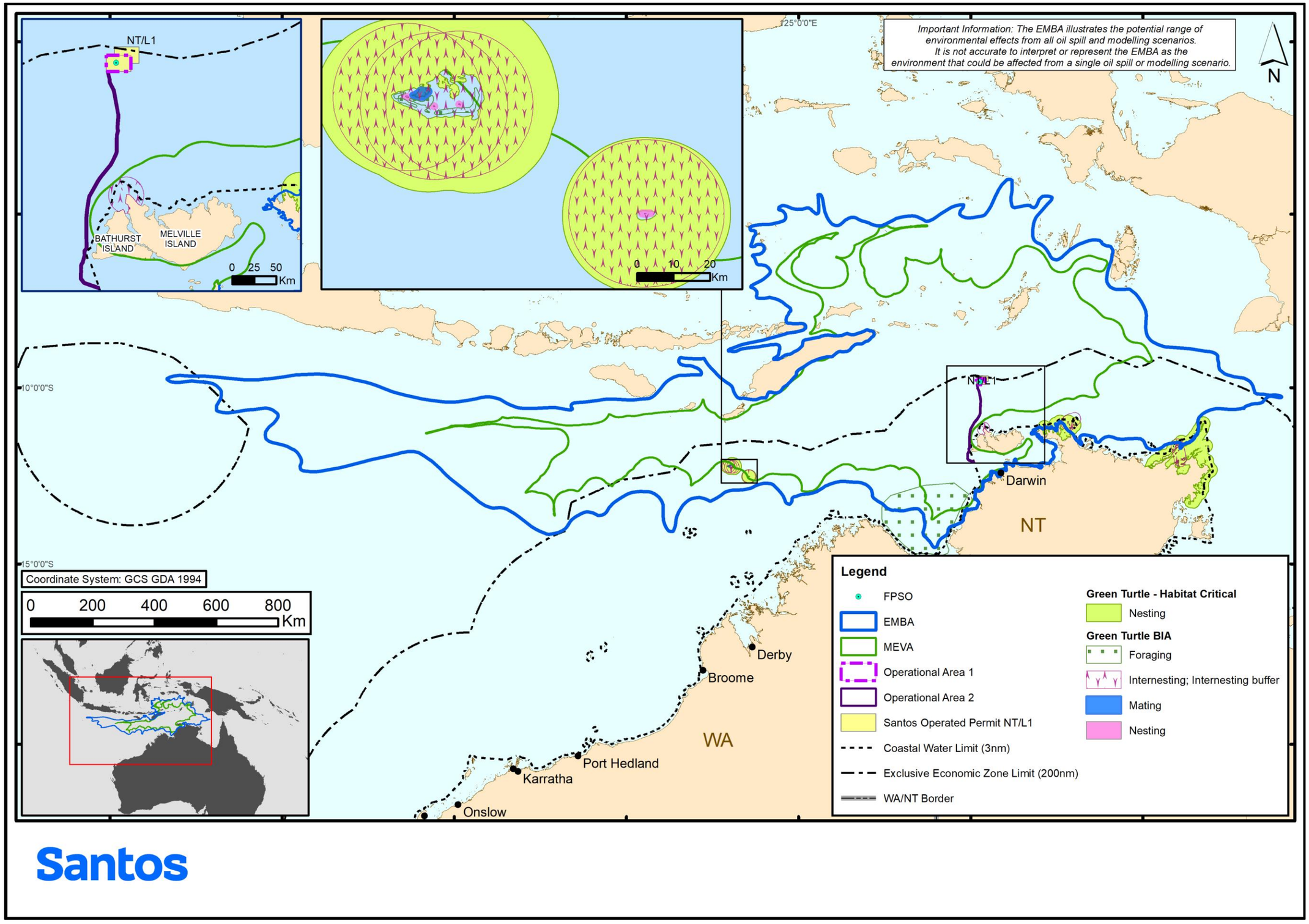

Figure 3-17: Green turtle biologically important areas, habitat critical, MEVA and EMBA

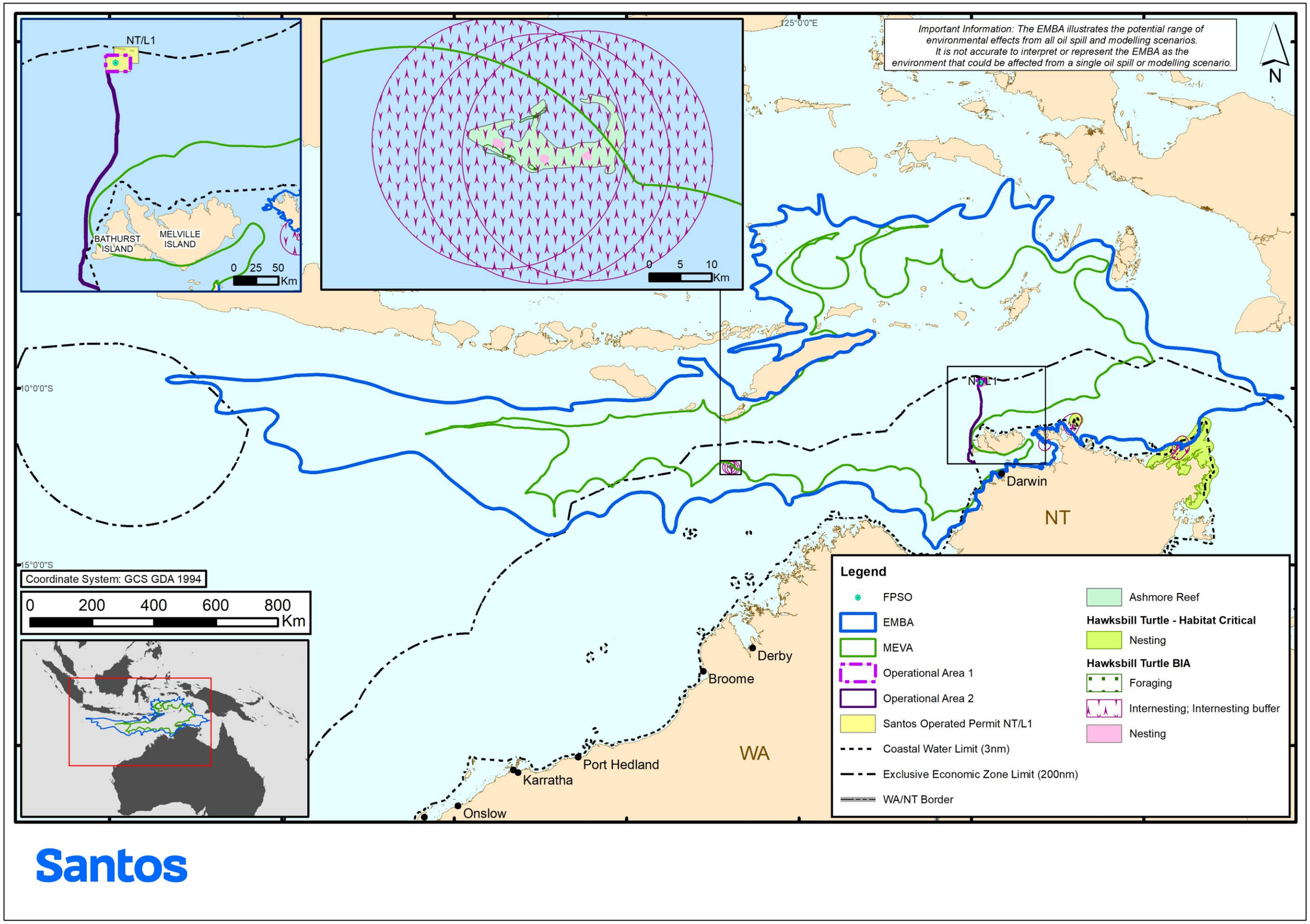

Figure 3-18: Hawksbill turtle biologically important areas, habitat critical, MEVA and EMBA

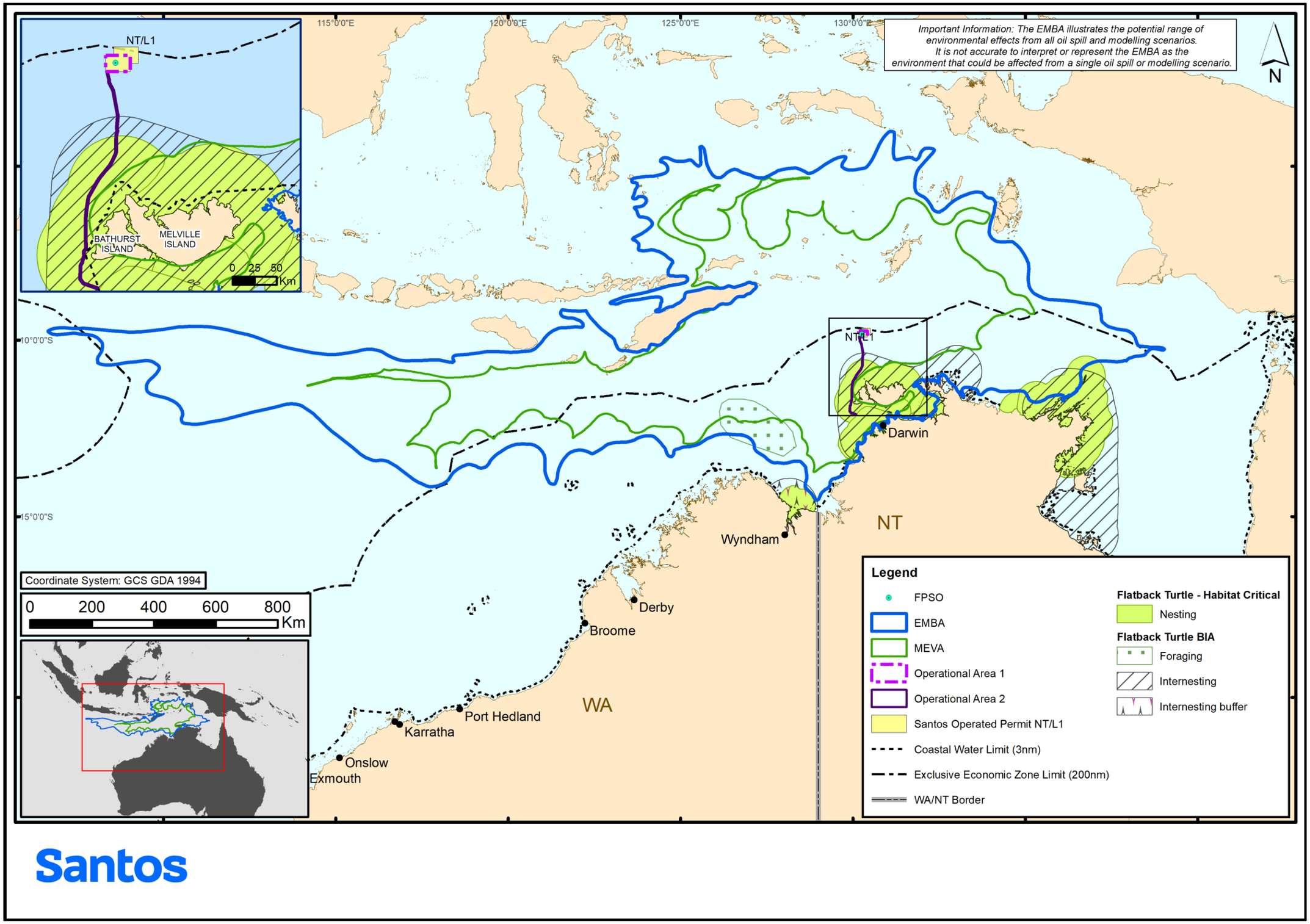

Figure 3-19: Flatback turtle biologically important areas, habitat critical, MEVA and EMBA

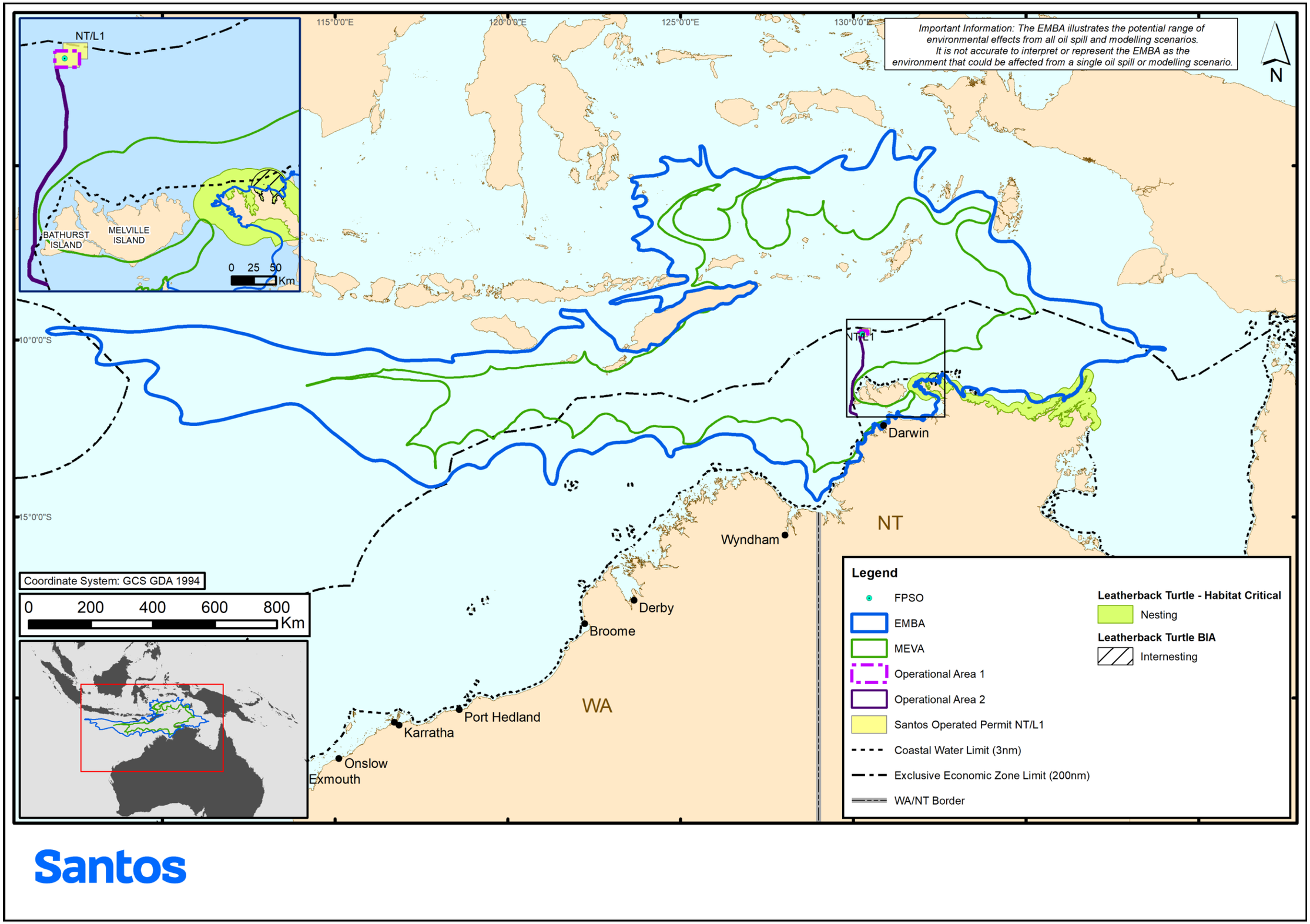

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Figure 3-20: Leatherback turtle biologically important areas, habitat critical, MEVA and EMBA

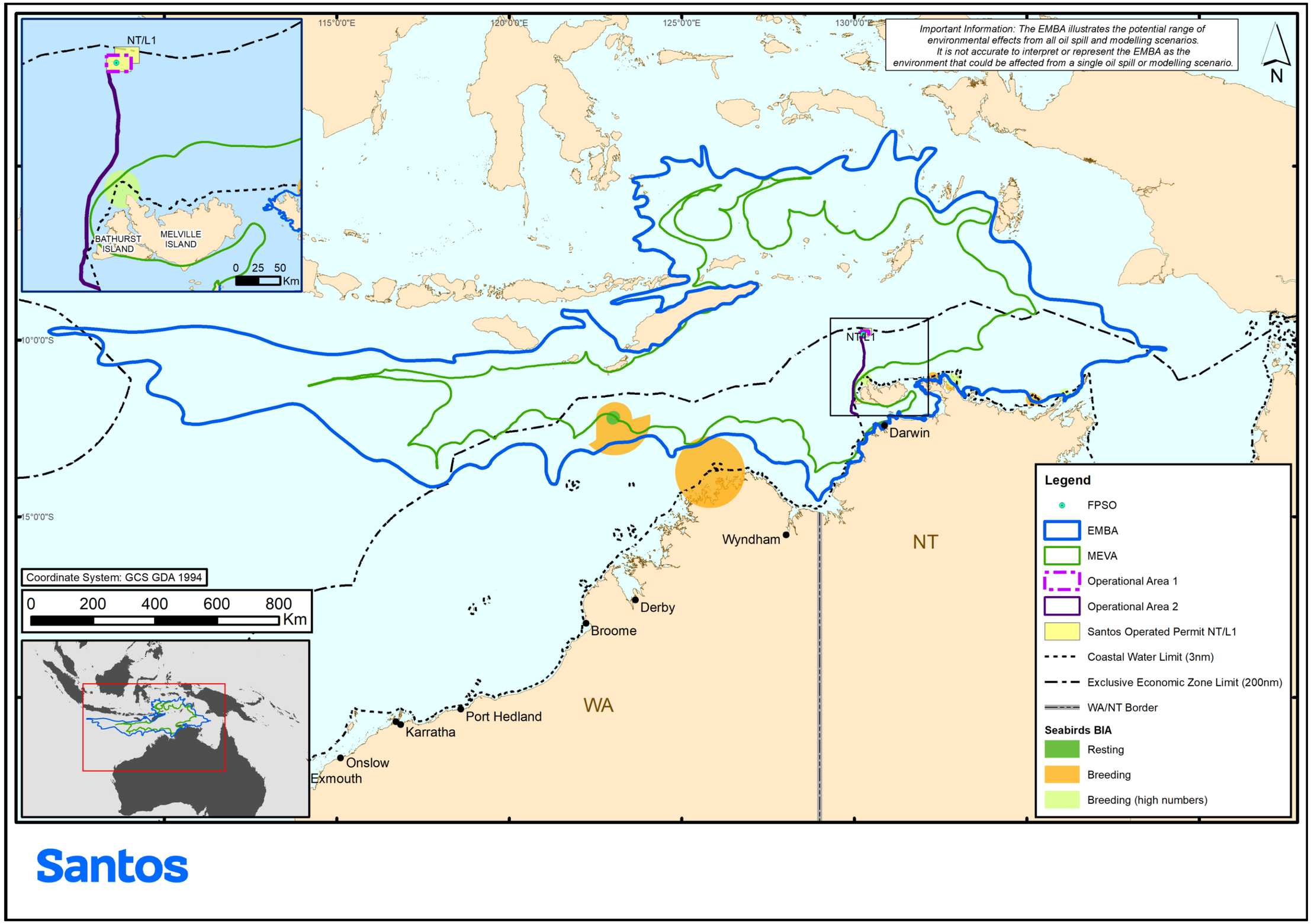

Figure 3-21: Seabird biologically important areas, MEVA and EMBA

3.6 Socio-economic Receptors

The EMBA encompasses both Australian and international waters, as shown in Figure 3-1, and extends beyond the Exclusive Economic Zone (EEZ) into parts of Indonesian and Timor-sovereign waters.

The nearest point on the coastlines of Indonesia and Timor-Leste are approximately 149 km and 347 km from the OAs, respectively. The EMBA extends to the Indonesian and Timor-Leste coastlines.

Socio-economic activities and features that may occur in the OAs and EMBA are set out in this section and summarised in Table 3-18.

The broader cultural features of the OAs and the EMBA are addressed in Section 3.7.

Table 3-18: Socio-economic-related activities / features that occur or may occur in the operational areas and environment that may be affected

Value/sensitivity	OA presence	EMBA presence
Commercial fisheries – Commonwealth (Figure 3-22)	Management areas for four Commonwealth managed commercial fisheries overlap the OAs: • Northern Prawn Fishery • Southern Bluefin Tuna Fishery • Western Skipjack Tuna Fishery • Western Tuna and Billfish Fishery.	Management areas for the following Commonwealth-managed commercial fisheries overlap the EMBA: • Northern Prawn Fishery • Southern Bluefin Tuna Fishery • Western Skipjack Tuna Fishery • Western Tuna and Billfish Fishery • North-West Slope Trawl Fishery • Torres Strait Fishery.
Commercial fisheries – NT/WA (Figure 3-23)	Management areas for five NT-managed commercial fisheries overlap the OAs: • Aquarium Fishery • Offshore Net and Line Fishery • Timor Reef Fishery • Spanish Mackerel Fishery • Pearl Oyster Fishery[6].	Management areas for the following NT managed commercial fisheries overlap the EMBA: • Coastal Line Fishery • Aquarium Fishery • Demersal Fishery • Offshore Net and Line Fishery • Timor Reef Fishery • Spanish Mackerel Fishery • Small Pelagic Development Fishery • Pearl Oyster Fishery[2]. Management areas for the following WA managed commercial fisheries overlap the EMBA: • Mackerel Managed Fishery • Northern Demersal Scalefish Managed Fishery • Abalone Fishery • Kimberley Crab Fishery • Kimberley Prawn Fishery • Marine Aquarium Managed Fishery • Pilbara Crab Fishery

[6] *The Pearl Oyster Fishery and the Small Pelagic Development Fishery are not active in the OAs or EMBA. Although no fishing activity occurs, the fisheries do intersect OAs and EMBA (Pearl Oyster Fishery) and the EMBA (Small Pelagic Development Fishery). These fisheries are not included in Figure 3-23 for the reasons stated*

Value/sensitivity	OA presence	EMBA presence
		• South West Coast Salmon Fishery • Specimen Shell Fishery • West Coast Deep Sea Crustacean Fishery.
Aquaculture	No aquaculture activities operate within the OAs.	One operator may occasionally conduct activities within the EMBA near Evans Shoal, 62 km west of OA1. Seaweed farming occurs off the Indonesian coastline.
Subsistence Indonesian fishing and Australian recreational fishing (Section 3.6)	Given the water depths in the OAs, Australian recreational fishing activity is not expected. Subsistence and modern Indonesian fishing is permitted in a small portion of the OA1.	Indonesian and Timorese traditional, subsistence and commercial fishers, as well as Australian recreational fishers, are expected to transit and fish in the EMBA.
Energy industry (Section 3.6.3)	There are no established petroleum operations within, or immediately adjacent to the OAs.	The closest operational offshore production facilities and infield subsea infrastructure are the Eni operated Blacktip Gas, approximately 254 km southwest from the OA2 and the Santos-operated Bayu–Undan platform, approximately 375 km northwest from the OA2. There are 2 existing pipelines within the vicinity—Bayu-Undan (0.1 km or greater distance from the OA2) and Ichthys (46.5 km distance from OA2). Oil and gas exploration permits are operated by other titleholders throughout the EMBA.
Telecommunications cables (Section 3.6.4)	North-West Cable System (NWCS) is located around 230 km south of OA1 NWCS is located around 30 km south of OA2.	NWCS intersects the EMBA, though a hydrocarbon spill will not have any impact on submarine cables.
Defence (Section 3.6.5)	There are no designated military and defence exercise areas within or in the immediate vicinity of the OAs. During their surveillance, Australian Border Force vessels may transit the OAs.	The EMBA intersects a practice area of the North Australian Exercise Area (NAXA) (Figure 3-24). During their surveillance, Australian Border Force vessels may transit the EMBA.
Shipping (Section 3.6.6)	The closest major commercial port to OA1 is Darwin Port, located 290 km away. No designated shipping fairways intersect OA1. The closest major commercial port to OA2 is Darwin Port, located 116 km away. No designated shipping fairways intersect OA2; however, at the southern end of OA2 is an area of high shipping presence.	Figure 3-25 shows the vessels recorded in the Australian Shipping Reporting System in 2024 and shipping density within the region. It shows the main commercial shipping channel tracking to the west of the OAs. Vessel traffic is expected within the EMBA.
Tourism (Section 3.6.7)	The OAs are located in offshore waters that are highly unlikely to be accessed for tourism activities such as recreational fishing and boating and charter boat operations. These tend to be centred around nearshore waters, islands and coastal areas.	There are several shoals and banks within the EMBA, and some of these may be visited by small numbers of recreational fishers and charter vessels targeting fish that inhabit these shallower features. Other tourism operators may also operate within the EMBA.

Value/sensitivity	OA presence	EMBA presence
Shipwrecks (Section 3.6.7)	No shipwrecks are recorded within the OAs.	One known shipwreck listed under the Commonwealth Underwater Cultural Heritage Act 2018 (Cth) is located at the Cartier Island Marine Park: the Ann Millicent (wrecked in 1888).
Research activities (Section 3.6.7)	No monitoring equipment deployed by AIMS, BOM or UWA is located within the OAs	Monitoring equipment including monitoring arrays deployed by AIMS and wave buoys deployed by BOM and UWA is present within the EMBA.

3.6.1 Commercial Fisheries

The Timor and Arafura seas support a variety of shark, demersal and pelagic finfish and crustacean species of commercial importance. Both overlap four Commonwealth-managed commercial fisheries, and five NT-managed commercial fisheries. The EMBA overlaps two additional Commonwealth managed- fisheries (Figure 3-22), as well as two additional NT-managed commercial fisheries and two WA managed- commercial fisheries (Figure 3-23) (NT Government, 2019a, 2019b, 2019c, 2019d, 2021). Santos' understanding of fishing effort within these commercial fisheries, based on publicly available information and consultation with Relevant Persons, is provided in Table 3-19.

3.6.1.1 Commonwealth Fisheries

Information on Commonwealth managed fisheries has been derived from the *Fishery status report 2023* (Department of Agriculture, Fisheries and Forestry, 2023). Commonwealth fisheries who have permits to operate in the EMBA, as shown in Figure 3-22, include:

- Northwest Slope Trawl (NWST)
- Northern Prawn Fishery (NPF)
- Southern Bluefin Tuna Fishery (SBFTF)
- Western Tuna and Billfish Fishery (WTBF) (including Southern Tuna and Billfish Fishery)
- Western Skipjack Tuna Fishery (STF)
- Torres Strait Fishery.

3.6.1.2 State Fisheries

State fisheries are managed by the Department of Primary Industries and Regional Development (DPIRD) in WA, and by the NT Fisheries Division Department of Industry, Tourism and Trade. State fisheries that intercept the EMBA are shown in Figure 3-23.

WA managed fisheries that intercept the EMBA:

- Mackerel Managed Fishery
- Northern Demersal Scalefish Managed Fishery.
- Abalone Fishery
- Kimberley Crab Fishery
- Kimberley Prawn Fishery
- Marine Aquarium Managed Fishery
- Pilbara Crab Fishery
- South West Coast Salmon Fishery
- Specimen Shell Fishery
- West Coast Deep Sea Crustacean Fishery.

NT managed fisheries that intercept the EMBA:

- Aquarium Fishery
- Coastal Line Fishery
- Demersal Fishery
- Offshore Net and Line Fishery
- Spanish Mackerel Fishery
- Timor Reef Fishery
- Pearl Oyster Fishery.
- Small Pelagic Development Fishery

No aquaculture occurs in the EMBA within Australian waters. Aquarium fish collection occurs on Evans Shoals (which is in the EMBA) twice a year.

Table 3-19: Commonwealth, Northern Territory and Western Australia-managed fisheries presence in the operational areas and environment that may be affected

Fishery	Permitted			Description	Likelihood of interaction with fishers
	OA1	OA2	EMBA		
Commonwealth-managed fisheries					
Northern Prawn Fishery	✓	✓	✓	Area: extends from 126° E near Cape Londonderry in WA across to the northernmost tip of Cape York in QLD. Most of the Northern Prawn Fishery effort lies in the Gulf of Carpentaria, Joseph Bonaparte Gulf and along the Arnhem Land coast (Patterson *et al*., 2022). Gear: trawl. Key target species: banana prawns, tiger prawns and endeavour prawns. There are two fishing seasons, with the season end date depending on catch rates: • Season 1 (mainly banana prawns caught): 1 April to 15 June • Season 2 (mainly tiger prawns caught): 1 August to end of November. Fishing for scampi also occurs in deeper waters, with fishing effort spread across two-to-three months of the year (December to February). Effort (2020): 54 active vessels, total catch in 2021 was 5068 tonnes (Patterson *et al*., 2022).	Effort known to occur within OA2 and expected in the EMBA. Therefore, interaction with this fishery is possible in these areas. Based on industry consultation, prawn fishing is not expected in water depths greater than around 130 m, therefore interaction with this fishery in OA1 is unlikely Scampi is targeted in deeper waters (more than 250 m) within the northern extremity of OA1. There is a low level of fishing effort, with December and January the peak scampi fishing periods. Therefore, interaction with this fishery is possible during these months.
Southern Bluefin Tuna Fishery	✓	✓	✓	Area: spans the Australian Fishing Zone. However, it is only active in waters offshore of south and SE Australia. Gear: purse seine and pelagic long line. Key target species: southern bluefin tuna. Effort (2021): 27 active vessels, around 6000 tonnes (Patterson *et al*., 2022).	No active fishing effort reported in the OAs or EMBA; therefore, interaction with this fishery is unlikely.
Western Skipjack Tuna Fishery	✓	✓	✓	Area: spans the Australian EEZ and adjacent high seas, from Cape York to the Victoria/South Australia border, including waters around Tasmania and the high seas of the Pacific Ocean. Gear: purse seine. Key target species: skipjack tuna. Effort (2021): None. There has been no fishing effort since the 2008–09 season, and in that season, activity concentrated off South Australia (Patterson *et al*., 2022).	No recent active fishing effort reported in the OAs or EMBA; therefore, interaction with this fishery is unlikely.

Fishery	Permitted			Description	Likelihood of interaction with fishers
	OA1	OA2	EMBA		
Western Tuna and Billfish Fishery	✓	✓	✓	Area: operates in Australia's EEZ and high seas of the Indian Ocean. In recent years, fishing effort has concentrated off south-west WA, with occasional activity off South Australia. Gear: pelagic longline. Key target species: bigeye tuna, yellowfin tuna, striped marlin, swordfish. Effort (2021): two active vessels, around 10,000 tonnes in 2021 (Patterson *et al*., 2022).	No recent active fishing effort reported in the OAs or EMBA; therefore, interaction with this fishery is unlikely.
North West Slope Trawl Fishery	✗	✗	✓	Area: operates off northwestern Australia from 114°E to 125°E, roughly between the 200 m isobath and the outer boundary of the Australian Fishing Zone. A large area of the Australia–Indonesia MoU Box falls within the NWS throughflow. Gear: demersal trawl. Key target species: scampi. Effort (2021): four active vessels, around 87 tonnes in 2021 (Patterson *et al*., 2022).	No fishing effort overlaps with the OAs. Effort known within the EMBA.
Torres Strait Fishery	✗	✗	✓	Area: between Cape York Peninsula (north QLD) and Papua New Guinea. Gear: traditional harvest. Key target species: prawns. Effort (2021): unknown as effort information is not mandatory (Patterson *et al*., 2022).	No fishing effort overlaps with the OAs. Effort known within the EMBA.
NT-managed fisheries					
Aquarium Fishery	✓	✓	✓	Area: includes freshwater, estuarine and marine habitats to the outer boundary of the Australian Fishing Zone. Most marine species are collected within 100 km of Nhulunbuy and Darwin. A specimen shell collection enterprise occurs around Ashmore Reef and Cartier Island (NT Government, 2016). Gear: handheld, nets and pots (dive-based). Key target species: fish, invertebrates and plants for aquariums. Effort: unknown – no restriction on number of licences.	No known recent fishing effort within the OAs. Therefore, interaction with this fishery is unlikely. Effort could occasionally occur within the EMBA at or near Evans Shoal.

Fishery	Permitted			Description	Likelihood of interaction with fishers
	OA1	OA2	EMBA		
Spanish Mackerel Fishery	✓	✓	✓	Area: commercial fishing for Spanish mackerel is allowed from the high water mark to the outer boundary of the Australian Fishing Zone, which is 200 nautical miles offshore. Most of the fishing effort occurs in the vicinity of reefs, headlands and shoals and includes waters near Bathurst Island, New Year Island, northern and western Groote Eylandt, the Gove Peninsula, the Wessel Islands, the Sir Edward Pellew Group and suitable fishing grounds on the western and eastern mainland coasts. Fishing generally occurs around reefs, headlands and shoals (NT Government, 2021). Gear: trolling, handline. Key target species: Spanish mackerel. Effort: 15 licences allowed.	Effort possible within OA2 and expected in the EMBA. Therefore, interaction with this fishery is possible. No known effort in OA1
Timor Reef Fishery	✓	✓	✓	Area: the Timor Box extends north-west of Darwin to the WA/NT border and to the outer boundary of the Australian Fishing Zone. The fishery has an area of approximately 8400 square nm (NT Government, 2022). Fishing occurs primarily in the 100 to 200 m depth range. Consultation indicates the main target species is goldband snapper, with other tropical snappers (such as crimson snapper and saddletail snapper) also making up part of the catch. There are two active fishing licence holders currently operating in the fishery; main fishing method is trap fishing. Fishery is most productive between October and May, with less activity during the dry season months of June to August due to strong northerly winds. Due to the water depth and based on a review of available historical catch data, fishing activity is not expected across the OAs. Gear: line and trap. Key target species: snapper, red emperor and cods. Effort: 15 licences allowed.	Effort known to occur within the OAs and expected in the EMBA. Therefore, interaction with this fishery is possible.
Offshore Net and Line Fishery	✓	✓	✓	Area: operates in NT waters from the low water mark to the boundary of the Australian Fishing Zone (NT Government, 2020). Most fishing is done in the coastal zone within 12 nm of the coast, and immediately offshore in the Gulf of Carpentaria (NT Government, 2021). Gear: longlines or pelagic nets (there are restrictions on where certain gear can be used). Key target species: blacktip sharks, grey mackerel. Effort: unknown – no restriction on number of licences.	Interaction with this fishery in the OAs is highly unlikely due to concentration of fishing effort in near coastal areas and distribution of the targeted species. Interaction within the EMBA is possible.

Fishery	Permitted			Description	Likelihood of interaction with fishers
	OA1	OA2	EMBA		
Demersal Fishery	✗	✓	✓	Area: allowed from 15 nm from the low water mark to the outer boundary of the Australian Fishing Zone, excluding the area of the Timor Reef fishery (NT Government, 2022). Gear: lines, fish traps and semi-demersal trawl nets. Key target species: snapper (various species). Effort: unknown – 18 licences currently issued.	No fishing effort overlaps with the OAs. Effort expected within the EMBA only.
Coastal Line Fishery	✗	✗	✓	Area: allowed between the high water mark and 15 nm out from the low water mark. The fishery extends from the WA border to Vashon Head on Cobourg Peninsula in the NT (NT Government, 2016). Gear: lines, drop lines, fish traps. Key target species: snapper (various species). Effort: unknown – restricted to 52 vessels.	No fishing effort overlaps with the OAs. Effort expected within the EMBA only.
Pearl Oyster Fishery	✓	✓	✓	Area: The fishery extends from the high-water mark in NT waters to the outer boundary of the Australian Fishing Zone, 200 nautical miles offshore in Commonwealth Waters. All current activity occurs in NT waters within 12 nautical miles of the mainland. There are five active fishing licence holders currently operating in the fishery which can be active throughout the year. Gear: farming by hand only. Effort: 5 licences allowed.	Fishery boundaries overlap with OAs and EMBA, but there is no fishing effort established within these areas.
State Managed Fisheries – WA					
Mackerel Managed Fishery	✓	✓	✓	Area: commercially fished between Geraldton and the WA/NT border. Gear: trolling. Key target species: Spanish mackerel. Effort: around 400 tonnes in 2020/2021 (Newman *et al*., 2021).	No fishing effort overlaps with the OAs. Effort expected within the EMBA.
Northern Demersal Scalefish Managed Fishery	✓	✓	✓	Area: operates off WA's coast in waters east of 120° E longitude. Gear: handline, dropline and fish traps, although the fishery has essentially operated as a trap-based fishery since 2002. Key target species: goldband snapper and red emperor. Effort: around 1400 tonnes in 2020/2021 (Newman *et al*., 2021).	No fishing effort overlaps with the OAs. Effort expected within the EMBA.

Fishery	Permitted			Description	Likelihood of interaction with fishers
	OA1	OA2	EMBA		
Abalone Fishery	✗	✗	✓	Area: commercially fished in specified zones between the South Australia and the WA/NT border. Gear: diving. Key target species: abalone. Effort: 18 tonnes in 2020/2021. 24 vessels registered to operate in the commercial Roe's Abalone Fishery but, given the economic impacts, only a small number of divers fish (Newman *et al*., 2021).	No fishing effort overlaps with the OAs. Effort expected within the EMBA.
Kimberley Crab Fishery	✗	✗	✓	Area: Broome and Cambridge Gulf. Gear: traps. Key target species: mud crabs. Effort: allocation of 1200 units (currently equivalent to 600 traps) to holders of a Managed Fishery Licence under the Kimberley Crab Managed Fishery Management Plan 2018 (Newman *et al*., 2021).	No fishing effort overlaps with the OAs. Effort expected within the EMBA.
Kimberley Prawn Fishery	✗	✗	✓	Area: north of the state between Koolan Island and Cape Londonderry. Gear: trawl. Key target species: banana prawns. Effort: annual catch of around 250 t in 2020/2021 (Newman *et al*., 2021).	No fishing effort overlaps with the OAs. Effort expected within the EMBA.
Marine Aquarium Managed Fishery	✗	✗	✓	Area: operates in all State waters between the NT border and South Australian border. Gear: trawl. Key target species: fish for aquariums. Effort: 11 out of 12 licences were active in the fishery in 2020, total catch in 2020 was 89,925 fishes, 32.12 t of coral, live rock and living sand and <20 L of marine plants and live feed (Newman *et al*., 2021).	No fishing effort overlaps with the OAs. Effort expected within the EMBA.
Pilbara Crab Fishery	✗	✗	✓	Area: inshore waters from Onslow through to Port Hedland. Gear: traps. Key target species: blue swimmer crabs. Effort: The fishery has an annual catch tolerance of 20 to 73 t with around 2 t caught in 2020/2021 (Newman *et al*., 2021).	No fishing effort overlaps with the OAs. Effort expected within the EMBA.
South West Coast Salmon Fishery	✗	✗	✓	Area: various beaches south of Perth. Gear: beach seine net. Key target species: WA salmon Effort: total catch in 2020/2021 was around 75 t (Newman *et al*., 2021).	No fishing effort overlaps with the OAs. Effort expected within the EMBA.

Fishery	Permitted			Description	Likelihood of interaction with fishers
	OA1	OA2	EMBA		
Specimen Shell Fishery	✗	✗	✓	Area: covers the entire WA coastline. Gear: hand collection. Key target species: shells. Effort: total catch in 2020/2021 was made up of 4258 shells (Newman *et al*., 2021).	No fishing effort overlaps with the OAs. Effort expected within the EMBA.
West Coast Deep Sea Crustacean Fishery	✗	✗	✓	Area: West Coast and Gascoyne bioregions. Gear: baited pots. Key target species: crystal crab. Effort: total catch in 2020–21 was 156.1 t (Newman *et al*., 2021).	No fishing effort overlaps with the OAs. Effort expected within the EMBA.

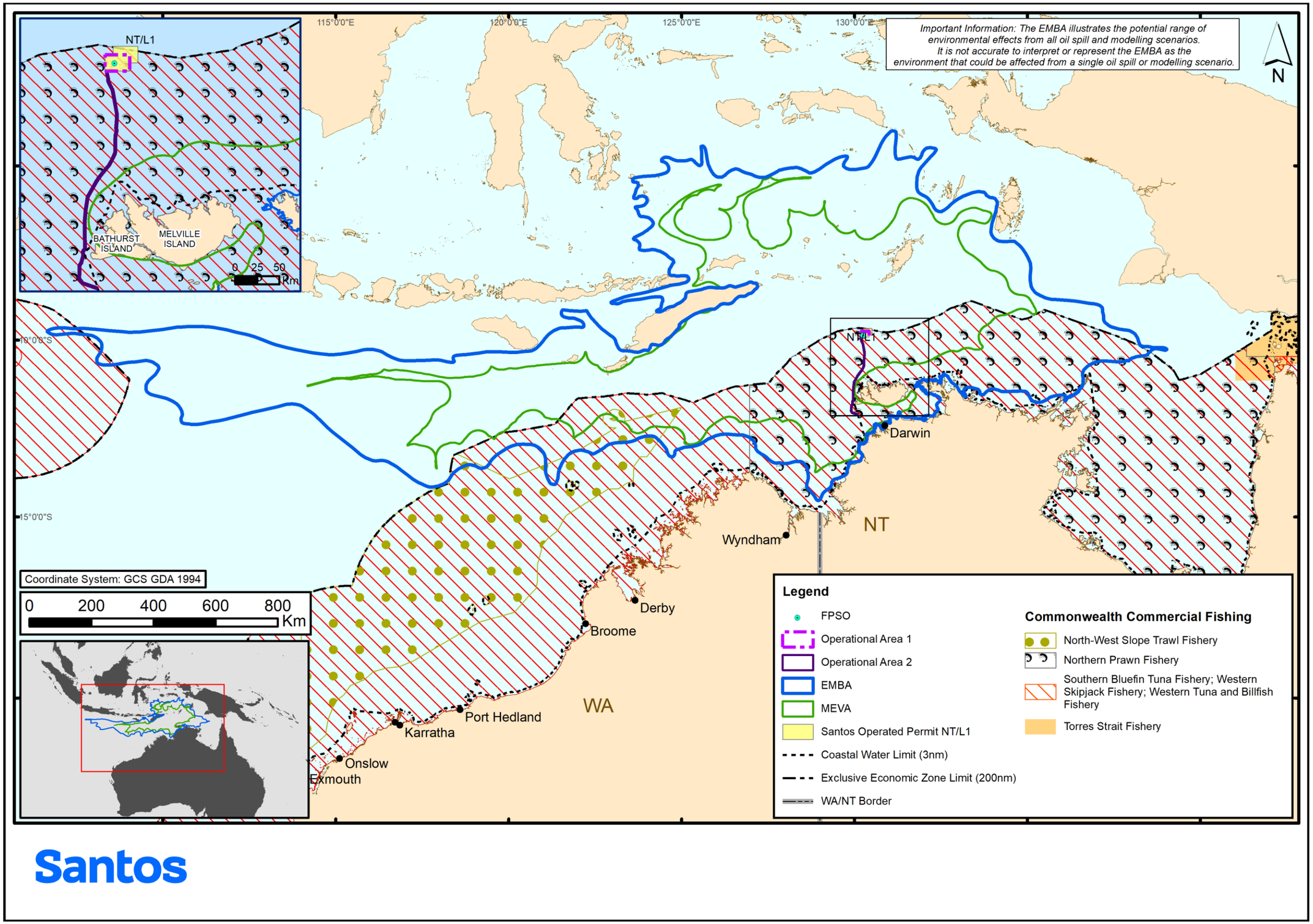

Figure 3-22: Commonwealth-managed commercial fisheries, MEVA and EMBA

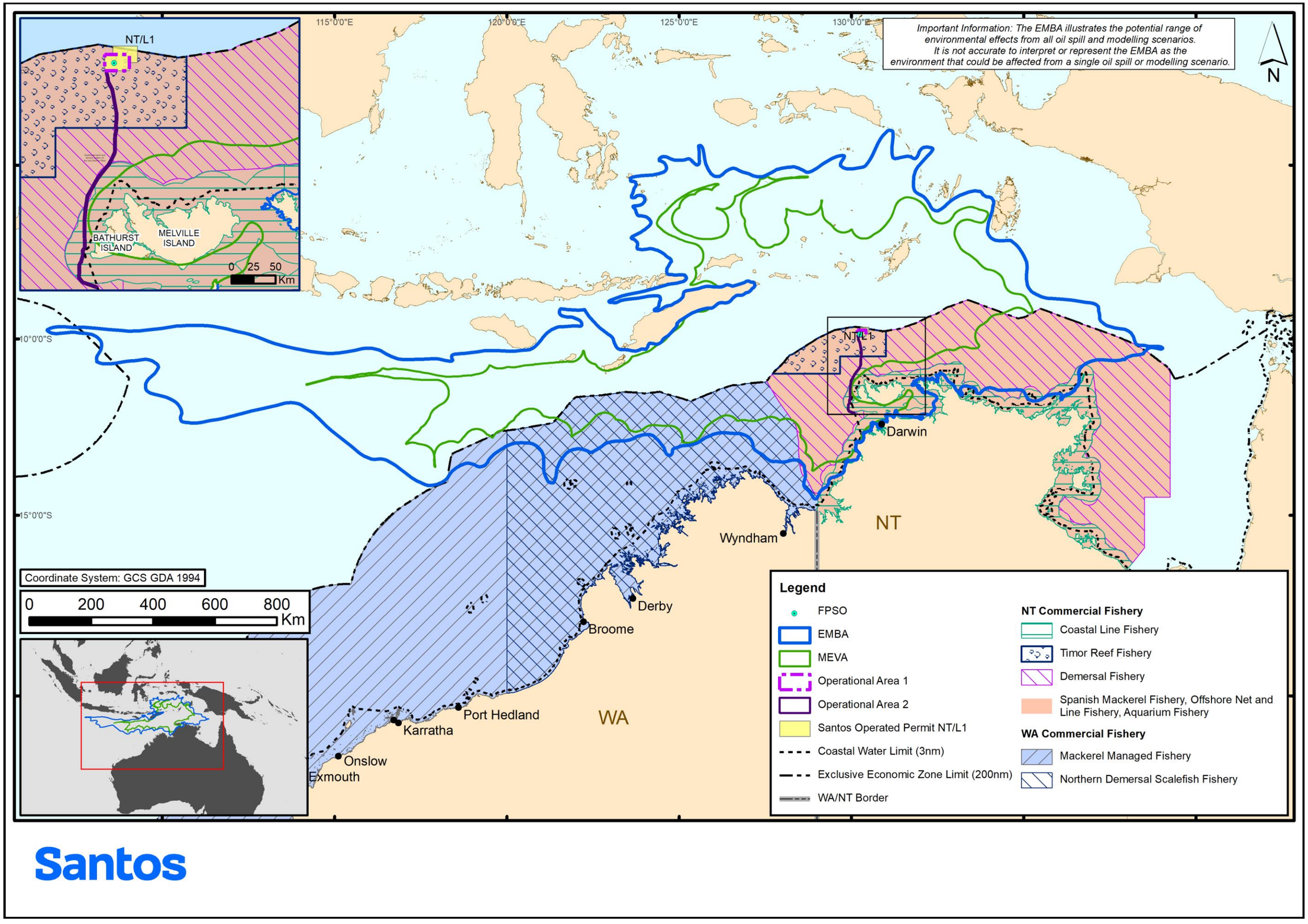

Figure 3-23: Western Australian and Northern Territory managed commercial fisheries, MEVA and EMBA

3.6.2 Indonesian and Timorese Commercial and Subsistence Fishing

Indonesian and Timor-Leste subsistence fishers generally fish in the Timor Sea and Arafura seas. Indonesian fishers typically utilise Australian locations such as Hibernia Reef and Ashmore Reef. Fishing occurs from April to December, with most activity occurring in September and October. The Big Bank shoals (located to the west of OA1) lie in the Indonesian EEZ and Indonesian commercial vessels may fish in and around the shoals (Heyward *et al.*,1997a). Species likely to be targeted by Indonesian or Timorese subsistence fishers are shark, tuna, mackerel and reef fish such as snapper. Seaweed farming also occurs off the Indonesian coastline.

An MoU between the Australian and Indonesian governments, officially known as the Australia-Indonesia Memorandum of Understanding on the Operations of Indonesian Traditional Fishermen in Areas of the Australian Fishing Zone and Continental Shelf – 1974 exists to:

'provide the framework for fisheries and marine cooperation between Australia and Indonesia, and facilitates information exchange on research, management and technological developments, complementary management of shared stocks, training and technical exchanges, aquaculture development, trade promotion and cooperation to deter illegal fishing.' (Department of Agriculture, Fisheries and Forestry [DAFF], 2022)

Cooperation under the MoU today occurs under the auspices of the Working Group on Marine Affairs and Fisheries. Established in 2001, the Working Group on Marine Affairs and Fisheries is the primary bilateral forum to enhance collaboration across the spectrum of marine and fisheries issues relevant to the areas of the Arafura and Timor seas. The Working Group brings together the fisheries, environment and scientific research portfolios and agencies from both countries.

The MoU enables traditional fishing to occur within sections of the Australian EEZ. The fishers focus their activities in and around the shallow water lagoons of Scott Reef, primarily targeting trepang; and opportunistically gather trochus shells, generally from July to October, and to a lesser extent from April to June. They also catch fish largely for subsistence purposes.

OA1 falls entirely within the Australian EEZ. Indonesian and Timor-Leste fishing is not permitted within OA1. Parts of the EMBA extend to an area of overlapping jurisdiction established in an Agreement between the Government of the Commonwealth of Australia and the Government of the Republic of Indonesia establishing Certain Seabed Boundaries (1971) and the Seabed Boundaries Agreement between the Commonwealth of Australia and the Republic of Indonesia on Seabed Boundaries in the Area of the Timor and Arafura Seas (1972). Each of these Agreements, together with the MOU, was affirmed by the Treaty between the Government of Australia and the Government of the Republic of Indonesia establishing an Exclusive Economic Zone Boundary and Certain Seabed Boundaries (Perth, 14 March 1997) (Perth Treaty). This area is commonly referred to as the Perth Treaty Area. When this treaty is ratified, Australia will have jurisdiction over the seabed and Indonesia will have jurisdiction over the water column within the Perth Treaty Area. The treaty permits Indonesian fishing by both traditional and modern vessels, although as noted above Indonesian commercial fishing activity is concentrated at locations several hundred kilometres to the west and south-west of OA1. Although not yet ratified, Santos understands that the Perth Treaty is generally observed.

3.6.3 Energy Industry

A number of oil and gas companies hold petroleum permits in and around the EMBA; however, no established operations are located within or in the immediate surrounds. The closest operational offshore production facilities and infield subsea infrastructure are the Eni operated Blacktip Gas, approximately 254 km southwest from the OA2 and the Santos-operated Bayu–Undan platform, approximately 375 km northwest from the OA2. There are 2 existing pipelines within the vicinity— the Santos operated Bayu-Undan pipeline (0.1 km or greater distance from OA2 for approximately 23km) and the INPEX operated Ichthys pipeline (46.5 km distance from OA2).

Petroleum retention lease area and exploration permit leases, or greenhouse gas emissions assessment permits within the EMBA (not including Santos' interests) are currently held by various oil and gas operators (and subsidiaries), including Bengal Energy Ltd, Woodside Energy Ltd, Shell Development (Australia) Pty Ltd., Eni Australia Limited, Finder No. 1 Pty Ltd, Jadestone Pty Ltd, Melbana Energy Pty Ltd, PTTEP Australia, EOG Resources Australia Block WA-488 Pty Ltd, INPEX Ichthys Pty Ltd, Neptune Energy (subsequently acquired by Eni) and SundaGas Bunda Unipessoal Lda.

3.6.4 Telecommunications Cables

The North-West Cable System is located approximately 230 km and 2.5 km south of OA1 and OA2, respectively. Extending 2100 km from Darwin to Port Hedland, the NWCS connects Australia's remote northern and western regions, including offshore energy facilities, with onshore locations (Figure 3-24).

3.6.5 Defence Activities

There are no designated military and defence exercise areas within OA1. OA2 intersects the Darwin Air Weapons Range central practice area (Figure 3-24). The EMBA is within the North Australian Exercise Area, a maritime military zone administered by Department of Defence which comprises practice and training areas. The NAXA extends approximately 290 km north and west from just east of Darwin into the Arafura Sea. The area is used for offshore naval exercises and onshore weapon-firing training, including the biannual Kakadu military training exercise; when this is occurring, a due regard area is put in place that usually excludes all other vessels from the area.

The Australian Border Force also undertakes civil and maritime surveillance (and enforcement) in Australian offshore maritime waters, which includes the Australian EEZ. During their surveillance, Australian Border Force vessels may transit through the OAs and EMBA.

The EMBA overlaps a historic Naval Gunnery area (1090 Melville Island) and Department of Defence has advised unexploded ordnances may be present on and in the seabed within this area.

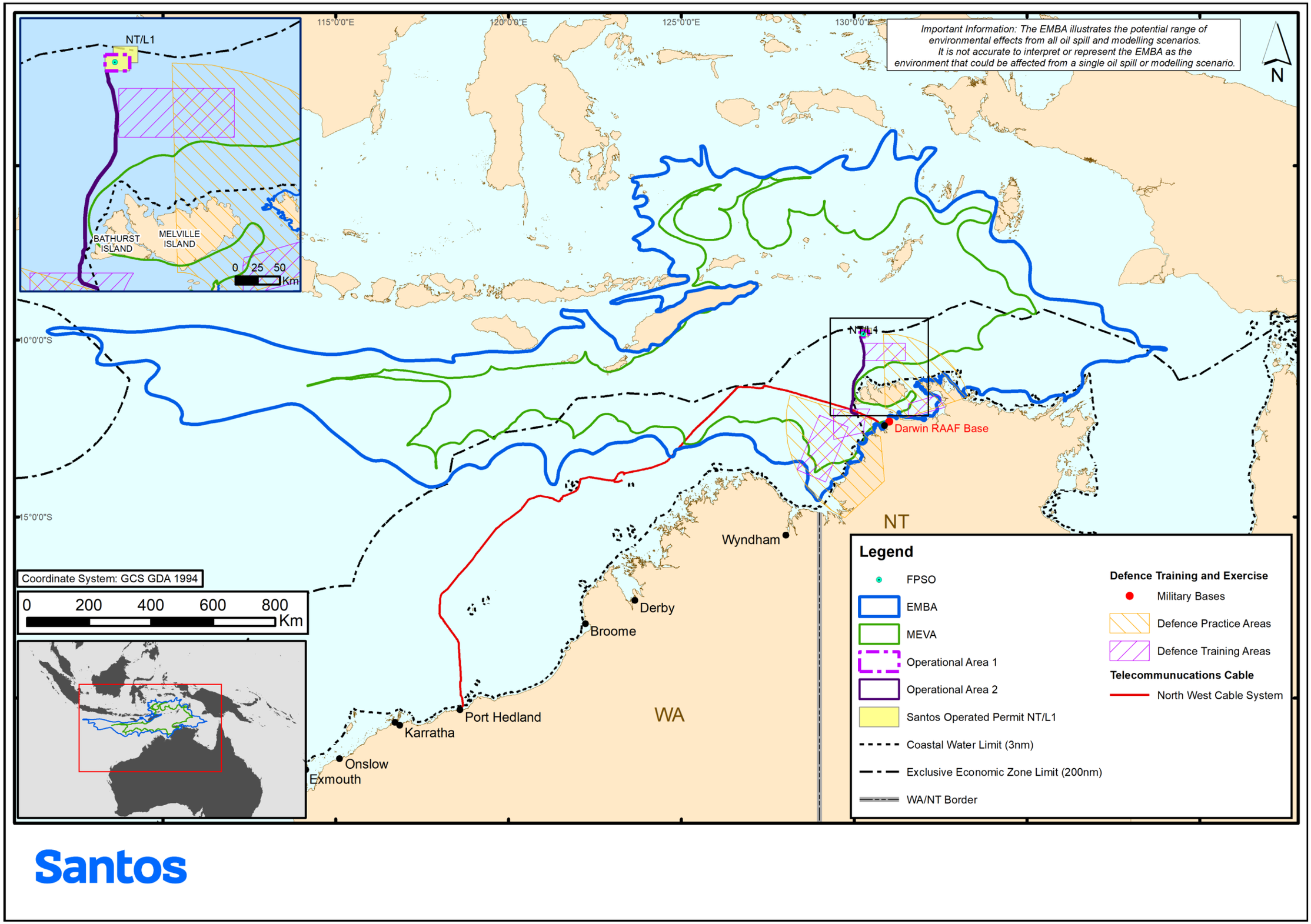

Figure 3-24: Defence training and exercise areas and telecommunications cables, MEVA and EMBA

3.6.6 Shipping

The closest major commercial port to the OAs is Darwin Port (outside the EMBA). The Darwin Port Corporation serves a number of shipping and cargo markets, including cruise and naval vessels, livestock exports, dry bulk ore, offshore oil and gas rig services, and container and general cargo. The port is located approximately 290 km and 116 km to the south-east of OA1 and OA2, respectively (Figure 3-25). Darwin Port is a major shipping port in Australia. In 2020-2021, there were a total of 1,510 vessel calls to port (Ports Australia, 2022).

Darwin Port is a major port of call for vessels servicing operations offshore from north-west Australia.

Although Darwin Port remains the primary active port in the region, there is small-scale port activity to the south and east of OA2 at the Tiwi Islands (Figure 3-25). Port Melville is located on Melville Island (122 km north of Darwin) and is situated on the Apsley Strait, immediately south of Parlow Point and the community of Pirlangimpi. Port Melville provides for the export of woodchips for Tiwi Plantations Corporation, and the shipment of equipment and supplies for other projects. The facility is capable of 24-hour operation, although most operations are undertaken during daylight hours. Most vessels enter and exit the Apsley Strait from its northern entrance. This is except for barges travelling between Darwin and Port Melville, which enter and exit the Apsley Strait from its southern entrance. The wharf infrastructure at Port Melville was constructed in 2013. Total projected monthly vessel movements (excluding pilot vessels) in 2015 was 23, increasing to 28.5 in 2019; however, this is subject to commercial arrangements in support of the plantation export and other future uses.

The main preferred shipping routes that occur within the EMBA are between Darwin and ports in SE Asia. Average vessel displacements and speeds for shipping vessels transiting the EMBA and OAs include:

- bulk carriers averaging 55,300 tonnes with speeds of 14 knots
- livestock carriers averaging 2800 tonnes with speeds of 12 knots
- general cargo vessels averaging 4900 tonnes with speeds of approximately 12 knots.

Figure 3-25 presents vessel movements recorded by Australian Maritime Safety Authority (AMSA) through the Australian Shipping Reporting System in 2024.

The Australian Maritime Safety Authority (AMSA) has established a network of shipping fairways off the north-west coast of Australia to manage traffic patterns (AMSA 2013). The Shipping Fairways are designed to keep shipping traffic away from offshore infrastructure and aims to reduce the risk of collision (AMSA, 2013).

Use of the fairways is strongly recommended but not mandatory. The International Regulations for *Preventing Collisions at Sea 1972* apply to all vessels navigating within or outside the shipping fairways. The use of these fairways does not give vessels any special right of way (AMSA 2012).

Under the *Navigation Act 2012 (Cth)*, certain vessels operating in Australian waters are required to report their location on a daily basis to the Rescue Coordination Centre (RCC) in Canberra. This Australian Ship Reporting System (AUSREP) is an integral part of the Australian Maritime Search and Rescue system and is operated by AMSA through the RCC. Vessels recorded within waters in the EMBA through the AUSREP system in 2024 are shown in Figure 3-25. The records show limited vessel movements through the OAs and some movements are associated with the construction of the Barossa GEP in the OAs and drilling and completion activities and installation of subsea umbilicals, risers and flowlines (SURF) infrastructure in OA1.

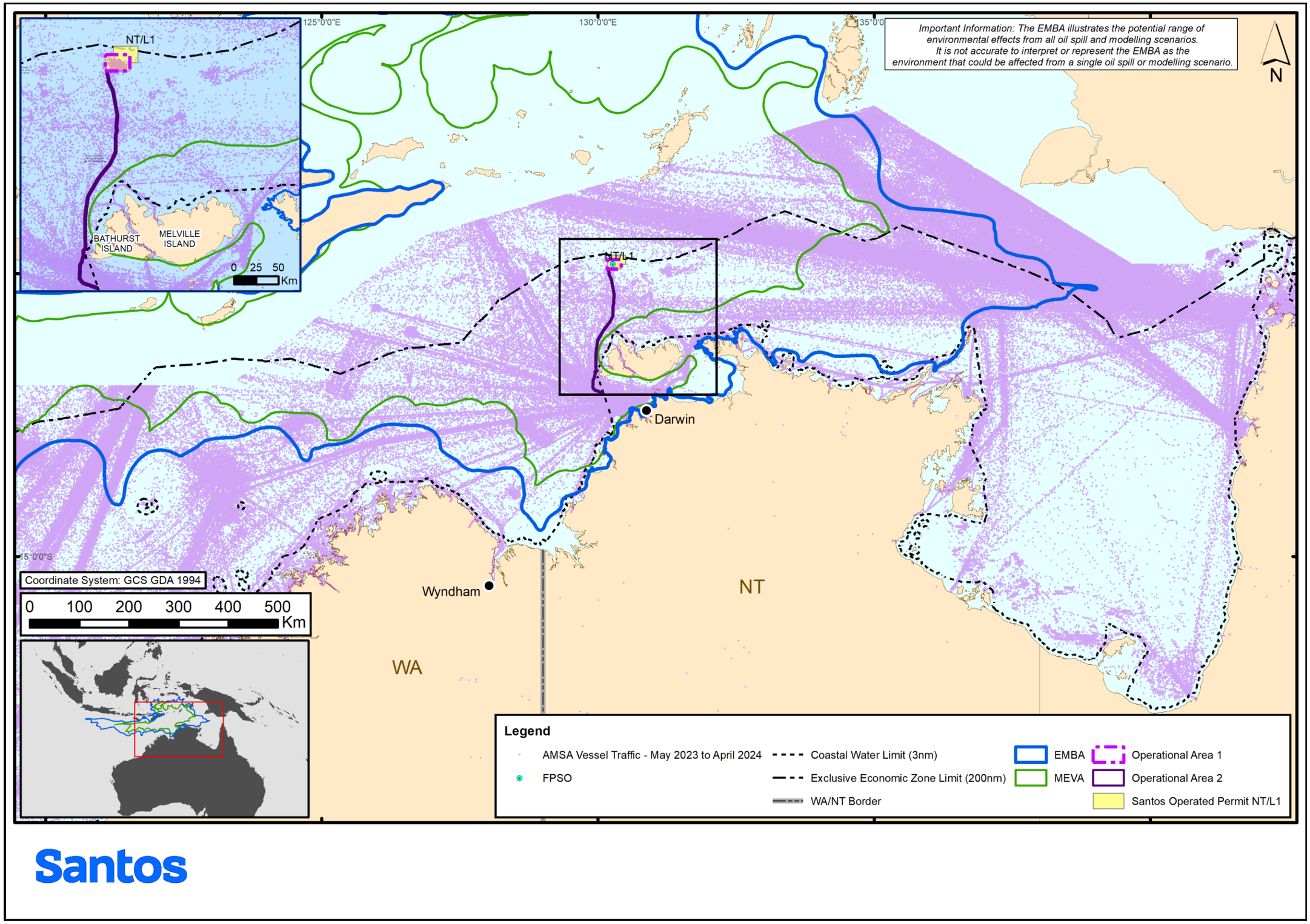

Figure 3-25: Australian Maritime Safety Authority recorded vessel movements and shipping routes, MEVA and EMBA

3.6.7 Research Activities

The Australian Institute of Marine Science (AIMS) outlined that they have planned voyages around the Goodrich Bank area between May - June 2025 and November- December 2025. This will result in vessel movements outside OA1 and OA2 but within the EMBA.

AIMS also have monitoring arrays within the NMR. Monitoring array NWSLYN is located approximately 7.5km to the east of OA2 within the EMBA. BOM and UWA also have wave buoys within the NMR to the west of OA2 within the EMBA.

3.6.8 Recreation and Tourism

OA1 is located in offshore waters that are not likely to be accessed for tourism activities (such as recreational fishing and boating and charter boat operations), as these tend to be centred around nearshore waters, islands and coastal areas. Several shoals and banks within the EMBA may be visited by small numbers of recreational fishers and charter vessels targeting fish inhabiting these shallower features. Consultation undertaken for the Barossa Development OPP (ConocoPhillips, 2018) identified one fishing charter operator who conducts tours in open offshore waters near Evans Shoal and Goodrich Bank during the main fishing season (September to December).

The Tiwi Islands are a popular tourist destination offering cruises, fishing, sailing and water tours, local arts and crafts, among other Indigenous cultural tours and activities. It was identified, during stakeholder consultation, that both recreational fishers and tourism operators use the southern section of the pipeline route. Tourism and recreational activities are likely to be more concentrated within coastal waters of the EMBA, but activities such as deepwater fishing and diving around offshore shoals and reefs may potentially occur in offshore areas of the EMBA and within OA2. However, these activities will be limited and infrequent.

A number of fishing charters operate in the coastal waters along the NT coastline (within 3 nm) and near Melville and Bathurst Islands which are likely to overlap with parts of OA2 and the EMBA. These waters are also used by recreational fishers. OA1 is not likely to be accessed for tourism activities (e.g. recreational fishing and boating, charter boat operations), as these tend to be centred around nearshore waters, islands and coastal areas.

A specimen shell collection enterprise occurs around Ashmore Reef and Cartier Island. Fishing and diving charter companies offer tours to fishing spots off the WA coast, including Seringapatam Reef, and dive spots which include Ashmore Reef, Cartier Island, Hibernia Reef and Seringapatam Reef. These offshore areas are encompassed in the EMBA. Indonesian and Timor-Leste-based marine tourism companies have advised that they also offer diving to areas predominantly close to shore. The majority occur off the northern coastlines, but some of these activities may occur in the EMBA.

In summary, there are limited recreational activities observed or expected to occur in the deep-water offshore environment of the OA1 and OA2. Nonetheless, some occasional activity may be encountered within the regional marine environment, including within the EMBA.

3.6.9 Underwater Cultural Heritage

Historic sunken aircraft, including associated artefacts that have been in Australian / Commonwealth waters more than 75 years are subject to automatic protection under the *Underwater Cultural Heritage Act 2018* (Cth). Shipwrecks, sunken aircraft and other types of UCH that have been underwater for less than 75 years can be protected through an individual declaration by the Minister for the Environment based on an assessment of heritage significance (DCCEEW, 2023). Underwater cultural heritage artefacts continue to be protected after removal from Australian / Commonwealth waters. There are no declared protected UHC sites within the OAs. Multiple known shipwrecks, sunken aircraft, an historic (more than 75 years old) aircraft and shipwreck and other sites occur within the EMBA (see Figure 3-26).

Three historic shipwrecks are known to occur in the EMBA; a steam ship (Florence D) that was sunk to the north-west of Bathurst Island, a steamer ship (Don Isidro USAT) that was sunk adjacent to the west coast of Bathurst Island, and a submarine (I-124) sunk in the Beagle Gulf. The vessels were sunk in 1942 during World War II and are protected under the *Underwater Cultural Heritage Act 2018* (Cth). The Florence D is located in water depths of 16 m, which the Don Isidro USAT is located in water depths of 6 m (DCCEEW, 2023). The submarine is located in water depts of 42 m. The Florence D and submarine both have designated 797 m radial protection zones. One known shipwreck listed under the *Underwater Cultural Heritage Act 2018* (Cth) is located at the Cartier Island Marine Park: the *Ann Millicent* (wrecked in 1888).

Underwater cultural heritage sites that have a declared protected zone prohibit types of conduct within a designated zone. There are no declared protected zones within the OAs. There are three sites that have a declared protected zone within the EMBA, being *I-124* (Submarine), *SS Florence* and *SS Macumba*. These

declared protected zones prohibit conduct within an 800 m radius, unless authorised by a permit issued under the *Underwater Cultural Heritage Act 2018* (Cth).

The Subsea Telegraph Cables Landing Site is located in the intertidal zone, offshore Darwin, approximately 112 km to the south-east of OA2 and within the EMBA. The site is listed under the NT *Heritage Act 2011*. There are also sites (e.g. USAT Mauna Loa and USAT Meigs) that are protected under the *Heritage Act 2011* (NT) within the EMBA. Underwater heritage artefacts continue to be protected after removal from the water.

Santos engaged Cosmos Archaeology to undertake maritime archaeological heritage assessments in OA1 and OA2. A maritime archaeological heritage assessment was undertaken by Cosmos Archaeology (2022) who reviewed historical sources, databases, and marine geophysical information. The assessment concluded there are no located shipwrecks, aircraft wrecks, dump sites, maritime infrastructure or UXO within the study area, which was defined as a 500 m buffer around the Barossa GEP route. Cosmos Archaeology (2023) analysed SSS and MBES geophysical survey data to identify potential underwater cultural heritage within OA1. The geophysical survey data did not provide clear evidence of shipwrecks or sunken aircraft wrecks. In the Timor Sea, there are no “known” or “known unlocated” historic shipwrecks that would be protected automatically under the UCH Act (Cosmos Archaeology, 2023). Three sonar contacts (anomalies) were identified as being potentially anthropogenic in origin. One anomaly was identified 15 m from a FPSO mooring line and the second was 39m from a production line. Santos undertook further targeted geophysical surveys of the anomalies ahead of SURF installation activities. Examination of the information gain from the further targeted surveys, no evidence was found that items of significant cultural heritage are present at or adjacent to either of the anomaly locations (Comber Consultants, 2024).

During the Last Glacial Maximum (LGM), sea level was at its minimum at 125 m below the present-day sea level (Wessex, 2023). A significant portion of the EMBA is within the 125 m depth contour, which represents the furthest extent of historical human habitation and potential for First Nations UCH. For water depths within OA2 less than 125 m, there is potential for unknown First Nations UCH to exist. However, given the time since sea levels were at these low levels (approximately 20,000 years ago), terrestrial landforms, and any associated heritage artefacts within the EMBA are likely to have been significantly modified over thousands of years, by environmental processes of erosion, sedimentation and deposition as sea levels increased to their present levels (Posamentier, 2023). A similar conclusion was drawn from a study undertaken for the DPD Project, of which 23km is included within OA2, to assess the potential for First Nations archaeological deposits associated with the LGM to be impacted by installation of the DPD (OzArk 2024). There was only one location along the submerged DPD corridor, in the vicinity of KP36.4 to 37.9, where potential sediments associated with the LGM were indicated. At this location, potential sediments are assessed likely to be at a depth of approximately 18 m below the sea floor. At this depth, no activities related to the construction of the Darwin Pipeline Duplication (DPD) project will have any direct or indirect impact on these potential sediments (OzArk 2024).

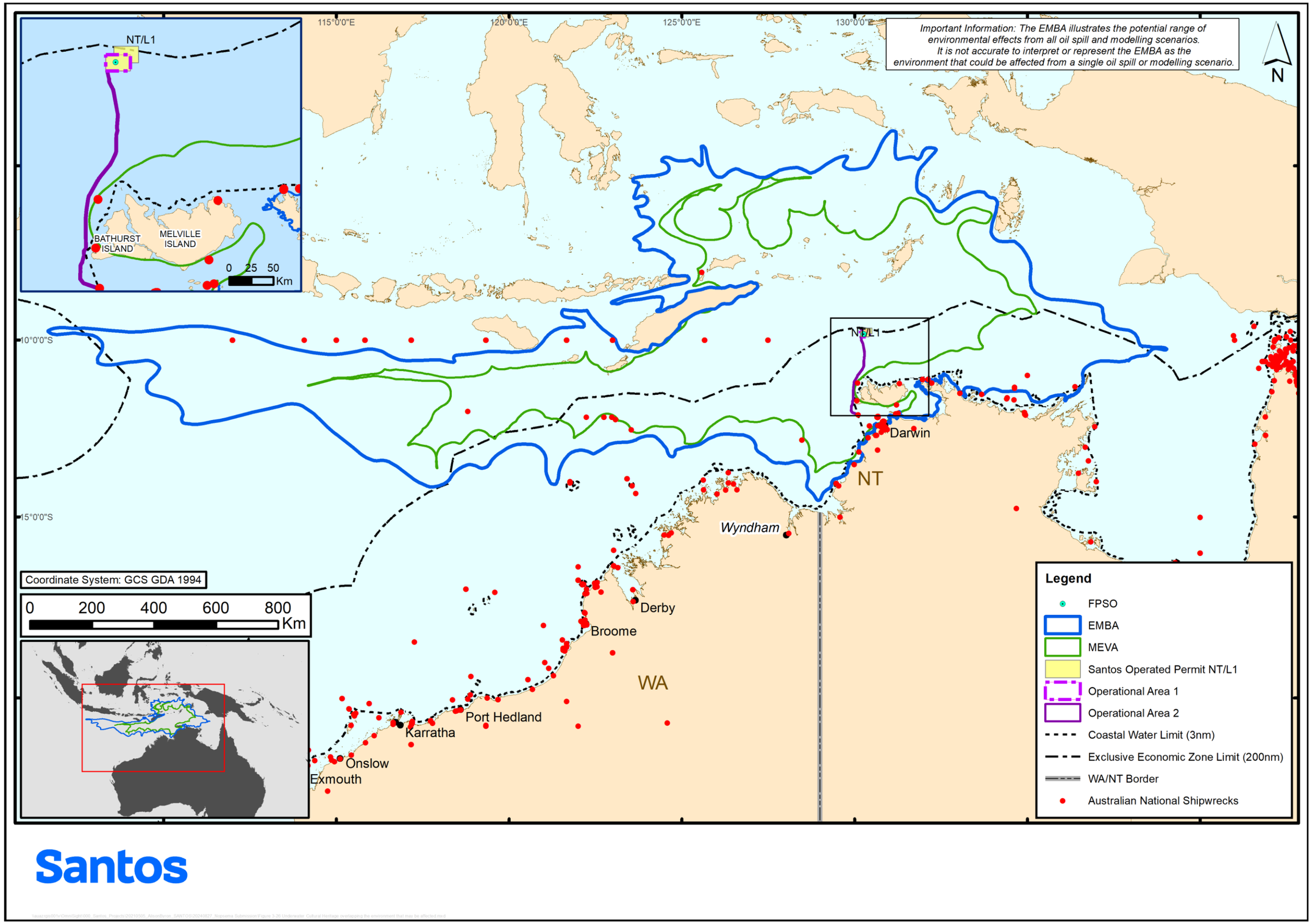

Figure 3-26: Underwater Cultural Heritage, MEVA and EMBA

3.7 Cultural features

Sections 3.7.1 to 3.7.12 provide detail on cultural features within the EMBA, other than the UCH sites described in Section 3.6.9.

3.7.1 Introduction

First Nations people have occupied the Australian continent for at least 65,000 years, making them the oldest continuous culture in the world. First Nations Australians' "*connection to land is essential to the continued cultural survival of Australia's First Peoples as well as their economic and social development*." (AIATSIS, 'Land Rights', Reuters).

Santos acknowledges the tradition of First Nations people of Australia includes a cultural and spiritual connection to their land and waters, including sea country. These connections are rooted in their traditional communal beliefs and practices. First Nations people view their land and waters as integral to their identity, culture, and spirituality and they have a deep respect for the natural world. First Nations persons and groups that identify as saltwater people/groups have a complex relationship with sea country, based, for the most part, on inherited rights, including totemic affiliation, and ceremonial duties. Santos understands that First Nations groups of Northern Australia are generally aware of the nature and geographic extent of their areas of responsibilities over sea country.

The cultural heritage of First Nations people is defined by indigenous tradition through traditional laws and customs amongst themselves.

It includes a vast array of cultural artifacts, practices and beliefs. The protected heritage of First Nations peoples is also of cultural value to Australia and the global community. The cultural value of First Nations protected heritage to Australia is evidenced and given force by a range of factors, including the laws, regulations and institutions established across Australia that are designed specifically to protect First Nations rights and interests in relation to sacred sites and other aspects of First Nations cultural heritage, including the *Native Title Act 1993* (Cth) (NT Act), *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth) (ATSIHP Act), *Underwater Cultural Heritage Act 2018* (Cth) (UCH Act), *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth) (ALR Act) and *Northern Territory Aboriginal Sacred Sites Act 1989* (NT) (NTASS Act) (see Sections 3.7.3 to 3.7.7).

In identifying the cultural features of the OAs and EMBA, Santos has considered:

1. information shared during consultation for this EP
2. information shared during consultation/engagement relevant to other Barossa EPs
1. lay and expert evidence adduced in *Munkara*, as well as the court's reasoning and findings
2. expert advice provided by consultant anthropologists (some of which was considered by the Court in *Munkara*)
3. other publicly available information.

Information about potential cultural features obtained during consultation/ engagement for all Barossa Environment Plans has been considered and included in this EP where potentially relevant, having regard to the recent guidance in *Munkara*.

Further to point 2 above, Santos was provided with information by First Nations people during consultation meetings for the D&C EP and by NOPSEMA in the course of preparing the D&C EP. NOPSEMA provided Santos with 4 separate letters from 4 Tiwi clan members to NOPSEMA in April 2022 requesting the statement of reasons for NOPSEMA's decision to accept Revision 3 of the D&C EP (2022 Statement of Reasons Requests22F[7]), and asked Santos to consider the relevance of the information provided in the letters to the D&C EP. Items raised in the letters from the Tiwi clan members include traditional hunting of marine species, totem species, dreamings, songlines and sacred sites, as well as broad concerns about potential impacts from other Barossa Gas Project activities (e.g. noise and light emissions) on the environment. Santos considered this feedback relevant to this EP given:

- songlines, sea country and sacred sites may occur in the general wider area of the Barossa Gas Project,
- the movement of marine and totemic species may occur within the EMBA for this EP, and

[7] *2022 Statement of Reasons Requests asked for copies of statement of reasons to be sent to EDO email addresses.*

- potential environmental impacts associated with this Activity are similar to those associated with the D&C activity (such as noise and light).

Santos also notes that the Tiwi clan members who sent the April 2022 letters attended multiple Tiwi clan consultation sessions for this EP. As described in Section 4, Santos provided Tiwi people (including the authors of the four letters) extensive opportunities for consultation specifically on the activities proposed to be conducted under this EP.

Further to point 4 above, Santos commissioned an independent expert assessment by Dr Brendan Corrigan for the purpose of identifying underwater cultural heritage places along the route of the Barossa GEP west and north-west of the Tiwi Islands ("Corrigan 2023 Report"). As part of his work, Dr Corrigan reviewed extensive ethnographic studies of the Tiwi people in order to gain an historical understanding of their society, culture and hierarchy, and conducted extensive interviews amongst the communities.

Dr Corrigan has also prepared an anthropological survey report ("Corrigan 2024 Report") on cultural and spiritual values in relation to the DPD Project which includes a portion of OA2, a link to the report is in Table 3-1. The Corrigan 2024 Report is based on a review of all relevant available ethnographic, linguistic and historical materials and consultations with key First Nations persons identified as having cultural and spiritual knowledge and authority associated with the study area. As far as possible, all persons understood to hold cultural and spiritual rights and interests in the study area, including those who assert relevant cultural knowledge, were identified and invited to participate.

Dr Corrigan concluded that a precise boundary which captures the extent of interests of both the Tiwi Islanders and Larrakia Peoples' in the context of the DPD and Barossa GEP is unclear. However, cultural and spiritual values of these groups are understood as extending out into the seas for an indeterminate distance. For example, the spiritual beings Jirukupai (crocodile man) and Ampitji are thought by Tiwi Islanders to travel in the surrounding sea, but it unclear precisely how far. This is also consistent with a range of views put to the Federal Court more recently, in the context of the accepted Barossa Gas Export Pipeline Environment Plan (GEP EP) (see for example, Corrigan 2023). Similarly, Tiwi Islanders routinely travel large distances at sea for the purpose of fishing and hunting turtle and dugong. However, there is no settled evidentiary data on the actual extent of these cultural and economic activities in the context of a sea country claim or the like.

There are no native title claims or determinations registered or sites recorded under the ATSIHP Act, UCH Act or ALR Act, Aboriginal land rights claimed or granted under the ALR Act or Indigenous Protected Areas (IPAs) within the OAs.

3.7.2 Meaning of 'Cultural Features'

In its evaluation, Santos has had close regard to the Court's guidance and findings in *Munkara v Santos NA Barossa Pty Ltd (No 3)* [2024] FCA 9 (*Munkara*) in identifying the cultural features of the environment. In *Munkara*, the Court clarified the meaning of 'cultural features' in the definition of 'environment' in section 4 (now section 5) of the OPGGS(E)R:

- The phrase cultural features, has a 'communal aspect' to it. This necessitates that individual beliefs are broadly representative of the beliefs of other members of the group, although there does not need to be consensus.[8] An idiosyncratic view or belief of an individual may be a manifestation of the culture of that person's society, but if it is not broadly representative of the beliefs of a group, then it will not constitute a cultural feature.[9]

In the context of limb (a) of the definition of 'environment', 'cultural features' attaches to the word 'ecosystem' with all of its constituent parts, including people and communities. The focus must remain on the ecosystem, of which people form a part. This focus is not upon an individual person devoid of the context of the ecosystem.[10]

- In the context of limb (c) of the definition of 'environment', each of the circumstances that:

  an area is the subject of a spiritual connection to Aboriginal people, provided that the connection is *by* the laws and customs of *a people*;[11]

  an 'area' is the country of an Aboriginal person in accordance with Aboriginal traditional laws and customs;[12] and

[8] *Munkara at [922], and see also at [194]-[199].*
[9] *Munkara at [204].*
[10] *Munkara at [204].*
[11] *Munkara at [201].*
[12] *Munkara at [855].*

there exists in those areas, locations or places cultural heritage in the form of artefacts or other objects evidencing human occupation and activities over the course of human history,[13]may readily be described as a 'cultural feature' of that location, place or area.

- In order for there to be a 'cultural feature' of the environment, there must be a 'sufficiently cogent or coherent belief' that is 'sufficiently accepted' so that it can be described as having normative content for the people or community viewed as a constituent part of an ecosystem, such that a singular perspective will not suffice.[14] The beliefs and values must be held by the relevant people as a people.[15] Further, the question of whether a view is sufficiently cogent or coherent may be answered by reference to the customs and practices of the relevant people, including relevant customs and practices concerning the authority to speak on a topic or relevant customs and practices (if any) concerning the resolution of division.[16]
- The inquiry as to what is 'broadly representative' must be undertaken in the proper cultural context, including by assessing which persons are generally accepted as having authority to speak on the particular topic and excluding those persons who are culturally irrelevant.[17]
- Evidence of dissenting views cannot be ignored, because they tend against a finding that beliefs have broad acceptance.[18]
- Proof that beliefs are broadly representative will be more difficult in the face of discord within the relevant group, and even more so when the discord is among persons of equivalent authority and persons having the same lineage.[19]

3.7.3 Native Title

Native title was first recognised in Australia in *Mabo v Queensland (No 2)* (1992) 175 CLR 1 (*Mabo*). Consequent to that decision, the NT Act (Cth) was enacted to provide a statutory mechanism for the recognition of claims for, and protection of, native title.

Native title claims are applications made to the Federal Court under the NT Act for a determination, or decision about native title in a particular area. A claimant application is made by a native title claim group which asserts it holds native title rights and interests in an area of land and/or water, according to its traditional laws and customs. By making a claimant application, the native title claim group seeks a decision that native title exists, so its physical and spiritual rights and interests are recognised by the common law of Australia. This is called a native title determination. A determination is a decision by a recognised body, such as the Federal Court or High Court of Australia, that native title either does or does not exist in relation to a particular area.

A native title claim group must demonstrate that the acknowledgement and observance of traditional laws and customs have continued substantially uninterrupted since sovereignty (capable of being recognised by the common law of Australia) (section 223(1) NT Act). Native title rights and interests are determined as a question of fact. For example, in *Western Australia v Ward* (2000) 99 FCR 316, [243], the Full Federal Court stated that:

Acknowledgment and observance may be established by evidence that traditional practices and ceremonies are maintained by the community, insofar as that is possible, off the land, and that ritual knowledge including knowledge of the Dreamings which underlie the traditional laws and customs, continue to be maintained and passed down from generation to generation. Evidence of present members of the community, which demonstrates knowledge of the boundaries to their traditional lands, in itself provides evidence of continuing connection through adherence to their traditional laws and customs.

A requirement to establishing a positive determination of native title in court is proving that there is an organised group that occupies the claimed land and waters at the time of British annexation. The requirement of an ‘organised society’ is set out in *Mabo*.

From this, it is considered that it is a group of native titleholders that hold communal native title and that native title claims are understood to represent the area over which First Nations groups are claiming their rights and interests.

A native title determination is where native title has been determined to exist, which may include only part of a native title claim and represents the lands and waters over which the native title group has recognised rights and interests. Where a Court has determined that native title exists, those native title rights and interests will be

[13] *Munkara at [200].*
[14] *Munkara at [206].*
[15] *Munkara at [208].*
[16] *Munkara at [206].*
[17] *Munkara at [923].*
[18] *Munkara at [923].*
[19] *Munkara at [924].*

held (often but not always) in trust by a Registered Native Title Body Corporate designated by the Native Title holders (section 57 NT Act).

Native title is, in any particular case, a collection of rights and interests the content of which varies according to the traditional laws and customs from which they are, in each particular case, derived. For example, these rights may include the right to have access, to camp, hunt, fish, use water, hold meetings, perform ceremony and/or protect cultural sites (see for example, *Akiba v The Commonwealth* (2013) 250 CLR 209).

For the Activity in this EP, there are no native title claims or determinations that overlap with the OAs. The EMBA overlaps with the Croker Island Native Title Determination and the Larrakia Native Title Determination (Darwin) (Figure 3-27).

The areas of responsibility for regional Native Title Representative Bodies that overlap with the EMBA as shown in Figure 3-28.

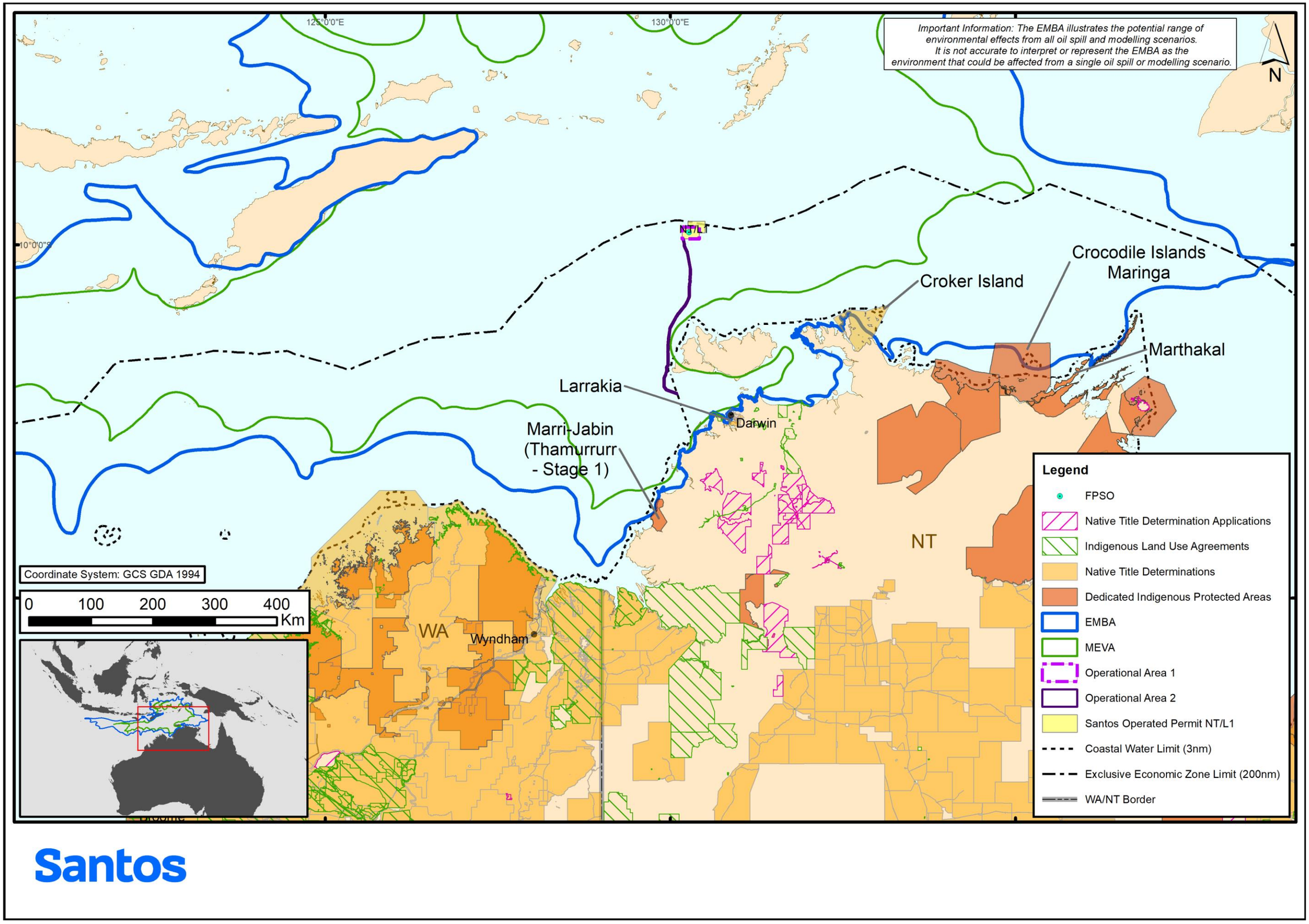

Figure 3-27: Native Title Determined Areas, Native Title Determination Applications, Indigenous Land Use Agreements and Dedicated Indigenous Protected Area

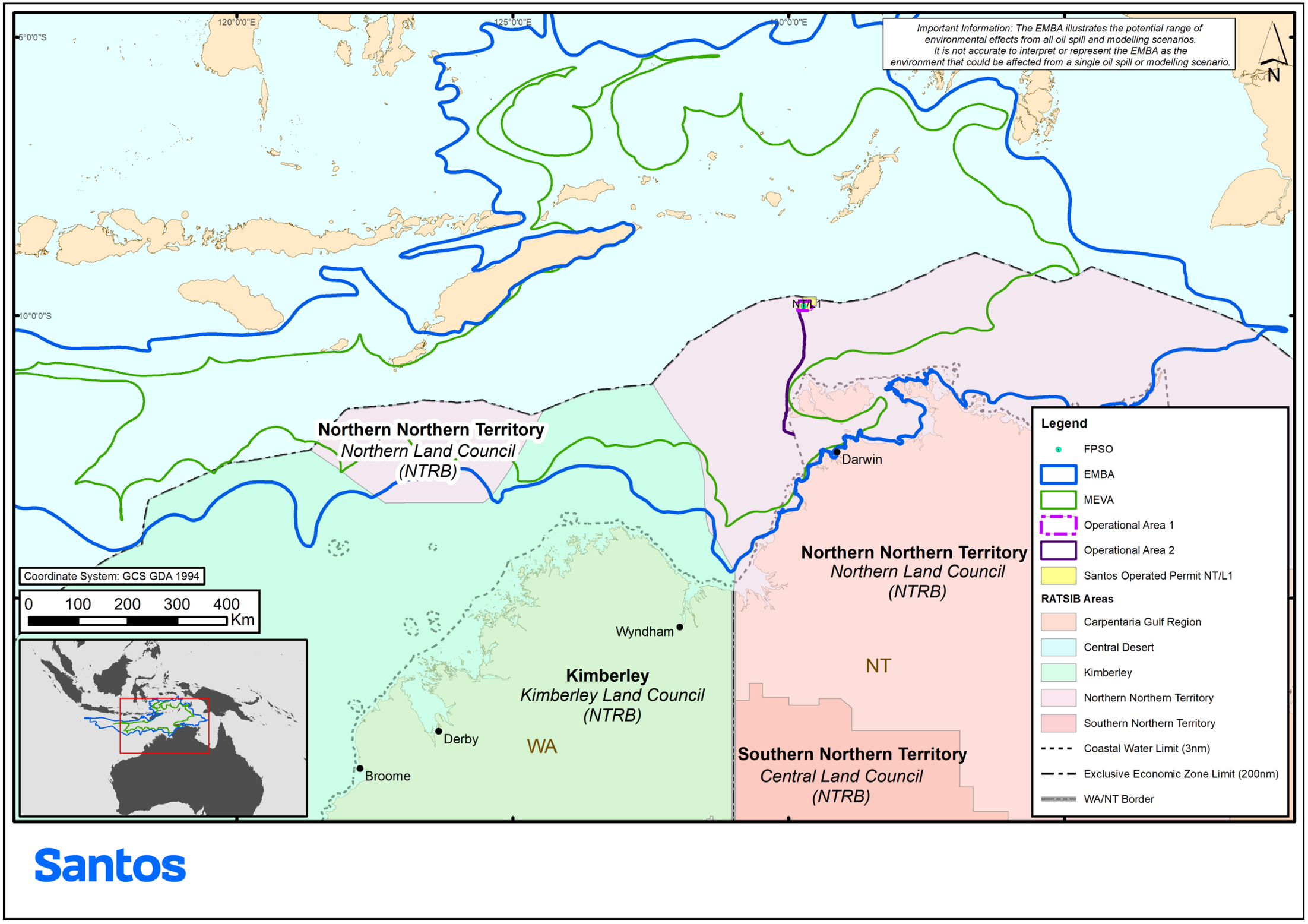

Figure 3-28: Representative Aboriginal/Torres Strait Islander Body Areas, MEVA and EMBA

3.7.4 Indigenous Land Use Agreements

An Indigenous Land Use Agreement (ILUA) is a voluntary agreement between native title parties and other people or bodies about the use and management of areas of land and/or waters. An ILUA can be made over areas where:

- native title has been determined to exist in at least part of the area
- a native title claim has been made
- no native title claim has been made.

While registered, ILUAs bind all native title holders to the terms of the agreement. ILUAs also operate as a contract between the parties. A register of ILUAs is maintained by the Native Title Registrar. The register of ILUAs does not disclose the existence of any ILUA which overlaps with the OAs. The EMBA does overlap the areas of land and tidal waters (between the low water mark and the highwater mark) of the Kenbi and Mary River ILUAs (refer to Figure 3-27).

The Northern Land Council (NLC) is a party to the Kenbi ILUA and NLC and members of the Wulna Clan are parties to the Mary River ILUA. Members of the Wulna clan have representation through the Jindiwi CC (refer to Table 4-18).

3.7.5 Indigenous Protected Areas

Indigenous Protected Areas (IPAs) are areas of land and sea managed by First Nations groups as protected areas for biodiversity conservation through voluntary agreements with the Australian Government. IPAs are an essential component of Australia's National Reserve System, which is the network of formally recognised terrestrial parks, reserves and protected areas across Australia's landmass. There are currently 82 dedicated IPAs over 87 million hectares of land. There is also around five million hectares of Australia's sea areas in dedicated IPAs. Managing IPAs helps First Nations communities protect the cultural features of their country for future generations.

For the Activity in this EP, there are no IPAs that overlap with the OAs. Three IPAs overlap with the EMBA. These include Crocodile Islands/ Maringa, Marthakal and Marri-Jabin (Thamurrurr) (Figure 3-27). Clans with responsibilities for each IPA have representation through the following FNCCs:

- for Crocodile Islands/ Maringa : Gapu Maringa FNCC;
- for Marthakal: Ngoy Garmak FNCC; and
- for Marri-Jabin (Thamurrurr): Kardu Lalingkin FNCC.

3.7.6 Sacred Sites

There are no known sacred sites within the OA. There are many sites along the mainland and island coastlines and potentially the surrounding waters that overlap the EMBA that are protected under the NTASS Act (whether registered, recorded, or not). These sacred sites may include features which lie both above and below the water (AAPA, 2022).

There are extensive coastal areas (down to the low water mark) that intersect the EMBA which are formally recognised as Aboriginal land under the ALR Act.

The Kenbi (Cox Peninsula) Land Claim No. 37 (CoA, 2000) publishes detail on the location and significance of culturally significant First Nations sites within Darwin Harbour and Bynoe Harbour (south-west of Darwin Harbour and separated by the Cox Peninsula), including registered sacred sites. These sites and areas include those used for hunting, fishing, gathering, camping, ceremonies and associated with dreamings. There are numerous sites identified in this report within the EMBA, including those associated with dreamings of totemic marine fauna species, including Ngalwatnyini (manta ray dreaming), Memarrandjamul-nyini (dugong dreaming), Iyn.garrayn-nyini (sea turtle dreaming) (CoA, 2000). The report also identifies 3 sites on the north-eastern side of Darwin Harbour.

Santos has obtained two authority certificates from the Aboriginal Areas Protection Authority (AAPA) which cover the DPD Project in NT waters (i.e. outside OA2 for the activity under this EP, but within the EMBA), including a nominal 1,000m buffer on each side of the pipeline.

All sacred sites in the NT are protected in accordance with the NTASS Act. Sacred sites may also be protected under the ATSIHP Act, *Heritage Act 2011* (NT), the UCH Act, the ALR Act and the EPBC Act.[20]

Sacred sites may be in sea country (whether registered, recorded or not), with access not permitted within 100 metres of any such sacred site, though some sacred sites may have more restrictive access.

3.7.7 Land Rights

The ALR Act governs Aboriginal land (not native title claims) in the NT. Land that has been granted or recommended for grant under the ALR Act is determined to be held communally by the "traditional Aboriginal owners" of that land. the ALR Act has enabled the establishment of Aboriginal Land Trusts (ALTs) to hold title to Aboriginal land granted in the Northern Territory under that Act.

Aboriginal land rights governed under the ALR Act do not extend past the low water mark of tidal waters overlaying the Northern Territory coastline. In coastal areas, grants of Aboriginal land under the ALR Act are made to the low water mark. *Northern Territory v Arnhem Land Aboriginal Land Trust* (2008) 236 CLR 24 confirmed that Traditional Owners of First Nations-owned Northern Territory coastline have exclusive access rights to the tidal waters overlying their land.

There is no Aboriginal land either claimed or granted under the ALR Act, or sea closures put into effect in accordance with that Act, that overlap with the OAs. The EMBA overlaps the following areas of land and tidal waters (between the low water mark and the highwater mark); Arnhem Land ALT, the Cobourg Peninsula Sanctuary ALT, the Tiwi ALT, the Kenbi ALT, and the Delissaville/ Wagait/ Larrakia ALT (CoA, 2023b).

Section 5(2) of the ALR Act provides that ALTs cannot exercise their functions in relation to land they hold except in accordance with directions given to them by the Land Council for the area in which the relevant land is situated. Where any such directions are given, ALTs must comply with them. Accordingly, ALTs cannot act independently of Land Councils. Under the ALR Act, the functions of Land Councils with respect to ALTs involve administering ALTs in their area, including storing their common seals and deeds of grant, maintaining a register of ALT membership, negotiating agreements on behalf of ALTs and receiving moneys on behalf of ALTs.

The NLC is the relevant Land Council for the Arnhem Land, Cobourg Peninsula Sanctuary, Kenbi and Delissaville/Wagait/Larrakia ALTs, while the TLC is the relevant Land Council for the Tiwi ALT.

3.7.8 Existing Marine Environment

During consultation for this Activity, the nature of currents and tides were discussed regarding the potential for moving debris in the oceans and impacting culturally significant species. First Nations people provided information regarding ghost nets getting caught in ocean currents, washing up on shore and impacting marine species. First Nations people also described marine pests as natural creatures and that there are songlines that sing about marine pests, these pests have the right to live under water.

3.7.9 Australian Marine Parks

The EMBA for this EP overlaps with features of the North Marine Parks Network Management Plan (DNP, 2018a) and the North-West Marine Parks Network Management Plan (DNP, 2018b), which identify natural, cultural and spiritual values associated with AMPs, specifically the Ashmore Reef AMP, the Cartier Island Marine Park, the Oceanic Shoals Marine Park and the Arafura Marine Park (Section 3.5.4).

Santos acknowledges that Commonwealth and State Marine Park Management Plans have sought to recognise cultural interests of First Nations groups. Australian Marine Parks has described this framework as taking 'values into account' when making decisions and taking action in relation to marine parks. Australian Marine Parks summarises these values as natural, cultural, heritage and socio-economic values. Additionally, the Commonwealth and State Marine Park Management Plans state that there could be First Nations groups or native title representative groups who may have responsibility for sea country within marine park areas (Section 3.5.4).

3.7.10 Cultural Fishing and Hunting Activities

First Nations fishing activity in NT waters predominately occurs within inshore tidal waters. Approximately 80% of NT's coastline is recognised as being under Aboriginal land and sea ownership under the *Aboriginal Land Rights Act 1976* (NT) (NT Government, 2022d). Almost all traditional fishing effort (approximately 93%) is

[20] *For completeness Santos notes that on 23 October 2023 it was informed by the DCCEEW that applications had been received under the ATSIHP Act in relation to certain areas of the sea. Santos understands that these areas are outside the OA but overlap the EMBA. Santos received written advice from DCCEEW on 13 December 2024 confirming that the applications had been withdrawn.*

concentrated within coastal waters (up to 3 Nm beyond the territorial baseline) of the NT coastline and Tiwi Islands (NT Government, 2017). Darwin Harbour is utilised by Larrakia people for collecting marine resources, including fishing, hunting, crabbing and the collection of shellfish (Corrigan, 2024). For the Tiwi Island people, traditional fishing effort is greatest near the larger communities of Wurrumiyanga on Bathurst Island, and Pirlangimpi and Milikapiti on Melville Island (DPIF, 2014).

Traditional subsistence food sources include fish (mullet, mackerel, barramundi, trevally), mud mussels, mud crabs, long bums shellfish, oysters, yams, mullet, eggs (turtle and bird), chilli worms, mangrove worms, turtles, stingrays, and dugongs. Green turtles are the main species harvested in the water, while eggs of all turtle species are taken periodically (Tiwi Land Council, 2022). Information provided during Tiwi Clan meetings during consultation for the accepted Barossa Drilling and Completion Environment Plan (D&C EP) indicated that some Tiwi people have a particular interest in turtles as a traditional food source. Santos was also provided with information during the preparation of the D&C EP from Croker Island members of the community in Minjilang (located outside the EMBA) that they rely on fish, turtles, dugong, oysters and other marine food sources. During consultation for D&C and this EP, Santos was not provided details about the locations of traditional fishing, hunting and gathering activities.

Feedback from the 2022 Statement of Reasons letters identified the following First Nations people's use of country for fishing/gathering food (fish, shellfish, turtle/turtle eggs, (mud) mussels, (mud) crabs, yams, mullets, mangrove worm, mackerel, barramundi, trevally, (black lip) oysters, chilli worm, stingray, dugong and seagull eggs.

Traditional subsistence food sources are captured in a culturally appropriate manner learnt from ancestral generations and taught to emerging descendants. This occurs in normal family and community circumstances as well as within the practices of the First Nations groups. (Corrigan, 2024).

With the support of the NT Government, Darwin Aquaculture Centre is working with Tiwi People to develop aquacultural enterprises that provide employment and business opportunities (Land Development Corporation, n.d.). Aquacultural options include Barramundi, Trepang, Mud Crab, Prawns, Oysters and Clams (Tiwi Land Council, 2021).

3.7.10.1 Indonesian Traditional Fishing

During negotiations between the governments of Australia and Indonesia regarding the delineation of seabed boundaries, the two governments entered into a Memorandum of Understanding (MoU) recognising the rights of traditional Indonesian fisherman to access shared water to the north of Australia. Access to traditional fisherman was granted in recognition of the long historical tradition of Indonesian fishing in the area. The MoU allows Australia to manage access to it waters while allowing traditional Indonesian fisherman to continue customary fishing practices including the targeting of species such as trepang, trochus, abalone, and sponges. Guidelines clarifying access boundaries for traditional fishers were agreed in 1989. The traditional Indonesian fishing area is established, the MoU Box, is located within the Australian Fishing Zone and the continental shelf adjacent to Ashmore Reef, Cartier Island, Scott Reef, Seringapatam Reef and Browse Island, approximately 720 km south-west of the permit area within the EMBA.

Between 2006 and 2008, a series of surveys were undertaken to understand the traditional practice of Indonesian fishers that journey to Scott Reef within the MoU Box. The majority of perahu (vessels) that travel to Scott Reef originate from the islands of Rote (near West Timor) and Tonduk and Raas (in East Java). Some crew from the Rote perahus are recruited from the region of Alor (one of the Lesser Sundas chain, located north of East Timor and east of Bali). In 2007, an estimated 800 fishers (about 80 vessels) travelled from these home islands to Scott Reef, mainly to collect trepang. Similar vessel numbers sailed to Scott Reef in 2008.

Journeys to Scott Reef are generally restricted to drier months when wind speeds and directions are more desirable. Most Indonesian fishers travel to Scott Reef during July to October, although a few Rotenese make the journey to Scott Reef in the early season between April and June. Other fishers plan to go after Idul Fitri, a religious holiday widely celebrated on Tonduk Island that celebrates the end of Ramadan.

The fishers focus their activities in and around the shallow water lagoons of Scott Reef primarily targeting trepang; and opportunistically gather trochus shells. They also catch fish largely for subsistence purposes although the average fish catch per lete-lete (traditional Indonesian fishing vessel) in 2008 increased to commercial volumes. Although deeper waters are more plentiful in trepang, deep diving is generally not undertaken by the fishers due to the MoU stipulation on the exclusive use of traditional equipment only (Woodside Energy Limited, 2011).

3.7.11 Culturally Significant Marine Species

In consultations with Tiwi Clans for the D&C EP, some Tiwi people emphasised that marine turtles are regarded by Tiwi people as totemic and culturally significant species. Therefore, environmental protection measures for marine turtles are important to Tiwi people.

Information about First Nations cultural beliefs and connection with their sea country, within and adjacent to the D&C EMBA, was provided during First Nations consultation meetings for the D&C EP and also from other information provided by NOPSEMA to Santos. As noted above, NOPSEMA provided Santos with four separate letters from Tiwi clans members to NOPSEMA in April 2022 requesting the statement of reasons for NOPSEMA's decision to accept Revision 3 of the D&C EP (*2022 Statement of Reasons requests*). The 2022 Statement of Reasons requests indicated that Tiwi people also consider fish, dugong and whales to hold cultural significance as totemic species (in addition to marine turtles), and that various marine species are traditional food sources for Tiwi people (refer Section 3.7.10). However, the significance of these species was not raised with Santos in its communal consultation sessions with Tiwi people for any of the Barossa EPs, noting that the Tiwi clan members who sent the 2022 Statement of Reasons Requests attended multiple Tiwi clan consultation sessions for this EP.

The Northern Land Council (NLC) in a submission as part of the consultation for the D&C EP indicated a number of marine species that are significant to Aboriginal dreamings including birds, crocodiles, crows, whales, manta rays, crabs, dugong, sea turtle, gropers, sea-eagles, octopus and other turtles.

The Corrigan 2024 Report also confirmed that Larrakia people identified turtle, dugong, and sting ray dreamings close to Talc Head (within the EMBA) and noting these have significant importance regarding resources and the spiritual dimensions of Larrakia life. Dreamings were identified as being associated with the sea, winds and stars and regarding the moon and the seasons, mermaid dreaming and dreamings near the Charles Point lighthouse. The term dreaming is used throughout the Corrigan 2024 Report to denote knowledge, songs and narratives associated with Aboriginal religious understandings which set out the origins of the social and physical world and expected behaviours within it.

The Corrigan 2024 Report also identified species important for protection including turtles, crocodiles, dugong, dolphins, whales, and the seagrass beds near Kings Table (within the EMBA).

Terrestrial species of cultural significance that do not have habitats along shorelines are outside the EMBA and therefore are not considered further in this EP.

3.7.12 Sea Country Connection

As outlined in Section 3.7.2 , Santos acknowledges that the cultural features of the environment include the circumstance that First Nations people have spiritual connections to a particular place within that environment, or that the place forms part of the country of a First Nations group, in accordance with the traditional laws and customs of that group. As such, the circumstance that an area of the environment is part of the sea country of a First Nations group, to which members of that group have a spiritual connection, is a cultural feature of that area of the environment.

The Australian Marine Parks North-west Marine Parks Network Management Plan 2018 states:

Sea country refers to the areas of the sea that Aboriginal people are particularly affiliated with through their traditional lore and customs. Sea country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years.

The nature of sea country was the subject of extensive lay and expert evidence in the *Munkara* proceeding, to which Santos has had regard in its consideration of cultural features of the environment. Based on this evidence, Santos understands that:

- the concept of country is intimately connected with questions of cultural authority. The First Nations group who is responsible for that area of country has authority to speak in relation to that country and has custodian responsibilities in respect of that country. One group's area of sea country will end where the next group's begins, although groups may share responsibility for particular Dreamings which traverse different areas of country
- sea country connections may manifest in the telling of stories about foundational creation myths explaining features of the landscape or particular species.[21]

In order to identify areas of sea country which may be affected by activities under this EP, Santos has consulted broadly with First Nations groups and representative organisations both in respect of this EP and its other Barossa EPs. Based on this consultation and Santos' review of publicly available information, Santos has identified that EMBA intersects with sea country, although the geographical extent of sea country interests is inherently indeterminate at this time.

[21] *Munkara at [866].*

Features of Sea Country

In the course of consultation on this EP and previous Barossa EPs, some First Nations Relevant Persons provided additional context as to the manifestation of their sea country connection, being particular stories and creation myths which they believe to be present within the EMBA. Santos acknowledges that expressions of sea country connection may be particular to families and individuals within groups and that there is accordingly divergence in the details of such stories within groups. Notwithstanding this, the information provided is summarised below and has been considered by Santos in the preparation of this EP, including with the benefit of expert anthropological advice.

During Croker Island consultation meetings in Darwin, Croker Islanders conveyed their affiliation to their land and sea. They advised that their culture is at the coast and includes everything in the water including the marine life. Some Croker Island people informed Santos during D&C EP consultation about their connections to sea country. Sea country was defined as to the north of Cape Croker out to the deep water (referred to as Inigarrka). Inigarrka is considered the most sacred place in the ocean and the Croker Island people are prohibited from the sacred area.

Dr Corrigan documented a range of views on Tiwi clans connection with sea country and considered claims for several items to be protected in accordance with Tiwi law and custom. This included:

- the travels of the Crocodile Man
- the location and existence of 'Mother Ampitji'
- the travels of Ampitji
- the necessity to look after country in a manner that seeks to ensure no industrial accidents occur which might affect sea country and marine resources (including spiritual connections to the same)
- the Imunka force present in the seas
- the location of a place under the sea where spirits go to upon people's death and then being moved on from the world of the living through Pukamani ceremony.

Tiwi Islanders interviewed by Dr Corrigan about the location of the above items expressed a variety of views. This is supported by the observations and findings of the Court in *Munkara*.[22]

The Court in Munkara reached a similar conclusion on tangible cultural heritage, finding that the evidence was insufficient to show anything other than a negligible chance that there exists one or more objects of archaeological value along the Barossa GEP route. Regarding intangible cultural heritage, the Court found that the evidence before the Court was insufficient to provide that the accounts given by the Applicant's witnesses in relation to Ampitji and the Crocodile Man were broadly representative of a belief held by the relevant people as people that Ampitji and the Crocodile Man extend into the vicinity of the pipeline route, such that the belief would constitute a cultural feature. The Court also found that there was insufficient evidence in relation to Imunka to establish that the belief constituted a cultural feature.

Whilst these conclusions of the Court and Dr Corrigan were made in relation to activities which are covered in a separate Barossa GEP EP, the conclusions are also relevant to this EP.

In its correspondence to Santos of 25 August 2023 in relation to the Barossa D&C EP, NOPSEMA drew Santos' attention to 2 reports provided to NOPSEMA by the EDO on behalf of seven Tiwi Islander clients on 21 July 2023. These EDO GEP Reports related to the Barossa GEP which NOPSEMA said may contain information relevant to the EMBA by the Activity covered by this EP. One of the EDO GEP Reports was prepared by Mr Lewis. The Court in Munkara doubted the rigor of Mr Lewis' anthropological work and ultimately found that his opinions constituted him acting as an advocate rather than assisting the Court to arrive at the correct answer. The other EDO GEP Report was prepared by Dr O'Leary. The Court ultimately placed no weight on this report and dismissed it, along with the subsequent reports prepared by Dr O'Leary, for all purposes.

The EDO GEP Reports claim to provide an assessment of the locations of potential impacts to Indigenous underwater cultural heritage sites along the Barossa GEP Route. While the locations of these claimed sites of significance are partially within the EMBA, the locations and significance of these claimed sites as put forward in the EDO GEP Reports is disputed by the Corrigan 2023 report.

The Corrigan 2023 report included consideration of detailed expert reports on archaeology and sedimentology along the Barossa GEP route conducted by Wessex Archaeology and Dr Posamentier; and the EDO GEP reports. The Corrigan 2023 Report concluded there are no specific underwater cultural heritage places along

[22] *See, e.g., Munkara at [871], [1003], [1011]-[1014], [1027] and [1212].*

the Barossa GEP to which people, in accordance with Indigenous tradition, may have spiritual and cultural connections that may be affected by the Barossa GEP activities. This conclusion also applies to this Activity.

The Corrigan 2023 Report provided the following independent expert comments on the EDO Reports:

- the EDO Reports come to dramatic conclusions about cultural heritage elements in the vicinity of the Barossa GEP which overestimate the consistency of the views of the EDO clients with those held by the wider jural public of the Tiwi Islanders
- some Tiwi Islanders express views consistent with the EDO Reports, but the authors of those reports failed to consider and take account of other alternative expression
- the narratives contained in the EDO Reports are not anything like the narratives described to Dr Corrigan in the interviews he undertook
- the location of mother Ampitji is not agreed by all relevant parties
- Dr O'Leary (the author of one of the EDO Reports) does not mention any qualification he holds for which he might rely upon to undertake detailed and nuanced ethnographic enquiries in the context of a controversial industrial project
- Dr O'Leary incorrectly assumes an accuracy of the advice he received about the location of paleo sub-sea burial places
- the EDO Reports do not correctly identify any specific underwater cultural heritage places along the Barossa GEP Route.

The Corrigan 2024 Report also documents input from Larrakia people and relevant First Nations persons from Belyuen and Wagait, who also advise the presence of a range of ancestral beings and dreaming stories of relevance to the Darwin Harbour, surrounding seas and the DPD project footprint. None of these cultural features are known to be associated with any specific or particular places in the DPD project footprint but rather have a more general association with the wider area, as well as having associations with particular and specific places outside of the DPD project footprint.

During consultation, some First Nations people provided information regarding song lines that run through the area and how information is recorded in the song lines. Song lines are believed to traverse from the bedrock in the land and out to the sea. Queries were raised about protecting the sea life, seabed and cultural values from potential environmental impacts. These were closed out in the information sessions (refer to Table 4-18 (Ngoy Garmak Consultative Committee)).

Spiritual Beings

As part of consultation in developing the Barossa D&C EP, some First Nations Relevant Persons expressed cultural connections with sea country in terms of spiritual beings in the 2022 Statement of Reasons requests.

During Tiwi Clan consultation meetings for the D&C EP, Tiwi people spoke about the importance of their spiritual dreaming which protects the Tiwi Islands from man-made and natural disasters. Santos recognises that some First Nations Relevant Persons fear sickness or other adverse effects from the actions of spiritual beings in response to impacts on the environment of sea country itself. A key Tiwi creation story concerns a spiritual being (or spiritual beings) called Ampitji (sometimes known as a Rainbow Serpent). The Court in *Munkara* considered lay and anthropological evidence about this creation story at [78]-[81], noting that while there was significant divergence in spiritual beliefs concerning Ampitji, it was not disputed that the spiritual belief in one or more Ampitji is a feature of Tiwi spiritual life and that Ampitji may have a role to play in ensuring compliance with Tiwi law.

During Croker Island consultation meetings in Darwin, Croker Islanders conveyed their affiliation to their land and sea. A key Croker Island creation story concerns a spiritual being (or spiritual beings) called Amidj/Umbidj (sometimes known as a Rainbow Serpent) who protects the ocean (north of Inigarrka and to the Tiwi Islands) and Minjilang. According to Minjilang Dreaming, Minjilang (located outside of the EMBA) is the birthplace of the Amidj/Umbidj.

In relation to the GEP EP project footprint, Dr Corrigan concluded that, in accordance with Indigenous tradition, there were no specific UCH places along the Barossa GEP route that may be affected by the activities under the GEP EP: that there are no known sacred sites or some other specific places that are part of well-known sets of ancestral creation stories amongst the Tiwi people (Corrigan 2023). An important outcome of Dr Corrigan's research for the DPD project is that no sacred sites or dreamings are shown to be directly impacted by the proposed DPD project footprint, although this is not to say that some persons do not have fears that this could be the case in the event of an unplanned event (Corrigan, 2024).

Dr Corrigan also identified a constant theme in his interviews with the Tiwi Islanders that Ampitji travel within the waterholes of the Tiwi Islands and surrounding the Tiwi Islands and the crocodile man, Jirukupai, is also

said by some to traverse the seas towards OA2. Dr Corrigan identified that some senior Tiwi people make the point that OA2 is, in their view, a long way away from the Tiwi Islands and that Jirukupai and Ampitji do not go that far into the water (Corrigan 2023).

Santos recognises the importance of cultural and spiritual beliefs to First Nations people. Santos recognises that some First Nations remain concerned about the potential for adverse consequences to First Nations people and the natural environment, that may arise as a result of disturbance from the Barossa Gas Project to spiritual dreaming and culturally important spiritual beings. In this regard, in his report on the DPD project Dr Corrigan identified the following recommendation, as put to him by First Nations people:

"*that Santos consider engaging cultural monitors to provide guidance and advice on the protection and maintenance of the cultural and spiritual places and activities throughout the DPD construction process and that a discussion on this topic be held with the Wickham Point Deed Reference Group in the first instance.*" (Corrigan, 2024)

Dr Corrigan's recommendation is considered further when evaluating impacts and risks to intangible cultural features and adoption of appropriate measures to reduce associated impacts and risks to ALARP and acceptable levels. Santos notes that discussions will not be limited to the Wickham Point Deed Reference Group but will also be held with other First Nations groups. This recommendation, including discussions with First Nations groups, has been captured as a control measure (BAO-CM-004) and associated environmental performance standards and measurement criteria.

Summary of Cultural Features

Cultural features relevant to the Activity as presented in Sections 3.7.3 to 3.7.12 are summarised below in Table 3-20. Table 3-20 provides summary context for the identified cultural features, where the information was sourced and an assessment of relevance to the EMBA or OAs (if known).

Cultural Features aspects presented in Table 3-20 are further assessed in the risk assessment sections (Sections 6 and 7), as applicable. Context for these aspects is described below:

- Cultural Heritage Protected Areas (including Native title, ILUAs, IPAs and land rights) – cultural knowledge and the passing down of cultural education to children can occur from performing of ceremonies and rituals and through dreaming narratives and songlines. Traditional laws and customs amongst a group or groups can define indigenous traditions amongst the group or groups. For example, laws and customs can provide a format for social life and ceremonial matters. The transfer of knowledge of traditional law and customs may be integral to a group's[23] intangible cultural heritage (UNESCO 2003) There may be implications to the transfer of First Nations knowledge if, for example, relevant aspects of the environment disappear. Ongoing observance of First Nations traditional laws and customs can also be recognised through Native Title determinations, and knowledge of and connection with country (land and sea) can be recognised through a range of mechanisms including ILUAs, IPAs and Aboriginal land rights claims.
- Sacred Sites – areas that are traditionally accessed by First Nation people, such as sea country and sacred sites, are important for transferring traditional knowledge and for caring for country. If physical landscapes are altered this could impact the values of sacred sites. Sacred sites and protection of these is a known cultural heritage concern.
- Cultural fishing, hunting and gathering – Through consultation it was identified that a number of marine species provide sustenance to some First Nations people and are obtained through cultural fishing, customary hunting (turtles and dugongs) and gathering (turtle and bird eggs).
- Culturally Significant Marine Species – A range of marine species (such as marine turtles, fish, dugongs, whales, sea-eagle, crocodile and manta rays) were raised during consultation as being important for Aboriginal dreaming, or as having totemic status and significance culturally. First Nations people maintain a continuing spiritual connection with sea country, through caring for sea country and access to cultural food sources.
- Marine Parks – Commonwealth and State Marine Park Management Plans have sought to recognise cultural interests of First Nations groups within Marine Parks, and the sea country value of Marine Parks to First Nations people.
- Sea Country connection through Songlines – Cultural stories and songlines can extend from the shoreline to deep water areas and they tell an important cultural story (Corrigan 2023 and 2024). If spiritual injury occurs from an activity, some First Nation people believe that songlines can be damaged. It is believed

[23] *As noted in Munkara v Santos NA Barossa Pty Ltd (No 3) [2024] FCA 9, this cultural heritage must be held communally by the group, although need not be the subject of consensus.*

that damaging songlines may have the potential to interfere with ability for First Nation people to reproduce cultural knowledge and continue to provide cultural education of their children.

- Sea Country connection through Dreaming sites and stories, and spiritual beings – Some First Nations people believe dreamings relate to powerful creative ancestors who left much of the natural and human world behind them as they travelled (Corrigan 2023 and 2024). It is believed ancestors can travel to areas such as in the water or land below the seas, where these ancestors continue to use these areas. Some First Nations people are of the opinion that if spiritual injury is caused it can damage dreaming tracks. They believe it is their responsibility to look after these dreaming sites to protect the known travels of the spiritual beings. Information provided to Santos by First Nations communities during consultation, also highlighted the importance of cultural spiritual beings, such as Ampitji, as protectors of First Nations communities, and that if spiritual beings are upset or offended it can result in natural disasters or sickness among First Nations communities.

Table 3-20: Summary of cultural features and heritage values

Identified cultural feature	Description	EP Source	OA presence	EMBA presence
Archaeological heritage				
None identified The Corrigan reports (Corrigan, 2023 and 2024) included consideration of other detailed expert reports on archaeology and sedimentology along the Barossa GEP route conducted by Wessex Archaeology and Dr Posamentier; and the EDO GEP reports. The Corrigan Report concluded there are no specific underwater cultural heritage places along the Barossa GEP to which people, in accordance with Indigenous tradition, may have spiritual and cultural connections that may be affected by the Barossa GEP EP activities. These reports, together with further expert evidence on potential archaeological heritage, were considered in *Munkara*, with the Court finding on the basis of this evidence that there was no more than a negligible chance of the existence of sites of archaeological relevance.[24] This conclusion also applies to the approximately 265km portion of the Barossa GEP (NT/PL5) in OA2. During the Last Glacial Maximum, sea level was at its minimum 125 m below the present-day sea level (Wessex, 2023). Areas within the EMBA within the 125 m depth contour, represent the furthest extent of historical human habitation and potential for First Nations underwater cultural heritage. For OA1 and parts of OA2 in water depth greater than 125m, there is no potential for First Nations UCH to exist.				
Tangible values				
Native title	First Nations people have interests in an area of land and/or water according to its traditional laws and customs, as recognised through cultural heritage legal and regulatory frameworks. There are no native title claims or determinations that overlap with the OA; however the EMBA intersects the Croker Island and Larrakia native title determinations (refer to Figure 3-27). The areas of responsibility for regional native title representative bodies that overlap the EMBA as shown in Figure 3-28.	Spatial datasets were downloaded from the National Native Title Tribunal website[25] and consultation identified no native title claims or determinations, ILUAs or IPAs (Section 3.7.3 to 3.7.7). However, areas of responsibility for regional native title representative bodies overlap the EMBA (Section 3.7.3).	No for both OAs	Yes (for Native Title Representative Bodies only)
Indigenous land use agreements	There are no ILUAs within the OA; however the EMBA does overlap the areas of land and tidal waters (between the low water mark and the highwater mark) of the Kenbi and Mary River ILUAs (Figure 3-27).		No for both OAs	Yes
Indigenous protected areas	Three IPAs overlap with the EMBA (Figure 3-27).		No for both OAs	Yes

[24] *Munkara at [1301]-[1302].*

[25] *Source: http://www.nntt.gov.au/assistance/Geospatial/Pages/Spatial-aata.aspx*

Identified cultural feature	Description	EP Source	OA presence	EMBA presence
Sacred Sites	There are no known registered sacred or First Nations UCH sites within the OAs. There are many NT coastal sacred sites along the mainland and island coastlines and potentially the surrounding waters that overlap the EMBA. One registered sacred site and three recorded sacred sites are located on the western coast of Bathurst Island within the EMBA and if physical landscapes are altered this could impact values of sacred sites.	AAPA Authority Certificates (C2022-098 and C2024/034). Consultation feedback and Corrigan 2024 Report including a view of extensive ethnographic studies (Section 3.7.6).	No for both OAs	Yes
Land rights	There is no Aboriginal land either claimed or granted under the ALR Act, or sea closures put into effect in accordance with that Act, that overlap with the OAs. The EMBA does overlap areas of land and tidal waters (between the low water mark and the highwater mark) granted under the ALR Act. This Aboriginal land is held by the Arnhem Land ALT, the Cobourg Peninsula Sanctuary ALT, the Tiwi ALT, the Kenbi ALT, and the Delissaville/ Wagait/ Larrakia ALT.	CoA, 2023b (Section 3.7.7)	No for both OAs	Yes
Marine Parks	The North MPNMP and the North-West MPNMP identify natural, cultural and spiritual values associated with AMP's, specifically the Oceanic Shoals AMP and the Arafura AMP. Cultural fishing, hunting and gathering of marine species is possible although not expected within OA2 given its depth (>50 m) and distance from nearest shoreline (~27 km).	DNP (Director of National Parks) (2018a). North Marine Parks Network Management Plan 2018, Director of National Parks, Canberra. DNP (Director of National Parks) (2018b). North-west Marine Parks Network Management Plan 2018. Canberra.	No for OA1 Yes for OA2 (Oceanic Shoals AMP)	Yes
Cultural fishing, hunting and gathering	Cultural fishing, hunting and gathering of marine species such as fish, shellfish, octopus, worms, turtles, dugongs, turtle and bird eggs occur within the EMBA.	Consultations with Tiwi Clans and Croker Island people for the D&C EP (Section 3.7.10) Corrigan 2024 Report (Corrigan, 2024) and consultation with First Nations people and representative groups (Section 3.7.10)	No for both OAs	Yes
Culturally Significant Marine Species	First Nations persons and groups that have a deep connection with the sea through totems such as marine fauna (marine turtles, whales, dugong) and consider them to be of cultural significance.	2022 Statement of Reasons requests and NLC consultation feedback in relation to the D&C EP (Section 3.7.11). Consultation feedback and Dr Corrigan report (2023 and 2024) including a view of extensive ethnographic studies (Section 3.7.11)	Yes for both OAs	Yes

Identified cultural feature	Description	EP Source	OA presence	EMBA presence
Intangible values				
Sea Country connection through Songlines	Songlines can go from land to sea and were identified as important by the Croker Island and Tiwi Islands people, as well as Larrakia people and other First Nations people's with interests in the Activity EMBA. They ordinarily traverse areas in a manner of travelling from named places to named places.	Consultation feedback and Dr Corrigan report including a view of extensive ethnographic studies (Section 3.7.12)	Possible (spatial extent undefined) for both OAs	Possible (spatial extent undefined)
Sea Country connection through Dreaming sites and stories and spiritual beings	*Dreaming* Minjilang Dreaming, the rainbow serpent sea country is sacred and important to Croker Island people. Dreamings were identified as being associated with the sea, winds and stars and regarding the moon and the seasons, mermaid dreaming and dreamings near the Charles Point lighthouse. A number of marine species are significant to Aboriginal Dreaming such birds, crocodiles, shellfish, whales, manta rays, crabs, dugong, sea turtle, gropers, sea-eagles and octopus.	Consultation feedback and Dr Corrigan reports (2023 and 2024) including a view of extensive ethnographic studies (Section 3.7.12). NLC consultation feedback in relation to the D&C EP (Section 3.7.11).	Possible (spatial extent undefined) for both OAs	Possible (spatial extent undefined)
	Spiritual beings Spiritual beings are important to Croker Island people and Tiwi Island people as well as Larrakia people and other First Nations people's with interests in the Barossa GEP route for their role as protectors of First Nations people and the natural environment. Spiritual beings are believed to be present in the vicinity of the islands.	Consultation feedback and Dr Corrigan reports (2023 and 2024) including a view of extensive ethnographic studies (Section 3.7.12).	Possible (spatial extent undefined) for both OAs	Possible (spatial extent undefined)

4. Consultation

4.1 Consultation background

Santos has undertaken a comprehensive consultation program for the Barossa Gas Project commencing with the initial primary approval (Barossa Area Development Offshore Project Proposal (OPP). Consultation with stakeholders on the OPP occurred during 2017 and included an eight-week public comment period prior to submission of the OPP to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for assessment. Santos notes that the information contained in the *Production Operations Information Booklet*, shared during consultation for this Environment Plan (EP), addresses the same activity scope as relevant to the operations phase of the Barossa Gas Project, that was presented and assessed in the OPP. As such information about the Production Operations activity has been publicly available for over six years.

The OPP was followed by extensive consultation for each of the activity specific EPs and other regulatory approvals prepared for different stages of the Barossa Gas Project.

These have included:

- Barossa Gas Export Pipeline (GEP) Installation EP (including through ConocoPhillips, as previous operator of the Barossa Development) – accepted by NOPSEMA in March 2020.
- Barossa Development Drilling and Completions EP – accepted by NOPSEMA in December 2023.
- The Darwin Pipeline Duplication (DPD) Project within Northern Territory (NT) jurisdiction approved in December 2023 by the NT Minister for Environment, Climate Change and Water Security (EP2022/022-001), on the recommendation of the NT Environmental Protection Authority (EPA).
- Barossa Subsea Infrastructure Installation EP – accepted by NOPSEMA in February 2024.
- DPD Project approval granted in March 2024 under the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) (EPBC 2022/09372).
- DPD Environment Plan – accepted by NOPSEMA in October 2024.
- Barossa DPD Project Coastal Waters Construction Environmental Management Plan - accepted by the NT Department of Mines and Energy (formerly the NT Department of Industry, Tourism and Trade – Energy Division) in November 2024 for construction activities to be undertaken in NT coastal waters only.[26]

Santos has also recently undertaken consultation on activities proposed to be managed under the Bayu-Undan to Darwin Gas Export Pipeline Environment Plan. The Bayu-Undan pipeline transports natural gas from the Bayu-Undan offshore platform in the Timor Sea to Darwin Liquefied Natural Gas (DLNG) facility. The Bayu-Undan Field is approaching end of field life, at which time production will cease at the Bayu-Undan facility. Activities to be managed in the EP are for ongoing operations and preservation activities.

This broader consultation program provides a backdrop to the consultation undertaken for this EP and has supported the development of this EP and other approvals / regulatory submissions related to operation of the GEP outside of Commonwealth waters (as to which, see Table 1-2 above).

For this EP consultation activities were undertaken in three broad phases:

- **Preliminary consultation** including to share consultation information and to allow authorities, persons and organisations opportunities to self-identify as Relevant Persons and directly contacting potential Relevant Persons.
- **Formal consultation** including seeking feedback from Relevant Persons to inform development of this EP.
- **Further consultation** with some authorities, persons and organisations following the formal consultation phase given existing relationships, consultation preferences and standing meeting and consultation arrangements.

Consultation for these activities has been undertaken in compliance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)R) consultation requirements, applicable case law and

[26] Operation of the GEP outside of Commonwealth waters is outside of NOPSEMA's jurisdiction and is addressed in other approvals (as to which, see Table 1-2 above).

applicable guidance (e.g. NOPSEMA guidance issued in May 2023 and subsequent guidance in May 2024 [GL2086 – Consultation in the course of preparing an environment plan]).

A summary report of the consultation carried out under section 25 OPGGS(E)R is included in Section 4.7.

Section 8.4.11 includes Santos' post EP acceptance consultation implementation strategy for activities covered by this EP in accordance with Regulation 22(15) of the OPGGS(E)R.

4.2 Consultation context

Santos has a long history of regional exploration, appraisal and operations offshore and onshore NT to support safe and reliable operation, including ownership and then operation of the Bayu-Undan Gas Project, which commenced operation in 2006. Santos has also undertaken other exploration and appraisal activities in the region.

Gas from the Bayu-Undan field in Timor-Leste offshore waters has been supplied via a 502 km pipeline to DLNG facility, which was the first LNG production facility in the NT and the second in Australia.

Over the Bayu-Undan Project's almost 20-year operating history, operational impacts that are analogous to the operation of facilities at the Barossa field and the Barossa GEP, as well as the ongoing operation of DLNG facility, have been managed by initial Operator Conoco Phillips and subsequently by Santos.

During Santos' time as operator, Santos has consulted a range of regional stakeholders to support environmental approvals for its operations. These consultation activities have provided the bedrock on which to build a comprehensive consultation program for the Barossa Gas Project, having regard to the nature and scale of proposed activities and the potential for Relevant Persons functions, interests and activities to be affected by proposed activities managed under respective EPs, including this EP.

Importantly, during this time, Santos has strengthened and developed relationships with a range of regional stakeholders not only through previous consultation, but also through engagements associated with local employment, training, education and enterprise opportunities central to delivering meaningful and long-lasting contributions in NT and Timor-Leste communities.

These engagements have helped Santos anticipate likely issues of interest or concern among Relevant Persons to inform the consultation process, including, for example development of materials to support consultation for this EP. Similarly, these engagements have provided a strong foundation for Relevant Persons to understand the activities proposed in this EP and environmental impacts and risks that may be associated with those activities, so as to support meaningful consultation for this EP.

4.3 OPGGS(E)R consultation requirements

Table 4-1 and Section 4.3 outline the applicable OPGGS(E)R requirements for consultation with Relevant Persons for this EP.

Table 4-1: Consultation requirements under the OPGGS(E)R

OPGGS(E)R 2023 Requirements
Section 24. Other information in the environment plan
The environment plan must contain the following: b. a report on all consultations under section 25 of any relevant person by the titleholder, that contains: i. a summary of each response made by a relevant person; and ii. an assessment of the merits of any objection or claim about the adverse impact of each activity to which the environment plan relates; and iii. a statement of the titleholder's response, or proposed response, if any, to each objection or claim; and iv. a copy of the full text of any response by a relevant person.
Section 25. Consultation with relevant authorities, persons and organisations, etc
(1) In the course of preparing an environment plan (including a revised environment plan referred to in Division 5) a titleholder must consult each of the following (a ***relevant person***): a. each Commonwealth, State or Northern Territory agency or authority to which the activities to be carried out under the environment plan may be relevant; b. if the plan relates to activities in the offshore area of a State—the Department of the responsible State Minister; c. if the plan relates to activities in the Principal Northern Territory offshore area—the Department of the responsible Northern Territory Minister; d. a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan;

e. any other person or organisation that the titleholder considers relevant. (2) For the purpose of the consultation, the titleholder must give each relevant person sufficient information to allow the relevant person to make an informed assessment of the possible consequences of the activity on the functions, interests or activities of the relevant person. (3) The titleholder must allow a relevant person a reasonable period for the consultation. (4) The titleholder must tell each relevant person the titleholder consults that: a. the relevant person may request that particular information the relevant person provides in the consultation not be published; and b. information subject to such a request is not to be published under this Part.
Section 26. Submission of environment plan
Form of environment plan (8) All sensitive information (if any) in an environment plan, and the full text of any response by a relevant person to consultation under section 25 in the course of preparation of the plan, must be contained in the sensitive information part of the plan and not anywhere else in the plan. Note: Subparagraph 24(b)(iv) requires the plan to contain a copy of the full text of any response by a relevant person to consultation under section 25 in the course of preparation of the plan.
Section 28. Publishing environment plan and associated information
(1) If NOPSEMA's provisional decision under section 27 is that the environment plan includes material apparently addressing all the provisions of Division 2 (Contents of an environment plan), NOPSEMA must publish on NOPSEMA's website as soon as practicable: a. the plan with the sensitive information part removed; and b. the name of the titleholder who submitted the plan; and c. a description of the activity or stage of the activity to which the plan relates; and d. the location of the activity; and e. a link or other reference to the place where the accepted offshore project proposal (if any) is published; and f. details of the titleholder's nominated liaison person for the activity.

4.4 Government and industry guidance

Santos has considered the following NOPSEMA guidance in developing its consultation activities and approach:

- GL2086 – Consultation in the course of preparing an environment plan (EP Consultation Guideline) (NOPSEMA, 2023; 2024a)
- GL1887 – Consultation with Commonwealth agencies with responsibilities in the marine area (NOPSEMA, 2024b)
- GL1721 – Environment plan decision making (NOPSEMA, 2024c)
- GN1344 – Environment plan content requirement (NOPSEMA, 2024d)
- GN1488 – Oil Pollution Risk Management (NOPSEMA, 2021)
- Petroleum activities and Australian Marine Parks: A guidance note to support environmental protection and effective consultation (Australian Government, 2024) jointly released by NOPSEMA and Parks Australia.

Santos has also considered other government and industry guidance, including:

- International Standards Organisation
  - ISO14001:2015 Environmental Management Systems
- Australian Fisheries Management Authority
  - Petroleum industry consultation with the commercial fishing industry
- Australian Heritage Commission
  - Ask First - A guide to respecting Indigenous heritage places and values
- Department of Agriculture, Fisheries and Forestry
  - Fisheries and the Environment – OPGGS Act
  - Offshore Installations–Biosecurity Guide (DAFF, 2023a)
- Department of Climate Change, Energy, the Environment and Water

  - Interim Engaging with First Nations People and Communities on Assessments and Approvals under the *Environment Protection and Biodiversity Conservation Act 1999* (DCCEEW, 2023c)
  - Assessing and Managing Impacts to Underwater Cultural Heritage in Australian Waters: *Guidelines on the application of the Underwater Cultural Heritage Act 2018* (DCCEEW, June 2024)
- Commonwealth Ministerial Council on Mineral and Petroleum Resources
  - Principles for Engagement with Communities and Stakeholders
- International Association for Public Participation
  - Quality Assurance Standard for Community and Stakeholder Engagement
- WA Department of Primary Industries and Regional Development
  - Guidance statement for oil and gas industry consultation with the Department of Fisheries
- WA Department of Transport
  - Offshore Petroleum Industry Guidance Note - Marine Oil Pollution: Response and Consultation Arrangements
  - WA Incident Management Plan Marine Oil Pollution
- Western Australian Fishing Industry Council
  - Commercial Fishing Consultation Framework for the Offshore Oil and Gas Sector - https://www.wafic.org.au/wp-content/uploads/2023/07/Oil-and-Gas-Consultation-Framework.pdf
  - Consultation approach for unplanned events - https://www.wafic.org.au/what-we-do/access-sustainability/oil-gas/consultation-approach-for-unplanned-events/

4.5 Applicable case law and guidance

In addition to considering the regulatory requirements and guidance set out above, in conducting Relevant Person consultation for the activities covered by this EP, Santos has considered the judgments of:

- Justice Bromberg in Tipakalippa v National Offshore Petroleum Safety and Environmental Management Authority (No. 2) [2022] FCA 1121;
- the Full Federal Court in Santos NA Barossa Pty Ltd v Tipakalippa [2022] FCAFC 193 (Appeal Judgement);
- Justice Colvin in Cooper v National Offshore Petroleum Safety and Environmental Management Authority (No 2) [2023] FCA 1158; and
- Justice Charlesworth in Munkara v Santos NA Barossa Pty Ltd (No 3) [2024] FCA 9

The EP Consultation Guideline (NOPSEMA, 2023; 2024a) provides a summary of the Full Federal Court's interpretation of “functions”, “activities” and “interests” referenced in section 25(1)(d) of the OPGGS(E)R, adopted by NOPSEMA to assist in informing who may be a Relevant Person and how Relevant Persons may be identified, as defined in Table 4-2.

Table 4-2: Relevant Person terms and definitions

Term	Interpretation
Functions	Refers to “a power or duty to do something”
Activities	To be read broadly and is broader than the definition of “activity” in section 5 of the OPGGS(E)R and is likely directed to what the Relevant Person is already doing
Interests	To be construed as conforming with the accepted concept of “interest” in other areas of public administrative law. Includes “any interest possessed by an individual whether or not the interest amounts to a legal right or is a proprietary or financial interest or relates to reputation”

Santos has also had regard to the purpose of consultation as outlined in the Appeal Judgment and EP Consultation Guideline (NOPSEMA, 2024a), the emphasis that superficial or tokenistic consultation is not sufficient and that:

- consultation must be appropriate and adapted to the nature of each Relevant Person;
- for each Relevant Person, the appropriate manner and method of consultation (including the nature of information, time periods for consultation and mode of communication) may differ; and

- there is good reason to adopt pragmatic and practical approaches to consultation conducted in accordance with section 25 of the OPGGS(E)R.

4.6 Santos' consultation methodology

4.6.1 Overview

Santos consults to ensure that any activity it is proposing under an EP is carried out in a manner:

- consistent with the principles of ecologically sustainable development set out in section 3A of the EPBC Act; and
- by which the environmental impacts and risks of the Activity will be reduced to low as reasonably practicable (ALARP) and to an acceptable level.

The consultation process is designed to assist Santos to further ascertain, understand and assess values and sensitivities of the environment (including ecosystems, including people and communities, natural and physical resources, the qualities and characteristics of locations, places and areas and the heritage value of places) that may be affected by a proposed activity, and the potential environmental impacts and risks, through information obtained during consultations.

Santos may then refine or change its proposed control measures to address potential environmental impacts and risks of the activity based on that information or any claims or objections raised through consultation.

Santos' consultation methodology and process adopted in developing this EP comprised the following key steps:

- Identifying Relevant Persons, as outlined in Section 4.6.2;
- Implementing a public awareness campaign and providing opportunities for Relevant Persons to identify themselves if they wished to be consulted, as outlined in Section 4.6.4;
- Consultation planning, preliminary consultation and consultation activities, as outlined in Section 4.6.5; and
- Assessing the merits of claims or objections made by Relevant Persons about alleged adverse impacts of each activity to which the EP relates and providing responses to queries, requests and feedback, as summarised in Section 4.7.

As described in Section 3, Santos considered the spatial extent of the environment that may be affected (EMBA) and the particular aspects of the relevant environment as part of its process for identifying Relevant Persons. As the EMBA represents the greatest geographical extent that could be affected by hydrocarbons in the event of a spill scenario (see Section 3.1.1), the EMBA is Santos' starting point in identifying potential Relevant Persons.

Santos notes that there is no reasonable possibility that planned impacts from the Activity (undertaken within Operational Area 1 (OA1) and Operational Area 2 (OA2) will have any consequences on functions, interests or activities concerning areas at the extremities of the EMBA. The only potential consequence for functions, interests or activities concerning these areas is as a result of the risk of an unplanned release of hydrocarbons, described in Section 7.6 and Section 7.7 of this EP. The modelling performed to generate the EMBA and MEVA for this EP, is based on the worst-case scenarios to understand the potential area of influence that could be expected from the worst-case Barossa condensate, MDO, MGO and HFO spill events. The likelihood of an unplanned release is Unlikely for Barossa condensate and MDO, MGO and Remote for Heavy Fuel Oil given the mitigation and management controls in place, and the residual risk is Low.

There is an even lower likelihood of an unplanned hydrocarbon release affecting a person or organisation's functions, interests or activities where these relate to the extremities of the EMBA. This is because there is significant conservatism associated with the EMBA extents given these:

- are determined from the combination of 300 individual modelled spill scenarios across all seasons
- are based on low exposure values (as described in Section 3.1.1) which represent the maximum potential extent of hydrocarbon contact with environmental receptors, and primarily used to inform Santos preparedness for potential spill response; and
- do not take into account any spill response activities by Santos (as described in the Barossa Production Operations Oil Pollution Emergency Plan (OPEP)) which would be implemented in event of a spill and reduce the EMBA extent.

The modelling itself represents the potential extent of detection of a spill in the environment rather than the geographical extent of environmental impact on receptors in the environment. Further, there is no single event that could ever result in the whole EMBA being affected at the same time.

When considering the remote possibility of any major unplanned spill event, and the inherent conservatism of the EMBA, the likelihood of there being persons or organisations along the Northern Australia NT/ Western Australia (WA) coastline having an interest that may be affected by the proposed activities becomes increasingly unlikely with increasing distance from the OAs, where planned activities will occur. By way of example, the outermost boundary of the EMBA is approximately 35km from the WA coastline for the activity covered by this EP, but more than 500km from OA1 at its closest point.

In considering this, while Santos has still identified and consulted with Relevant Persons whose functions, interests or activities may only be affected by unplanned events (the likelihood of which is remote), Relevant Persons identification steps and direct consultation effort has tended to focus more closely on those most proximate to the OAs. By way of example, Santos held multiple consultation sessions with First Nations Relevant Persons most likely to be affected by activity impacts and risks (e.g. Tiwi and Larrakia people), while Santos held single consultation sessions with those First Nations Relevant Persons most likely to be affected by unplanned events only.

Santos' methodology demonstrates a very broad capture of potential Relevant Persons, including providing ample opportunities, as outlined in Section 4.6.4, for Relevant Persons to self-identify and provide input to the development of the EP if they consider they may be impacted by the activities.

4.6.2 Identifying Relevant Persons

Table 4-3 summarises the preliminary steps adopted by Santos to identify Relevant Persons, noting that the identification of Relevant Persons is an iterative process.

Table 4-3: Preliminary identification methodology

Process steps	EP reference
1. Identify the impacts of the planned activities and the risks and impacts of unplanned events.	The activity description is described in Section 2. The impacts from planned activities are described in Section 6. The impacts from unplanned events are described in Section 7.
2. Consider the spatial extent of the EMBA by the Activity impacts and risks.	The spatial extent of the activity EMBA is described in Section 3.1.1.
3. Consider and identify aspects of the environment within the environment that may be affected, having regard to: (a) ecosystems and their constituent parts, including people and communities (b) natural and physical resources (c) the qualities and characteristics of locations, places and areas (d) the heritage value of places (e) the social, economic and cultural features of the matters mentioned in paragraphs (a), (b), (c) and (d).	The existing environment is described in Section 3. Particular aspects of the environment considered in Relevant Person identification are outlined in Table 4-4.
4. Identify Relevant Person categories, having regard to: (a) aspects of the environment identified at Item 3 (b) the departments or agencies of Commonwealth, State and Territory governments that could therefore be relevant (c) the kinds of functions, interests or activities of people or organisations that could therefore be affected (d) submissions received in response to Santos' advertisements asking Relevant Persons to identify themselves if they wished to be consulted (e) any other person or organisation that the titleholder considers relevant. Update during consultation based on new information, if appropriate.	Relevant Person categories considered in Relevant Person identification are outlined in Table 4-5
5. Identify Relevant Persons within Relevant Person categories, having regard to items 1–4 above.	Actions to identify Relevant Persons are outlined in Table 4-6.

Table 4-4 outlines the environmental aspects within the EMBA (described in detail in Section 3). Santos considered these aspects for the purpose of identifying Relevant Person categories.

Table 4-4: Environmental aspects considered for Relevant Person category identification

Aspects of the environment	EP Reference
Provincial bioregions	Section 3
Physical environment	Section 3.
Benthic habitats and communities	Section 3.4.1
Shoreline habitats	Section 3.4.2
Threatened and migratory fauna	Section 3.4.3
Conservation management plans	Section 3.4.4
World Heritage Properties	Section 3.5.1
Wetlands of national and international importance (Ramsar)	Section 3.5.2
Commonwealth heritage places	Section 3.5.3
Marine parks	Section 3.5.4
Key ecological features	Section 3.5.4.4
Biologically important areas and critical habitat	Section 3.5.6
Commercial fisheries	Section 3.6.1
Indonesian and Timorese commercial and subsistence fishing	Section 3.6.2
Energy industry	Section 3.6.3
Telecommunications cables	Section 3.6.4
Defence activities	Section 3.6.5
Shipping	Section 3.6.6
Research activities	Section 3.6.7
Recreation and tourism	Section 3.6.8
Underwater cultural heritage	Section 3.6.9
Cultural features	Section 3.7

Table 4-5 lists the Relevant Person categories following consideration of the environmental aspects.

Table 4-5: Relevant Person categories Environmental aspects considered for Relevant Person category identification

• Section 25(1)(a)(b)(c) of the OPGGS(E)R
• Commonwealth Government agency or authority; • NT Government agency or authority; and • WA Government agency or authority.
• Section 25(1)(d)(e) of the OPGGS(E)R:
• academic and research organisations; • commercial fishing (Commonwealth-managed); • commercial fishing (NT-managed); • commercial fishing (WA-managed); • energy industry titleholders/operators; • environmental conservation organisations; • First Nations people and groups including recognised community reference/liaison groups; • infrastructure operators; • shipping; • industry associations; • local government; • recreational fishing; and • tourism operators.

Table 4-6 outlines actions used by Santos to identify Relevant Persons within those categories.

Table 4-6: Actions for identifying Relevant Persons by category

Relevant Person Category	Actions to identify Relevant Persons
All Relevant Person categories	• Review of relevant regional historical consultation by Santos in the region, including all previous Barossa EPs. • Review of identified Relevant Persons in publicly available EPs submitted by other Titleholders that may be relevant to proposed activities to be managed under this EP. • Reviewing media coverage and associated organisation websites to identify persons and organisations with reasonably ascertainable functions, interests and activities that may be affected by the activities under this EP. • Public awareness campaign as outlined in Section 4.6.4. • Review advice from authorities, consultants and other Relevant Persons as to potential Relevant Persons. • Review of information provided by or claims made by persons claiming to be Relevant Persons or made on behalf of organisations who claimed to be Relevant Persons. • Review of published NOPSEMA guidance relevant to consultation.
Section 25(1)(a) of the OPGGS(E)R	
Commonwealth agency or authority to which the activities to be carried out under the environment plan may be relevant	• Review of government agency websites and directories to understand agency roles, functions and responsibilities. • Review government agency guidance on consultation expectations.
Section 25(1)(b) and (c) of the OPGGS(E)R	
State and Territory Departments/Agencies	• Review of government agency websites and directories to understand agency roles, functions and responsibilities. • Review government agency guidance on consultation expectations.
Section 25(1)(d) and (e) of the OPGGS(E)R	
Academic and research organisations	• Conducting key-word searches of publicly available online search engines, review media coverage and review organisation websites to identify organisations with reasonably ascertainable functions, interests or activities that may be affected, having regard to the region, activities or risks/impacts under this EP.
Commercial fishing	• Review of Commonwealth, NT and WA Government commercial fishing catch and effort data. • Review of fisheries entitled to fish in the EMBA.
Energy industry	• Review of EMBA overlap with petroleum, greenhouse gas and any other National Offshore Petroleum Titles Administrator (NOPTA) issued titles.
Environmental conservation organisations	• Conducting key-word searches of publicly available online search engines, review media coverage and review organisation websites to identify organisations with reasonably ascertainable functions, interests or activities that may be affected, having regard to the region, activities or risks/impacts under this EP.
First Nations people and groups including recognised community reference/liaison groups	• Review of the Judgment and the Appeal Judgment. • Review of EMBA overlap with Native Title determined areas and claims, Indigenous land use agreements (ILUAs), land rights and Indigenous Protected Areas (IPAs). • Review of Representative Aboriginal/Torres Strait Island Bodies (RATSIBs) and Native Title Representative Bodies (NTRBs) on Native Title website. • Review of Prescribed Bodies Corporate on Native Title website, where relevant. • Conducting searches of public cultural heritage databases relevant to the EMBA. • Review of marine park management plans relevant to the EMBA.

Relevant Person Category	Actions to identify Relevant Persons
	• Engagement with government departments/agencies with relevant knowledge or relevant responsibilities. • Engagement with representative bodies under the *Native Title Act 1993* (NT Act) and the *Aboriginal Land Rights (Northern Territory) Act 1976* (ALR Act). • Engagement with other representative organisations in areas of potential relevance to Barossa Project activities such as liaison committees and First Nations Consultative Committees (FNCCs). • Engagement with other First Nations organisations that may support specific interests of First Nations people, such as economic development. • Engagement with third party consultants to assist with identification of potential First Nations Relevant Persons.
Infrastructure operators	• Review of EMBA overlap with offshore and onshore infrastructure, such as submarine telecommunications cables or ports.
Industry associations	• Review of industry representation of the following Relevant Person groups: • commercial fishing • local industry • shipping • recreational fishing • tourism operators.
Local government	• Review of EMBA overlap with boundaries of local government areas.
Recreational fishing	• Review of EMBA overlap with areas of interest to recreational fishing. • Review of potential presence of recreational fishing club members in the EMBA. • Review of website information of relevant agencies/organisations that represent recreational fishing interests.
Tourism operators	• Review of EMBA overlap with areas of interest to charter and tourism operators. • Review of potential presence in the EMBA. • Conducting key-word searches using online search engines and review of website information of relevant operators/organisations that represent commercial tourism interests with reasonably ascertainable functions, interests and activities that may be affected by the activities under this EP.

4.6.2.1 Identification of First Nations people and groups

Santos has developed a comprehensive process for identifying First Nations Relevant Persons.

As with Santos' process for identifying Relevant Persons generally, this is an iterative process with multiple avenues of enquiry including, but not limited to, the following actions:

- Consideration of known cultural features of the environment;
- Active steps to identify First Nations people and groups as per actions outlined in Table 4-6, and further described below, directed to identifying First Nations Relevant Persons with functions, interests or activities that may be affected;
- Asking identified Relevant Persons if there are other persons or organisations who may be a Relevant Person; and
- Advertising broadly to ensure that Relevant Persons that are not otherwise identified by Santos' examination of the EMBA are given the opportunity to self-identify.

Santos' process involved engaging a third party consultant to assist Santos in identifying First Nations groups, clans and/or organisations along the NT/WA coastline in the vicinity of the EMBA.

In order to positively identify First Nations Relevant Persons Santos considered the following questions, based on information gathered when taking the steps described in Table 46:

- Do any First Nations groups, clans and/or organisations along the NT/WA coastline in the vicinity of the EMBA have any native title claims pending[27] or determined, or any ILUA, that extend offshore and cross into the EMBA?
- Do any First Nations groups, clans and/or organisations along the NT/WA coastline in the vicinity of the EMBA have any reasonably ascertainable responsibilities for sacred sites that extend offshore and cross into the EMBA (recognised and protected under the ALR Act, the *Northern Territory Aboriginal Sacred Sites Act 1989* (NTASS Act), the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (ATSIHP Act), the Underwater Cultural Heritage Act (UCH Act), or the EPBC Act)?
- Do any First Nations groups, clans and/or organisations along the NT/WA coastline in the vicinity of the EMBA have any land rights (apart from native title claims) pending or determined that extend offshore and cross into the EMBA?
- Are there any IPAs that extend offshore and cross into the EMBA?

If the answer to any of the above questions was affirmative, this resulted in identification of the particular First Nations group, clan or organisation as a Relevant Person.

Santos recognises that not all relevant functions, interests or activities of First Nations persons or groups will be identified through the four steps above, and that even if the answer to all four of the above questions is negative, First Nations groups in the vicinity of the EMBA could still potentially have communal cultural interests (such as connection to sea country) that extend into the EMBA.

As is the case for determining whether any person's or organisation's functions, interests or activities may be affected, the context for how the spatial extent of the EMBA is determined is also relevant when evaluating whether any First Nations sea country or other interests could potentially be affected by the activity. In the case of this EP, the EMBA is informed by modelling the maximum potential extent of all major unplanned spill events under all seasonal conditions as further explained in Section 3.1.1.

Having regard to the residual potential for other cultural interests within the EMBA, Santos supplemented its consideration of the four questions above by:

- the completion of the other First Nations Relevant Persons identification steps (see Table 4-6);
- making sustained efforts to engage and build relationships with identified NTRBs and PBCs/RNTBCs through a range of appropriate communication methods;
- inviting information from identified First Nations Relevant Persons as to other potential First Nations Relevant Persons; and
- conducting a public awareness and advertising campaign targeted at increasing awareness of the Barossa Gas Project and the activities proposed in this EP; and encouraging any persons or organisations who consider they have functions, interests or activities that may be affected by the activities in this EP to contact Santos (see Section 4.6.4).

These steps were carried out to further inform Santos' identification of First Nations people or groups with reasonably ascertainable functions, interests or activities that may be affected by the activities to be carried out under this EP. Santos proceeded to consult with a number of First Nations groups identified through the above processes as potential Relevant Persons, with a view to ascertaining during consultation sessions what, if any, functions, interests or activities they had that may be affected by the activities proposed in this EP. Santos has taken a broad approach and considers that these First Nations people or groups are Relevant Persons for the purposes of consultation on this EP (and therefore they have been included in Table 4-9 and Table 4-19) notwithstanding that in some cases, no potentially affected functions, interests or activities were ultimately ascertained.

Santos was not directed to any other First Nations groups or organisations (other than those Santos had identified) in response to Santos' invitation in its consultation materials for Relevant Persons to notify Santos of other potentially Relevant Persons for Santos to consider consulting about this EP.

Santos utilised the public awareness campaign outlined in Section 4.6.4 to assist in identification of other First Nations groups with interests (such as connection with sea country) that may be affected by the Activity, that weren't identified through other identification steps described above and in Table 4-6.

While Santos recognises that the obligation to identify Relevant Persons lies on the titleholder, and titleholders cannot rely solely on a process of public notification and self-identification, Santos considers its public awareness campaign to be an appropriate and sufficient measure to promote comprehensive identification of First Nations (and other) Relevant Persons, particularly having regard to the remoteness of the activity, the remote possibility of

[27] *meaning registered claims that are yet to be determined.*

a major unplanned spill event, the inherent conservatism in spill modelling used to inform the EMBA and the difficulty in ascertaining whose functions, interests or activities may be affected in remote offshore waters.

4.6.3 International persons

With regard to the location of the proposed activities, there are no impacts from planned activities that may affect the functions, interests or activities of international Relevant Persons (see Section 5).

However, the worst-case credible spill scenario modelled for this EP indicates a possibility that the Indonesian and Timor-Leste coastline could be in contact with residual entrained hydrocarbons.

As stated in Section 4.6.1 there is significant conservatism associated with the depiction of the EMBA based on low exposure values that Santos has applied, and especially given the modelling process (Section 3.1.1) which combines a large number of individual unmitigated spill simulations and the low likelihood of occurrence given the planned engineering prevention measures (Section 7.6 and Section 7.7).

In addition, the modelling at low exposure values is primarily used to inform Santos' preparedness for potential spill response and does not take into account the suite of mitigations described in the Barossa Production Operations OPEP that would be implemented and reduce the EMBA extent in the unlikely event of a spill.

Santos also acknowledges the judicial guidance outlined at Section 4.5 above, including that Relevant Persons must be "reasonably capable of ascertainment". Santos further acknowledges the judicial guidance that there is good reason to adopt practical and pragmatic approaches to consultation and that the requirements of Section 25 must be capable of being complied with within a reasonable time.[28]

Santos therefore sought to reasonably ascertain international Relevant Persons in a manner proportionate to the remote likelihood of any effect on the functions, interests or activities of international persons or organisations from a worst-case unmitigated spill. This involved the following steps:

- Conducting key-word searches of publicly available online search engines and review organisation websites to identify environmental conservation organisations with reasonably ascertainable functions, interests or activities that may be affected, having regard to the region, activities or risks/impacts under this EP.
- Writing to international persons or organisations that had self-nominated for consultation in respect of previous Barossa Gas Project EPs to:
    - afford them a direct opportunity to self-nominate for consultation for this EP and to indicate what functions, interests or activities that have or that may be affected by the activities proposed in this EP
    - invite them to nominate any other persons or organisations they considered Santos should consider consulting.
- Advertising on social media platforms Facebook, Instagram and Messenger, geotargeting Indonesia and Timor-Leste (during March 2024), inviting Relevant Persons to contact Santos to self-nominate. This was in addition to the general widespread media and advertising campaign (see Table 4-7 and Table 4-8). Both the international and the domestic advertisements contained links to Santos' website with Production Operations consultation information that included information about activities the subject of this EP and a form for self-nomination as a potential Relevant Person. There were no further persons or organisations that self-nominated following the international advertising campaign.

Santos also consulted the Department of Foreign Affairs and Trade (DFAT) which has a function in coordinating and facilitating communication between Australia and the Indonesian or Timor-Leste governments.

During consultation with DFAT, DFAT's Timor-Leste desk recommended consultation with the Government of Timor-Leste on Santos' Environment Plan given the proximity of Santos' operations to the territory of Timor-Leste and that the appropriate authority for such consultation is the Autoridade Nacional Do Petróleo (ANP - National Petroleum Authority). Santos proceeded to consult with the ANP accordingly.

DFAT's Indonesia Branch had no comments on the EP and offered advice that should Santos wish to consult with the Indonesian Government, the Indonesian Embassy in Canberra should be contacted in the first instance. As Santos has assessed there to be no Activity impacts or risks to internationally held functions, interests or activities, the only matter in respect of which consultation with Indonesian and Timor-Leste persons or organisations might be required is in relation to a hydrocarbon spill that reaches Indonesian or Timor-Leste waters.

With the exception of ANP, no other Indonesian or Timor-Leste government person or organisation has been identified as having reasonably ascertainable functions, interests or activities that may be affected by the Activity.

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[28] *Santos NA Barossa Pty Ltd v Tipakalippa [2022] FCAFC 193 at [88] (per Kenny and Mortimer JJ) and at [136] (per Lee J).*

Santos understands that in the unlikely event of a hydrocarbon spill, communication about such matters is to occur at a State-to-State level, in addition to Santos' notifications to the ANP.

Under the National Plan for maritime environmental emergencies (AMSA, 2020) Australia has entered into mutual aid arrangements and associated cooperation agreements with other countries impacted by maritime environmental emergencies. In this regard, Australian has entered into a bilateral agreement with Indonesia, and a Maritime Boundaries Treaty with Timor-Leste. Any relevant affected government authorities of Indonesia or Timor-Leste would be identified and notified through the domestic arrangements of that State, at a State-to-State level.

Having regard to the above, Santos considered that no further steps were reasonably required to identify international Relevant Persons.

4.6.4 Public awareness campaign and self-identification opportunities

In addition to undertaking the process for identification of potential Relevant Persons, as described above, Santos has undertaken a range of activities to promote opportunities for other organisations or individuals to self-identify as potential Relevant Persons if they considered that their functions, interests or activities may be affected.

These promotional activities included a public information campaign using a range of appropriate media, including, radio, print media, targeted social media and drop-in sessions where information about the proposed activities is provided. Drop-in sessions were provided for Darwin community members from 26-28 March 2024 and were supported by advertising in the 23 March 2024 edition of the NT News.

Details of the public information campaign for this EP are described in Table 4-7 and a detailed advertising schedule is described in Table 4-8. In addition, Santos also made additional efforts to promote awareness of the consultation process among First Nations communities considered most likely to have functions, interests or activities that may be affected by the Activity. Such additional efforts are described in Table 4-10. Santos also has an online self-nomination form on its Consultation Hub website, where consultation materials are published and available for download.

The media and advertising campaign had a regional focus, noting the remoteness of First Nations and other communities in Northern Australia. Social media and/or radio advertising were seen as useful tools to raise awareness in First Nations communities about the proposed Activity and associated consultation opportunities and to invite potentially affected persons to contact Santos.

Further, Santos' third-party consultants and supporting cultural advisors, comprising a team of First Nations leaders with extensive knowledge and experience in relation to First Nations cultures of Northern Australia, were active in raising awareness and opportunities for participation in consultation through activities to support the establishment of First Nations Consultative Committees. See Section 4.6.5.1.4.

Such activities provide a more than reasonable opportunity for organisations and individuals to self-identify as a Relevant Person for the purpose of OPGGS(E)R section 25 consultation, where they consider themselves to have interests, functions or activities that may be affected by the planned activities and for Relevant Persons to provide their input.

In addition to the above opportunities, Santos also wrote to a number of persons and organisations, of whom Santos was aware and considered to be potential Relevant Persons, where it was unclear what, if any, functions, interests or activities the person or organisation had that may be affected by the activities under this EP. Santos shared links to the Barossa Production Operations Information Booklet and invited these persons or organisations to respond confirming if and what functions, interests or activities they had that may be affected by the activities in this EP in order for Santos to ascertain them as Relevant Persons and consult them accordingly.

Potential Relevant Persons who did not respond to the opportunity provided them to self-identify in the initial email of 9 February 2024, were still included by Santos in the second email on 11 March 2024 advising the formal commencement of the four-week consultation period. Once again, any who did not respond were followed up by Santos via phone and/or email in May and still afforded an opportunity to respond during an additional two-week consultation phase in May 2024.[29]

Santos' process includes opportunities for the self-identification or nomination of others as Relevant Persons, having regard to consultation information and materials shared directly to known and potential Relevant Persons, and/or indirectly during Santos' public awareness campaign.

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[29] *In some cases, persons or organisations identified at later stages in the consultation process were contacted by email outside the above timeframes, to inform them about the consultation for this EP, and share information about the EP activity and associated environmental impacts and risks. Such persons or organisations were invited to indicate to Santos if they considered themselves to be a person (or organisation) whose functions, interests or activities may be affected by the activities proposed to be carried out under this EP; and, if so, the nature of those potentially affected functions, interests or activities; and to indicate if they wish to be consulted further for this EP.*

Table 4-7: Public awareness campaign overview

Preliminary Consultation		
Website: Website content and consultation materials developed and made available at: https://www.santos.com/offshoreconsultation/	Provide the public with: • Information about Santos' consultation obligations and approach. • Descriptions of proposed activities, including potential activity impacts and risks, and proposed management measures. • Contact details to enable Relevant Persons to provide feedback. • Information about how to self-identify as a Relevant Person, including an on-line nomination form. • Details about how feedback will be managed, including provision of Santos' offshore WA and NT privacy notice.	From 9 February 2024
Advertising: Advertisements in the following publications: • The Australian • The West Australian • NT News • Broome Advertiser • Kimberley Echo • Social media • Advertisements on the following radio stations: Darwin Hot 100	Promote awareness of proposed activities and invite Relevant Persons to self-identify.	From 28 January to 8 June 2024
Consultation materials: Email to identified/potential Relevant Persons with a link to the consultation materials for this EP	Provide Relevant Persons with details on proposed Activities, including potential activity impacts and risks, and proposed management measures, and establish consultation expectations.	From 9 February to 2 May 2024
One-to-one meetings: Meetings held with authorities, persons and organisations		February to July 2024
Consultation		
Consultation email: Email to identified Relevant Persons and potential Relevant Persons advising of the commencement of the formal consultation period	Reminder to Santos' identified Relevant Persons and potential Relevant Persons of the commencement and closing dates for the formal consultation period.	From 11 March 2024
Advertising: Advertisements in the following publications: • The West Australian • The Australian • NT News • Advertisements on the following radio stations: • Hit 101.3 Broome • Darwin Mix 104.9 • Darwin Hot 100 • Pilbara and Kimberley Aboriginal Media Radio	Promote awareness of proposed Activities and seek feedback from Relevant Persons.	From 11 March 2024
Consultation email:	Reminder to Santos identified Relevant Persons and potential	From 3 April 2024

Preliminary Consultation		
Reminder email to identified Relevant Persons and potential Relevant Persons advising pending closure of consultation period	Relevant Persons of the closing dates for consultation.	
Consultation email: Email to identified Relevant Persons and potential Relevant Persons advising of extension of consultation period.	Advice to Santos identified Relevant Persons and potential Relevant Persons of the new closing date for consultation.	From 7 May 2024
Online meetings	Discussions with Relevant Persons who requested an online meeting.	March to July 2024
Community drop-in sessions	Opportunities for Darwin community members to learn more about the Barossa Gas Project.	26-28 March 2024
Meetings (in-person)	Provide Relevant Persons with information about this EP and discussions with Relevant Persons regarding this information.	March to July 2024

Table 4-8: Targeted advertising campaign details

Publication date	Advertising type	Towns / Communities	Reach
Preliminary consultation			
March 2024	Social Media post	Facebook, Instagram and Messenger	Geotargeted – Darwin, Tiwi Island, Indonesia and Timor-Leste
January - February 2024	Radio ad - Darwin Hot 100	Darwin towns and communities, focusing on remote communities	Ad aired 28 times
17 February 2024	Press ad NT News	Half page, page 11	Targeted NT with reach of 25,000
17 February 2024	Press ad, The West Australian	Half page, page 11	Targeted WA with reach of 481,000
24 February 2024	Press ad NT News	Half page, page 7	Targeted NT with reach of 25,000
28 February 2024	Press ad NT News	Half page, page 4	Targeted NT with reach of 25,000
1 March 2024	Press ad NT News	Half page, page 12	Targeted NT with reach of 25,000
1 March 2024	Press ad The Australian	Half page, page 6	Targeted WA with reach of 398,000
2 March 2024	Press ad, The West Australian	Half page, page 11	Targeted WA with reach of 481,000
7 March 2024	Press ad Broome Advertiser	Half page, page 7	Targeted WA with reach of 14,000
7 March 2024	Press ad Kimberley Echo	Half page, page 5	Targeted WA with reach of 450
9 March 2024	Press ad NT News	Half page, page 14	Targeted NT with reach of 25,000
Consultation			
March-April 2024	Radio ad - Hit 101.3 Broome	Broome towns and communities, focusing on remote communities	Ad aired 28 times
March-April2024	Radio ad - Darwin Mix 1049	Darwin towns and communities, focusing on remote communities	Ad aired 56 times
March – April 2024	Radio ad - Darwin Hot 100	Darwin towns and communities, focusing on remote communities	Ad aired 48 times

Publication date	Advertising type	Towns / Communities	Reach
Preliminary consultation			
March – April 2024	Radio ad - Pilbara and Kimberley Aboriginal Media Radio	Pilbara and Kimberley towns and communities, focusing on remote communities	Ad aired 28 times
16 March 2024	Press ad NT News	Half page, page 18	Targeted NT with reach of 25,000
16 March 2024	Press ad, The West Australian	Half page, page 11	Targeted WA with reach of 481,000
23 March 2024	Press ad NT News	Half page, page 4	Targeted NT with reach of 25,000
27 March 2024	Press ad NT News	Half page, page 9	Targeted NT with reach of 25,000
Public Notice			
23 March 2024	Press ad NT News	Quarter page, page 5	Targeted NT with reach of 25,000

Relevant Persons consulted for this EP are listed in Table 4-9.

Table 4-9: Summary of Relevant Persons

Relevant Person Category	Summary of Relevance
Section 25(1)(a) of the OPGGS(E)R: Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant	
Australian Communications and Media Authority (ACMA)	ACMA is responsible for the regulation of communications and media services in Australia. ACMA is a relevant agency because the Activity has the potential to impact future proposed subsea communications cable installations.
Australian Fisheries Management Authority (AFMA)	AFMA is responsible for managing Commonwealth fisheries and is a relevant agency because the Activity has the potential to impact on fisheries resources in AFMA managed fisheries. AFMA expects petroleum operators to consult directly with fishing operators about all activities and projects which may affect day to day fishing activities. AFMA also provides industry association contacts for petroleum operators to use when consultation with fishing operators is required.
Australian Hydrographic Office (AHO)	AHO is responsible for maintaining and disseminating nautical charts, including the distribution of Notices to Mariners.
Australian Institute of Marine Science (AIMS)	AIMS is Australia's tropical marine research agency and is established under the *Australian Institute of Marine Science Act 1972* (AIMS Act).
Australian Maritime Safety Authority (AMSA) – maritime safety/marine pollution	AMSA is the statutory and control agency for maritime safety and vessel emergencies in Commonwealth Waters. AMSA is a relevant agency because the proposed offshore activities may impact on the safe navigation of commercial shipping in Australian waters. AMSA is also a relevant agency as one of its functions is to prevent and combat ship-sourced pollution in the marine environment.
Clean Energy Regulator (CER)	CER administers schemes legislated by the Australian Government for measuring, managing, reducing or offsetting Australia's carbon emissions, including the National Greenhouse and Energy Reporting (NGER) Scheme and the Safeguard Mechanism underpinned by the NGER framework.
Climate Change Authority (CCA)	CCA is a statutory agency responsible for providing independent advice to government on climate change policy. It was established by and operates under the *Climate Change Authority Act 2011*.
Commonwealth Science and Industry Research Organisation (CSIRO)	CSIRO's functions include international scientific liaison, training of research workers, publication of research results, technology transfer of other research, provision of scientific services and dissemination of information about science and technology. CSIRO has a division dedicated to oceans and atmosphere research.
Department of Agriculture, Forestry and Fisheries (DAFF) – Biosecurity	DAFF Biosecurity administers the *Biosecurity Act 2015* (Cth). DAFF Biosecurity is a relevant agency for consultation because the Activity involves the movement of aircraft or vessels between Australia and offshore petroleum activities either inside or outside Australian territory.
Department of Agriculture, Forestry and Fisheries (DAFF) – Fisheries	DAFF Fisheries also has primary policy responsibility for promoting the biological, economic and social sustainability of Australian fisheries. DAFF Fisheries is a relevant agency for consultation because the Activity has the potential to impact on fishing operations and/or fishing habitats in Commonwealth waters.
Department of Climate Change, Energy, the Environment and Water (DCCEEW) – Underwater Cultural Heritage	DCCEEW protects Australia's natural environment and heritage sites, helps Australia respond to climate change and carefully manages water and energy resources. The Underwater Cultural Heritage branch at DCCEEW is responsible for administering the UCH Act.

Relevant Person Category	Summary of Relevance
Department of Defence (DoD)	DoD is a relevant agency for consultation because: • the proposed Activity may impact DoD training and operational requirements, in that the EMBA overlaps DoD training areas. • the proposed Activity encroaches on known training areas and/or restricted airspace. • there is a risk of unexploded ordnance in the area where the Activity is taking place.
Department of Foreign Affairs and Trade (DFAT)	DFAT is a relevant agency for consultation where: • a proposed activity may cross into or impact on waters outside of Australia's maritime jurisdiction; and/or • a proposed activity poses any oil spill or other environmental risks that could result in impacts to other international jurisdictions where persons or organisations that may be impacted by a proposed activity include foreign individuals or governments. DFAT has a role in assisting Oil and Gas operators to liaise with foreign governments in the event waters outside Australian jurisdiction are impacted by an activity.
Department of Home Affairs and Australian Border Force (ABF)	The Department of Home Affairs is responsible for overseeing migration, national security and resilience, and border-related functions. ABF is an operationally independent body within the Home Affairs portfolio. ABF is Australia's border law enforcement agency and customs service. ABF's vessels undertake patrols as part of its surveillance and response activities throughout an offshore maritime area of almost 45.1 million km^2. This area includes the EMBA.
Department of Industry, Science and Resources (DISR)	DISR is a relevant agency for consultation because its responsibilities include offshore oil and gas development and safety and greenhouse gas (GHG) storage.
Director of National Parks (DNP)	DNP is the statutory authority responsible for administration, management and control of Commonwealth marine reserves. The DNP is a Relevant Person for consultation where: • the Activity or part of the Activity is within the boundaries of a proclaimed Commonwealth marine reserve; • activities proposed to occur outside a reserve may impact on the values within a Commonwealth marine reserve; and / or • an environmental incident occurs in Commonwealth waters surrounding a Commonwealth marine reserve and may impact on the values within the reserve.
Fisheries Research Development Council (FRDC)	FRDC has a formal role in the planning and investment in fisheries research and development to support the ongoing sustainability of aquatic sectors and aquatic ecosystems. It is a co-funded partnership between the Australian Government and fisheries and aquaculture and a statutory corporation under the *Primary Industries Research and Development Act 1989* (Cth) responsible to the Minister for Agriculture, Fisheries and Forestry.
National Indigenous Australians Agency (NIAA)	NIAA is an Australian Government agency responsible for whole-of-government coordination of policy development, program design and service delivery for Indigenous Australians.
Section 25(1)(b) of the OPGGS(E)R: Departments or agencies of the Northern Territory to which the activities to be carried out under the environment plan may be relevant.	
Aboriginal Areas Protection Authority (AAPA)	The AAPA supports development while safeguarding Aboriginal sacred sites. Under the NTASS Act, the AAPA is responsible for overseeing the protection of Aboriginal sacred sites on land and sea across the whole of the NT. The NTASS Act also gives the Authority the power to prosecute people and organisations that damage sacred sites.

Relevant Person Category	Summary of Relevance
Darwin Harbour Advisory Committee (DHAC)	The DHAC provides advice to the NT Government through the Minister for Environment, Parks and Water Security on the effective management of Darwin Harbour and its catchment.
Department of Lands, Planning and the Environment (DLPE) (formerly the Department of Environment, Parks and Water Security (NT) during the initial consultation period for this EP (DEPWS NT).	DEPWS NT combines the functions of the previous Department of Environment and Natural Resources and the Parks and Wildlife Commission from the former Department of Tourism, Sport and Culture (DTSC). The government established the department to combine many of the key functions that foster and protect the environment and natural resources in the NT. This includes water, land resource management, environmental issues and the parks and wildlife functions.
Department of Agriculture and Fisheries (DAF) (formerly the Department of Industry, Tourism and Trade (NT) – Fisheries Division during the initial consultation period for this EP (DITT_NT - Fisheries).	DITT NT Fisheries Division has functions in relation to NT managed fisheries. The OAs overlap NT managed fisheries. The Aquatic Biosecurity Unit of Northern Territory Fisheries monitors and manages the risk of new marine pests arriving in the NT. The unit monitors for early detection of aquatic pests; coordinates inspections and treatment of high-risk vessels entering Darwin; responds to reported sightings of invasive freshwater and marine pests; and educates the public about the impacts, prevention and management of aquatic pests. The Department also operates the Darwin Aquaculture Centre, the NT Government's key aquaculture research and development facility.
Department of Logistics and Infrastructure (DLI) (formerly the Department of Infrastructure, Planning and Logistics (NT) – Transport and Civil during the initial consultation period for this EP (DIPL-NT).	DIPL NT Transport is responsible for all aspects of marine transport in NT waters, including the Port of Darwin which will continue to be the supply base for Barossa offshore activities.
Department of Lands, Planning and the Environment (DLI) (formerly the Department of Territory Families, Housing and Communities (NT) – Heritage branch during the initial consultation period for this EP.(DTFHC NT Heritage)	The DTFHC NT Heritage branch has a role in protecting the maritime heritage of the Northern Territory. Multiple known shipwrecks, sunken aircraft, and historic (more than 75 years old) aircraft and shipwrecks and other sites occur within the EMBA. There are multiple sites protected under Commonwealth Underwater Cultural Heritage Act 2018 and NT Heritage Act 2011.
Environmental Protection Authority NT (EPA NT)	The EPA NT is an independent authority established under the *NT Environment Protection Authority Act 2012*. The EPA NT approves conditions for the DPD in NT Waters and can amend these at any time. Water quality and other environmental aspects of Darwin Harbour and NT waters could be impacted in the event of an unplanned hydrocarbon spill.
NT Fire and Emergency Services (formerly Department of Police, Fire and Emergency Services during the consultation period for this EP.	The Department would be involved in response measures in the event of a spill in NT Waters.
Parks and Wildlife Commission of the Northern Territory	Parks and Wildlife Commission of the Northern Territory is the NT Government agency responsible for tasks including the establishment, management and protection of parks, reserves, sanctuaries and other land, and the protection, conservation and sustainable use of wildlife.
Department of Tourism and Hospitality (DTH) (formerly Tourism NT during the initial consultation period for this EP. (Tourism NT)	Tourism NT is the government statutory authority responsible for promoting tourism in the NT, including potential activity by NT based operators in the EMBA.
Section 25(1)(b) of the OPGGS€R: Departments or agencies of Western Australia to which the activities to be carried out under the environment plan may be relevant.	
Department of Biodiversity, Conservation and Attractions Western Australia (DBCA WA)	DBCA WA has functions in relation to the protection of Western Australian flora and fauna, including in relation to the Scott Reef Reserve (which is in WA waters) and works in tandem with Department of Primary Industries and Regional Development (DPIRD) to promote biodiversity and conservation with an interest in sustainable management of species and ecosystems.

Relevant Person Category	Summary of Relevance
Department of Primary Industries and Regional Development (DPIRD) – Fisheries	DPIRD-WA is responsible for managing West Australian fisheries. Several WA-managed commercial fisheries' zones extend beyond WA Waters and into Commonwealth Waters of the EMBA.
Department of Transport Western Australia (DoT WA)	DoT WA has functions in relation to commercial vessel movements in the navigable waters of the State and seas adjacent to WA. Its interests extend to response to an unplanned spill event through its Maritime Environmental Emergency Response unit.
Kimberley Ports Authority	The Authority is responsible for the safe and efficient operation of the port and to protect the environment in which the port operates.
WA Marine Science Institution (WAMSI)	WAMSI is a government consortium of state, government and academic organisations working collaboratively for promotion of science research.
Section 25(1)(c) of the OPGGS(E)R: Department of the responsible Northern Territory Minister.	
Department of Mining and Energy (DME) (formerly the NT Department of Industry, Tourism and Trade– Mines and Energy (DITT-NT – Energy) during the initial consultation period for this EP.(DITT-NT – Energy)	DITT-NT Energy is the department of the responsible Territory Minister and is required to be consulted under regulation 25(1)(c) of the OPGGS(E)R.
Section 25(1)(d) of the OPGGS(E)R: Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan	
Academic and Research Organisations	
Arafura Timor Research Facility (ATRF)	ATRF is a joint venture between AIMS and the Australian National University. It was developed through a successful Major National Research Facilities grant application with support from the NT government and Charles Darwin University. The facility was established to accommodate world class research into marine and coastal ecosystems of the Arafura and Timor seas and to explore the increasing threats to Australia's fisheries and marine biodiversity in the region. A wide range of research activities are being processed.
Australian Marine Sciences Association – NT (AMSA-NT)	AMSA-NT is a professional body for marine scientists, with a branch in the NT. Its listed interests and stated activities include promoting all aspects of marine science in the NT and making formal comment on NT marine development assessments and NT Government policies, strategies and plans, and nominations of rare and threatened marine species and habitats in the NT.
AusTurtle Inc	AusTurtle Inc. is a non-profit organisation that promotes sea turtle conservation and research in northern Australia.
Charles Darwin University (CDU)	The NT's main university is research-intensive with a range of projects and partnerships in indigenous and tropical health, environmental science and public policy. One example is the current investigation of low technology, sea-based aquaculture systems for remote coastal communities. The team is sampling wild blacklip oysters from 8 locations across the NT, assessing shellfish quality, heavy metals and vibrio testing. CDU is a member of the Darwin Harbour Advisory Committee
Commercial fishing – Commonwealth managed	
Commonwealth-managed fisheries that overlap the EMBA (based on AFMA guidance): • Northern Prawn Fishery	Licence holders of these fisheries are entitled to fish within the EMBA and consultation based on published AFMA guidance, including via representative organisations.

Relevant Person Category	Summary of Relevance
• Southern Bluefin Tuna Fishery • Western Skipjack Tuna Fishery • Western Tuna and Billfish Fishery • North-West Slope Trawl Fishery • Torres Strait Fishery	
Commercial fishing – Northern Territory managed	
NT-managed fisheries that overlap the EMBA: • Aquarium Fishery • Coastal Line Fishery • Demersal Fishery • Development Fishery (Small Pelagic) • Offshore Net and Line Fishery • Pearl Oyster Fishery • Spanish Mackerel Fishery • Timor Reef Fishery	Licence holders of these fisheries are entitled to fish in the EMBA.
Commercial fishing – Western Australian managed	
Licence holders in the following WA-managed fisheries: • Abalone Fishery • Kimberley Crab Fishery • Kimberley Prawn Fishery • Mackerel Managed Fishery • Marine Aquarium Fishery • Northern Demersal Scalefish Managed Fishery • Pilbara Crab Fishery • South-West Costal Salmon Fishery • Specimen Shell Fishery • West Coast Deep Sea Crustacean Fishery	Licence holders of these fisheries are entitled to fish within the EMBA. Santos has consulted via representative organisation, Western Australian Fishing Industry Council (WAFIC), noting WAFIC published guidance on consultation of fishers.

Relevant Person Category	Summary of Relevance
Energy Industry – Petroleum titleholders and GHG permit holders	
Operators: • Bengal Energy • Eni Australia Ltd • EOG Resources • Finder Energy • INPEX Ichthys Pty Ltd • Jadestone • Melbana Energy • Neptune • PTTEP Pty Ltd • Shell Development (Australia) Pty Ltd • SundaGas Bunda Unipessoal Lda • Woodside Energy Ltd	Operators within the EMBA.
Environmental conservation organisations	
ATSEA-2 Project	According to its website, ATSEA-2 is a Global Environment Facility-funded program, managed and executed under the United Nations Development Program. It has a Regional Steering Committee made up of representatives from national government and lead agencies in Australia, Indonesia, Papua New Guinea and Timor-Leste.
Australia Institute	The Australia Institute is a public policy think tank based in Canberra that carries out research and comments publicly on a broad range of economic, social, and environmental issues.
Australian Conservation Foundation (ACF)	ACF is a national non-government environmental advocacy organisation based in Melbourne.
Australian Marine Conservation Society – NT (AMCS NT)	According to its website, AMCS NT is a grassroots independent environmental conservation organisation and charity that works to protect ocean wildlife along the NT coastline, waters and seas. It advocates for evidence-based solutions to conservation activity and works closely with marine research centres.
Australian Parents for Climate Action Darwin and NT	According to its NT website, Australian Parents for Climate Action Darwin and NT is on a mission to empower parents, carers, families and everyone who cares about kids, to advocate for urgent action on climate. It plans family-friendly, non-partisan activities that engage communities, engage politicians in climate solutions, and amplify positive stories.
Climate Action Darwin	According to its website, Climate Action Darwin influences decision-makers to adopt climate-friendly policies, supports Darwin residents to take climate action and reduce their own climate impact, advocates for a transition to a zero-carbon economy, informs and educates audiences on NT climate change impacts and solutions and supports other local and active groups working for a safe climate.
Conservation Council of Western Australia (CCWA)	According to its website and correspondence dated 12 April 2023, CCWA promotes an interest in the protection and restoration of the WA natural environment, including waters, a marine park and marine life potentially within the EMBA.

Relevant Person Category	Summary of Relevance
Doctors for the Environment Australia	Doctors for the Environment Australia (DEA) is a national organisation of medical professionals concerned at the impacts of climate change on human health.
Environment Centre Northern Territory (ECNT)	According to its website, ECNT is a not-for-profit incorporated association whose objects include protection of all aspects of the natural environment, conducting campaigns to protect the natural environment, environmental research, and public education and information about the natural environment. ECNT is involved in the "Stop Barossa Gas" campaign.
Greenpeace	According to its website, Greenpeace's stated goals include the protection of ocean biodiversity and marine life, including campaigning for protection of whales[30] (fauna identified in this EP as potentially affected by the Activity impacts or risks) and sea turtles[31] (also fauna identified in this EP as potentially affected by the Activity impacts or risks).
Jubilee Australia Research Centre	Jubilee Australia Research Centre states that it engages in research and advocacy to promote economic justice for communities in the Asia-Pacific region and accountability for Australian corporations and government agencies operating there. The Centre is involved in the Stop Barossa campaign.
Keep Top End Coasts Healthy	According to its website, Keep Top End Coasts Healthy is part of an alliance of environment groups including the AMCS NT and the ECNT. Keep Top End Coasts Healthy claims to work with stakeholders with respect to coastal preservation and establishment of marine protected areas.
Sea Turtle Foundation	According to its website, the Sea Turtle Foundation[32] is a non-profit, non-government group based in Australia with a stated interest in protecting sea turtles through research, education and action, including specifically the olive ridley turtle, leatherback turtle, loggerhead turtle and flatback turtle, being turtle species cited in this EP as being potentially affected by the impacts or risks of the Activity.
West Timor Care Foundation	According to previous correspondence received from West Timor Care Foundation, the Foundation claims to be an advocacy organisation concerned with the interests and welfare of people who depend on the coast of Timor for their livelihoods and who have been, or may be, impacted by oil spills from petroleum activities in the Timor Sea, including areas within the EMBA. Santos has been unable to locate a website for West Timor Care Foundation.
Wilderness Society	According to its website, the Wilderness Society is a peak conservation body with an interest in activities that may affect the marine environment.
WorldFish Timor-Leste	According to its website, WorldFish is a research organisation focusing on sustainable aquatic food systems in Timor-Leste. It has an interest in resilient and sustainable aquaculture projects and small-scale fisheries production, promoting community-based resource management of coastal fisheries to strengthen livelihoods and combat poverty and malnutrition and works in a partnership model with non-government organisations (NGOs) and governments.
World Wildlife Fund (WWF)	WWF is a peak conservation body with an interest in activities that may affect the marine environment.
First Nations People and groups	

[30] *https://www.greenpeace.org.au/what-we-do/protecting-oceans/whales/*

[31] *https://www.greenpeace.org/international/story/28229/turtle-journey-urgent-protect-the-oceans/; https://www.greenpeace.org/international/publication/28181/turtles-under-threat/*

[32] *https://seaturtlefoundation.org/about*

Relevant Person Category	Summary of Relevance
The following groups may have interests that intersect the EMBA. Information was also provided to these organisations to help identify and consult groups or individuals whose spiritual or cultural connections to land and sea country in accordance with Indigenous tradition may be affected by proposed activities. In addition, targeted regional advertising was conducted to provide opportunity for individuals whose functions, interests and activities may be affected by the proposed activity to self-identify as Relevant Persons.	
Representative organisations – NT	
Larrakia Nation Aboriginal Corporation (LNAC)	LNAC is one of Darwin's leading community service organisations. Larrakia Nation Aboriginal Corporation was set up in 1997 through the Northern Land Council originally to provide a corporate identity for Larrakia people to uphold Native Title claims. In the subsequent 20 years, it has grown to represent the Traditional Owners of the Darwin region and to speak on behalf of Larrakia people, deliver community and outreach services to the broader Darwin community, and operate the Larrakia Land and Sea Ranger services. LNAC board members, six of eight of whom are Larrakia member directors, are responsible for governing LNAC on behalf of all Larrakia members. LNAC has over 600 Larrakia families' members, any Larrakia person is eligible to be a member. Benefits of membership include: • election of family representatives at the Annual General Meeting • advocacy on a members' behalf. [33]
Northern Land Council (NLC)	The NLC is the Native Title Representative Body for the Northern Region, including sea country. Its functions are prescribed under the NT Act. The NLC also has statutory obligations under the ALR Act and is authorised to perform certain functions under the NT Act. The NLC's area of interest includes sea country where non-exclusive native title rights and interests may exist, including within the EMBA. NLC Executive Council members are also the directors of the Top End (Default Prescribed Body Corporate/Community Living Area) Aboriginal Corporation RNTBC (TED PBC) which is responsible for an area of sea country near the Croker Islands. The NLC also provides administrative services to the Corporation. The NLC is also responsible for the administration of Land Trusts. Consultation with Land Trusts also occurs via the NLC.
Tiwi Land Council (TLC)	The TLC is governed under the ALR Act. The Tiwi ABT was also established under the ALR Act and the TLC is the only body with authority to direct the Trust. The authority of the TLC does not extend into Commonwealth offshore waters, although the sea country interests of Tiwi Island clans do, including within the EMBA.
Wickham Point Deed Liaison Committee (WPDLC)	The objective of the WPDLC is to strengthen the dialogue between Santos and the Larrakia people and support the delivery of the parties' commitments under the Wickham Point Deed entered into between Darwin LNG and the Northern Land Council on 29 April 1999. Santos coordinates quarterly meetings with the Wickham Point Deed liaison committee, which includes representatives from Larrakia family groups, the functions of which are set out in the Wickham Point Deed and include making recommendations to Santos on various matters such as environmental, cultural heritage, employment and business opportunities.
First Nations Consultative Committees and coastal clan groups – NT	

[33] Source: https://larrakia.com/

Relevant Person Category	Summary of Relevance
Larrakia People	The Larrakia people are the traditional owners of the Darwin region. Larrakia country runs from Cox Peninsula in the west to Gunn Point in the north, Shoal Bay in the east and down to the Manton Dam area southwards. The Larrakia People consist of between eight to fourteen family groups, depending on how families are grouped.[34]
Cobourg Peninsula Consultative Committee	The Cobourg Peninsula Consultative Committee speaks for all of the Cobourg Peninsula, south to Endyalgout Island and east towards Wauk, and includes the adjacent sea country. The committee includes the Agalda, Murran, Ngaindjagar and Madjunbalmi clans, and includes the Garig Gunak Marine Park (NT)
Kardu Lalingkin Consultative Committee	The Kardu Lalingkin Consultative Committee FNCC speaks for country extending from the Fitzmaurice River, including Wadeye community to north of the Marri-Jabin (Thamururr) Indigenous Protected Area, and including coastal parts of the Joseph Bonaparte Marine Park.
Djulidki (Bradshaw) Consultative Committee	The Djulidki Consultative Committee speaks for the area approximately contiguous with, but larger than the Bradshaw Field Training Area, in the south west coast of the NT. It includes Quoin and Clump Islands and is bordered by the Victoria River to the south and the Fitzmaurice River to the north.
Gapu Maringa Consultative Committee	The Gapu Maringa Consultative Committee speaks for country extending from the Blyth River through to the westernmost part of Elcho Island. It includes coastal areas and islands (Darbada, Crocodile, Milingimbi, Rabuma, Banyan and Mooroongga Islands) and includes the western tip of Elcho Island, including the community of Galiwin'ku and the entirety of the Crocodile Islands Maringa IPA.
Goulburn Island Consultative Committee	The Goulburn Island Consultative Committee speaks for north and south Goulburn Islands. It includes the western section of the Arnhem Marine Park.
Jindiwi Consultative Committee	The Jindiwi Consultative Committee speaks for country extending east from the Adelaide River, through to just south of Endyalgout Island, at the bottom of the Cobourg Peninsula, and including Van Diemen Gulf, Field and Barron Islands. It includes groups living along the coastal areas, of the West, South and East Alligator Rivers, including the Wulna Clan. It also includes the coastal section of the Mary River IPA.
Maningrida Regional Consultative Committee	The Maningrida Regional Consultative Committee speaks for an extensive coastal area beginning south of Wauk and continuing east under the Goulburn Islands past the Nungbalgarri Creek and extending past Maningrida community to the west bank of the Blyth River. It includes the middle and eastern sections of the Arnhem Marine Park, and the Djelk Stage 2 IPA.
Miyarrka Consultative Committee	The Miyarrka Consultative Committee speaks for country around the community of Gapuwiy'ak (Lake Evella) and extends north and west to include the sea country and coastal areas of the Hardy Island Bay and including Inglis, and Cotton Islands, and includes Yolŋu language groups living in these areas. It extends east to the edge of the Dhimurru IPA and includes the south-eastern part of the Marthakal IPA.
Mulyurrud Consultative Committee	The Mulyurrud Consultative Committee speaks for Croker Island, including the Gadura-Minaga, Mangalarra and Mandilarri clan estates, and the adjacent sea country, including several islands to the east and north east of Croker Island and the Ildugidj clan estate located on the mainland coastline (south from Croker Island). This Committee's area includes the southern portion of the Arafura Marine Park.

[34] *2012 paper " Larrakia Family Groups" written by Mr Bill Day (https://www.drbilldayanthropologist.com/resources/Larrakia%20Family%20groups.pdf)*

Relevant Person Category	Summary of Relevance
Ngoy Garmak Consultative Committee	The Ngoy Garmak Consultative Committee speaks for the Wessel Islands chain, excluding Galiwin'ku, but including the central and northern parts of Elcho Island and small sections of adjacent mainland coastal areas. It includes Yolŋu language groups living in these areas. This Committee also speaks to the northern part of the Marthakal IPA.
Rak Badjalarr Consultative Committee	The Rak Bajalarr Consultative Committee speaks for country extending north from the Daly River to the Cox Peninsula, and adjacent coastal sea country, including the Peron Islands and the Dum In Mirrie, Beer Eeetar, Windirr and Grose, Quail and Indian Islands. It includes the western part of the Darwin harbour and associated waterways, and represents the Kenbi, Emmiyangal, Mendheyangal, Kiyuk, Wadigany, Murranungu, Malak Malak and Marriamu clans located over the coastal areas from the Cox Peninsula to the Daly River.
Tiwi Islands Clan Groups and Individuals	The Appeal Judgment found that "Mr Tipakalippa and the Munupi clan had interests within the meaning of reg 11(A)(d)[35] of the OPGGS(E)R that required them to be consulted[36]. Mr Tipakalippa had claimed that he and the Munupi clan, as well as other Tiwi Island people, have "sea country" in the Timor Sea to the north of the Tiwi Islands. The Tiwi Islands are located approximately 80 km north of Darwin in the Arafura Sea. There are three major communities on the Tiwi Islands. The largest community is Wurrumiyanga (on Bathurst Island), with smaller communities of Milikapiti and Pirlangimpi located on Melville Island. There are eight landowning groups (clans) on the islands, Mantiyupwi, Munupi, Yimpinari, Malawu, Wulirankuwu, Wurankuwu, Mirrikawuyanga and Jikilaruwu (or Tikalaru). Members of the Mantiyupwi clan also speak for the Vernon Islands, which are located between the Tiwi Islands and mainland NT.
Wulna Clans	Wulna Clan are a party to the Mary River ILUA. Wulna clans have representation through the Wulna representatives on the Jindiwi Consultative Committee, consistent with their preferences expressed at meetings with Wulna clans prior to this EP consultation.
Other First Nations organisations – NT	
Aboriginal Sea Company	Incorporated entity with administrative support provided by the NLC. The Aboriginal Sea Company's area of interest is the entire Top End (sea country and intertidal). The Company facilitates the participation of Traditional Owners in commercial fishing, aquaculture and other opportunities associated with fishing activities in NT waters that could be impacted by planned activities or an unplanned spill. The Company is governed by a board comprising representation from the three land councils with traditional ownership of sea country – Northern, Tiwi and Anindilyakwa land councils.
Gwalwa Daraniki Association (GDA)	Administers the Kalaluk and Minmarama communities near Darwin, including Larrakia people, and is responsible for overseeing a number of developments aimed at improving the long term physical and economic wellbeing of the tenants of those communities.
Kenbi Rangers	The Kenbi Rangers manage the country of the Cox Peninsula - Darwin and Bynoe Harbours and Islands. The Kenbi Rangers' base on Cox Peninsula is administered by the NLC.
Larrakia Development Corporation (LDC)	The LDC aims to create economic opportunity for Larrakia People through the creation and operation of sustainable businesses models, and the maintenance of the Larrakia Development Trust. The Larrakia Development Corporation's core activities include land holdings and development, property development, heritage monitoring, ground

[35] *Section 25(1)(d) of updated OPGGS(E)R 2023*

[36] *Santos NA Barossa Pty Ltd v Tipakalippa [2022] FCAFC 193 [80]*

Relevant Person Category	Summary of Relevance
	maintenance, and landscaping. LDC is governed by a board of independent directors. Santos has consulted with LDC in its capacity as a commercial organisation that aims to support positive economic outcomes for Larrakia people
North Australian Indigenous Land and Sea Management Alliance	Darwin-based Native Title Prescribed Body Corporate with administrative services via the NLC. NLC Executive Council members are the directors of the Top End Default Prescribed Body Corporate. Place / Area of Interest (descriptions of land includes adjacent sea country): Entire Top End.
Representative Organisations – WA	
Kimberley Land Council (KLC)	The KLC is the Native Title Representative Body for the Kimberley region in WA. Its primary role is to provide native title services to Kimberley Aboriginal people. KLC's area of interest includes sea country where non-exclusive native title rights and interests may exist, including within a section of Commonwealth waters within the EMBA. The KLC is also named in several Marine Park Management Plans off the Kimberley coast.
Balanggarra Aboriginal Corporation	The Balanggarra Aboriginal Corporation, based in Wyndham, is the Registered Native Title Body Corporate (RNTBC) for the Balanggarra People and manages their native title determination
Bardi and Jawi Niimidiman Aboriginal Corporation	The Bardi and Jawi Niimidiman Aboriginal Corporation, based in Broome, is the RNTBC for the Bardi and Jawi Niimidiman People and manages their native title determination.
Dambimangari Aboriginal Corporation	The Dambimangari Aboriginal Corporation, based in Derby, is the Aboriginal corporation nominated by the Wanjina Wunggurr RNTBC, (which holds the larger native title determination over the area) to manage the southern part of the determination.
Mayala Inninalang Aboriginal Corporation	The Mayala Inninalang Aboriginal Corporation, based in Broome, is the RNTBC for Mayala Inninalang people, and manages their determination.
Miriuwung and Gajerrong Aboriginal Corporation	The Miriuwung and Gajerrong Aboriginal Corporation, based in Kununurra, is the RNTBC for the Miriuwung-Gajerrong People and manages their native title determination.
Wunambal Gaambera Aboriginal Corporation	The Wunambal Gaambera Aboriginal Corporation, based in Wyndham, is Aboriginal Corporation nominated by the Wanjina Wunggurr RNTBC (which holds the larger native title determination over the area) to manage the northern part of the determination.
Industry Associations – commercial fishing	
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	ASBTIA represents the interests of commercial fishers in the Southern Bluefin Tuna Fishery and Western Skipjack Fishery.
Commonwealth Fisheries Association (CFA)	CFA represents the interests of commercial fishers with licences in Commonwealth waters.
Northern Prawn Fishery Industry (NPFI)	NPFI represents the interests of the interests of commercial fishers in the Northern Prawn Fishery.
Northern Territory Seafood Council (NTSC)	NTSC is the peak representative body for the wild catch, aquaculture and trader/processor seafood sectors in the NT.
Western Australian Fishing Industry Council (WAFIC)	WAFIC represents the interests of the WA commercial fishing, pearling and aquaculture sector.
Industry Associations – recreational fishing	
Amateur Fishermen's Association of the Northern Territory (AFANT)	AFANT is the peak body representing NT recreational fishers whose interests may intersect the EMBA.

Relevant Person Category	Summary of Relevance
Recfishwest	Peak WA body representing the interests of the recreational fishing sector.
Industry Associations – tourism	
Assosiasaun Turizmu Maritima iha Timor-Leste	The Association is a registered, national industry body that represents the marine tourism sector in Timor-Leste.
Kimberley Marine Tourism Association	Based in Broome, the Kimberley Marine Tourism Association represents charter boat operators from the Kimberley and wider region
Marine Tourism WA	Marine Tourism WA is the peak body representing WA charter boat owners and operators.
Northern Territory Guided Fishing Industry Association (NTGFIA)	NTGFIA is the peak body responsible for promoting, developing, and maintaining the guided fishing industry in the NT. It represents professional fishing guides and operators. Interests may intersect the EMBA.
Tourism Top End	Tourism Top End is the Regional Tourism Association, a non-profit entity serving businesses, individuals and organisations involved in tourism activities in the NT. Interests may intersect the EMBA.
WA Game Fishing Association	Coordinates game fishing activities throughout Western Australia.
Industry Associations – local industry	
Chamber of Commerce Northern Territory	Regional representative organisation representing the interests of local business.
Infrastructure operators	
BW Digital	BW Digital is a privately-owned, carrier-neutral and innovative to deliver optimal customer service. It develops, builds and operates a digital ecosystem, specialising in data transport, compute and storage to connect countries across oceans sustainably.
Darwin Port	Private consortium responsible for the management of shipping and other commercial activities requiring use of Darwin Harbour. Santos-contracted vessels plan to use Darwin Harbour.
NT Port and Marine	Private consortium that owns and operates the commercial port at Port Melville on the Tiwi Islands.
Power and Water Corporation (NT)	Power and Water Corporation is a government-owned corporation responsible for the transmission and distribution of electricity and provision of water and sewerage services across the NT. The Corporation's main operating facility relies on the water quality in Darwin Harbour.
Sun Cable	Privately-owned consortium with plans to install a new submarine cable infrastructure in NT and Commonwealth waters in the EMBA.
Telstra	Telstra Group Limited is an Australian telecommunications company that builds and operates telecommunications networks and markets related products and services.
Vocus	Operator of the following infrastructure, which is in the EMBA: Darwin-Jakarta-Singapore Cable and North West Cable System (NWCS).
Local Government Authorities – NT	
Belyuen Community Government Council	Represents the Belyuen Community, located approximately 120km from Darwin on the Cox Peninsula. The Council's area includes NT coastline within the EMBA.

Relevant Person Category	Summary of Relevance
City of Darwin	The City of Darwin includes the central business district of the capital, Darwin City, and represents two-thirds of its metropolitan population. The Council's area includes NT coastline within the EMBA.
City Of Palmerston Council	The City of Palmerston Council contains the suburbs of Darwin's satellite city, Palmerston, and is situated between the outer industrial areas of Darwin and the rural areas of Howard Springs. The Council's area includes NT coastline within the EMBA.
East Arnhem Regional Council	East Arnhem Regional Council services the communities of Milingimbi, Ramingining, Galiwin'ku, Gapuwiyak, Yirrkala, Gunyangara, Umbakumba, Angurugu and Milyakburra. The Council's area includes NT coastline within the EMBA.
Litchfield Council	Litchfield Council represents people living in some of Darwin's outer rural suburbs. The Council's area includes NT coastline within the EMBA.
Roper Gulf Regional Council	Roper Gulf Regional Council services the communities of Mataranka, Yugul Mangi, Numbulwar Numburindi, Borroloola, Nyirranggulung and Jilkminggan as well as a large amount of unincorporated land in the Gulf, Roper Valley, Stuart Plateau and Southern Arnhem Land. The Council's area includes NT coastline within the EMBA.
Tiwi Islands Regional Council	The Tiwi Islands Regional Council provides a range of local government and other services to Bathurst and Melville Islands and the communities of Wurrumiyanga, Wurankuwu, Milikapiti (Snake Bay) and Pirlangimpi (Garden Point), as well as several smaller outstations. The Council's area includes NT coastline within the EMBA.
Victoria Daly Regional Council	Victoria Daly Regional Council services the communities of Nauiyu/Daly River, Pine Creek, Timber Creek, Yarralin Walangeri and Kalgkarindji Daguragu. The Council's area includes NT coastline within the EMBA.
Wagait Shire Council	The Wagait Shire Council services community on the Cox Peninsula west of Darwin. The Council's area includes NT coastline within the EMBA.
West Arnhem Regional Council	Victoria Daly Regional Council services the communities of Gunbalanya, Jabiru, Maningrida, Minjilang, Warruwi, as well as outstations.The Council's area includes NT coastline within the EMBA.
West Daly Regional Council	West Daly Regional Council services the communities of Wadeye, Palumpi and Peppimenarti. The Council's area includes NT coastline within the EMBA.
Tourism Operators – Timor-Leste	
Dreamers Dive Academy Timor	According to its website, the Dreamers Dive Academy is a tourism and diver training business operating from a base near Dili on the north shore of Timor-Leste. Diving activity is undertaken around Atauro Island in locations that may be within or transit the EMBA.
Tourism Operators – NT	
Darwin and Tiwi Islands-based operators	Marine tourism operators active within the EMBA are listed in Table 4-22.
Other Relevant Persons	
Autoridade Nacional do Petróleo – Timor-Leste (ANP)	ANP is a public institution established by the Timor-Leste Government to manage and regulate petroleum activities in the Timor-Leste area.

4.6.5 Consultation planning, preliminary and consultation activities

Santos acknowledges that consultation processes need to have sufficient flexibility to adapt to the "nature of the interests of the Relevant Persons"[37].

In planning the consultation program for this EP, Santos was initially informed by its previous experience in consulting with Relevant Persons about Barossa Project Activities (refer Section 4.1)

For this EP consultation activities were generally undertaken in three broad phases[38]:

- **Preliminary consultation (9 February – 10 March 2024)** – this included:
  - activities to allow authorities, persons and organisations opportunities to self-identify as Relevant Persons and provide feedback about consultation methods and information needs via a portal and form available on its website. [refer to Section 4.6.4]; and
  - directly contacting Relevant Persons and potential Relevant Persons to:
    - inform them about the consultation for this EP, including sharing information about the EP activity and associated environmental impacts and risks;
    - seek information to better understand if the person contacted was from a relevant government Department or agency, or was a person (or organisation) whose functions, interests or activities may be affected by the activities proposed to be carried out under this EP; and, if so, the nature of those potentially affected functions, interests or activities; and to
    - share information about titleholder responsibilities and opportunities to provide guidance for consultation expectations.
- **Formal consultation (11 March 2024 – 23 May 2024[39])** – this included seeking feedback from Relevant Persons to inform development of this EP during or following exchanges that involved the provision of sufficient information and a reasonable period of time (refer to Section 4.6.6).
- **Further consultation (23 May 2024 until submission to the regulator) –** Santos undertook consultation with some authorities, persons and organisations following the formal consultation phase given existing relationships, consultation preferences and standing meeting and consultation arrangements.

Santos offered and provided information in different formats and via a range of different mediums.

Preferences expressed by Relevant Persons regarding design of the consultation process were considered and accommodated by Santos, where reasonably practicable and appropriate. This approach has included:

- Providing Relevant Persons access to information using different mediums and platforms both at the request of Relevant Persons and of its own volition, having regard to the nature of particular Relevant Persons and their potentially affected functions, interests or activities;
- Consultation methods and platforms including by telephone, email, letters, website, electronic materials including power point presentations, video content, in person and virtual meetings. Santos provided a toll free 1800 number and a dedicated email address for Relevant Person input and feedback;
- Making information about the proposed activities to be managed under this EP available on the Santos website at www.santos.com/offshoreconsultation. Provision of hyperlinks or QR codes to this website were included in consultation emails and in advertising in print media and on social media;
- Recognising NTSC's feedback that information should be provided via post direct to relevant licence holders in addition to being provided to the NTSC which consults directly with the chairs of each fishery;
- Recognising NPFI's feedback that it will pass along any information to its members where required and relevant, acknowledging NPFI has advised there is no need for Santos to directly engage with its members;
- Recognising AFANT's feedback that it will respond on an Association level and pass along any information to its members where required and relevant for their own individual feedback;

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[37] *Santos NA Barossa Pty Ltd v Tipakalippa [2022] FCAFC 193 at paragraph [104]*

[38] In some cases, contact with persons or organisations identified at later stages in the consultation process did not strictly align with the typical phases as set out below.

[39] Although initial consultation correspondence advised that the consultation period would close on 9 April 2024, Santos subsequently sent further correspondence providing updated information to account for an additional risk associated with the activities proposed in this EP and extending the consultation period until 16-23 May 2024.

- Recognising DFAT's feedback to contact DFAT's Indonesian and Timor-Leste desks on consultation matters relevant to Indonesia and Timor-Leste respectively;
- Continuing to respect direction from Tiwi Islands clans and individuals on appropriate consultation methods, which have for some time been a mutually agreed approach to support consultation for other environmental approvals for the Barossa Gas Project, which have been accepted or are under assessment by respective Regulators; and
- Consulting with First Nations communities via consultative committees, or other representative bodies where Santos understands this to have been culturally appropriate (see Section 4.6.5.1). This included consulting with Wulna Clan through the Jindiwi Consultative Committee and Algada Clans through the Cobourg Peninsula Consultative Committee in line with preferences expressed by each of these clans during the course of engagement relating to consultation for the Barossa Darwin Pipeline Duplication Environment Plan.

All authorities, persons and organisations engaged during the preliminary consultation and consultation phases were provided a link to the *NOPSEMA community information brochure: Consultation on offshore petroleum environment plans* and/or had hard copies of the brochure made available during in-person consultation sessions.

Santos also informed each Relevant Person that they may request that particular information they provide during the consultation not be published and that information subject to such a request will not be published under the relevant regulations (and will instead be included in a separate report which will not be published on NOPSEMA's website).

Typically, where Santos did not receive a response from a Relevant Person to its correspondence and/or in person conversations, follow-up attempts were made (usually using different mediums e.g. phone, email or letter) including to confirm receipt of emails/letters and/or to prompt provision of a response. Most cases involved multiple follow-up attempts.

4.6.5.1 Consultation with First Nations people and groups

For this EP, Santos has provided consultation opportunities and supporting information to First Nations communities, clans and groups, representative organisations and other First Nation organisations listed in Table 4-8, acknowledging the use of a highly conservative EMBA (as described in Section 3) for the purpose of assisting to identify potentially Relevant Persons.

This conservative approach has ensured a very broad capture of potential Relevant Persons and provided them an opportunity to provide input if they feel their functions, interests or activities may be impacted. The consultation process is further explained below and includes, if and where applicable:

- Consulting First Nations people through existing representative organisations, including Registered Native Title Bodies Corporate, groups associated with Native Title Determinations and groups in active Native Title Claims, Native Title Representative Bodies, and groups who may be parties to Indigenous Protected Areas, or be named in ILUAs;
- Consulting First Nations people through existing liaison committees or reference groups that have been established between Native Title Parties, Native Title Representative Bodies and industry/government;
- Supporting the establishment of First Nations consultative committees or groups that are intended to be representative and able to speak on behalf communities where formal structures do not exist and consulting such committees or groups;
- Working with First Nations communities, groups and clans to develop culturally appropriate consultation methods reflecting the information needs of First Nations communities, groups and clans. By way of example, Santos held multiple community consultations with Tiwi people at the community's request for previous Barossa EP consultation; and
- Consulting other First Nations organisations that may support specific interests of First Nations people, such as economic development and community well-being.

In addition, Santos has undertaken a range of activities to promote opportunities for First Nations people to provide input and feedback during consultation to support identification and evaluation of environmental impacts and risks for proposed activities and develop appropriate measures to reduce these impacts and risks to ALARP and to an acceptable level.

These activities included a public information campaign using a range of appropriate media, including, radio, print media, targeted social media, drop-in meetings with information about the project activities, provision of consultation materials and availability of Santos staff to answer questions at its central Darwin shopfront and inviting people to self-identify as a Relevant Person in response, where they considered themselves to have interests, functions or activities that may be affected by the planned activities. Details of the public information

campaign for this EP are included in Section 4.6.4, Table 4-8 and Table 4-10, which outlines advertising and notifications targeting Tiwi and Larrakia clans/communities.

4.6.5.1.1 Consultation with existing representative organisations

For this EP consultation effort in the NT with existing representative organisations has focused on providing input and feedback opportunities for the NLC, TLC, LNAC and WPDLC.

Consultation effort in WA with existing representative organisations has focused on providing input and feedback opportunities for the KLC and six PBCs. The EMBA intersects the Kimberley representative Aboriginal/Torres Strait Islander body (RATSIB) area (refer Figure 3-28). As a RATSIB, the KLC has responsibility for providing services to native title parties in the Kimberley.

While the EMBA does not intersect the native title interests of PBCs in the Kimberley region, Santos as a precautionary approach consulted six PBCs given their responsibilities under the *Native Title Act 1993* (Cth) for representing Native Title holders who may have a particular interest in the activity or knowledge that could assist with the consideration of management of environmental impacts and risks.

Santos recognises that native title rights and interests are held by PBCs on behalf of the native title group they represent and reflect the traditional laws and customs of the native title group. These rights and interests may include, among other things, management and protection of cultural values.

Wickham Point Deed Liaison Committee

A key mechanism for ongoing consultation by Santos with the Larrakia people is through the Wickham Point Deed Liaison Committee (previously title Wickham Point Deed Reference Group) which includes representation of Larrakia family groups. The Wickham Point Deed was entered into between DLNG and the NLC (which is also identified as a Relevant Person in Table 4-9) on 29 April 1999 and the liaison committee represents a long-running dialogue between Santos and Larrakia families.

Santos coordinates quarterly Wickham Point Deed Liaison Committee meetings and the functions of the committee include making recommendations to Santos on various matters such as environmental matters, cultural heritage, employment and business opportunities.

Santos has discussed the Barossa Gas Project with the Wickham Point Deed Liaison Committee as a regular agenda item for several years, including providing information on Project activities, approval requirements, impacts and risks, the AAPA Authority Certificate process and proposed management measures.

The Wickham Point Deed liaison committee has been identified as a Relevant Person for consultation with respect to activities within this EP (refer Table 4-9), with a consultation session held on 7 March 2024 covering the following:

- Recapitulation of the Barossa Project to include a project update on existing activities and Project progress;
- Recapitulation of the regulatory consultation processes and privacy considerations;
- Informing the committee that Relevant Persons may request that particular information they provide during the consultation not be published and that information subject to such a request will not be published under the relevant regulations (and will instead be included in a separate report which will not be published on NOPSEMA's website);
- Discussing the activities covered by this EP, including installation steps and vessel descriptions
- Introducing and discussing the potential environmental impacts and risks involved with the planned activities and planned controls to manage those risks;
- Introducing and discussing the EMBA in the event of an unplanned event, the risks and planned controls to manage those risks;
- Providing opportunities for input, including in relation to potential cultural or other environmental impacts and risk of the activities under this EP and proposed control measures; and
- Responding to and closing out any outstanding matters including questions, issues or concerns.

Larrakia Nation Aboriginal Corporation

Outside of the Wickham Point Deed Liaison Committee, Santos also sought to consult with the Larrakia Nation Aboriginal Corporation (LNAC). The summary of Santos' consultation efforts is presented in Table 4-10

TheLNAC was set up in 1997 through the Northern Land Council to provide a corporate identity for Larrakia people to uphold Native Title claims. LNAC have grown to represent the Traditional Owners of the Darwin region and to speak on behalf of Larrakia people while delivering community and outreach services to the broader Darwin community.

4.6.5.1.2 Consultation with Larrakia people

For this EP, Santos adopted a multi-faceted approach to providing input and feedback opportunities for Larrakia people. Approximately 2000 Larrakia people live in the urban environment of Darwin and comprise eight to fourteen family groups.

Consultation effort with Larrakia people focused on providing consultation opportunities through:

- existing representative organisations with a dedicated Larrakia focus, these being NLC, WPDLC and LNAC;
- face-to-face Larrakia People Consultation Sessions coordinated by Santos;
- provision of the Barossa Production Operations Information Booklet, playing of the Barossa project video on a large screen monitor and availability of Santos staff to answer questions at its central Darwin shopfront;
- Santos Darwin LNG (DLNG) facility site tours;
- other First Nations organisations that support specific interests of First Nations people, such as economic development, these being LDC and GDA; and
- the public awareness campaign.

In addition to the above activities, Santos also met with LDC to better understand a proposal for the development of a consultation framework allowing project proponents to consult all Larrakia families though LDC, including the provision of additional and independent advice where needed to meet the information needs of Larrakia people. Santos understands that the framework is still under development and has not yet received confirmation that the framework is supported by all Larrakia family groups.

As such, the framework was not in place for the purpose of consultation for this EP. In addition, during Santos' consultation with Larakia people and Larrakia representative bodies, Santos was not advised that the Larrakia people want LDC to represent them for the purpose of consultation for this EP.

Santos will continue to engage with LDC on their proposed consultation framework and if it is prepared and supported by all Larrakia family groups, will have regard to it in relation to ongoing consultation over the life of the Barossa project and for future proposals.

Santos' future consideration of the framework will include consideration of appropriate financial recompense for meeting attendance and input, and consideration of any financial assistance and/or access to independent advice that the framework may propose.

Larrakia People Consultation Sessions

To expand the opportunity to reach more Larrakia People outside of the families represented on the Wickham Point Deed Liaison Committee, Santos, has, in consultation unrelated to this EP, requested and received assistance from LNAC.

Santos previously received advice from LNAC on the best way to directly consult with Larrakia People in a culturally sensitive and appropriate way. The consultation process comprised:

- Santos to undertake face-to-face consultation
- Santos to advertise in the NT News the face-to-face consultation sessions
- LNAC to promote the consultation sessions on their social media

In response, Santos implemented the following tailored consultation approach for Larrakia people:

- A total of four individual Larrakia consultation sessions were held specifically for Larrakia People between April and June 2024, including:
    - face-to-face consultation sessions, which were held on 23 April 2024 and 12 June 2024
    - two time slots (during and after work hours) were provided on each date to maximise opportunity to attend. There were no Larrakia attendees at the 12 June 2024 session during work hours.
    - the April consultation was held in Darwin CBD however feedback from Larrakia at this session was for future consultations to be held at more accessible and convenient location
    - the June session was held in the northern suburb of Malak in a community hall with free parking
- Consultation sessions were advertised as described in Table 4-10

- Santos requested LNAC (confirmed) to post the Notice of Consultation on social media channels (Facebook and LinkedIn) for the April and June 2024 Larrakia consultation sessions.

Hardcopy consultation materials were produced and distributed or made available prior to the start of the session for use as a tool to refer to during the consultation session. Material included, but was not limited to, copies of the Production Operations Information Booklet, Santos Privacy Statement and the *NOPSEMA community information brochure: Consultation on offshore petroleum environment plans*.

Other visual aids such as AO poster sized maps of the project area and EMBA, and AO sized posters with photos and images taken as part of the Barossa Project were positioned at each venue to present information regarding operational activity and the project more generally.

Santos also informed attendees that Relevant Persons may request that particular information they provide during the consultation not be published and that information subject to such a request, will not be published under the relevant regulations (and will instead be included in a separate report which will not be published on NOPSEMA's website).

The consultation sessions were conducted as an open forum. People were encouraged to ask questions and raise concerns through the presentation. Santos' representatives and subject matter experts (SMEs) explained the activity and associated environmental risks and impacts during the face-to-face presentations, assisted by video content and PowerPoint slides.

During the sessions Santos provided opportunities for input, including in relation to potential cultural or other environmental impacts and risk of the activities under this EP and proposed control measures. Santos responded to questions and at the completion of each session, Santos SMEs were also available to speak with individuals who had additional questions, concerns or wished to discuss matters that may not have been raised during the open forum. Table 4-18 includes a chronology of consultation with Larrakia people.

Through this approach Santos has provided sufficient opportunities and a reasonable period of time for Larrakia People to be consulted for this EP and in accordance with the advice provided by LNAC.

Santos shopfront and DLNG site tours

As part of its broader outreach program, Santos operates a shopfront office in central Darwin where members of the public can learn more about Santos' current and proposed activities. The shopfront is open Monday to Thursday, 10am to 3pm and provides resources and consultation materials and Santos people are available to answer questions on Santos activities.

During the development of the Barossa Gas Project approximately 100 people have visited the shop front, including Larrakia people.

Similarly, Santos has conducted site tours of its DLNG facilities specially for Larrakia people, providing opportunities for Larrakia people to learn more about Santos' activities and ask questions about proposed activities, such as the Barossa Gas Project.

Public awareness campaign

The public awareness campaign used a range of appropriate media, including, radio, print media, targeted social media and drop-in sessions through which information about the proposed activities was made available. Table 4-8 and Table 4-10, which outlines advertising and notifications targeting Larrakia people.

4.6.5.1.3 Consultation with Tiwi Islands clans and individuals

As a result of specific requests and feedback as to the consultation process and consultation preferences, which Tiwi People have historically expressed during previous consultation on Barossa Project EPs, Santos implemented the following tailored and culturally considered consultation approach for Tiwi people:

- A total of 16 individual clan consultation sessions were held for Tiwi people from March to May 2024.
- Consultation activities were conducted face-to-face in the form of clan sessions held at two locations on Bathurst Island, and one location on Melville Island, collectively known hereon in as the Tiwi Islands.
- Scheduling of consultation sessions was undertaken in conjunction with Clan Trustees/Traditional Owners, the Tiwi Land Council, Tiwi Recourses and Tiwi Enterprises to ensure no clashes with community events, cultural ceremony or "Sorry Business".
- Ensuring appropriate permissions from the Tiwi Land Council were obtained to allow Santos personnel to visit the Tiwi Islands.
- Clan sessions were scheduled with approximately four weeks' prior written notice (see Table 4-10), ensuring community members were provided sufficient notice. Santos promoted the sessions via public notices at town stores and the Tiwi Islands Facebook page notice board. Santos employees also received

and responded to phone calls and drop ins at the Darwin shop front from Tiwi people asking for details about consultation sessions.

- Tiwi Island Consultation sessions were on the following dates: 5–7 March 2024, 8-10 April 2024, 13 May 2024, 15-17 May 2024 and 21-22 May 2024.
- Clan specific sessions, consultation sessions were also conducted in Darwin to accommodate Tiwi people who were unable to attend the Tiwi Island based sessions on 22 March 2024 and 8 April 2024. These sessions were open to whomever identified as being a representative from the Tiwi Islands.
- A Welcome/ Acknowledgement to Country was performed at each consultation session by the appropriate senior Clan Traditional Owner/Elder/Senior. This person also opened meetings in language, thanked people for their attendance and encouraged attendees to listen, ask questions and provide feedback.
- Consultation sessions were arranged for clans independent of one another and at a location convenient for that clan. Nevertheless, the attendance and representation at each designated clan session varied for a multitude of reasons. At times clans came together in one meeting in entirety and/or, there was diversified clan representation. Where clans came together in entirety, this was with the agreeance of the clans' trustees. For the latter, this was managed between the individuals present.
- Consultation session attendance by qualified interpreters.
- Consultation attendance by third-party Tiwi Cultural Advisers (individuals and organisations) to Santos who provided advice to Santos to ensure meetings were conducted in a culturally appropriate and respectful way, as well as to provide interpretation support where needed.
- On two occasions Santos rescheduled consultation sessions to accommodate 'Sorry Business' on the Tiwi Islands at the request of the impacted clans. On these occasions Santos liaised with the appropriate clan representatives to reschedule the session to an alternate and acceptable date.

Three rounds of meetings, not including the Darwin-based sessions, were held with each individual clan group with the aim of:

- recapitulation of the Barossa Project to include a project update on existing activities and Project progress;
- recapitulation of the regulatory consultation processes and privacy considerations;
- informing attendees that Relevant Persons may request that particular information they provide during the consultation not be published and that information subject to such a request will not be published under the relevant regulations (and will instead be included in a separate report which will not be published on NOPSEMA's website);
- discussing the activities covered by this EP, including installation steps and vessel descriptions;
- introducing and discussing the potential environmental impacts and risks involved with the planned activities and planned controls to manage those risks;
- introducing and discussing the EMBA in the event of an unplanned event, the risks and planned controls to manage those risks;
- providing opportunities for community input including in relation to potential cultural or other environmental impacts and risk of the activities under this EP and proposed control measures; and
- responding to and closing out any outstanding matters including questions, issues or concerns.

Hard copy consultation materials were produced and distributed or made available prior to the start of the session to support informed discussion during the consultation session. Material included, but was not limited to, copies of the Production Operations Information Booklet, Santos Privacy Statement and the *NOPSEMA community information brochure: Consultation on offshore petroleum environment plans*.

Santos also presented information using videos and displayed other visual aids at each venue to present information regarding operational activity and the project more generally, such as iPads with images and additional materials for distribution during meetings and AO-sized maps of the project area and EMBA and AO-sized posters with photos and images featuring Barossa Project activities.

The consultation sessions were conducted as an open forum. People were encouraged to ask questions and raise concerns through the presentation. Santos representatives and subject matter experts (SMEs) explained the activity, and associated environmental risks and impacts during the face-to-face presentations, assisted by video content and PowerPoint slides.

During the sessions Santos responded to questions where appropriate. If a matter was raised that required additional information, this was taken on notice.

At the end of each session, Santos SMEs were also available to speak with individuals who had additional questions, concerns or wished to discuss matters that may not have been raised during the open forum.

Matters raised at meetings were captured and responded to in several ways, pending the forum in which it was raised and the nature of the discussion.

For example, open forum matters that were of interest to wider clan representatives were populated into a table and provided at subsequent meetings during the main presentation. Where appropriate, frequently asked questions (FAQ) documents in response to matters were prepared and distributed or made available at subsequent sessions.

Other confidential and/or individually specific matters were managed either in person at subsequent meetings, or via an emailed response pending the nature of the request, and the request of the questionee.

Consultation sessions for Tiwi people were notified and advertised as set out in Table 4-10, which includes a chronology of consultation with the Tiwi Islands clans.

Tiwi people have also utilised the Santos shopfront in central Darwin and participated in site tours of DLNG specifically for them , providing an opportunity for Tiwi people to learn more about Santos' activities and ask questions about proposed activities, such as the Barossa Gas Project.

4.6.5.1.4 Consultation with First Nations Consultative Committees

Santos notes that there are remote areas of coastal Northern Australia where formal mechanisms for consultation are few or non-existent.

To support consultation in these areas for this EP, Santos engaged a consultant to support the establishment of First Nations Consultative Committees (FNCCs) with the intention that these be self-nominating and self-governing, and independent of government or industry. The intended purpose of these committees is to provide a forum to allow for culturally appropriate consultation with First Nations peoples represented through FNCCs, and to serve as a means for those peoples to provide feedback to third parties on matters on which the FNCC is consulted.

The FNCC establishment process is led by cultural advisors, comprising a team of First Nations leaders with extensive knowledge and experience in relation to First Nations cultures of Northern Australia, and who possess deep cultural connections to First Nations peoples of the region.

The FNCC establishment process commences with the identification by the cultural advisers of First Nations clans and associated persons who may have functions, interests or activities that may be affected by activities Santos proposes to carry out under an environment plan.

The cultural advisors then contact the identified First Nations persons to discuss the FNCC concept. Santos understands that this includes meetings with Elders and other First Nations leaders who speak for coastal and sea country that may be affected by project activities. Where an interest to participate in the FNCC process is expressed, the cultural advisers support the relevant clan group to establish their own FNCC and to self-determine its functions and operations, including in relation to committee membership, leadership and governance arrangements and desired level and method of consultation.

This process involves the cultural advisors sharing knowledge and experience in relation to their participation on established committees and supporting the identified clan members to determine their own rules and processes for committee decision-making, membership and the nomination of chairs. Once determined, these matters are formally documented in charters adopted by the FNCCs. Santos has been provided with copies of charters of FNCCs consulted for this EP, which include details about the FNCCs' purposes, membership and procedures.

Once established, and subject to the wishes of FNCC members, the external cultural advisors may provide ongoing support to the FNCCs, including administrative and advisory services. Santos engaged a consultant to support FNCC establishment and operations. This consultant maintains regular contact with FNCCs and Clan groups to facilitate Santos' consultation with these groups.

The activities of these committees are complementary to the functions and responsibilities of representative organisations, such as Land Councils or other formal bodies, with the intention that they be in a position to represent First Nations peoples.

FNCC activities are understood to include disseminating consultation information to First Nations community members of relevance.

Santos acknowledges the establishment and operation of these committees in response to the growing need for a means for First Nations voices to be heard and considered. This need is particularly relevant along the NT coastline where formal consultative mechanisms are typically not in existence, in contrast with the WA coastline

Prescribed Bodies Corporate (PBCs) which provide an avenue for consulting First Nations people who have been recognised by Australian law as holding rights and interests to traditional land and waters.[40]

Santos has consulted FNCCs with representative functions across the EMBA for this Activity, providing a broad coverage of any potential sea country interests within the EMBA. Eleven FNCCs were consulted in the preparation of this EP given the expanded geographical coverage of the spill EMBA. Consultation sessions for FNCC members were notified via provision of a specific meeting invitation. Table 4-18 includes a chronology of consultation with FNCCs.

4.6.5.1.5 Consultation with other First Nations organisations

Santos has also consulted other First Nations organisations that support specific interests of First Nations people, such as economic development and community well-being.

These organisations were Aboriginal Sea Company, GDA, Kenbi Rangers, and North Australian Indigenous Land and Sea Management Alliance.

Santos also consulted LDC in its capacity as a commercial organisation that supports positive economic outcomes for Larrakia people.

4.6.5.1.6 Advertising and notification of Tiwi and Larrakia Consultation Sessions

Table 4-10: Advertising and notification of Tiwi and Larrakia Consultation Sessions

Date	Advertising/notice	Description	Reach
For Tiwi Island March/April/May 2024 consultation sessions			
March/April/ May 2024	Social media Notice	Facebook, Tiwi Notice Board Facebook Page	Geotargeted Tiwi Islands – 2,800 members
March/April/May 2024	Notice of Consultation	Emailed to several independent stakeholders for sharing across their direct networks, in person, and for posting on Tiwi Island notices boards	Geotargeted Tiwi Islands – 2,800 members
19 February 2024	Press Ad NT News	Page 19 advertising March sessions	Target NT with reach of 25,000
26 February 2024	Press Ad NT News	Page 6 advertising March sessions	Target NT with reach of 25,000
4 March 2024	Press ad – NT News	Page 6 Advertising March sessions	Target NT with reach of 25,000
23 March 2024	Press ad – NT News	Page 5 Advertising March Community drop-in sessions	Geo-targeted Darwin and surrounding areas (e.g. Burrundie and Kakadu, Tiwi Islands and NT)
26 March 2024	Press ad – NT News	Full page, page 6 Advertising April sessions	Target NT with reach of 25,000
2 April 2024	Press ad – NT News	Full page, page 6 Advertising April sessions	Target NT with reach of 25,000
6 April 2024	Press ad – NT News	Full page, page 12 Advertising April sessions	Target NT with reach of 25,000
8 May 2024	Press ad NT News	Full page, page 8 Advertising May sessions	Targeted NT with reach of 25,000
15 May 2024	Press ad NT News	Full page, page 6 Advertising May sessions	Targeted NT with reach of 25,000
20 May 2024	Press ad NT News	Page 6 advertising May sessions	Targeted NT with reach of 25,000

Date	Advertising/notice	Description	Reach
For Larrakia April/June 2024 sessions			
23 March 2024	Press ad – NT News	Page 5 advertising March Community drop-in sessions	Targeted NT with reach of 25,000
April	Notice of Consultation	Emails to representative organisations for sharing across their direct networks.	Targeted for Larrakia people
April	Notice of Consultation	Emails and phone calls notifying individual Larrakia family representatives	Targeted for Larrakia people
April	Notice of Consultation	Promotion via Santos' Darwin shop front	Targeted for Larrakia people
April	Notice of Consultation	Larrakia Nation social media advertising including Facebook and LinkedIn	Targeted Larrakia people
June	Notice of Consultation	Emailed to representative organisations for sharing across their direct networks.	Targeted for Larrakia people
June	Notice of Consultation	Promotion via Santos' Darwin shop front.	Targeted for Larrakia people
June	Notice of Consultation	Emails and phone calls notifying individual Larrakia family representatives	Targeted for Larrakia people
1 June 2024	Press ad – NT News	Page 30 advertising for June	Target NT with reach of 25,000
5 June 2024	Press ad – NT News	Page 8 advertising for June	Target NT with reach of 25,000
8 June 2024	Press ad – NT News	Page 21 advertising for June	Target NT with reach of 25,000
June	Notice of Consultation	Larrakia Nation social media advertising including Facebook and LinkedIn	Targeted Larrakia people

4.6.6 Provision of sufficient information

Having regard to the purpose of consultation (described above at Section 4.6.1), Santos provided Relevant Persons with sufficient information so they can make an informed assessment about the possible consequences of the Activity on their functions, interests or activities. Santos provided Relevant Persons with information regarding:

- The Activity proposed under this EP;
- The environment that may be affected by the Activity, including depictions of the modelled EMBA and explaining how the EMBA is determined;
- The potential environmental impacts and risks of the Activity and proposed control measures;
- The environmental approval process;
- The purpose of consultation, who may be a Relevant Person and how to self-nominate as a potential Relevant Person;
- The titleholder's obligations during consultation in the course of preparing an environment plan, including informing Relevant Persons that they can request that particular information they provide during consultation not be published and that information subject to such a request will not be published under the relevant regulations (and will instead be included in a separate report which will not be published on NOPSEMA's website);
- The obligation of the titleholder not to publish particular information if so requested by the Relevant Person; and
- How to provide feedback.

Relevant Persons were provided access to information using different mediums and platforms, including by telephone, email, website (https://www.santos.com/barossa/), hard copy and electronic materials, social media, in person and virtual meetings.

At a minimum, this information was available on the Santos website and included in the Barossa Production Operations Information Booklet, which Santos typically shared with Relevant Persons by mail, email and/or made available during consultation sessions.[41]

Other examples of the consultation materials used are included in Appendix F and included the following:

- A FAQ document, responding to queries and feedback during consultation with Tiwi People provided as part of the consultation process; and
- For particular Relevant Persons or particular groups of Relevant Persons, videos, animations, PowerPoint slides, photos, and maps to convey technical information to different audiences in a clear and accessible way.
- Facebook page translated into Tetum and Bahasa Indonesian

Santos also sent Relevant Persons (and potential Relevant Persons) links to the NOPSEMA community information brochure, *Consultation on offshore petroleum environment plans* and/or made this available during in-person consultation sessions. This brochure contains information for community members to better understand the responsibilities of titleholders to consult Relevant Persons in the development of environment plans, the purpose of consultation and how Relevant Persons can provide feedback.

4.6.6.1 First Nations consultation sessions

In addition to the above, to ensure the information provided to First Nation people was culturally appropriate, for each First Nations consultation session, Santos played a short video explaining the purpose of the session and key information relating to the consultation process, how feedback could be provided, privacy considerations and the option for Relevant Persons to request that particular information they provide during consultation not be published and that information subject to such a request will not be published under the relevant regulations (and will instead be included in a separate report which will not be published on NOPSEMA's website).

Santos made available independent, qualified interpreters via the Aboriginal Interpreter Service to assist in the delivery of consultation sessions where appropriate. Santos also used local community members where qualified interpreters were not available.

Santos representatives and subject matter experts explained the activity, risks and impacts during in person presentations. To improve accessibility and comprehension, they were assisted by visual aids/photos, maps, videos, animations, and PowerPoint slides to present information regarding the activity and the project more generally (including information of a more technical nature).

After each consultation session, Santos representatives and subject matter experts were available to answer additional questions or provide further information to clan members and individuals. This offered First Nations people the opportunity to speak to Santos representatives or subject matter experts one-on-one or in a smaller group setting (based on feedback this was a more comfortable format for some people).

As mentioned at Section 4.6.6 above Santos also provided information about NOPSEMA's community information brochure, *Consultation on offshore petroleum environment plans* and made the brochure available at consultation sessions, as well as making the Barossa Production Operations Information Booklet available at all consultation sessions.

Further detail on consultation sessions is provided in Table 4-10**.**

4.6.7 Reasonable period for consultation

Santos is required to allow a Relevant Person a reasonable period for consultation. In considering what constitutes a reasonable period of time for consultation for each Relevant Person, Santos had regard to the nature, extent and likelihood of the potential impact of the Activity on that person's functions, interests or activities.

[41] Between 8 April to 10 May 2024, Santos shared an updated Barossa Production Operations Information Booklet. This was updated to account for an additional risk associated with the Activity, namely a gas release in the unlikely event of an unplanned pipeline loss of containment. A link to the updated booklet was generally shared with Relevant Persons and potential Relevant Persons via email and/or by making a hard copy available during in-person consultation sessions. Santos sent further correspondence linking the updated booklet, highlighting the nature of the additional information in its subsequent emails and indicated where to find that information in the updated version, Santos typically extended the consultation period by approximately two weeks to allow reasonable time for its consideration and for Relevant Persons to provide any consultation inputs having regard to the additional information.

Santos has undertaken a comprehensive consultation program for the Barossa Gas Project commencing with the OPP. The OPP has been followed by extensive consultation for each of the activity specific EPs and other regulatory approvals prepared for different stages of the Barossa Gas Project.

For this EP, Santos provided 31 days through a 'preliminary consultation' phase for Relevant Persons to consider consultation information, including that shared via a link to the Barossa Production Operations Information Booklet which contained information about the proposed activities and their potential impacts and risks.

Santos then generally provided approximately 70 days during the 'formal consultation' phase for Relevant Persons to respond with feedback about the proposed activities.

In cases where a different period was provided for consultation, Santos considered this to be reasonable having regard to:

- the nature, extent and likelihood of the potential impact of the Activity on that person's functions, interests or activities; and/or
- Santos' understanding of the Relevant Persons' consultation preferences.

Santos directly contacted Relevant Persons notifying them of the consultation process and formal consultation period. Emails or letters were sent to Relevant Persons to invite feedback for the EP, confirming the date by which feedback was sought and outlining how feedback may be provided. In other cases, one or more meetings were arranged, by agreement with the Relevant Person, for the purposes of the consultation.

Following an approximate one month public awareness campaign during the preliminary consultation period to raise awareness of this EP activity and to seek out Relevant Persons for consultation (Table 4-7), Santos also conducted a public awareness campaign from 11 March 2024 to 9 April 2024, specifically reminding Relevant Persons of the consultation opportunity and seeking feedback from Relevant Persons for this EP (refer Table 4-7).

Where no comments were received from a Relevant Person, Santos generally followed up the Relevant Person during the formal consultation phase to prompt them to consider the information materials previously provided and/or confirm whether the Relevant Person intended to provide feedback. In some cases, Santos extended the formal consultation period to allow Relevant Persons more time to make an informed assessment of the possible consequences of the proposed activity on their functions, interests or activities. Santos also accepted feedback from Relevant Persons at any time prior to the submission of this EP, which was approximately 6 months after consultation materials were initially provided to most Relevant Persons.

As outlined in Section 4.6.1, Santos notes that there is no reasonable possibility that planned impacts from the Activity will have any consequences on functions, interests or activities concerning areas at the extremities of the EMBA. In addition, the likelihood of the unplanned release is assessed as remote given the mitigation and management controls in place, and the residual risk is considered low. There is an even lower likelihood of an unplanned hydrocarbon release affecting a person's or organisation's functions, interests or activities where these relate to the extremities of the EMBA. While Santos has still consulted Relevant Persons whose functions, interests or activities may only be affected by unplanned events (the likelihood of which is remote), consultation tended to focus more closely on those most proximate to the Operational Areas and in respect of whom the period reasonably required for consultation is considered to likely be greater.

- Considering the above, Santos considers it has provided a more than reasonable period for consultation.

4.7 Consultation report

A summary report including the outcomes of consultation with Relevant Persons, including any objections or claims about the adverse impact of the Activity and Santos' assessment of them, satisfying the requirements of section 24(b)(i)-(iii) of the OPGGS(E)R, is provided in Table 4-11 to Table 4-23. The full records of Relevant Persons consultation, as required by section 24(b)(iv) of the OPGGS(E)R, is provided in the Sensitive Information Report.

Where objections or claims made during consultation were considered relevant to this EP, sections within this EP and the Barossa Production Operations OPEP have been referenced within the consultation report (refer Table 4-11 to Table 4-23) for each objection or claim, showing where existing information relevant to that objection or claim is located.

Where Santos has received input from Relevant Persons in consultations undertaken in the course of preparing other environment plans, it has considered and applied that input in the course of preparing this EP and included EP references where appropriate.

In addition to including a statement of Santos' response to objections or claims (per section 24(b)(iii)), a statement of the titleholder's response, or proposed response, if any, to each objection or claim; and a summary of responses to Relevant Persons is also included where appropriate.

4.7.1 Commonwealth Government Agency or Authority

Table 4-11: Consultation Summary Table - Commonwealth Government Agency or Authority

Section 25(1)(a) of the OPGGS(E)R: Commonwealth agency or authority to which the activities to be carried out under the environment plan may be relevant

Australian Communications and Media Authority (ACMA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed ACMA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests, or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed ACMA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 27 March 2024 ACMA emailed Santos and advised that Vocus' North-West Cable System is likely to share a cable crossing with the proposed Gas Export Pipeline and is aware of other proposals to install submarine cables landing in Darwin and ACMA recommends engaging with the owners. ACMA advised there are no submarine cable protection zones declared by the ACMA in the vicinity of Santos' proposed activities and does not require additional consultation. [Con-3795]
- On 27 March 2024 Santos emailed ACMA and confirmed Santos is in ongoing engagement with Vocus, BW Digital, Sun Cable, Telstra and NT Power and Water Corporation. [Con-3796]
- On 7 May 2024, Santos emailed ACMA further to ACMA's response on 27 March 2024, to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from ACMA. [Con-4137]
- On 10 July 2024 Santos emailed ACMA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from ACMA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
ACMA recommended Santos engage with the owners of any submarine cables (existing or planned) within the OA to discuss the activities.	Santos has considered the matters raised in the EP and provided a response. Santos notes ACMA's advice and has consulted with the relevant owners of submarine cables (existing or planned) in preparing this EP.	Santos confirmed it was consulting with the relevant owners of submarine cables (existing or planned).	Refer to Table 4-19 (Infrastructure Operators) for consultation with submarine cable owners BW Digital, NT Power and Water Corporation, Sun Cable, Telstra and Vocus.

Australian Fisheries Management Authority (AFMA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed AFMA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed AFMA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 14 March 2024, AFMA emailed Santos and advised that it has no specific comments on the proposal as it lies outside the main area of their fisheries operations and encouraged Santos to engage with state fisheries agencies and operators. [Con-3797]
- On 27 March 2024, Santos emailed AFMA to confirm it is consulting with the following organisations on this EP: WA Department of Fisheries, NT Department of Fisheries, WAFIC, NTSC, NPFI, ASBTIA, CFA and licence-holders in each fishery through their representative organisations. [Con-3798]

- On 27 March 2024 AFMA thanked Santos for confirmation of which organisations Santos was consulting with. [Con-3799].
- On 7 May 2024, Santos emailed AFMA further to AFMA's response on 27 March 2024, to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that that consultation will close on the revised date unless Santos hears otherwise from AFMA. [Con-4138]
- On 10 July 2024 Santos emailed AFMA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from AFMA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
AFMA advised Santos to consult directly with commercial fishing industry stakeholders, including via representative organisations.	. Santos notes AFMA's advice and has consulted with relevant commercial fishing industry stakeholders in preparing this EP.	Santos confirmed it was consulting with relevant commercial fishing industry stakeholders.	Refer to Table 4-17 (Commercial Fishing (Commonwealth / NT / WA managed) for consultation with licence holders. Refer to Table 4-20 (Industry Associations) for consultation with ASBTIA, CFA, NPFI, NTSC and WAFIC.

Australian Hydrographic Office (AHO)

Summary of consultation effort:

- On 9 February 2024 Santos emailed AHO to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 12 February 2024, AHO provided an acknowledgement to Santos that the email has been received and the data will now be registered, assessed, prioritised and validated. AHO advised that standards may result in some data generalisation or filtering due to the scale of existing charts, proximity to other features, and the level of risk a reported feature presents to mariners. [Con-3800]
- On 11 March 2024 Santos emailed AHO further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 13 March 2024, AHO provided an acknowledgement to Santos that the email has been received and the data will now be registered, assessed, prioritised and validated. [Con-3801]
- On 7 May 2024, Santos emailed AHO further to emails sent previously, to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from AHO. [Con-4139]
- On 8 May 2024, AHO provided an acknowledgement to Santos that the email has been received and the data will now be registered, assessed, prioritised and validated. [Con-4141]
- On 10 July 2024 Santos emailed AHO to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 23 August 2024 Santos phoned AHO and followed-up with an email on 28 August 2024 advising that, in the absence of any specific response from AHO, Santos has reverted to the standard advice provided by AHO in response to requests for feedback during consultation on other Barossa EPs. In the email Santos provided details of the DAFF information being included in the EP and requested any further input by 9 September 2024. [Con-5609]
- On 5 September 2024 AHO responded to Santos' email of 23 August 2024. AHO advised it had no further comment other than requesting that the final positions of any permanent features are sent to the AHO for charting action. [Con-5640] Santos responded via email the same day stating the AHO's charting requirements would be cited in the relevant EPs. [Con-5641]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from AHO.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
Other than its standard advice with respect to maritime safety matters, the AHO advised it had no other comments that would value add to the activity. The AHO requested that, once the activity is fully complete, the final positions of any permanent features are sent to the AHO for charting action.	Santos has followed and actioned the standard advice provided by AHO and AMSA for every EP with respect to maritime safety matters. Santos has considered and applied this standard advice to this EP, including activity notifications. Santos considers Section 25 consultation requirements to have been met.	Santos will include all formal notification requirements in the relevant sections of this EP, specifically the following: • Requirement to notify the AHO through datacentre@hydro.gov.au no less than 4 working weeks before operations commence for the promulgation of related notices to mariners. • Requirement to notify AMSA's JRCC through rccaus@amsa.gov.au (Phone: 1800 641 792 or +61 2 6230 6811) for promulgation of radio-navigation warnings 24-48 hours before operations commence. Santos also acknowledges the following standard AHO advice: • Vessel obligations to comply with the International Rules for Preventing Collisions at Sea (COLREGs), in particular, the use of appropriate lights and shapes to reflect the nature of operations (e.g. restricted in the ability to manoeuvre). Vessels should also ensure their navigation status is set correctly in the ship's AIS unit. • Evaluation and implementation of adequate anti-collision measures, including the collision risk mitigation measures cited by AMSA, being additional warnings and/or lights to attract attention and offshore guard vessel/s that can monitor traffic and take early action to alert a vessel approaching the area of operations. • Santos' vessel anti-collision measures are in accordance with COLREGs and AMSA requirements. Additionally, Santos will implement cautionary zones around Project vessels and use surveillance vessel to guard cautionary zones. Santos will also provide the AHO with the final positions of any permanent features for charting action.	Notification requirements for AHO are included in and control measure BAO-CM-6.6.1.

Australian Institute of Marine Science (AIMS)

Summary of consultation effort:

- On 9 February 2024 Santos emailed AIMS to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 21 February 2024 AIMS emailed Santos and advised its schedule was indicative only. However, it has planned voyages around the Goodrich Bank area and enquired if Santos anticipated disruption to these operations. [Con-3802]
- On 28 February 2024 Santos emailed AIMS and advised it was waiting on internal feedback and would respond soon. [Con-3803]
- On 29 February 2024 Santos emailed AIMS and requested coordinates and details of its Goodrich Bank interests. [Con-3804]
- On 1 March 2024 AIMS provided Santos with the information requested. [Con-4120]
- On 5 March 2024 Santos thanked AIMS and advised it would revert back. [Con-4056]
- On 11 March 2024 Santos emailed AIMS further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 27 March 2024 Santos emailed AIMS with information on potential activities during dates in 2025, in response to AIMS' emails of 21 February 2024 and 1 March 2024. In the email Santos advised it did not believe there would be any impacts from Barossa activities on any AIMS activities during the advised time periods due to the distance from the nearest Barossa Operational Area. [Con-5153]
- On 2 May 2024 Santos emailed AIMS further to its response in March 2024, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet has been updated to account for an additional risk associated with the proposed activity. In the email, Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from AIMS. [Con-4219]
- On 3 May 2024 AIMS emailed Santos requesting information on the infrastructure it had in the approaches to Darwin Harbour. The email related to Barossa DPD activities in NT waters and was not relevant to this EP. [Con-4945] Santos subsequently responded to AIMS separate to the consultation process for this EP.
- On 10 July 2024 Santos emailed AIMS to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from AIMS.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
Discussion was held on indicative voyages planned by AIMS to Goodrich Bank.	Santos has considered the matters raised in the EP and provided a response. Planned activities to be managed under this EP are unlikely to affect AIMS' field activities given the distance from OA1 and OA2 to Goodrich Bank. As a result, no credible impacts to AIMS' potential field activities are expected from planned activities. While impacts to AIMS' functions, interests and activities are possible in the event of an unplanned hydrocarbon spill, Santos considers appropriate controls are in place to prevent a hydrocarbon spill. Santos considers the measures and controls described within the Barossa Production Operations OPEP adequately address oil spill planning and response in the event of a spill. AIMS is kept updated on Santos' activities in the OA via Notice to Mariners issued by the Australian Hydrographic Office, Santos' pre-activity notifications to marine users and Santos' Barossa Quarterly Project Update.	Santos thanked AIMS for provision of details on its Goodrich Bank interests. Santos advised AIMS that it did not believe there would be any impacts from Barossa activities on any AIMS voyages during the advised time periods due to the distance from the nearest Barossa Operational Area. Santos advised AIMS that it would be kept updated on Santos' activities via Notice to Mariners issued by the Australian Hydrographic Office, Santos' pre-activity notifications to marine users and Santos' Barossa Quarterly Project Update.	Shoals and banks area described in Section 3.3.5. Research activities including AIMS proposed voyages around Goodrich bank and AIMS, BOM and UWA monitoring equipment is included as a socio-economic receptor in Section 3.6.7 The potential impact of the Activity on AIMS field activities and monitoring equipment is assessed in Section 6.2.2 Control measures for unplanned events are described in Section 7. Notifications Section 8.4.9 and
AIMS asked for information on Santos' infrastructure in the approaches to Darwin Harbour.	Santos has considered the matters raised in the EP and provided a response. The information request from AIMS with respect to Darwin Harbour infrastructure is outside the scope of this EP. Santos' infrastructure in the approaches to Darwin Harbour are located in NT waters. Petroleum activities in NT waters are within the regulatory jurisdiction of DITT NT.	Santos responded to AIMS and provided requested information, separate to the activities to be managed under this EP.	Not applicable.

Australian Maritime Safety Authority (AMSA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed AMSA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 7 March 2024 AMSA emailed Santos and advised it would like to register as a Relevant Person for further consultation on the development of the Environment Plan and Environmental Management Plan. [Con-3805]
- On 11 March 2024 Santos emailed AMSA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 12 March 2024 AMSA's marine safety division emailed Santos with an auto-response providing further information on relevant Maritime Safety Information (MSI). [Con-3806]
- On 9 April 2024 AMSA's marine safety division emailed Santos to advise that AMSA's Joint Rescue Coordination Centre (JRCC) should be notified for promulgation of radio-navigation warnings 24-48 hours before operations commence. Vessels should exhibit appropriate lights and shapes to reflect the nature of operations and comply with the International Rules for Preventing Collisions at Sea (COLREGs). In particular, the use of appropriate lights and shapes to reflect the nature of operations (e.g. restricted in the ability to manoeuvre). Vessels should also ensure their navigation status is set correctly in the vessel's AIS unit. Collision risk mitigation measures may include but are not limited to:
    - Additional warnings and/or lights to attract attention
    - Installation of Automatic Identification System (AIS) units
    - Offshore guard vessel/s that can monitor traffic and take early action to alert a vessel approaching the area of operations. [Con-3807]
- On 8 May 2024, Santos emailed AMSA further to emails previously sent, to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from AMSA. [Con-4142]
- On 10 July 2024 Santos emailed AMSA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from AMSA's marine safety division. AMSA's marine pollution division did not provide any response.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
AMSA's marine safety division advised Santos of the required formal notifications process prior to and during activities.	Santos has considered the matters raised in the EP. Santos notes AMSA's advice and has included requirements in the relevant sections of this EP, specifically the following: • Requirement to notify the Australian Hydrographic Office through datacentre@hydro.gov.au no less than four working weeks before activities commence for the promulgation of related notices to mariners. • Requirement to notify AMSA's JRCC through rccaus@amsa.gov.au (Phone: 1800 641 792 or +61 2 6230 6811) for promulgation of radio-navigation warnings 24-48 hours before operations commence.	No response required.	Notification requirements for AHO and AMSA JRCC are included in and control measure BAO-CM-6.6.1 for notifying AHO.
AMSA's marine safety division advised Santos of the required maritime safety measures.	Santos has considered the matters raised in the EP Santos notes AMSA's advice and has included requirements in the relevant sections of this EP, specifically the following: • Vessels to comply with COLREGs, in particular, the use of appropriate lights and shapes to reflect the nature of operations (e.g. restricted in the ability to manoeuvre). • Vessels to ensure their navigation status is set correctly in the ship's AIS unit. • Evaluation and implementation of adequate anti-collision measures, including the collision risk mitigation measures cited by AMSA, being additional warnings and/or lights to attract attention and offshore guard vessel/s that can monitor traffic and take early action to alert a vessel approaching the area of operations.	No response required.	Vessel anti-collision measures in accordance with COLREGs and AMSA requirements are included in a control measures (refer to BAO-CM-6.1.2 and BAO-CM-6.6.1) and associated performance standards.

Clean Energy Regulator (CER)

Summary of consultation effort:

- On 9 February 2024 Santos emailed CER to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed CER further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 28 March 2024, CER emailed Santos and provided detail on the schemes legislated by the Australian Government for measuring, managing, reducing or offsetting Australia's carbon emissions. It confirmed none of these schemes currently required Santos to obtain regulatory approval to progress. CER advised that during the course of its activities Santos will need to meet any reporting requirements that apply under the *National Greenhouse and Energy Reporting Act 2007* (NGER Act). Additionally, if the activities of the Barossa Gas project exceed covered 'scope 1' emissions of 100,000 tonnes of carbon dioxide equivalent (tCO_{2e}), it will have obligations under the Safeguard Mechanism. CER provided a case number and additional contact details. [Con-3808]
- On 30 March 2024, Santos emailed CER and requested a meeting in mid-April 2024 to discuss CER's response and other queries. [Con-3809]
- On 4 April 2024, CER emailed Santos and advised the NGER section can provide advice on the requirements for companies to report and that it appears the consultation relates primarily to safety and environment matters, which they were not able to provide any further information on. CER requested some questions or points of discussion for the meeting in mid-April, so it can determine attendees to support provision of advice on these matters. [Con-3810]
- On 18 June 2024, Santos sent CER an email requesting a meeting via Teams [Con-4946].
- On 28 June 2024 CER emailed Santos to accept the meeting request. [Con- 4947]
- On 3 July 2024 Santos met with CER to discuss how Santos will present the following information in the EP:
  - The role of the CER in administering the Safeguard Mechanism.
  - Application of the Safeguard Mechanism to regulate GHG emissions in support of Australia meeting its emissions reduction targets.
  - Application in principle of the Safeguard Mechanism to regulate GHG emissions from Barossa production operations. [Con-5036]
- At the meeting CER did not raise any concerns with the information presented by Santos.CER agreed to review the information provide within the next week. [Con-5036] Santos emailed the presentation slides to CER the same day for its further review. [Con-4948]
- On 9 July 2024 CER emailed Santos to advise it was satisfied with the information describing the Safeguard Mechanism regulations administered by the CER that will be included in the Barossa Production Operations EP, as presented by Santos at the meeting on 3 July 2024. [Con-5013]
- On 10 July 2024 Santos emailed CER to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]

- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from CER.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
CER advised Santos that it was satisfied with information to be included in the EP on its regulation of GHG emissions from Barossa production operations.	Santos has considered the matters raised in the EP. The GHG Emissions section of the EP describes the Safeguard Mechanism regulations, and that the Activity will comply with the requirements.	No response required.	The National greenhouse gas emissions framework is described in Section 6.3.2.6.2.

Climate Change Authority (CCA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed CCA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and
- what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed CCA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned CCA and spoke to a team member and advised it would send a request for a meeting.
- On 6 May 2024 Santos emailed CCA further to the phone call on 3 April 2024 to advise it had extended the consultation period for the EP until 20 May 2024. Santos repeated its request for a meeting. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from CCA. [Con-4132]
- On 10 July 2024 Santos emailed CCA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised CCA that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from CCA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from CCA.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

CSIRO

Summary of consultation effort:

- On 9 February 2024 Santos emailed CSIRO to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed CSIRO further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 3 and 4 April 2024 Santos phoned and spoke to the general enquiries line and left a message regarding consultation for Barossa Production Operations EP activities.
- On 2 May 2024, Santos emailed CSIRO further to previous correspondence to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, the Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from the CSIRO. [Con-3855]
- On 10 July 2024 Santos emailed CSIRO to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]

- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from CSIRO.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from CSIRO.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Department of Agriculture, Forestry and Fisheries (DAFF) – Biosecurity (marine pests) and Fisheries

Summary of consultation effort:

- On 9 February 2024 Santos emailed DAFF to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests, or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed DAFF further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 11 March 2024, DAFF's Conveyance Policy (Maritime) team (formerly Seaports Team) provided an automated response. [Con-3811]
- On 8 May 2024, Santos emailed DAFF further to the previous correspondence, to advise it has extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet has been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from DAFF. [Con-4143]
- On 8 May 2024, DAFF's Conveyance Policy (Maritime) team (formerly Seaports Team) provided an automated response. [Con-4950]
- On 10 July 2024 Santos emailed DAFF to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised DAFF that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 23 August 2024 Santos phoned DAFF and followed-up with an email on 28 August 2024 advising that, in the absence of any specific response from DAFF, Santos has reverted to the standard advice provided by DAFF in response to requests for feedback during consultation on other Barossa EPs. In the email Santos provided details of the DAFF information being included in the EP and requested any further input by 9 September 2024. [Con-5608]
- On 28 August 2024 DAFF emailed an auto-response to Santos' email of 28 August 2024 [Con-5610]
- On 11 September 2024 Santos met with DAFF's Conveyance Policy Biosecurity Operations Division to discuss preparation of the Barossa FPSO Biosecurity Management Plan. Topics included the biosecurity roadmap for the FPSO, hull biofouling and cleaning, topside biosecurity & inspections, voyage preparations, ballast water treatment system exemption, FPSO arrival in Australia and the timing/ checklists, reporting requirements and arrival schedules. [Con-6019]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from DAFF.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
DAFF Biosecurity (Conveyance Policy Biosecurity Operations Division) provided input & guidance in the preparation of the FPSO Biosecurity Management Plan. It had no comments on any other aspects of the EP.	Santos and BW Offshore (BWO) have met with DAFF during preparation of the FPSO-specific biosecurity management plan. Pursuant to requirements under the *Biosecurity Act 2015,* the plan will be submitted to DAFF for approval in line with operational readiness of the FPSO ahead of sailaway. Advice received was not limited to but included – • The Biosecurity Plan will manage actions required from sailaway and arrival in Australian waters as well as the ongoing Operations of the FPSO (e.g. offtake tanker arrival process), • Management of food & waste on arrival in Australian waters, • Timing of receiving the "low risk determination", • Customs requirements, and • Timing for submitting the Plan.	All DAFF biosecurity requirements are understood and referenced in relevant commitments documented in this EP. Santos will report and engage directly with DAFF for the management of biosecurity risk post EP acceptance as stated in the cited offshore biosecurity guidelines and other associated documentation. Santos will continue to keep DAFF informed and incorporate DAFF's assistance offer into relevant management plans.	Notifications to DAFF Biosecurity are included in . Santos' environmental management framework relevant to biosecurity risk is outlined in Section 8.3.2.9 and is consistent with DAFF Biosecurity requirements. Adopted control measures are listed in Section 8.1.2 – FPSO specific Biosecurity Plan BAO-CM-7.2.1
No response was received from DAFF Fisheries.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. In the absence of any specific response, Santos has reverted to standard advice provided by DAFF Fisheries with respect to fishery	No response required.	Refer to Table 4-17(Commercial Fishing (Commonwealth / NT / WA managed) for consultation with licence holders.

	matters. Santos has considered and applied this standard advice to this EP, including activity notifications. Santos considers Section 25 consultation requirements to have been met.		Refer to Table 4-20 (Industry Associations) for consultation with industry association relevant to Commonwealth fisheries - ASBTIA, CFA and NPFI.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Underwater Cultural Heritage Branch

Summary of consultation effort:

- On 9 February 2024 Santos emailed DCCEEW's Underwater Cultural Heritage Branch to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed DCCEEW's Underwater Cultural Heritage Branch further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 3 April 2024 Santos phoned the DCCEEW's Underwater Cultural Heritage Branch and left a message with reception regarding consultation for Barossa Production Operations EP activities.
- On 5 April 2024, a representative from DCCEEW's Underwater Cultural Heritage Branch phoned Santos and left a voicemail. [Con-4955]
- On 9 April 2024, DCCEEW's Underwater Cultural Heritage Branch emailed Santos advising Santos of the UCH Act requirements, including a summary of the UCH Act protections, key responsibilities and obligations, management considerations and recommendations. [Con-3814]
- On 8 May 2024, Santos emailed DCCEEW's Underwater Cultural Heritage Branch further to recent correspondence to acknowledge the advice provided in the Branch's 9 April 2024 email and advise that Santos had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from DCCEEW's Underwater Cultural Heritage Branch. [Con-4144]
- On 10 July 2024 Santos emailed DCCEEW's Underwater Cultural Heritage Branch to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from DCCEEW Underwater Cultural Heritage Branch.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
DCCEEW Underwater Cultural Heritage Branch provided advice to Santos on its obligations under the UCH Act.	Santos has considered the matters raised in the EP. Santos acknowledged the advice from DCCEEW with respect to obligations under the UCH Act, including following DCCEEW guidance if UCH is detected during planned activities or as a result of an unplanned event.	No response required.	Underwater cultural heritage is described in Section 3.6.9. Notifications to DCCEEW Underwater Cultural Heritage Branch are included in Section 8.4.9 and BAO-CM-6.1.3 EPO-20

Department of Defence (DoD)

Summary of consultation effort:

- On 9 February 2024 Santos emailed DoD to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed DoD further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned DoD and left a voice mail message with two DoD contacts regarding consultation for Barossa Production Operations EP activities
- On 6 May 2024 Santos emailed DoD further to previous correspondence to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from DoD. [Con-4133]

- On 10 July 2024 Santos emailed DoD to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised DoD that it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from DoD.
- In the absence of any specific response, Santos has reverted to standard advice provided by DoD with respect to defence matters. Santos has considered and applied this standard advice to this EP, including activity notifications.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from DoD.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Defence activities are described in Section 3.6.5. Notifications to DoD are included in .

Department of Foreign Affairs and Trade (DFAT)

Summary of consultation effort:

- On 9 February 2024 Santos emailed DFAT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests, or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed DFAT further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned DFAT regarding consultation for Barossa Production Operations EP activities. A DFAT representative requested Santos follow-up by email.
- On 15 April 2024 DFAT wrote to Santos and advised that given the location of the activity, there are several areas within DFAT that may need to provide views. DFAT asked if there was still an opportunity for DFAT to provide information, including the specific questions at the end of the email. [Con-3815]
- On 8 May 2024 Santos emailed DFAT further to its response of 15 April 2024 to advise it has extended the consultation period until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from DFAT. [Con-4146]
- On 24 May 2024 DFAT's Timor-Leste Branch emailed Santos and recommended it consult with the Government of Timor-Leste on Santos' Environment Plan given the proximity of Santos' operations to the territory of Timor-Leste. The appropriate authority for such consultation is the Autoridade Nacional Do Petróleo Timor-Leste (ANP - National Petroleum Authority). [Con-4215]
- On 24 June 2024 Santos responded via email to DFAT's Timor-Leste Branch confirming that it would be consulting with ANP. [Con-4956]. A separate email was sent to the Indonesia Branch of DFAT asking whether it had any similar advice re the consultation process. [Con-4957]
- On 2 July 2024 Santos followed up one of the emails sent on 24 June 2024 with a phone call to DFAT's Indonesia Branch. The Indonesia Branch representative asked that the email be re-sent which Santos did the same day. [Con-4958]
- On 10 July 2024 DFAT's Indonesia Desk emailed Santos to advise that it had no comment on the EP. [Con-5083]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from DFAT.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
DFAT recommended, via its Timor-Leste Branch, that Santos consult with the Autoridade Nacional Do Petróleo Timor-Leste (ANP - National Petroleum Authority).	As Santos has assessed there to be no Activity impacts or risks to internationally held functions, interest and activities, the only matter in respect of which consultation with Indonesian and Timor-Leste persons or organisations might be required is in relation to a hydrocarbon spill that reaches Indonesian or Timor-Leste waters. As a result of DFAT's recommendation, Santos consulted with the Timor-Leste Government's National Petroleum Authority on the basis of the above assessment.	Santos acknowledged the responsibility Autoridade Nacional Do Petróleo Timor-Leste (ANP - National Petroleum Authority) had for petroleum-related environmental matters in Timor-Leste, including in the event of a hydrocarbon spill entering its waters due to a spill originating in another jurisdiction's waters. Santos responded that consultation with the ANP is being undertaken as part of the EP preparation process.	

Department of Home Affairs (DHA) / Australian Border Force (ABF)

Summary of consultation effort:

- On 9 February 2024 Santos emailed DHA/ABF to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]

- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed DHA/ABF further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned DHA/ABF and spoke to a representative from the branch responsible critical infrastructure. The representative advised that its interest in the activities under this EP lies in offshore security matters once the floating production, storage and offloading (FPSO) facility is constructed and Santos' requirement to hold and maintain a security plan. The representative advised DHA/ABF had been separately in contact with the Health and Safety section of Santos re the requirements for the Barossa project.
- On 6 May 2024, Santos emailed DHA/ABF and acknowledged ABF's guidance in relation to the Maritime Transport and Offshore Facilities Security Act 2003 and accompanying Regulations. Details of DHA/ABF's request and Santos' response are listed below. In the email Santos also advised that it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from DHA/ABF. [Con-4134]
- On 10 July 2024 Santos emailed DHA/ABF to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from DHA/ABF.

Summary of response by Relevant	Assessment of merits	Santos' Response Statement	EP Reference
DHA/ABF advised that its interest in proposed activities to be managed under this EP related to offshore security matters, specifically for Santos to hold and maintain a security plan following construction of the FPSO.	Santos has considered the matters raised in the EP and provided a response. Santos notes advice from DHA/ABF with respect to obligations under the *Maritime Transport and Offshore Facilities Security Act 2003*. BW Offshore (BWO) will develop a Ship Security Plan and Santos will develop the Offshore Security Plan in accordance with the *Maritime Transport and Offshore Facilities Security Act 2003* and the accompanying Maritime Transport and Offshore Facilities Security Regulations 2003. Santos will submit the plan for approval upon completion and in line with operational readiness of the vessel. Santos acknowledges its obligations in accordance with the *Security of Critical Infrastructure Act 2003* and prior to SOCI thresholds being met will ensure registration notification and the application of Critical Infrastructure Risk Management Plans and provided direct contact details for the Santos Senior Security Adviser.	Santos confirmed it understood its regulatory requirement to hold and maintain a security plan.	Appendix C.

Department of Industry, Science and Resources (DISR)

Summary of consultation effort:

- On 9 February 2024 Santos emailed DISR to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 9 February 2024, DISR emailed Santos and advised DISR has no comment on the environmental management of the proposed activity. [Con-3816]
- On 15 February 2024, Santos emailed DISR thanking it for its response and advised it will continue to keep DISR updated on Barossa activities. [Con-3817]
- On 7 May 2024, Santos emailed DISR further to the previous correspondence, to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from DISR. [Con-4140]
- On 10 July 2024 Santos emailed DISR to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised DISR that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]

- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from DISR.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from DISR.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Director of National Parks (DNP)

Summary of consultation effort:

- On 9 February 2024 Santos emailed DNP to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed DNP further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 3 April 2024 Santos phoned DNP and left a voice mail.
- On 12 April 2024, DNP emailed Santos seeking an extension to comment until the week beginning 22 April. [Con-3812] Santos subsequently agreed to the request in a phone discussion with DNP on 18 April 2024.
- On 26 April 2024, DNP emailed Santos to advise that based on the information provided it had no objections and claims. However, as part of the ongoing inspection, maintenance, monitoring and repair (IMMR) of the Barossa GEP, Parks Australia would like to discuss the provision of a report, or similar, that outlines the findings of these activities in relation to the Barossa GEP which traverses parts of the Oceanic Shoals Marine Park. [Con-4122]
- On 30 April 2024, Santos emailed DNP to acknowledge the guidance note provided and confirm it will consider this information in the course of preparing the EP and suggested dates for a meeting. [Con-4123]
- On 1 May 2024 DNP emailed Santos and advised that 24 May 2024 was suitable for a meeting. [Con-4124]
- On 1 May 2024, Santos emailed DNP further to the previous correspondence, to advise it has extended the consultation period until mid-May 2024 and that in providing this extension of time, the information in the booklet and factsheet has been updated to account for an additional risk associated with the proposed activity. [Con-4125]
- On 2 May 2024, DNP emailed Santos and advised that the preventative and mitigation measures appeared appropriate for the additional risk. Parks Australia requested a brief summary at the meeting and provided initial questions that could also be answered during the meeting. [Con-4127]
- On 24 May 2024 Santos met with DNP. At the meeting it was agreed that Santos would include a measure in the Barossa Production Operations EP to provide a report on outcomes of IMMR activities in the Oceanic Shoals Marine Park multiple use zone (for 30km) and the habitat protection zone (for 31km). If additional raw data is requested by DNP for the remainder of the Barossa GEP, Santos would also provide this. Santos also responded to questions asked by DNP at the meeting (see table entries below). [Con-4952]
- On 9 July 2024 Santos emailed DNP minutes of the meeting held with Parks Australia on 24 May 2024. [Con-5018]
- On 10 July 2024 Santos emailed DNP to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from DNP.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
DNP asked for information on methods of pipeline monitoring to detect potential gas releases.	Santos has considered the matters raised in the EP and provided a response. Santos presented further information on the detection methods including live pressure monitoring and detection controls and ROV inspections, these are discussed in Section 7.6 of the EP and reflected in adopted management controls.	Santos confirmed: • Leaks could be long term or short term. Short term leaks / release could potentially occur in areas that are more at risk of dropped objects. • Safety procedures are strictly adhered to during lifting operations over the pipeline. • Long term leaks may potentially occur at flanges and would be detected during IMMR activities.	Section 7.6 BAO-CM-7.1.1BAO-CM-7.1.1 BAO-CM-7.6.3.
DNP asked for information on timeliness to detect potential gas releases.	Santos has considered the matters raised in the EP and provided a response. Santos discussed the leak detection timeliness in respect to the cause and size of the leak. The detection methods include FPS process monitoring via pressure detection controls and ROV inspections, these are discussed in Section 7.6 of the EP and reflected in adopted management controls.	Santos confirmed: • It will send out a remotely operated vehicle (ROV) as soon as possible if a leak occurred due to a dropped object. Santos would then need to obtain equipment. The earliest response is within hours if equipment is available in Darwin. • The inspection of the leak and repair may take longer, e.g. up to a couple of months if the equipment is not available locally. • The FPSO and DLNG facility will pick up any pressure changes in the pipeline for a larger release. If a larger breach occurs, it could lose the full contents of the pipeline.	Section 7.6 BAO-CM-7.6.1 BAO-CM-7.6.5.
DNP asked for information on response times following detection of gas releases.	Santos has considered the matters raised in the EP and provided a response. Santos discussed the scenarios and associated response times to a gas release. These are discussed in Section 7.6 of the EP and reflected in adopted management controls.	Santos confirmed: • Santos will respond immediately once a gas release is identified. • Response will be in accordance with emergency response plan, similar to the response information in Bayu Undan EP (which is also gas), which will also be provided in the Barossa Production Operations EP. • For releases from flowlines/ wells, Santos will activate the Oil Pollution Emergency Plan which has a first strike response.	Section 7.6 BAO-CM-7.6.4 BAO-CM-7.7.8.7.
DNP asked for information on proposed repair activities to be undertaken in proximity of the Barossa GEP.	Santos has considered the matters raised in the EP and provided a response. Santos discussed what potential repair activities could take place in the event of a subsea release. These are included in Section 7.6 of the EP and reflected in adopted management controls.	Santos confirmed: • A large release may require replacement of a component or section of pipeline.	Section 7.6 BAO-CM-7.6.3 BAO-CM-7.6.5.

		• Santos would need to mobilise a pipelay vessel and may take months to fix and would need environmental and safety approvals as well. • The gas flow would be turned off and the pipeline would be repaired and tested again before resuming operations. • Small leaks are generally from old equipment or poor installation. Newly installed pipelines have a rigorous regime of Quality Assurance. • Pipeline components have been tested onshore and tested again as part of full Barossa GEP system commissioning. • Leaks could potentially occur in areas where flanges are or areas where the pipeline may move over time. These areas will be priority areas during surveys and subject to further investigations during IMMR activities.	
DNP suggested provision of a report, or similar, that outlines the findings of Santos' IMMR activities in relation to the section of the Barossa GEP that traverses the Oceanic Shoals Marine Park.	Santos has considered the matters raised in the EP and provided a response. DNP requested the finding of Santos IMMR activities as part of their role of managing marine parks. Santos described the typical information included in IMMR report and agreed to provide the report on outcomes of IMMR activities once undertaken. The Barossa JV will also provide the raw data if requested by DCCEEW Parks Australia Branch.	Santos confirmed: • Santos will provide a report on outcomes of IMMR activities in the Oceanic Shoals Marine Park multiple use zone (for 30km) and the habitat protection zone (for 31km). • Santos will also provide raw data if requested by DCCEEW Parks Australia Branch for the remainder of the Barossa GEP.	Section 8.1.2.

Fisheries Research and Development Corporation (FRDC)

Summary of consultation effort:

- On 9 February 2024 Santos emailed FRDC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed FRDC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 4 April 2024 Santos phoned FRDC and was advised the Communication Program Team is the right contact and a message was left for that team.
- On 6 May 2024, Santos emailed FRDC further to the previous correspondence, to advise it has extended the consultation period until 20 May 2024 and that in providing this extension of time, the information in the booklet and factsheet has been updated to account for an additional risk associated with the proposed activity. In the email Santos stated that, if input is not received by this date Santos will infer this means you do not want Santos to consult with you further on the Productions Operations EP. [Con-4131]
- On 10 July 2024 Santos emailed FRDC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised FRDC that it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from FRDC.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from FRDC.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable

National Indigenous Australians Agency (NIAA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed NIAA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed NIAA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 4 April 2024 Santos phoned the NIAA and left a message with reception regarding consultation on Barossa Production Operations activities with reception.

- On 5 April 2024, the NIAA emailed Santos to advise that it does not, as a general practice, make comments on proponent's environmental management plans and only responds to requests for comment under arrangements with the Department of Climate Change, Energy, the Environment and Water (through the Environmental Protection and Biodiversity Conservation Act 1999 public consultation process) and the Department of Industry, Science and Resources (through the Major Projects Facilitation Agency). [Con-3818]
- On 2 May 2024, Santos emailed NIAA to acknowledge its email of 5 April 2024 and advise it has extended the consultation period until 16 May 2024 and that in providing this extension of time, the information in the booklet and factsheet has been updated to account for an additional risk associated with the proposed activity. [Con-4128]
- On 10 July 2024 Santos emailed NIAA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from NIAA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
NIAA advised Santos that it does not, as a general practice, make comments on proponent's environmental management plans	Santos notes the responses provided. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable

4.7.2 NT Government Agency or Authority

Table 4-12: Consultation Summary Table - NT Government Agency or Authority

Section 25(1)(b) of the OPGGS(E)R: Northern Territory agency or authority to which the activities to be carried out under the environment plan may be relevant

Aboriginal Areas Protection Authority (AAPA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed AAPA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed AAPA further to previous response, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 21 March 2024, the AAPA emailed Santos providing comments from the AAPA on the EP and advising that it considers itself a Relevant Person. [Con-3819]
- On 30 April 2024, Santos emailed AAPA a letter of response to its comments. AAPA's comments and Santos' responses are summarised below. In the letter Santos also advised it had extended the consultation period until 13 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from AAPA. [Con-4364]
- On 10 July 2024 Santos emailed AAPA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from AAPA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
AAPA stated that its interests and activities may be affected by the activity proposed to be carried out under the EP as Santos spill modelling indicated potential impacts to sacred sites in the event of a spill.	Santos considers AAPA's claim has merit. However, there are no registered sacred sites in the operational areas. As a result, no credible impacts to known sites are expected from planned activities. While impacts to sacred sites are possible in the event of an unplanned hydrocarbon spill, Santos considers appropriate controls are in place to prevent a hydrocarbon spill. Santos also has controls to respond in the highly unlikely event of a hydrocarbon spill. Santos notes access restrictions to sacred sites under the NTASS Act and the need for appropriate permissions in the event that access to sacred sites is required to support spill response.	No response required.	Sacred sites are described in Section 3.7.6. Control measures for unplanned hydrocarbon spill events are described in Section 7.7.
AAPA requested that Santos speak to the Australian Energy Producer's Oil Spill Working Group which had held recent discussions with the NT Government.	Santos has considered the matters raised in the EP and provided a response. Santos notes that it has conferred with a member of the Australian Energy Producer's Oil Spill Working Group.	Santos confirmed it had conferred with a representative of the Working Group.	No reference required.

Darwin Harbour Advisory Committee (DHAC)

Summary of consultation effort:

- On 9 February 2024 Santos emailed DHAC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed DHAC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 2 May 2024, Santos emailed DHAC further to the previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from DHAC. [Con-4374]
- On 3 May 2024 a representative from DEPWS NT emailed Santos on behalf of the Chairperson of DHAC and advised that Santos' email had been forwarded to DHAC committee members who will respond separately if they have questions. [Con-4369]
- On 10 July 2024 Santos emailed DHAC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised DHAC that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]

- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from DHAC or DEPWS NT on behalf of the Chairperson of DHAC.
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from DHAC committee members.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from DHAC.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Department of Lands, Planning and the Environment (DLI) formerly the Department of Environment, Parks and Water Security (DEPWS-NT) during the initial consultation period for this EP.

Summary of consultation effort:

- On 9 February 2024 Santos emailed DEPWS-NT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 9 February 2024 DEPWS-NT emailed Santos in response to the email of 11 March 2024. DEPWS did not provide any comments on the Barossa Production Operations EP due to the activities being outside NT waters. [Con-3823]
- On 11 March 2024 Santos emailed DEPWS-NT further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 May 2024, Santos emailed DEPWS-NT further to the previous correspondence, to advise it has extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from DEPWS-NT. [Con-4966]
- On 10 July 2024 Santos emailed DEPWS-NT to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from DEPWS-NT.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
DEPWS-NT did not provide any comments on the Barossa Production Operations EP due to the activities being outside NT waters.	Santos has considered the matters raised in the EP. A request from DEPWS-NT for some technical information was outside the scope of this EP. Petroleum activities in NT waters are within the regulatory jurisdiction of NT DITT.	No response required.	Not applicable.

Department of Agriculture and Fisheries (DAF) formerly the Department of Industry, Tourism and Trade – Fisheries Division (DITT-NT Fisheries) during the initial consultation period for this EP.

Summary of consultation effort:

- On 9 February 2024 Santos emailed DITTNT Fisheries to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 15 February 2024, the DITT NT Fisheries emailed Santos and provided contact details for appropriate persons within DITT NT Fisheries for consultation. It also nominated the NT Seafood Council, NT Guided Fishing Association and Amateur Fishing Association as other organisations that should be consulted and provided contact details. [Con-3826]
- On 15 February 2024, Santos emailed DITT NT Fisheries and confirmed it was consulting with those organisations and that it would add the Chief Scientist from DITT NT Fisheries as advised. Santos offered to meet in Darwin during 11-15 March 2024. [Con-3827]
- On 15 February 2024, DITT NT Fisheries advised it would meet with Santos while in Darwin and to please advise of specific questions to discuss. [Con-3828]
- On 11 March 2024 Santos emailed DITT NT Fisheries further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos met with DITT NT Fisheries. The Barossa Production Operations video was shown and potential impacts from planned activities and control measures to reduce impacts to ALARP was discussed. DITT NT Fisheries sought further information on seabed disturbance, planned discharges from the floating production system, and water discharge modelling. Santos confirmed that vessels would comply with MARPOL requirements and advised on fishery exclusion zones. No objections or claims were raised by DITT NT Fisheries. [Con-3832].
- On 17 April 2024 Santos emailed DITT NT Fisheries to provide a copy of the Minutes from the meeting of 3 April 2024 regarding the Barossa Production Operations EP. [Con-3833]
- On 10 July 2024 Santos emailed DITT NT Fisheries to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from DITT NT Fisheries.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference

DITT NT Fisheries requested information on seabed disturbance, planned discharges from the floating production system, and water discharge modelling.	Santos has considered the matters raised in the EP. Santos provided the information requested at the meeting. Santos will comply with MARPOL requirements to reduce impacts and risks from planned discharges to ALARP.	No additional response required.	Commercial fisheries are described in Section 3.6.1. Control measures for planned activities are described in Section 6. Control measures for unplanned events are described in Section 7.

Department of Logistics and Infrastructure (DLI), formerly the Department of Infrastructure, Planning and Logistics – Transport and Civil (DIPL-NT) during the initial consultation period for this EP.

Summary of consultation effort:

- On 9 February 2024 Santos emailed DIPL NT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 12 February 2024, the DIPL NT identified itself as an interested party for all marine infrastructure projects in the NT and specifically around the Darwin Harbour. [Con-3820]
- On 15 February 2024, Santos emailed DIPL NT and advised it is planning to be in Darwin the week of March 11-15 and seeking a meeting on respective works in Darwin Harbour during 2024, including Darwin Pipeline Duplication, Mandorah Marine Facilities upgrade and Barossa Production Operations and reminded that DIPL provided input during the EPA assessment process. Santos sought a meeting during that week or alternatively earlier on Teams. [Con-3830]
- On 15 February 2024 DIPL-NT confirmed via email that the meeting arrangements were convenient. [Con-3831]
- On 11 March 2024 Santos emailed DIPL NT further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 20 March 2024, held a meeting with DIPL NT at which DIPL-NT advised it had read the information provided on the EP and did not require a briefing. The meeting instead focused on operational matters associated with coming Santos and DIPL-NT activities in Darwin Harbour. [Con-5632].
- On 10 July 2024 Santos emailed DIPL-NT to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from DIPL-NT.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
DIPL-NT provided a response on Santos' proposed activities in NT waters stating it had read the information provided on the EP and did not require a briefing and instead discussed operational matters associated with coming Santos and DIPL-NT activities in Darwin Harbour.	Santos has considered the matters raised. The information request from DIPL-NT with respect to NT waters is outside the scope of this EP. Petroleum activities in NT waters are within the regulatory jurisdiction of DITT-NT.	No response required.	Not applicable.

NT Fire and Emergency Services, formerly the Department of Police, Fire and Emergency Services – NT (NT Police, Fire and Emergency Services) during the initial consultation period for this EP

Summary of consultation effort:

- On 9 February 2024 Santos emailed NT Police, Fire and Emergency Services to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed NT Police, Fire and Emergency Services further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned NT Police, Fire and Emergency Services and spoke to a team member left a message regarding consultation for Barossa Production Operations EP activities.
- On 6 May 2024, Santos emailed NT Police, Fire and Emergency Services further to previous emails to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from NT Police, Fire and Emergency Services. [Con-4383]
- On 10 July 2024 Santos emailed NT Police, Fire and Emergency Services to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised NT Police, Fire and Emergency Services that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]

- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from NT Police, Fire and Emergency Services.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from NT Police, Fire and Emergency Services.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Department of Lands Planning and the Environment (DLI), formerly within the Department of Territory Families, Housing and Communities, NT Heritage branch (DTFHC NT Heritage) during the course of initial consultation for this EP.

Summary of consultation effort:

- On 9 February 2024 Santos emailed DTFHC NT Heritage to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 February 2024, the DTFHC NT Heritage advised it should be consulted throughout this process under the Heritage Act 2011 and the Underwater Cultural Heritage Act 2018 and asked that the generic email heritage.branch@nt.gov.au be used and signed off with a name. [Con-3821]
- On 13 February 2024, Santos emailed DTFHC NT Heritage to arrange a meeting to provide a more detailed briefing on how Santos is approaching the requirements and seeks to meet during the week of March 11- 15 in Darwin or via Teams another week. [Con-3822]
- On 14 February 2024, Santos emailed DTFHC NT Heritage and advised it will send an invitation via Teams. [Con-3825]
- On 15 February 2024, Santos emailed the DTFHC NT Heritage and confirmed it would send a meeting request. [Con-3829]
- On 11 March 2024 Santos emailed DTFHC NT Heritage further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 12 March 2024 Santos met with DTFHC NT Heritage. At the meeting DTFHC NT Heritage stated that it did not require a separate full consultation session on the Barossa Production Operations EP as its requirements will have already been met during the Project's DPD construction activities. As a result, the meeting instead focused on how the requirements will be met during Darwin Pipeline Duplication construction activities in NT and Commonwealth waters, and is not relevant to this EP. [Con-4970]
- On 13 March 2024, Santos emailed the DTFHC NT Heritage minutes from the meeting held on 12 March 2024. [Con-4970]
- On 19 March 2024, the NT Heritage Branch confirmed the minutes from the meeting held on 12 March 2024. [Con-4972]
- On 10 July 2024 Santos emailed DTFHC NT Heritage to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from DTFHC NT Heritage.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
DTFHC-NT-Heritage provided a response that its requirements will have already been met during the project's DPD construction activities in NT and Commonwealth waters.	The project's construction activities are not within the scope of this EP. DPD construction activities in NT waters are already approved under NT legislation. DPD construction activities in Commonwealth waters are subject to a separate EP currently being assessed by NOPSEMA. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Environment Protection Authority (NT) (EPA NT)

Summary of consultation effort:

- On 9 February 2024 Santos emailed EPA NT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed EPA NT further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned EPA NT and spoke to a team member regarding consultation for Barossa Production Operations EP activities. The team member advised that the emails sent on 9 February 2024 and 11 March 2024 had been forwarded to the assessments team which had advised that engagement with Santos had concluded.
- On 3 May 2024, Santos emailed EPA NT further to the previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from the EPA NT. [Con-4966]
- On 10 July 2024 Santos emailed EPA NT to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from EPA NT.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
EPA NT advised that engagement with Santos had concluded.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

NT Parks and Wildlife Commission

- Summary of consultation effort:
- On 9 February 2024 Santos emailed NT Parks and Wildlife Commission to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed NT Parks and Wildlife Commission further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned NT Parks and Wildlife Commission and left a message with a team member regarding consultation for Barossa Production Operations EP activities.
- On 6 May 2024, Santos emailed NT Parks and Wildlife Commission further to the previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from the NT Parks and Wildlife Commission. [Con-4377]
- On 10 July 2024 Santos emailed NT Parks and Wildlife Commission to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised NT Parks and Wildlife Commission that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from NT Parks and Wildlife Commission.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference

No response was received from NT Parks and Wildlife Commission.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Department of Tourism and Hospitality (DTH), formerly Tourism NT during the course of initial consultation for this EP

Summary of consultation effort:

- On 9 February 2024 Santos emailed Tourism NT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Tourism NT further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Tourism NT and left a message with a team member regarding consultation for Barossa Production Operations EP activities.
- On 6 May 2024, Santos emailed Tourism NT further to the previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from the Tourism NT. [Con-4375]
- On 10 July 2024 Santos emailed Tourism NT to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Tourism NT Commission that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Tourism NT.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Tourism NT.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Section 25(1)(c) of the OPGGS(E)R: Department of the responsible Northern Territory Minister

Department of Mining and Energy (DME), formerly the Department of Industry, Tourism and Trade, NT – Mines & Energy (DITT NT Energy) during the course of initial consultation for this EP

Summary of consultation effort:

- On 9 February 2024 Santos emailed DITT NT Energy to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed DITT NT Energy further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned DITT NT Energy and spoke to the nominated contact person who advised that DITT NT Energy input on Barossa Production Operations would be via assessment of an Operations Environmental Management Plan under NT legislation.
- On 3 May 2024, Santos emailed DITT NT Energy further to previous correspondence to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from DITT NT Energy. [Con-4382]
- On 7 May 2024 DITT NT Energy emailed Santos acknowledging the email sent on 3 May 2024. [Con-4968]
- On 10 July 2024 Santos emailed DITT NT Energy to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from DITT-NT-Energy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DITT NT Energy with respect to proposed activities in Commonwealth waters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

4.7.3 WA Government Agency or Authority

Table 4-13: Consultation Summary Table - WA Government Agency or Authority

Section 25(1)(b) of the OPGGS(E)R: Western Australia agency or authority to which the activities to be carried out under the environment plan may be relevant

Department of Biodiversity, Conservation and Attractions (DBCA WA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed DBCA WA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Barossa Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed DBCA WA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned DBCA WA and left a voice mail message regarding consultation for the Barossa Production Operations EP.
- On 4 April 2024 DBCA-WA emailed Santos with advice that based on the documentation provided for review and other readily available information, DBCA WA has no comments in relation to its responsibilities under the *Conservation and Land Management Act 1984* and *Biodiversity Conservation Act 2016*. [Con-3836]
- On 7 May 2024, Santos emailed DBCA WA further to its response on 4 April 2024, to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from DBCA WA. [Con-4367]
- On 10 July 2024 Santos emailed DBCA WA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from DBCA-WA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
DBCA WA responded that it had no comments in relation to its responsibilities under the *Conservation and Land Management Act 1984* and *Biodiversity Conservation Act 2016*.	Santos notes DBCA WA's response	No response required.	Not applicable.

Department of Primary Industries and Regional Development – Fisheries (DPIRD Fisheries)

Summary of consultation effort:

- On 9 February 2024 Santos emailed DPIRD Fisheries to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed DPIRD Fisheries further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned DPIRD Fisheries and left a message with a team regarding consultation for the Barossa Production Operations EP.
- On 8 May 2024, Santos emailed DPIRD Fisheries further to the previous correspondence, to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from DPIRD Fisheries. [Con-4370]
- On 10 July 2024 Santos emailed DPIRD Fisheries to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised DPIRD-WA-Fisheries that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No objections or claims were raised by DPIRD Fisheries.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from DPIRD Fisheries.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Department of Transport (DoT WA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed DoT WA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024and close on 9 April 2024.
- On 22 February 2024 DoT WA emailed Santos to advise that if there is a risk of a spill impacting State waters to please ensure that the Department of Transport is consulted. [Con-3834]
- On 11 March 2024 Santos emailed DoT WA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 27 March 2024 Santos emailed DoT WA to confirm that the environment that may be affected (EMBA) modelled and provided for this EP does not show impact to WA State Waters. [Con-3835]
- On 5 April 2024 DoT WA emailed Santos to thank it for the clarification. [Con-3837]
- On 8 May 2024, Santos emailed DoT-WA further to the previous correspondence, to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from DoT WA. [Con-4371]
- On 10 July 2024 Santos emailed DoT-WA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from DoT WA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
DoT WA responded that it sought clarification on spill modelling given its marine pollution response authorities in WA water and that it should be consulted if there is a risk of a spill impacting State waters.	Santos has considered the matters raised in the EP and provided a response. Santos notes DoT WA's request that Santos advise DoT WA in event there is a spill that may impact WA State waters.	Santos responded to DoT WA's request to advise DoT WA in event there is a spill that may impact WA State waters, Santos responded advising that based on Santos' modelling, there are no predicted potential spill impacts to WA waters.	Not applicable.

Kimberley Ports Authority

Summary of consultation effort:

- On 9 February 2024 Santos emailed Kimberley Ports Authority to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024and close on 9 April 2024.
- On 11 March 2024 Santos emailed Kimberley Ports Authority further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned the Kimberley Ports Authority regarding consultation for the Barossa Production Operations EP. A representative asked that the emails be re-sent and emails previously sent on 9 February and 11 March 2024 were resent the same day. [Con-4372]
- On 7 May 2024, Santos emailed Kimberley Ports Authority further to the previous correspondence, to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Kimberley Ports Authority [Con-4057]
- On 10 July 2024 Santos emailed Kimberley Ports Authority to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Kimberley Ports Authority that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]

- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Kimberley Ports Authority.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Kimberley Ports Authority.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

WA Marine Science Institution (WAMSI)

Summary of consultation effort:

- On 9 February 2024 Santos emailed WAMSI to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024and close on 9 April 2024.
- On 13 March 2024 Santos emailed WAMSI further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 4 April 2024 Santos phoned WAMSI and left a voice mail message regarding consultation for the Barossa Production Operations EP.
- On 2 May 2024, Santos emailed WAMSI, further to the previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from WAMSI. [Con-4368]
- On 10 July 2024 Santos emailed WAMSI to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised WAMSI that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from WAMSI.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from WAMSI.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

4.7.4 Academic and Research Organisations

Table 4-14: Consultation Summary Table - Academic and Research Organisations

Section 25 (1)(d) of the OPGGS(E)R: Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan

Arafura Timor Research Facility

Summary of consultation effort:

- On 9 February 2024 Santos emailed AIMS, in its capacity as operator of the Arafura Timor Research Facility, to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed AIMS further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned AIMS, in its capacity as operator of the Arafura Timor Research, regarding consultation for the Barossa Production Operations EP but was unable to leave a voice message.
- On 2 May 2024, Santos emailed AIMS, in its capacity as operator of the Arafura Timor Research facility, further to the previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from the Arafura Timor Research facility [Con-3854]
- On 10 July 2024 Santos emailed AIMS, in its capacity as operator of the Arafura Timor Research facility, to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Arafura Timor Research Facility.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Arafura Timor Research Facility.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Australian Marine Sciences Association – NT (AMSA-NT)

- Summary of consultation effort:
- On 9 February 2024 Santos emailed AMSA-NT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed AMSA-NT further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos attempted to phone AMSA NT on three occasions without success. On 3 April 2024, Santos resent the emails sent on 9 February and 11 March 2024 and advised that the consultation is closing on April 9. [Con-3838]
- On 11 April 2024, AMSA-NT advised that it wished to be considered as 'Relevant Person' for this EP. [Con-3839]
- On 8 May 2024, Santos emailed AMSA-NT further to previous correspondence, to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from AMSA-NT.[Con-3927]
- On 25 June 2024 Santos returned a phone message left by AMSA-NT on 24 June 2024. AMSA-NT requested an extension until the end of that week for submittal of its comments. Santos followed-up with an email to AMSA-NT the same day agreeing to the extension. [Con-5053]
- On 30 June 2024 AMSA-NT emailed a letter to Santos with comments on the EP. A summary of feedback is outlined below. [Con-5054]
- On 13 August 2024 Santos emailed AMSA-NT a letter in response to AMSA-NT's letter of 30 June. [Con-5351]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]

- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from AMSA-NT.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
AMSA-NT correspondence to Santos on 30 June 2024 AMSA-NT raised concerns that the Barossa Production Operations information booklet was insufficient to assess the potential environmental risks and impacts of the proposed activity and control measures. (paragraphs 4-5)	Santos does not agree with the AMSA-NT's assertion that the information booklet does not provide sufficient information to enable the AMSA-NT to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities. The information booklet provides a comprehensive description of the environment that may be affected by the Activity, identification of impacts and risks from planned activities and unplanned events and associated proposed control measures.	Santos' correspondence to AMSA-NT on 13 August 2024 in response to AMSA-NT's letter of 30 June 2024 Santos considers the Production Operations information booklet and Gas Export Pipeline Operation factsheet provides AMSA with sufficient information to allow it to make an informed assessment of the possible consequences of the activity to be carried out under the EP on any of AMSA's functions, interests or activities.	Not applicable
AMSA-NT noted their opinion that the regulatory framework is flawed for assessing the cumulative impact of oil and gas industry. (para 7)	Santos has considered the matters raised in the EP and provided a response, that the regulatory framework is out of scope of the EP.	NOPSEMA's regulatory framework is outside the scope of consultation for this activity.	Not applicable
AMSA-NT stated that it reiterated concerns raised in previous Barossa Offshore Gas Project submissions regarding the project's environmental impact and risk assessment. (para 8)	Santos noted the request and has previously provided a response.	Santos notes your previous correspondence and has responded accordingly for these, a copy of which was included in the relevant approvals document submitted to the regulator, NOPSEMA.	Not applicable
AMSA-NT suggests Santos and the regulator are not adequately considering globally significant environmental, fisheries and megafauna values of Darwin Harbour and the region and the international and transboundary issues, when assessing major development activities in the Arafura and Timor Seas region including: • ecological connectivity, shared species, shared resources of the region and failure to assesses potential transboundary species, resources and impact in the EMBA and MEVA (para 9(a)). • Failure to consult with relevant stakeholders in Indonesia and Timor-Leste that meets the requirements of international law (para 9(b)). • Failure to assess potential transboundary environmental harm (para 9(c)).	Santos noted this request and has provided details on how the impacts associated with the proposed activity are assessed, including the potential for transboundary environmental harm.	[9(a)] The Barossa Production Operations information booklet provides a summary of the existing environment (Regional Existing Environment Summary) against which impacts were assessed. Santos has assessed the full potential spatial extent of a worst-case spill event with consideration for biological impacts within the MEVA and socio-economic impacts within the EMBA, including beyond Australia's EEZ into parts of Indonesian and Timor-Leste sovereign waters and impacts to marine users such as commercial and subsistence fishing activities (pages 11, 12, 28 - 36 of the information booklet). Santos has assessed potential impacts on known migratory, rare, threatened, endangered, and protected marine species in the Timor Sea – particularly cetaceans, sea turtles and sharks/rays (Figure 10 and pages 28 - 36 of the information booklet). Potential impacts and risks to marine fauna have been assessed as environmentally acceptable and ALARP. [9(b)] Santos considers its consultation for the EP meets the requirements of s 25 of the Environment Regulations and is consistent with NOSPEMA guideline 'Consultation in the course of preparing an environment plan' (N-04750-GL2086 A900179; 12/05/2023). This has included consultation with the Autoridade Nacional Do Petróleo Timor-Leste (ANP - National Petroleum Authority) and Department of Foreign Affairs and Trade's Indonesia Branch. [9(c)] Internationally significant fauna, wetlands of international importance, internationally significant habitats and internationally significant marine parks are described in the OPP and will be described in the EP. Potential impacts associated with unplanned releases of hydrocarbons that may enter international waters are also described in the OPP will be described in the EP.	Section 4.6 and 4.7 Section 7.7 No additional measures adopted.
AMSA-NT stated that it reiterated concerns regarding data gaps, data analysis and integrity and independence of data, including: • lack of assessment of cumulative impacts (para 10(a)). • data gaps in baseline information (para 10(b)). • issues associated with monitoring, impact and risk assessments in a 'data-poor' setting (para 10(c)). • assessing potential impacts from the seabed through the water column (para 10(d)). • impact detection and monitoring of marine megafauna populations (para 10(e)). • failure to use appropriate data particular for matters of national environmental significance (MNES) species (para 10(f)).	Santos has considered AMSA-NT's concerns and notes that: • Santos performed detailed field and desktop environmental studies and considers adequate data is available; • potential cumulative impacts will be assessed and evaluated through the Activity specific' Water and Sediment Quality Monitoring Plan (Appendix J), and managed (if required) through the Produced Water Adaptive Management Plan (Appendix I; BAO-CM-6.8.7); • Santos has a chemical selection process (BAO-CM-6.7.5); • concurrent activities and cumulative impacts area assessed in the EP; • the NOPSEMA environment plan content requirement guidance note relevant to matters protected matters is presented in the EP;	[10(a)] As noted in the Production Operations information booklet, all planned discharges will be managed in accordance with maritime industry standards and MARPOL requirements to reduce the potential for significant cumulative impacts. Potential for longer term cumulative impacts will be assessed through water and sediment quality monitoring during production operations and need for any additional mitigations assessed. Cumulative impacts are unlikely due to the non-bioaccumulative and rapid biodegradation properties of the chemicals typically used in production. In addition, any hydrocarbons from produced water would begin to breakdown as soon as they enter the water through a complex mix of processes such as evaporation, oxidation, and biodegradation. Concurrent activities may occur in OA1 (approved under other accepted Barossa EPs), such as the operation of the mobile	Section 2.7.3.8 Section 3 Section 6 Section 7.3 Section 7.7 Appendix I Appendix J BAO-CM-6.8.7 BAO-CM-6.7.5 BAO-CM-6.1.1 No additional measures adopted.

• lack of scientific independence and peer review of studies (para 10(g)).	• assessments are undertaken on the full spatial extent of the MEVA and EMBA, based on worst-case credible spills; • interactions with marine fauna are recorded and reported (BAO-CM-6.1.1).	offshore drilling unit, campaign vessels and geophysical equipment. Potential cumulative impacts from noise emissions, light emissions, air emissions, seabed disturbance, physical presence (effects on other marine users) and operational discharges from concurrent activities in OA1 will be presented in the EP for assessment by the regulator. [10(b), (f) and (g)] The information utilised in the development of the EP is appropriate to identify risks and impacts arising from production and operations activities and for informing risk mitigation and controls. Santos has followed the NOPSEMA environment plan content requirement guidance note relevant to matters protected under Part 3 of the EPBC Act, which will be presented in the EP for assessment by the regulator. [10(c)] Santos considers adequate data is available and appropriate environmental studies have been undertaken to characterise the existing marine environment within and surrounding the Operational Areas. [10(d)] Santos has assessed the full potential spatial extent of a worst case spill event with consideration for biological impacts within the MEVA and socio-economic impacts within the EMBA, including those that extend beyond Australia's Exclusive Economic Zone. [10(e)] Interactions with marine fauna will be recorded and reported as per the requirements of the Protected fauna Interaction and Sighting Procedure (page 26 of the Production Operations information booklet). Incident reporting, investigation and follow-up is monitored (page 37 of the Production Operations information booklet).	
AMSA-NT raised concerns regarding Santos' proposed control measures for marine fauna interactions (para 11). AMSA-NT noted its ongoing concern regarding Santos' non-inclusion of five voluntary (non-legislated) control measures in the Drilling EP including: ○ further measures to those outlined in EPBC Regulations 2000 — Part 8 Division 8.1 during peak periods of ecological sensitivity, for vessels outlined in the Australian National Guidelines for Whale and Dolphin Watching (2017) (para 12(a)); ○ avoiding peak periods of ecological sensitivity (para 12(b)); ○ restricting vessel speeds in the OA (para 12(c)); ○ having a dedicated marine mammal observer (MMO) on vessels (EPBC Policy Statement 2.1 Part B) (para 12(d)); and ○ activities occurring in daylight hours only (para 12(e)). AMSA-NT criticised Santos' decision to not incorporate these control measures in previous Barossa approval documents, including: • Barossa Development Drilling and Completions Environment Plan (para 13(a)); and Barossa Area Development Offshore Project Proposal (para 13(b). AMSA-NT highlighted findings from acoustic baseline studies by JASCO for the Barossa OPP and asserted that noise impacts are not well understood Bryde's, Omura's and Pygmy Blue Whales within the Barossa field area (para 14). AMSA-NT recommended Santos: • undertake further analysis of existing acoustic data (JASCO 2016) to identify habitat use of to better understand and evaluate noise impacts (para 15); and • accept the five voluntary control measures based on: ○ threatened marine fauna have been detected acoustically in the Barossa area (para 16(a)) ○ uncertainty of extent of habitat use by Bryde's, Omura's and Pygmy Blue Whales (para 16(b)) ○ vessel shipping impacts such as fauna displacement and avoidance (para 16(c))	Santos notes AMSA-NT feedback regarding Santos proposed control measures for marine fauna interaction and concern regarding non-inclusion of non-legislated control measures in the Drilling EP. Although drilling is outside the scope of this EP Santos has evaluated the control measures from the Drilling EP, which are addressed for the purposes of this EP in Section 6.1.3 and Section 7.3.3. Control measures evaluated at the request of AMSA NT include: • further measures to those outlined in 'EPBC Regulations 2000 — Part 8 Division 8.1 during peak periods of ecological sensitivity, for vessels outlined in the Australian National Guidelines for Whale and Dolphin Watching (2017) BAO-CM-6.1.1 • Application of EPBC Policy Statement 2.1 Interaction between offshore seismic exploration and whales and having a dedicated MMO. • Activities occurring in daylight hours only. • Use of passive acoustic monitoring • Manage timing of activities to avoid coinciding with sensitive periods for marine fauna present in the operations area (pygmy blue whale migration period) • Restrict vessel operating speeds in OA1 Santos' assessment is that it has reduced impacts and risks from Activity to ALARP and acceptable levels regarding marine fauna interaction.	[11] See response to #12(a)-(e) below. [12(a)] The Production Operations information booklet contains proposed control measures that will be adopted as relevant to potential impacts to species, including marine fauna, and in relation to biologically important areas. All considered control measures (adopted and not adopted) will be presented in the EP for assessment by the Regulator/s. Santos' planned vessel activities overlap the internesting buffer for flatback turtles. Specific to marine fauna interactions, the Production Operations information booklet describes control measures at pages 9, 10 and 26. Santos adopts the following specific controls to protect marine fauna from vessel activities for Barossa Operations in accordance with: (a) Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000: i) avoid collision; ii) reduce speed to 6 knots & steer away within caution zone (300m of whales / whale sharks and 150m of dolphins); iii) operate vessel at constant speed (6 knots); iv) do not drift or approach marine fauna; v) do not restrict fauna pathway or pursue fauna; and (b) Australian National Guidelines for Whale and Dolphin Watching 2017: Adopting cautionary and no approach distances for whales, whale sharks (100m no approach and 300m cautionary distances) and dolphins (50m no approach and 150m cautionary distances). [12(b)] The risk of interactions with marine fauna in OA1 is very low. The FPSO is stationary during operations. Supply vessels are expected to enter OA1 two times per week and their speeds will be low. Ongoing inspection, maintenance, monitoring and repair (IMMR) activities will be temporary in nature and performed according to a planned inspection and maintenance schedule, or at other intervals if unplanned inspections or repairs are required (page 5 of the Production Operations information booklet).	Section 6.1.3 evaluates additional control measures to minimise marine fauna interactions in terms of environmental benefit vs cost/issues and no additional measures were adopted. Section 6.2.3 Section 7.3 BAO-CM-6.1.1 No additional measures adopted.

○ ability to detect marine mammals and potential impacts (by restricting to daylight hours and have MMOs on board) (para 16(d)) ○ having consistency with the National Vessel Stike Strategy (reduce speed to < 12 knots in the OA) (para 16(e)) a lack of uncertainty of habitat use by threated marine fauna (para 16(f)).		It is not practical to operate the activity to avoid 'sensitive periods'. The acceptability evaluation of environmental risks is described in the EP for assessment by the regulator. [12(c)] Operational area speed restrictions refer to limits on vessel speeds within the operational area/s to maintain safe operations (see page 26 of Information Booklet). [12(d)] Dedicated MMOs on the FPSO, supply vessels and IMMR vessels have been assessed during the risk assessment process and based on the nature and scale of the activity have been determined as not required. Further details will be provided in the EP for assessment by the regulator. [12(e)] Activities to occur during daylight hours only has been assessed during the risk assessment process and based on the nature and scale of the activity, these restrictions have not been adopted. [13(a)] The Barossa Development Drilling and Completions Environment Plan was accepted by NOPSEMA on 15 December 2023. Control measures for the production operations activity are separately considered and evaluated by Santos with a view to reducing impacts and risks to ALARP and acceptable levels. Santos' evaluations will be documented in the EP and will be reviewed by NOPSEMA during its assessment of the EP. Refer also to #12. [13(b)] The Barossa Development Drilling and Completions Environment Plan was accepted by NOPSEMA on 15 December 2023. Control measures for the production operations activity are separately considered and evaluated by Santos with a view to reducing impacts and risks to ALARP and acceptable levels. Santos' evaluations will be documented in the EP and will be reviewed by NOPSEMA during its assessment of the EP. Refer also to #12. [14(a)-(h) and 15] The Production Operations information booklet refers to noise sources and identified proposed control measures for managing potential impacts on marine mammals (e.g. whales) from noise. It presents a summary of the results of underwater acoustic assessments for noise sources relevant to the scope of this EP. Santos' evaluation of impacts and risks to marine mammals from noise emissions will be a matter for the Regulator to assess against the requirements of the Regulations. [Para 16(a) and (b)] Santos' proposed control measures associated with interaction with marine fauna are outlined on page 26 of the Production Operations information booklet and are designed to align with management actions outlined in government-published fauna recovery plans, the Environment Protection and Biodiversity Conservation Regulations 2000 and include speed restrictions. Refer to #12(a)-(e) above. [Para 16(c)] Page 26 of the Production Operations information booklet outlines that the highest potential for interactions with marine fauna will be during temporary IMMR vessel operations. A lower likelihood of interaction is expected in OA1 as the FPSO is stationary and support vessel speeds will be low. The risk of interactions with marine fauna is very low. The ALARP and acceptability evaluation of environmental risks in the EP for assessment by the regulator. [Para 16(d)] Refer to #12(a)-(e) above. [Para 16(e)] Operational area speed restrictions refer to limits on vessel speeds within the operational area/s to maintain safe operations (page 26 of the Production Operations information booklet). Vessel speeds will be addressed in the EP for assessment by the regulator, which includes vessel speed of 8	

		knots or less within 500m safety zone around the FPSO and campaign vessels. [Para 16(f)] Santos will address the precautionary principles in the ALARP and acceptability evaluation of environmental risks in the EP for assessment by the regulator.	
AMSA-NT stated that it reiterated and highlighted Santos' possible contravention or non-alignment with Blue Whale Conservation Management Plan (CMP) including: • vessel strike and underwater noise are key threats (para 17(a). • recent research providing evidence of Pygmy Blue Whales aggregation and foraging in the Timor Sea and within the defined EMBA and MEVA for this Barossa Offshore Gas project), i.e. see 'aggregation' and 'foraging/reproduction' areas identified in the Timor Trough region (Sahri *et al*. 2022, Burton *et al*. 2023, Ferreira *et al*. 2024). (para 17(b)). • recent major sightings of Pygmy Blue Whales in close proximity (approximately 40 km) to the Barossa OA (para 17(c)). • uncertainty regarding habitat usage by Pygmy Blue Whales in the Barossa field area (para 17(d)). • the OPP acoustic studies (JASCO 2016) should be reassessed (para 17(e). • BIAs should be updated (para 17(f)). AMSA NT noted that temporal control measures were adopted by another operator in the Timor Sea to deal with uncertainty in blue whale presence (para 17(g))	Santos has considered the recommendation from AMSA-NT to review published research papers on the Pygmy Blue Whale by Sahri *et al*. 2022, Burton *et al*. 2023, Ferreira *et al*. 2024. These papers provide evidence of foraging, migration, and aggregation activity, which has been incorporated into Section 3.4.3.2 Santos' assessment is that Pygmy Blue Whale foraging, migration and aggregation activity occurs outside the OAs therefore no additional control measures are required. Santos also notes the feedback from AMSA-NT regarding temporal control measures adopted by another operator. Santos has reviewed and evaluated the relevant controls adopted by the operator in Section 6.1.3 of the EP with regard to environmental benefits gained versus risk/cost of implementation. No additional control measures were adopted.	[17(a) and (d)] Figure 10 in the Production Operations information booklet depicts the blue whale biologically important area (page 9). Operational areas 1 and 2 do not overlap with the blue whale BIA and it is noted in the Production Operations booklet that the blue whale may travers OA1 in low numbers. Potential impacts to marine mammals (e.g. whales) from vessel strike an underwater noise have been assessed and control measures presented in the Production Operations information booklet on page 16 (noise) and page 26 (interaction with marine fauna). The nature and scale of environmental impacts, taking into account the Blue Whale CMP, will be provided in the EP for assessment by the regulator. [17(b)] The information utilised in the development of the EP is appropriate to identify risks and impacts arising from the activities and for informing risk mitigation and controls. Santos has followed the NOPSEMA environment plan content requirement guidance note for matters of national environmental significance protected under Part 3 of the EPBC Act, which will be presented in the EP for assessment by the regulator. (In further response to AMSA-NT recommendations, published research studies on the Pygmy Blue Whale by Sahri *et al*.2022, Burton *et al*. 2023 and Ferreira *et al*. 2024 have been reviewed and Section 3.4.4.2 has been updated) [17(c)] The information utilised in the development of the EP is appropriate to identify risks and impacts arising from the activities and for informing risk mitigation and controls. Santos has followed the NOPSEMA environment plan content requirement guidance note for matters of national environmental significance protected under Part 3 of the EPBC Act, which will be presented in the EP for assessment by the regulator. [17(e)] Refer to #15 above. [17(f)] BIAs are addressed in Figure 10 of the Production Operations information booklet. BIA data and maps are managed by the Australian Government - Department of Climate Change, Energy, the Environment and Water (DCCEEW), therefore the updating of BIA data and maps are outside the scope of consultation for this activity. [17(g)] Refer to #15 above.	Section 3.4.3 Section 3.4.3.2 Section 6.1.3
Concerns were raised regarding lack of biologically important areas (BIAs) for Threatened Marine Megafauna, Baseline Marine Megafaunal Surveys, noting that additional marine megafauna surveys are required and the need to develop BIAs for other known conservation priority marine species occurring in the EMBA, MEVA and the region including Bryde's Whale, Omura Whales, Fin Whales, Sei Whales and Sperm Whales (para 18)	Santos has considered the matters raised and provided a response. The development of BIAs is out of scope of the EP.	Undertaking surveys and developing BIAs is outside the scope of consultation for this activity.	Not applicable

AusTurtle Inc

Summary of consultation effort:

- On 9 February 2024 Santos emailed AusTurtle Inc to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed AusTurtle Inc further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]

- On 4 April 2024 Santos phoned AusTurtle Inc regarding consultation for this EP and spoke to the nominated person who advised that AusTurtle would be sending Santos some information.
- On 7 April 2024, AusTurtle emailed Santos and provided a submission with detailed information on sea turtles, sea snakes and sea birds within the area, including an assessment of nesting, internesting and migration patterns. AusTurtle advised that the number of nests laid on the island during the standard fortnightly survey appears independent of anthropogenic offshore activities such as petroleum or fishing activities. [Con-4006]
- On 27 May 2024, Santos emailed AusTurtle to thank it for the feedback provided to assist Santos' preparation of the EP. Santos noted that AusTurtle did not raise any objections or claims and referenced information provided on AusTurtles' ongoing research at Bare Sand Island. Santos advised it was interested in the Olive Ridley and Flatback species, to be referenced in the EP with respect to the presence and behaviour of sea turtles within the Environment that May Be Affected. Santos also referenced the information on the presence of Crested Sea Terns on Bare Sand Island and sea snake behaviour in the proposed Operational Areas, which correlated with comments previously provided. Santos asked if AusTurtle research papers or details could be provided to enable it to be referenced in the appropriate sections of the EP. [Con-4211]
- On 28 May 2024, AusTurtle emailed Santos and advised that it would get some papers together and that most of the information has come from AusTurtle internal annual reports. [Con-4213]
- On 10 July 2024 Santos emailed AusTurtle to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from AusTurtle.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
AusTurtle provided the following information in relation to flatback sea turtles (on 11 March 24): AusTurtle has monitored nesting flatback sea turtles since 1996 on Bare Island which is located at the edge of the MEVA. During construction of the Bayu-Undan to Darwin gas pipeline from 2004-2006 and the INPEX Ichthys gas pipeline in 2014-2016 there was no detectable impact on the numbers of nesting turtles. The DPD section will pass through the flatback turtle internesting area where gravid females will dive to depths of 40 m and rest on the bottom to surface every hour or so to breathe. The previous pipelines had no detectable impact as is expected with this pipeline. Any impact, including attraction to lights, is likely to be on individuals rather than the population.	Santos has considered the matters raised in the EP and provided a response. Santos notes information provided on 11 March 24 by AusTurtle. Santos notes that AusTurtle has not provided the papers as per correspondence 28 May 2024.	Santos responded to AusTurtle thanking it for the information provided.	Marine turtles are described in Section 3.4.3.3.1. Sea snakes are described in Section 3.4.3.3.2. Sea birds are described in Section 3.4.3.4.

Charles Darwin University (CDU)

Summary of consultation effort:

- On 9 February 2024 Santos emailed CDU to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed CDU further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned CDU and left a voice mail message regarding consultation for Barossa Production Operations EP activities.
- On 2 May 2024, Santos emailed CDU to advise further to its previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from CDU. [Con-3856]
- On 10 July 2024 Santos emailed CDU to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised CDU that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP by CDU.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from CDU.	Santos considers it has provided sufficient information and a reasonable period of time for consultation.	No response required.	Not applicable.

	Santos considers Section 25 consultation requirements to have been met.		

4.7.5 Energy Industry Titleholders / Operators

Table 4-15: Consultation Summary Table - Energy Industry Titleholders / Operators

Section 25(1)(d) of the OPGGS(E)R: Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan

Bengal Energy

Summary of consultation effort:

- On 9 February 2024 Santos emailed Bengal Energy to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Bengal Energy further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Bengal Energy and left a voice message regarding consultation for Barossa Production Operations EP activities.
- On 2 May 2024, Santos emailed Bengal Energy further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Bengal Energy. [Con-3984]
- On 10 July 2024 Santos emailed Bengal Energy to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Bengal Energy that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Bengal Energy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Bengal Energy.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Eni Australia

Summary of consultation effort:

- On 9 February 2024 Santos emailed Eni Australia to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Eni Australia further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned Eni Australia and spoke to a company representative and left a message regarding consultation for Barossa Production Operations EP activities.
- On 6 May 2024, Santos emailed Eni Australia further to previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Eni Australia. [Con-3989]
- On 10 July 2024 Santos emailed Eni Australia to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Eni Australia that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Eni Australia.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Eni Australia.	Santos considers it has provided sufficient information and a reasonable period of time for consultation.	No response required.	Not applicable.

	Santos considers Section 25 consultation requirements to have been met.		

EOG Resources

Summary of consultation effort:

- On 9 February 2024 Santos emailed EOG Resources to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed PO activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed EOG Resources further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 5 April 2024 Santos phoned EOG Resources and left a voice mail message regarding consultation for Barossa Production Operations EP activities.
- On 2 May 2024, Santos emailed EOG Resources further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from EOG Resources [Con-3986]
- On 3 May 2024, EOG Resources emailed Santos to advise it does not have any input for the Barossa Production Operations EP and asked to be kept updated if there are any material changes. [Con-3987]
- On 10 July 2024 Santos emailed EOG Resources to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised EOG Resources that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from EOG Resources.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from EOG Resources.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Finder Energy

Summary of consultation effort:

- On 9 February 2024 Santos emailed Finder Energy to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Finder Energy further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 19 March 2024 Finder Energy emailed Santos and advised it has no comment or objection to the Barossa Production Operations EP activities. [Con-3981]
- On 7 May 2024, Santos emailed Finder Energy further to previous correspondence, to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Finder Energy. [Con-3994]
- On 10 July 2024 Santos emailed Finder Energy to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence has been received from Finder Energy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
Finder Energy advised it had no comment or objection.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

INPEX

Summary of consultation effort:

- On 9 February 2024 Santos emailed INPEX to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed INPEX further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 21 March 2024 INPEX emailed Santos to enquire about the INPEX contacts on Santos' mailing list. [Con-3575]
- On 3 April 2024 Santos phoned INPEX regarding consultation activities and left a message with a company representative.
- On 23 April 2024 Santos emailed INPEX and provided information requested on 21 March 2024. [Con-3786]
- On 6 May 2024, Santos emailed INPEX to further to previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from INPEX. [Con-3990]
- On 10 July 2024 Santos emailed INPEX to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from INPEX.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No correspondence was received from INPEX.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met	No response required.	Control measures for planned activities are described in Section 6. Control measures for unplanned events are described in Section 7.

Jadestone Energy

Summary of consultation effort:

- On 9 February 2024 Santos emailed Jadestone Energy to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 28 February 2024 Jadestone Energy emailed Santos and advised it has no comments regarding Barossa Production Operations EP activities and indicated that if the project outlined in correspondence changed significantly they would like to remain informed. [Con-3190]
- On 11 March 2024 Santos emailed Jadestone Energy further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 7 May 2024, Santos emailed Jadestone Energy further to previous correspondence, to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Jadestone Energy. [Con-3993]
- On 10 July 2024 Santos emailed Jadestone Energy to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence has been received from Jadestone Energy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
Jadestone Energy advised it had no comments.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Melbana Energy

Summary of consultation effort:

- On 9 February 2024 Santos emailed Melbana Energy to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Melbana Energy further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 12 March 2024 Melbana Energy emailed Santos and advised it had no feedback or objection to Barossa Production Operations EP activities. [Con-3980]
- On 4 April 2024 Santos phoned Melbana Energy regarding consultation for Barossa Production Operations EP activities and left a voice mail message.
- On 7 May 2024, Santos emailed Melbana Energy further to previous correspondence, to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Melbana Energy. [Con-3992]
- On 10 July 2024 Santos emailed Melbana Energy to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence has been received from Melbana Energy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
Melbana Energy advised it had no feedback or objection.	Santos considers it has provided sufficient information and a reasonable period of time for consultation.	No response required.	Not applicable.

	Santos considers Section 25 consultation requirements to have been met.		

Neptune Energy

Summary of consultation effort:

- On 9 February 2024 Santos emailed Neptune Energy to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Neptune Energy further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Neptune Energy regarding consultation for Barossa Production Operations EP activities and was not able to leave a message.
- On 2 May 2024, Santos emailed Neptune Energy further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Neptune Energy. [Con-3970]
- On 20 May 2024, Neptune Energy emailed Santos and advised that it does not have any input for the Barossa Production Operations EP and supports Santos' Barossa Gas Project. Neptune Energy further requested that due to the location of the Petrel field in the Bonaparte Basin, that they continue to be kept updated of Santos' activities in relation to this field and mentioned Eni's acquisition of Neptune Energy. [Con-3979]
- On 10 July 2024 Santos emailed Neptune Energy to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]

- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
  - No further correspondence has been received from Neptune Energy.
  - Santos notes that Eni Australia's acquisition of Neptune was completed in January 2024. *https://www.eni.com/en-IT/media/press-release/2024/01/eni-acquisition-neptune-completed.html*

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
Neptune Energy requested that Santos keep them informed of activities in relation to Barossa.	Santos has considered the matters raised in the EP. Santos provides pre-activity notifications and quarterly project updates to Eni, noting that the Neptune assets are now owned by Eni Australia.	No response required.	Notifications (to Eni) are in Section 8.4.9 and .

PTTEP Australia

Summary of consultation effort:

- On 9 February 2024 Santos emailed PTTEP Australia to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed PTTEP Australia further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned PTTEP Australia regarding consultation for Barossa Production Operations EP activities and was not able to leave a message.
- On 2 May 2024, Santos emailed PTTEP Australia further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from PTTEP. [Con-3982]
- On 2 May 2024, PTTEP Australia emailed Santos and advised it had no input or objections to the proposed Barossa Production Operations EP activities. [Con-3985]
- On 10 July 2024 Santos emailed PTTEP Australia to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]

- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]

- No further correspondence has been received from PTTEP Australia.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
PTTEP Australia advised it had no input or objections.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Shell Development

Summary of consultation effort:

- On 9 February 2024 Santos emailed Shell Development to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787],
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Shell Development further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned Shell Development regarding consultation for Barossa Production Operations EP activities and left a voice mail message.
- On 2 May 2024, Santos emailed Shell Development further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Shell Development. [Con-3983]
- On 10 July 2024 Santos emailed Shell Development to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Shell Development that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Shell Development.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No correspondence was received from Shell Development.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

SundaGas

Summary of consultation effort:

- On 9 February 2024 Santos emailed Sunda Gas to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Sunda Gas further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 5 April 2024 Santos phoned Sunda Gas regarding consultation for Barossa Production Operations EP activities and was not able to leave a message.
- On 6 May 2024, Santos emailed Sunda Gas further to previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Sunda Gas. [Con-3988]
- On 10 July 2024 Santos emailed SundaGas to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised SundaGas that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from SundaGas.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No correspondence was received from SundaGas.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Woodside Energy

Summary of consultation effort:

- On 9 February 2024 Santos emailed Woodside Energy to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Woodside Energy further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned Woodside Energy and left a message with a company representative regarding consultation for Barossa Production Operations EP activities.
- On 6 May 2024, Santos emailed Woodside Energy further to previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Woodside Energy. [Con-3991]
- On 10 July 2024 Santos emailed Woodside Energy to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Woodside Energy that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Woodside Energy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No correspondence was received from Woodside.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

4.7.6 Environmental Conservation Organisations

Table 4-16: Consultation Summary Table – Environmental Conservation Organisations

Section 25 (1)(d) of the OPGGS(E)R: Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan

Conservation Organisations

ATSEA-2 Project

Summary of consultation effort:

- On 9 February 2024 Santos emailed ATSEA-2 Project to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed ATSEA-2 Project further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 4 April 2024 Santos phoned ATSEA-2 Project and left a message regarding consultation for Barossa Production Operations EP activities with a team member.
- On 8 May 2024, Santos emailed ATSEA- 2 Project further to previous correspondence to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from ATSEA- 2. [Con-4029]
- On 10 July 2024 Santos emailed ATSEA-2 Project to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised ATSEA-2 Project that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from ATSEA-2 Project.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from ATSEA-2 Project.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Australia Institute

Summary of consultation effort:

- On 9 February 2024 Santos emailed Australia Institute to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed Australia Institute further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 4 April 2024 Santos phoned Australia Institute and left a voice message regarding consultation for Barossa Production Operations EP activities.
- On 2 May 2024, Santos emailed Australia Institute further previous correspondence to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from the Australia Institute. [Con-4012].
- On 3 May 2024 the Australia Institute emailed Santos to thank it for the reminder and advised the Australia Institute would be providing input by 16 May. [Con-4016]
- On 10 July 2024 Santos emailed Australia Institute to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]

- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence has been received from Australia Institute.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
The Australia Institute responded that it would be providing input by 16 May 2024.	Santos notes that the institute did not provide further input by 16 May 2024. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Australian Conservation Foundation (ACF)

Summary of consultation effort

- On 9 February 2024 Santos emailed ACF to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Barossa Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Barossa Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed the ACF to advise that the formal consultation period for the EP had commenced. Santos provided links to the Barossa Production Operations Activity Information Booklet, the Barossa Production Operations section of Santos' website, and NOPSEMA's Brochure: 'Consultation on offshore petroleum environment plans – Information for the Community'. Santos advised that consultation period closes on 9 April 2024. [Con-3794]
- On 9 April 2024 the ACF wrote to Santos to express its concerns and request further information on a range of topics related to the EP. The ACF's concerns primarily related to sufficiency of information in relation to GHG emissions from the project, the project's ability to meet the requirements of the Safeguard Mechanism, potential spill impacts and decommissioning. The ACF also requested a meeting with Santos to discuss the EP. [Con-4007]
- On 13 June 2024 Santos wrote to the ACF in response to the ACF's letter of 9 April 2024. Santos responded to each of the ACF's concerns and information requests, as well as its concerns regarding the consultation process. Santos also provided the ACF with notice of an update to the information booklet and factsheet. Santos requested the ACF provide its availability for a meeting. [Con-5022]
- On 19 June 2024 the ACF wrote to Santos to suggest dates and times for a meeting. The ACF asserted that it was not satisfied with the answers Santos provided in its letter of 13 June 2024, and Santos' correspondence to date was not sufficient to meet the consultation requirements. [Con-5023]
- On 26 June 2024, Santos wrote to the ACF to confirm its availability for a meeting at 2pm on 9 July 2024 (WST). Santos requested the ACF send an agenda by 1 July 2024. [Con-5024]
- On 26 June 2024, the ACF wrote to Santos to confirm its attendees at the meeting [Con-5025]
- On 2 July 2024 Santos emailed ACF thanking it for confirming the meeting attendees and again asked ACF to send an agenda by no later than 4 July 2024. [Con-5028]
- On 8 July 2024 Santos emailed ACF to ask them to send an agenda or list of topics that they would like to discuss at the upcoming meeting. [Con-5138]
- On 9 July 2024, ACF emailed Santos with an agenda for the upcoming meeting. [Con-5050]
- On 9 July 2024, Santos met with ACF via a Microsoft Teams video conference. [Con-5212] At the meeting the ACF:
  - queried how Santos is assessing climate change impacts attributable to the Activity on matters of national environmental significance and vulnerable ecosystems and communities;
  - queried how the Activity is aligned with the Paris Agreement temperature targets;
  - queried how Santos is assessing scope 3 emissions impacts;
  - requested details regarding the management procedures and/or management plans that will be in place for marine fauna and ecosystems.
- At the meeting on 9 July 2024 Santos stated that:
  - there are limitations to linking the Activity's emissions with specific climate change impacts;
  - it has considered impacts to matters of national environmental significance from global climate change;
  - it acknowledged ACF's concerns regarding climate change impacts on matters of national environmental significance, as well as vulnerable ecosystems and communities;
  - the Barossa project will be subject to the Safeguard Mechanism, which is the regime that implements Australia's Paris Agreement targets;
  - customers of the Barossa project will be subject to their own countries' emissions regulation frameworks, which implement their Paris Agreement Nationally Determined Contributions (NDCs);
  - the management procedures and/or plans for marine fauna and ecosystems align with DCCEEW guidance and EPBC regulations;
  - it will consider any further information that ACF provides in writing following the meeting.
- At the conclusion of the meeting, ACF said that it will write to Santos to set out its remaining concerns and any further information it requires to assess the impacts of the Activity on its functions, interests or activities.
- On 11 July 2024, ACF emailed Santos [Con-5117]. In its email the ACF:
  - reiterated its concerns regarding how Santos is considering climate change impacts attributable to the Activity;
  - reiterated its concerns regarding how the Barossa project will comply with the Paris Agreement 1.5-degree scenario; and
  - request details of the control measures and protocols that Santos has developed to protect marine fauna and biologically important areas.
- On 7 August 2024, Santos wrote to ACF in response to ACF's email of 11 July 2024. Santos responded to the matters raised by ACF. Santos thanked ACF for its comments and submissions in respect of the risks, impacts, and potential controls in relation to the activity. Santos advised ACF that Santos was finalising the EP for submission in coming weeks. [Con-5283]
- On 9 September 2024 ACF responded to Santos' email of 7 August 2024 claiming Santos had not sufficiently addressed a number of the concerns ACF had raised during the consultation process to date. [Con-5642]
- On 20 September 2024 Santos wrote to ACF in response to ACF's letter of 9 September 2024. Santos responded to the matters raised or restated by ACF. Santos thanked ACF for its comments and submissions in respect of the risks, impacts, and potential controls in relation to the activity. Santos advised ACF that Santos was finalising the EP for submission. [Con-5644]
- On 30 September 2024 ACF emailed Santos in response to Santos' letter of 20 September 2024. In the email the ACF stated it did not agree with Santos' assertion that sufficient information has been provided, it was reviewing the information sent and would provide follow-up correspondence on these matters before 14 October 2024. [Con-5661].
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 19 December 2024 Santos emailed ACF to advise that, given that no further correspondence was received by 14 October or since, and having regard to the elapsing of time, Santos has proceeded on the basis that the ACF does not intend to provide any further feedback and that consultation for preparation environment plans relating to Barossa Production Operations activities is complete. [Con-6023]
- On 20 December 2024 ACF responded to Santos' email of 19 December 2024. ACF stated in the email that it was finalising its response and will provide it to Santos early next week. [Con-6031]
- On 23 December 2024 ACF emailed the response Santos outlining its queries on the EP. [Con-6034]

- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036].
- On 31 January 2025 Santos emailed ACF and provided responses to the matters raised by ACF in its email of 23 December 2024. [Con-6038]
- On 24 March 2025 ACF responded to Santos' letter of 31 January 2025 with concerns about the content of the Barossa Production Operations EP.[Con-6071]
- On 31 March 2025 Santos responded to the ACF's letter of 24 March 2025 [Con-6075].

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
ACF correspondence to Santos on 9 April 2024 Concern raised that the Information Booklet provided insufficient information in relation to: • GHG emissions from the project; • the project's ability to meet the requirements of the Safeguard Mechanism; • whether carbon capture and storage (CCS) is considered a component of the project; • hydrocarbon and non-hydrocarbon spills; and • decommissioning.	Santos has considered the matters raised by ACF in the EP and provided a response to ACF. Santos does not agree with the ACF's assertion that the information booklet does not provide sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities. The information booklet provides a comprehensive description of the environment that may be affected by the Activity, identification of impacts and risks from planned activities and unplanned events, and associated proposed control measures.	**Santos' correspondence to ACF on 13 June 2024 in response to ACF's letter of 9 April 2024**[i42] *Santos notes your comments regarding the sufficiency of information provided by Santos in consultation, and your requests for further information.* *Santos considers that the information provided to date (in the Booklet and Factsheet) is sufficient for the ACF to make an informed assessment of any potential consequences of the Production Operations Activity (Activity) on any of its functions, interests or activities (FIAs). Notwithstanding this, Santos has provided responses to requests #1-15 below, where possible and reasonable.*	EP reference not relevant to the ACF's assertion that the information booklet does not provide sufficient information.
The ACF raised concerns about the project's emissions intensity and availability of offsets and requested further information in relation to how the Barossa project will enter the Safeguard Mechanism system at net zero emissions.	Santos has considered the matters raised by ACF in the EP and provided a response to ACF. Santos will meet its Safeguard Mechanism compliance obligations, set by the CER in accordance with Australian Government policy and emissions reduction targets, through the purchase and/or generation of Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs).. The responsible Commonwealth minister has communicated to the Barossa joint venture partners on a number of occasions that he anticipates there being ACCUs available for this project. Natural gas remains an integral part of the energy mix out to 2050 (AEMO 2024, IEA 2023c) and, with ACCUs being part of the national carbon management framework, it is reasonable to assume the availability of ACCUs for gas projects would have been contemplated in setting Australia's NDCs. In this regard, the projected ACCU demand and issuance for the period 2025-2040 is set out at Figure 17 of Australia's emissions projections 2024 chart data, which was released with the DCCEEW reports released in November 2024, as referenced above. This data has been derived by reference to the emissions projection information in these reports and it is therefore reasonable to assume that the number of ACCUs anticipated by the Barossa Development have been considered with relation to Australia's anticipated ACCU issuance. Santos' reliance on ACCUs will form part of its reporting to the CER and will continue to be monitored by the CER. Section 6.3.2.6.2. further captures Santos' consideration of the availability of ACCUs and SMCs. Santos views that ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	**[Response (1)]** *The treatment of the Barossa project under the Safeguard Mechanism is a matter for the Clean Energy Regulator. Santos will abide by the Clean Energy Regulator's final determination.* *There are various options available to meet a baseline (including direct abatement and acquiring offsets, in addition to mechanisms available under the Safeguard Rules such as borrowing adjustments and multi-year monitoring periods).* *Santos will be required to comply with the applicable baseline for the Barossa project in each compliance year. It is a matter for Santos to determine how it will achieve this compliance. This information is not necessary for the ACF to make an informed assessment of the possible consequences of the Activity on any of its FIAs.*	Section 6.3, in particular section 6.3.2.6.2. BAO-CM-6.3.10 BAO-CM-6.3.11
The ACF requested Santos clarify whether CCS is a component of the project.	Santos has considered the matters raised by ACF and provided a response to ACF. It was clarified that CCS is not part of the Activity described in this EP.	**[Response (2)]** *While Santos has committed to explore CCS opportunities at Bayu-Undan and elsewhere, CCS is not part of the Barossa development and any CCS developments will be subject to a separate environmental approvals process, and is not within the scope of the Production Operations EP.*	Section 6.3.3
The ACF requested a range of further information in relation to CCS development and operation.	Santos has considered the matters raised by ACF and provided a response to ACF. As CCS is not part of the Activity for this EP Santos did not provide ACF further information in response to this request.	**[Response (3)]** *As noted in response to #2, CCS is not part of the Barossa development, and any CCS developments will be the subject of a separate environmental approvals process. Therefore, the information you have requested is not relevant to the EP, which is the subject of this consultation.*	Section 6.3.3

[42] Santos has given each ACF response a corresponding response number which is marked in bold. Where Santos has cross-referred to earlier responses within its letter of 13 June 2024, it has not reproduced the text in this consultation table but rather than included the response number.

The ACF raised concerns about the project's emissions impact on climate change. The ACF requested further information regarding how Santos will address climate change impacts of scope 1 and 3 emissions.	Santos has considered the matters raised by ACF in the EP and provided a response to ACF. The EP acknowledges the linear relationship between cumulative anthropogenic CO_2 emissions and global warming. The EP references the latest commentary from the IPCC on the causes and impacts of climate change. The Activity's projected emissions are contextualised against established emissions budgets (national and global). Climate change is a global problem with the solution being led at the international level. Domestically, GHG emissions are regulated through Australia's NDC and the SGM and the Barossa JV has legal obligations to ensure that the Activity operates in accordance with that framework. The Barossa Joint Venture (JV) has adopted environmental performance outcomes and control measures directed to minimising the GHG emissions from the Activity. A range of controls have been considered for both direct (Scope 1) and indirect (Scope 3) emissions. Santos views that ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	**[Response (4)]** *As outlined in the Booklet, as a result of the complex nature of the global emissions system, climate change impacts cannot be meaningfully linked to any one activity or emissions source.* *The 'GHG emissions' section of the Booklet provides information about Santos' proposed control measures to reduce impacts and risks of Scope 1 and 3 emissions from the Activity to as low as reasonably practicable and an acceptable level.* *To the extent the ACF believes that there is any potential impact on the ACF's FIAs as a result of GHG emissions, the ACF is able to make an informed assessment of that impact with the information set out in the Booklet, including the total annual estimates provided. Santos welcomes the ACF's input regarding any control measures that it considers may be appropriate to adopt for Santos' consideration when preparing the EP for submission to NOPSEMA, including in relation to GHG emissions. Santos has invited a meeting with the ACF, in part to provide an opportunity to receive any such input.*	Section 6.3 BAO-CM-6.4.10 BAO-CM-6.3.1 BAO-CM-6.3.2 BAO-CM-6.3.3 BAO-CM-6.3.4 BAO-CM-6.3.5 BAO-CM-6.3.6 BAO-CM-6.3.7 BAO-CM-6.3.8 BAO-CM-6.3.9 BAO-CM-6.3.10 BAO-CM-6.3.11 BAO-CM-6.3.12 BAO-CM-6.3.13 BAO-CM-6.3.14 BAO-CM-6.3.15 BAO-CM-6.3.16 BAO-CM-6.3.18 BAO-CM-6.3.19 BAO-CM-6.3.20 BAO-CM-6.3.21 BAO-CM-6.3.22 BAO-CM-6.3.23 BAO-CM-6.3.24
The ACF requested further information regarding how Santos will address the direct or indirect consequences to the environment, including matters of national environmental significance, from GHG emissions. The ACF raised concerns that providing more gas to the market will make it more difficult for countries to progress renewable developments.	Santos has considered the matters raised by ACF in the EP and provided a response to ACF. The Barossa JV has adopted environmental performance outcomes and control measures directed to minimising the GHG emissions from the Activity. A range of controls have been considered for both direct (Scope 1) and indirect (Scope 3) emissions. Section 6.3.2.2 describes the role of natural gas in energy transition. Gas plays a critical role in the transition to a lower carbon future, able to flexibly fill market supply gaps as alternative energy sources emerge. Analysis of almost 100 IPCC scenarios, all aligned to the temperature goals of the Paris Agreement, show a range of gas demand profiles and all include a continued role for gas in the global energy mix out to 2050. (IPCC 2050). Santos views that ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	**[Response (5)]** *See response to #4.* *Globally, the energy sector needs to simultaneously invest in and develop two energy systems; ensure the current system continues to operate and meet global energy demands, while increasing efforts to build the new system centred on lower carbon alternatives. Maintaining a steady supply of gas allows for the orderly and measured development of the new energy system.* *For further information on this topic, please refer to Santos's Sustainability and Climate Report 2023, available here: https://www.santos.com/wp-content/uploads/2024/03/Sustainability-and-Climate-Report-2023.pdf*	Section 6.3.2.2
The ACF raised concerns regarding Santos' proposed scope 3 emission control measure. The ACF asked Santos whether it will be checking its customers' countries performance against their Paris Agreement NDC's and adjust or revoke sales contracts accordingly.	Santos has considered the matters raised by ACF in the EP and provided a response to ACF. The proposed Scope 3 emissions control measures are appropriate and practicable given that Santos does not have operational control over third party GHG emissions.	**[Response (6)]** *See responses to #4 and #5.* *Santos otherwise thanks the ACF for providing this feedback, which it will consider.*	Section 6.3.3 BAO-CM-6.3.19 BAO-CM-6.3.20 BAO-CM-6.3.21 BAO-CM-6.3.22 BAO-CM-6.3.23 BAO-CM-6.3.24
The ACF asked Santos whether it will ensure customers are using its product in a responsible way to reduce emissions. The ACF provided examples, which included ensuring: • Santos's customers are meeting best practice standards for LDAR and MRV; and	Santos has considered the matters raised by ACF in the EP and provided a response to ACF. The proposed Scope 3 emissions control measures are appropriate and practicable given that Santos does not have operational control over third party GHG emissions.	**[Response (7)]** *See response to #6.*	Section 6.3.3 BAO-CM-6.3.19 BAO-CM-6.3.20 BAO-CM-6.3.21 BAO-CM-6.3.22 BAO-CM-6.3.23 BAO-CM-6.3.24

• Santos is not selling gas to customers for new (post 2020) gas-fired power stations unless it can unequivocally prove that energy is displacing coal and not renewables.			
The ACF raised concerns that Santos had provided inconsistent emission estimates for different Barossa approval documents. The ACF requested: • further information regarding discrepancies in emissions estimates; • confirmation regarding whether Santos will share data on the methodologies used to calculate emissions estimates; • confirmation regarding whether Santos will provide ongoing transparency to the public in relation to the quantity of Greenhouse Gases it finds in it's wells and details on the technologies used and uncertainty factors.	Santos has considered the matters raised by ACF in the EP and provided a response to ACF. The discrepancy between emissions estimates provided in the SER and the Activity information booklet are explained by different inputs and assumptions for the respective estimates, based on the level of engineering and design at time of the approval preparation, with the conservative estimates reflecting this. The EP includes greenhouse gas estimates for both Scope 1 and Scope 3 emissions including the assumptions that underpin these estimates. Santos will meet applicable regulatory requirements of the National Greenhouse and Energy Reporting Act 2007, as relevant to Barossa production operations.	**[Response (8)]** *a. The annual emissions estimates included in the Booklet are applicable to the Activity. The annual emissions estimates provided in the Booklet are conservative (when extrapolated for 25 years of production operations) given annual emissions are expected to reduce over the life of the Activity as production rates decline. For the purpose of the Activity, the ACF should focus its review on the information provided in the Booklet. To the extent that the ACF believes there is any potential impact on the ACF's FIAs as a result of GHG emissions, the ACF is able to make an informed assessment of that impact with the information set out in the Booklet.* *b. Information regarding calculation of the GHG emissions and emissions intensity (as required) will be presented in the EP for consideration and assessment by the Regulator for assessment against the requirements of the Regulations.* *c. (i) Santos has and will continue to be transparent in both the EP, and other published information, about the quantity of GHG emissions in the Barossa wells.* *(ii) Santos will meet applicable regulatory requirements of the National Greenhouse and Energy Reporting Act 2007, as relevant to Barossa production operations.* *In any event, Santos considers that the ACF does not require this additional technical information about reporting of Barossa GHG emissions in order to make an informed assessment of the potential consequences of the Activity on any of its FIAs.*	GHG emissions forecast is provided in Section 6.3. See in particular section 6.3.2.1, which includes the emissions sources and assumptions.
The ACF raised concerns regarding the adequacy of information Santos provided in relation to non-hydrocarbon liquid releases. In particular, the ACF requested more detail in relation to the 'suite of procedures, storage, handling and clean-up', and the control measures proposed to be adapted.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos does not agree with the ACF's claim that the information booklet does not provide sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities. Sections 7.4 and 7.5 of the EP address unplanned impacts and risks of non-hydrocarbon liquid releases, and proposed control measures to reduce impacts and risks to ALARP and acceptable levels. Santos views that ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	**[Response (9)]** *The potential impacts and risks from an unplanned non-hydrocarbon liquid release event are described on page 27 of the Booklet, with consideration for the extent of potential impacts and sensitive receptors that could be affected.* *The suite of operational procedures referred to in the Booklet to manage risk of non-hydrocarbon liquid releases relates to both prevention of unplanned releases and mitigation of environmental impact if an unplanned release were to occur. Procedures relevant to prevention of unplanned releases include chemical handling and storage, equipment inspection and maintenance and dropped object prevention. Procedures relevant to impact mitigation include chemical selection, drain system management and spill response. These suites of procedures form the basis of the proposed control measures for non-hydrocarbon liquid releases.* *The adequacy of the procedures as proposed control measures will be a matter for the Regulator to assess against the requirements of the Regulations. To the extent the ACF believes the risk of a non-hydrocarbon liquid release (as outlined in the Booklet) may affect the ACF's FIAs, Santos welcomes the ACF's input regarding this in accordance with the legislative purpose of s 25 consultation and has invited a meeting with the ACF, in part to provide an opportunity to receive any such input.*	Section 7.4 Section 7.5. BAO-CM-6.1.2 BAO-CM-6.4.10 BAO-CM-6.4.5 BAO-CM-6.6.2 BAO-CM-6.7.5 BAO-CM-7.1.4 BAO-CM-7.1.1 BAO-CM-7.1.2 BAO-CM-7.1.3 BAO-CM-7.5.1 BAO-CM-7.4.3 BAO-CM-7.4.5 BAO-CM-7.4.4 BAO-CM-7.4.1 BAO-CM-7.4.2
The ACF raised concerns regarding impact of a potential hydrocarbon spill on surrounding habitats and species, and requested further information, including: • copies of condensate spill modelling; • the Production Operations Oil Pollution Emergency Plan'; and • the Well Operations Management Plan; and • other response plans which detail the actions Santos will take to control and manage cleanup activities if a spill occurs.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos has appropriately addressed the potential risks and impacts associated with a potential hydrocarbon spill. Sections 7.6 and 7.7 of the EP describe the potential impacts for a range of unplanned hydrocarbon release scenarios of relevance to the Activity for this EP; and proposed control measures to reduce impacts and risks to ALARP and acceptable levels. Santos views that ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	**[Response (10)]** *a) Santos has performed sufficient stochastic spill modelling of credible unplanned spill events and applied exposure value impact thresholds in line with NOPSEMA guidance, to present the entirety of the risk, which has informed the EMBA and MEVA as presented in the Booklet. It is not necessary for the ACF to have the spill modelling in order for the ACF to make an informed assessment of the potential consequences of the Activity on any of its FIAs.* *To the extent the ACF believes the risk of an unplanned hydrocarbon release (as outlined in the Booklet and Factsheet) may affect the ACF's FIAs, Santos welcomes the ACF's input regarding this in accordance with the legislative purpose of s 25 consultation and has invited a meeting with the ACF, in part to provide an opportunity to receive any such input.* *b) The Production Operations Oil Pollution Emergency Plan (**Production OPEP**) will be provided to the Regulator for assessment against the requirements of the Regulations. Consistent with the requirements of the Regulations, Santos plans are not finalised at the time of consultation and won't be finalised until plans are submitted to the Regulator for assessment. It is not necessary for the ACF to have the Production OPEP in order for the ACF to make an informed assessment of the potential consequences of the Activity on any of its FIAs however, this consultation offers an opportunity for the ACF to provide input on the kinds of measures that it would like to see included in the OPEP.* *c) The Well Operations Management Plan (**WOMP**) will be provided to the Regulator for assessment against the requirements of the Regulations. It is not necessary for the ACF to have the WOMP in order for the ACF to make an informed assessment of the potential consequences of the Activity on any of its FIAs.*	Section 7.6 Section 7.7 Barossa Production Operations Oil Pollution Emergency Plan

		d) Reference to response plans on pp. 31 refers to secondary Production OPEP plans. Further to the response above, the Production OPEP will be provided to the Regulator for assessment against the requirements of the Regulations. Consistent with the requirements of the Regulations, Santos plans are not finalised at the time of consultation and won't be finalised until plans are submitted to the Regulator for assessment. It is not necessary for the ACF to have the Production OPEP in order for the ACF to make an informed assessment of the potential consequences of the Activity on any of its FIAs, however, this consultation offers an opportunity for the ACF to provide input on the kinds of measures that it would like to see included in the OPEP.	
The ACF raised concerns regarding methane emissions and suggested that a "strong" methane reduction and mitigation plan, as well as publicly available transparent reporting can help Santos address scope 1 emissions associated with the project.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Section 6.3 of the EP details the facility design and operations measures to reduce Scope 1 emissions to ALARP, inclusive of sources of methane emissions. Santos reports its scope 1 emissions transparently through the NGER scheme. Section 8.3.2.12 and 8.3.2.13 of the EP describe the Methane Emissions Management and GHGEMP.	**[Response (11)]** *Management of fugitive GHG emissions (inclusive of methane emissions) during production operations will be addressed by the GHG Management Plan which is identified as a proposed control measure in the Booklet. Santos reports its scope 1 emissions transparently through its annual Sustainability and Climate Report, and under the National Greenhouse and Energy Reporting framework.* *The adequacy of proposed control measures to address impacts/risks from methane emissions will be a matter for the Regulator to assess against the requirements of the Regulations however, this consultation offers an opportunity for the ACF to provide input on the kinds of measures that it would like to see Santos consider in its management plans.*	Section 6.3. The Methane Emissions Management is described in Section 8.3.2.12 The Operations GHGEMP is described in Section 8.3.2.13. BAO-CM-6.3.12 BAO-CM-6.4.1
The ACF queried how Santos will approach flaring and venting on the FPSO, and whether Santos can commit to no venting and routine flaring.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Section 6.3 of the EP details the facility design and operations measures to reduce Scope 1 emissions to ALARP, inclusive of sources of flare and vent emissions on the FPSO. Santos has committed to no routine flaring and has evaluated control measures that substantially align with the ACF's proposal that Santos commit to no flaring, at Section 6.3.3. Santos cannot commit to no venting due to safety reasons (see further Santos' evaluation in Section 6.3.3 however, it has designed the facility to reduce unplanned venting to ALARP and acceptable levels.	**[Response (12)]** *Santos has committed to no routine flaring, with the exception of the continuously-lit high pressure flare pilot to ensure the operation of the safety critical flare is not impaired.* *Santos has not committed to no planned venting for production operations. Some planned venting is unavoidable for safety reasons when undertaking planned maintenance activities, such as tank/vessel integrity inspections. Santos has however designed the FPSO to include a vapour recovery system that captures low pressure vented gas that would otherwise be vented. This system reduces unplanned venting.*	Section 6.3.3
The ACF requested further information regarding, and queried whether Santos would apply, practice leak detection and repair to the Barossa project.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. The EP includes a proposed control measure (BAO-CM-6.3.12) to implement an operations GHG emissions management plan that addresses ongoing management of scope 1 emissions over the life of the Activity, inclusive of: • emissions performance target setting; • critical equipment maintenance; • methane emissions management; • decarbonisation opportunity management. This control measure is supported by EPSs which require: • implementation of a bi-annual source-level fugitive detection and measurement survey supported by site-level drone methane measurements, to begin within 12 months of FPSO final acceptance test; and • rectification of identified leaks as soon as practicable. Santos views that ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	**[Response (13)]** *Management of fugitive GHG emissions (with consideration for best practice leak detection and repair) during production operations will be addressed by the GHG Management Plan which is identified as a proposed control measure in the Booklet.* *The adequacy of proposed control measures to address impacts/risks from fugitive emissions will be a matter for the Regulator to assess against the requirements of the Regulations however, this consultation offers an opportunity for the ACF to provide input on the kinds of measures that it would like to see included in Santos' management plans.*	Section 8.3.2.13. BAO-CM-6.3.12
The ACF requested further information in relation to Santos's commitment to use the Oil & Gas Methane Partnership 2.0 (OGMP 2.0) framework level 5 for reporting on its methane emissions and whether Santos would publicly report its OGMP 2.0 findings.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. The EP includes a proposed control measure that commits to compliance with GHG emissions reporting under the NGER Scheme. Control measures adopted have reduced the impacts of GHG emissions including methane to ALARP. Santos will continue to report its Scope 1 and 2 emissions, and specifically its methane emissions, transparently via its annual Climate Report. Santos views that ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	**[Response (14)]** *Santos is not a signatory to the Oil & Gas Methane Partnership 2.0 (**OGMP 2.0**) reporting framework. Santos is committed to action on methane and will continue to evaluate potential enhancements to our measurement and mitigation programs. Earlier this year, Santos signed up to the OGCI's near zero methane initiative.* *In any event, Santos will continue to report its scope 1 and 2 emissions, and specifically its methane emissions, transparently via its annual Sustainability and Climate Report. This is in line with regulatory requirements in the countries in which we operate, such as the National Greenhouse and Energy Reporting Framework in Australia.*	Santos reports on GHG emissions as per the NGER scheme BAO-CM-6.3.9. Section 6.3.2.6.2 and 6.3.2.6.3

The ACF requested further information in relation to the decommissioning of the Barossa project, including whether Santos could commit to taking responsibility for decommissioning.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Although decommissioning and removal of the Barossa production facilities are outside the scope of this EP, structures have been designed and selected to meet the regulatory base case for full removal (OPGGS Act s.572(3)). The FPSO is designed to leave the field at the end of field life. Notwithstanding, Santos will me*et al*l relevant and applicable regulatory requirements at the time of decommissioning. Santos views that ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	**[Response (15)]** *Barossa decommissioning will be the subject of a future Barossa Decommissioning Environment Plan, that will meet the requirements of the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth) and the Regulations, and any additional relevant legislation, policies (such as NOPSEMA Policy 'Section 572 Maintenance and removal of property') and guidelines (such as Department of Industry, Science and Resources [DISER] Guideline 'Offshore Petroleum Decommissioning Guideline') in force at the time (NOPSEMA, 2020; DISER, 2022).*	Santos Decommissioning Strategy is presented in Section 8.2.6
Meeting with ACF on 9 July 2024 The ACF reiterated concerns regarding the Activity's climate change impacts on matters of national environmental significance and vulnerable communities and ecosystems. The ACF suggested Santos should undertake the analysis required to attribute the Barossa project's climate change impact on specific environments of national significance.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. The EP acknowledges the linear relationship between cumulative anthropogenic CO_2 emissions and global warming. The impacts on the climate cannot be attributed to one specific sector or activity. The Activity's projected emissions are contextualised against established emissions budgets (national and global).The EP references the latest commentary from the IPCC on the causes and impacts of climate change. Management of the emissions from the Activity and in accordance with the Safeguard Mechanism will ensure that this Activity does not have an unacceptable impact on climate change, as the Scope 1 GHG emissions of the Activity are being considered as part of Australia's NDC and, therefore, also into the global trajectory to limit global warming in line with the Paris Agreement targets.	Santos explained that there are limitations to linking emissions from the Activity to any specific climate change impacts. Santos invited ACF to provide further information regarding how it is able to undertake an analysis that links climate change impacts from the Activity to specific environments or ecosystems.	Section 6.3. Impacts of GHG emissions are assessed in Section 6.3.4
The ACF reiterated concerns that the Barossa project is not aligned with the temperature targets of the Paris Agreement. The ACF also queried whether Santos will be ensuring its customers are abating or offsetting their emissions to align with Paris Agreement targets.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Given that natural gas has a continued role under a range of Paris-aligned scenarios, GHG emissions associated with the Activity are able to be accommodated and managed under Australia's carbon budget and, internationally, under the carbon budget of Paris Agreement signatories and countries with mid-century net-zero commitments. Management of the emissions of the Barossa Development in accordance with the Safeguard Mechanism will ensure that this Activity does not have an unacceptable impact on climate change, as the Scope 1 GHG emissions of the Activity are being considered as part of Australia's NDC and, therefore, also into the global trajectory to limit global warming in line with the Paris Agreement targets. Specific control measures have been adopted for the Activity (including BAO-CM-6.3.23 and 6.3.24). Santos has also committed to only selling Barossa products generated from the Activity to customers from countries who are signatories to the Paris Agreement or have mid-century net-zero commitments (BAO-CM-6.3.19). Implementation of these control measures will allow Santos to continually pursue a range of management and abatement measures relevant to GHG emissions associated with third party consumption of gas from the Barossa Development. These are appropriate and practicable given that Santos does not have operational control over third party GHG emissions. Given the dynamic conditions in which the industry operates, Santos' strategies and targets will change and adapt over time.	Santos explained that it will comply with the Safeguard Mechanism, which is the regime that implements Australia's commitment to the Paris Agreement. Santos also explained that it will only sell gas to customers of Paris Agreement signatory countries, and Santos is unable to influence how those countries comply with the Paris Agreement temperature targets.	Section 6.3. Section 8.3.2.13. BAO-CM-6.3.19 BAO-CM-6.3.23 BAO-CM-6.3.24
The ACF requested any management plans that Santos has prepared in relation to marine fauna and biologically important areas / ecosystems.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. The EP contains information on plans procedures required for the Activity for marine fauna and ecosystems that align with DCCEEW guidance and EPBC regulations. Examples of management controls and procedures prepared by Santos to minimise impacts to marine fauna, biologically	Santos explained that the Environment Plan will provide specific information regarding each plan and/or procedure required for the Activity. Santos assured ACF that the management procedures and plans for marine fauna and ecosystems align with DCCEEW guidance and EPBC regulations. Santos invited ACF to provide more information in relation to the specific detail they require on this topic that is not already provided in the Information Booklet and regulatory guidance.	BAO-CM-6.1.1 BAO-CM-6.3.12 BAO-CM-6.7.5 BAO-CM-6.8.8 BAO-CM-7.2.1 BAO-CM-7.7.8.7

	importance areas/ ecosystems are listed in the EP Reference column. Santos views that ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.		
The ACF requested further information regarding the type of offsetting methodology Santos intend to use to abate emissions from the Activity.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos will meet its Safeguard Mechanism compliance obligations, set by the CER in accordance with Australian Government policy and emissions reduction targets, through the purchase and/or generation of ACCUs or SMCs. This is described in Section 6.3.2.6.2 of the EP. Santos views that ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	Santos explained that it will comply with the rules of the Safeguard Mechanism, which is administered by the Clean Energy Regulator. Santos also stated that it does not decide what the criteria for ACCUs or SMCs are but that it is rather Santos' responsibility to comply with the rules set by the Clean Energy Regulator.	Section 6.3.2.6.2
Noting the Barossa gas's CO_2 composition, the ACF requested information regarding how the gas will be vented in first instance on the FPSO and/or at the DLNG facility.	Santos has considered the matters raised by ACF and provided a response to ACF. Santos provided information on the CO_2 composition of Barossa gas and venting offshore. Santos views that ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	Santos confirmed that there is approximately 18% CO_2 in the Barossa gas. The DLNG facility is designed to process and vent 6% CO_2. The balance (approximately 12%) is processed and vented offshore.	Not applicable.
The ACF queried the expected lifespan of the DLNG facility.	Santos has considered the matters raised and provided a response. Operation at the DLNG facility is outside the scope of this EP and is controlled by a different joint venture to this Activity, notwithstanding that, Santos provided information on the design life of DLNG.	Santos confirmed that the DLNG facility is undergoing minor modifications and maintenance to extend the design life of the facility to process Barossa gas for another 20-25 years.	Not applicable.
The ACF queried whether produced water from seabed would contain mercury.	Santos confirmed the likelihood of low levels of mercury in produced water.	Santos confirmed that produced water from the seabed would likely contain very low levels of mercury, which is not atypical for these types of projects.	Section 6.8
The ACF queried where else Santos is exploring CCS opportunities, other than at Bayu Undan.	Santos has considered the matters raised by ACF and provided a response to ACF. Other CCS opportunities are outside the scope of this EP, notwithstanding this, Santos provided information in response to this request.	Santos confirmed it has exploration permits located in the Bonaparte Basin for seismic and drilling exploration in the next 12 to 24 months	Not applicable.
The ACF queried how Santos is making a decision about acceptable climate change impacts on MNES without having conducted an analysis regarding direct climate impacts attributable from the project and whether it is able to articulate what an acceptable level of impact is.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. The EP acknowledges the linear relationship between cumulative anthropogenic CO_2 emissions and global warming. The EP references the latest commentary from the IPCC on the causes and impacts of climate change. Even assuming that emissions from the Activity will cause an equivalent net increase in cumulative Australian and global emissions, this increase comprises a nominal amount in the overall scheme of the national and international carbon budgets and will not materially or substantially contribute to Australia's GHG emissions or global emissions levels; and there is no correlation between where GHG emissions are released and where climate change impacts are felt. It is not possible to draw a link between GHG emissions from the Activity and any specific climate related impact on any specific element of the Australian environment which may result from any net increase to cumulative GHG emissions globally. By keeping the Project emissions under the Safeguard Mechanism baseline, the Project's incremental contribution to global warming is within acceptable limits as determined by reference to Australia's NDC under the UNFCCC.	Santos explained that the Paris Agreement is key to the solution of managing climate impacts because the Paris Agreement is designed to limit global temperature increase and by doing so limit climate impacts to the environment to acceptable levels. Santos also stated that the acceptable level will depend specifically on the ecosystem and global cooperation to reduce emissions to limit temperature increase. Santos reiterated that the goal is for no significant impacts on MNES from climate impacts.	GHG impact assessment is outlined in Section 6.3.4 Acceptability levels are outlined in Section 6.3.3
ACF correspondence to Santos on 11 July 2024 The ACF reiterated its concerns regarding how Santos are considering climate change impacts attributable to the Activity. The ACF asserted that Santos must state in the Environment Plan what the environmental impacts from climate change	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. The EP acknowledges the linear relationship between cumulative anthropogenic CO_2 emissions and global warming. The EP references the latest commentary from the IPCC on the causes and impacts of climate change.	**Santos correspondence to ACF on 7 August 2024** *Santos refers ACF to paragraph 4 of the Annexure to Santos' 13 June 2024 correspondence.* *The acceptability of environmental impacts of GHG emissions from the Activity will be evaluated in the EP, for assessment by the Regulator against the requirements of the Regulations. Santos' methodology for this evaluation of acceptability will be broadly consistent with the methodology adopted for previous Barossa EPs, as an example refer section 5.1 of the Barossa Subsea Infrastructure Installation Environment Plan.*	GHG impact assessment is outlined in Section 6.3.4 GHG ALARP assessment Section 6.3.5 GHG Acceptability evaluation Section 6.3.6

due to the Activity will be. To do this, ACF asserted that Santos must undertake an analysis that measures the temperature increase attributable to the total lifetime emissions of the project and then analyse what this temperature increase would mean for the environment (including MNES).	The Activity's projected emissions are contextualised against established emissions budgets (national and global). Climate change is a global problem with the solution being led at the international level. Domestically, GHG emissions are regulated through Australia's NDC and the SGM and the Barossa JV has legal obligations to ensure that the Activity operates in accordance with that framework. It is not possible to draw a link between GHG emissions from the Activity and any specific climate related impact on any specific element of the Australian environment which may result from any net increase to cumulative GHG emissions globally. By keeping the Project emissions under the Safeguard Mechanism baseline, the Project's incremental contribution to global warming is within acceptable limits as determined by reference to Australia's NDC under the UNFCCC.		
The ACF asserted that Santos must demonstrate in the Environment Plan how the Barossa project is compatible with the 1.5-degree scenario under the Paris agreement. The ACF also requested Santos provide it with more information to demonstrate how it will comply with the 1.5-degree scenario.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Given that natural gas has a continued role under a range of Paris-aligned scenarios, GHG emissions associated with the Activity are able to be accommodated and managed under Australia's carbon budget and, internationally, under the carbon budget of Paris Agreement signatories and countries with mid-century net-zero commitments. Barossa will meet its Safeguard Mechanism compliance obligations, set by the CER in accordance with Australian Government policy and emissions reduction targets, including through the purchase and/or generation of ACCUs or SMCs. Management of the emissions of the Barossa Development in accordance with the Safeguard Mechanism will ensure that this Activity does not have an unacceptable impact on climate change, as the Scope 1 GHG emissions of the Activity are being considered as part of Australia's NDC and, therefore, also into the global trajectory to limit global warming in line with the Paris Agreement targets. Further specific control measures have been adopted for the Activity (including BAO-CM-6.3.23 and 6.3.24). Santos has also committed to only selling Barossa products generated from the Activity to customers from countries who are signatories to the Paris Agreement or have mid-century net-zero commitments (BAO-CM-6.3.19). Implementation of these control measures will allow Santos to continually pursue a range of management and abatement measures relevant to GHG emissions associated with third party consumption of gas from the Barossa Development. These are appropriate and practicable given that Santos does not have operational control over third party GHG emissions. Given the dynamic conditions in which the industry operates, Santos' strategies and targets will change and adapt over time. Santos views that ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	*Santos refers ACF to paragraphs 4 and 5 of the Annexure to Santos' 13 June 2024 correspondence.* *Santos will be required to comply with the applicable baseline under the Safeguard Mechanism for the Barossa project in accordance with Australia's Paris Agreement targets and associated emissions budget. Santos understands that ACF has a specialist understanding of the Safeguard Mechanism. Compliance with Santos' obligations under the Safeguard Mechanism may be achieved through (among other things) purchase or surrender of ACCUs or SMCs. Santos refers ACF to page 22 of Santos' 2023 Annual Report, which provides further information on Santos' generation and acquisition of carbon credits as follows:* *In 2023, Santos executed agreements to build a portfolio of projects supporting the development of five nature-based projects across Queensland, Alaska and Papua New Guinea, to generate carbon credits. Further, in 2023 Santos entered into forward contracts for the purchase of 2.5 million ACCUs at fixed prices to be delivered and paid between December 2023 and January 2027.* *NOPSEMA, in the exercise of its functions as Regulator, will consider whether Santos has demonstrated how the requirements applicable to the Activity will be met.*	Section 6.3.and Section 8.3.2.13 BAO-CM-6.3.10 BAO-CM-6.3.11 BAO-CM-6.3.19 BAO-CM-6.3.23 BAO-CM-6.3.24
The ACF requested details of the control measures and protocols that Santos has developed for the Barossa project to protect marine fauna and biologically important areas.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos provided the ACF with additional information of the specific protocols to be adopted in accordance with guidance from Part 8 *of the Environment Protection and Biodiversity Conservation Regulations 2000. and the Australian National Guidelines for Whale and Dolphin Watching 2017.* Santos views that ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	*The Production Operations information booklet contains proposed control measures that will be adopted as relevant to potential impacts to species, including marine fauna, and in relation to biologically important areas. All considered control measures (adopted and not adopted) will be presented in the EP for assessment by the Regulator/s.* *Santos' planned vessel activities overlap the internesting buffer for flatback turtles.* *Specific to marine fauna interactions, the Production Operations information booklet describes control measures at pages 9, 10 and 26. Santos adopts the following specific controls to protect marine fauna from vessel activities for Barossa Operations in accordance with:* *(a) Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000:* *(i) avoid collision;* *(ii) reduce speed to 6 knots & steer away within caution zone (300m of whales / whale sharks and 150m of dolphins);* *(iii) operate vessel at constant speed (6 knots);* *(iv) do not drift or approach marine fauna;* *(v) do not restrict fauna pathway or pursue fauna; and* *(b) Australian National Guidelines for Whale and Dolphin Watching 2017:*	Section 7.3.3

		(i) Adopting cautionary and no approach distances for whales, whale sharks (100 m no approach and 300 m cautionary distances) and dolphins (50 m no approach and 150 m cautionary distances).	
ACF correspondence to Santos on 9 September 2024 The ACF reiterated concerns that Santos has not provided it with sufficient information in relation to the climate change impacts attributable to the project, including an analysis that measures the impact on the environment as a result of an increase in temperatures attributable to the total lifetime emissions of the project.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. The EP acknowledges the linear relationship between cumulative anthropogenic CO_2 emissions and global warming. The impacts on the climate cannot be attributed to one specific sector or activity. In the context of evaluating potential impacts and risks that may be associated with GHG emissions from all sources globally, including from this Activity, this EP has considered broader climate change issues. The EP references the latest commentary from the IPCC on the causes and impacts of climate change. Management of the emissions from the Activity and in accordance with the Safeguard Mechanism will ensure that this Activity does not have an unacceptable impact on climate change, as the Scope 1 GHG emissions of the Activity are being considered as part of Australia's NDC and, therefore, also into the global trajectory to limit global warming in line with the Paris Agreement targets. Santos considered this claim having regard to the previously exchanged information and correspondence as described above in this table, noting that the ACF's 30 September 2024 correspondence reiterated the ACF's claim that it has not been provided with sufficient information, but did not elaborate on it any further. Santos views that ACF has been provided sufficient information and a reasonable period of time to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	**Santos correspondence to ACF on 20 September 2024** *Thank you for your letter of 9 September 2024. Santos has considered the matters raised or restated by ACF in that letter, and provided responses to your concerns and requests for further information, where possible and reasonable, in the attached Annexure.* *Santos remains of the view that sufficient information, and more than a reasonable amount of time, has been provided to ACF to allow ACF to make an informed assessment of the possible consequences of the activity to be carried out under the EP on any of ACF's functions, interests or activities.* *Santos is finalising the EP for submission to NOPSEMA and thanks ACF for its comments and submissions in respect of the risks, impacts, and potential controls in relation to this EP.* *Santos will comply with its Safeguard Mechanism obligations, which is part of the Australian Government's approach to meeting Australia's Nationally Determined Contribution under the Paris Agreement. Direct GHG emissions from Barossa (and a portion of indirect emissions associated with processing at DLNG) are to be managed under Australian regulations.* *As a result of the complex nature of the global emission system, climate change impacts cannot be meaningfully linked to any one activity or emissions source. The whole system for achieving emissions reductions involves additions in some areas and reductions in others, with net emissions reducing over time and there are many pathways to achieve NDCs in each country. Products generated from the Barossa Development will only be sold to customers from countries that are signatories to the Paris Agreement (or that have policies for reducing GHG emissions that are equivalent to policies required by the Paris Agreement).* *Santos confirms that in drafting the EP, it has had regard to the IPCC AR6 and relevant CSIRO publications.* *Otherwise, Santos:* • *refers ACF to paragraph 4 of the Annexure to Santos' 13 June 2024 correspondence and Santos' response in the first row of the Annexure to Santos' 7 August 2024 correspondence; and* • *is of the view that sufficient information has been provided to ACF to allow ACF to make an informed assessment of the possible consequences of the activity to be carried out under the EP on any of ACF's functions, interests or activities.* *The acceptability of environmental impacts of GHG emissions from the activity will be evaluated in the EP, for assessment by the Regulator against the requirements of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS Regulations).*	Section 6.3.
The ACF asserted that it was concerned about marine impacts and has engaged a marine expert to provide specific questions and solutions, which it expected to provide Santos in mid-October.	Santos has considered the matters raised by ACF in this EP and has provided information to the ACF regarding the marine impact of the activity. The potential impacts of the activity are assessed in Sections 6 & 7 of the EP. Santos views that ACF has been provided sufficient information and a reasonable period of time to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	*Santos notes the ACF's concern. Santos' consultation with ACF for the EP commenced on 9 February 2024. During the period of consultation, Santos has provided information in relation to impacts to marine species, based on the extensive scientific literature publicly available, and has consulted with the ACF in respect of concerns regarding potential impacts. Santos has provided ACF more than a reasonable amount of time to make an informed assessment of the possible consequences of the activity on its functions, interests or activities. The matters raised by ACF during consultation demonstrate that it has been able to engage comprehensively in the consultation process based on the information provided by Santos.*	Marine impacts of the activity as assessed in Sections 6 & 7
The ACF reiterated concerns regarding the activity's impact on marine species and requested further information regarding: the precautions Santos were taking to protect precious and vulnerable species; crossover or near crossover with Santos' operations and Pygmy Blue Whale feeding/foraging or possible breeding areas; and whether Santos is open to evaluating and consulting on additional control measures.	Santos has considered the matters raised by ACF in this EP. Santos provided information on control measure that would be adopted in the EP to protect marine species. Santos views that ACF has been provided sufficient information and a reasonable period of time to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	*a. In addition to the control measures set out in its letter of 7 August 2024, Santos proposes to adopt a control measure that will limit vessel speeds within 500m around the FPSO, IMMR vessels and campaign vessels to further mitigate the risk of marine fauna interaction.* *b. Operational Areas 1 and 2 do not overlap with pygmy blue whale biologically important areas (BIAs) for migration or foraging. The closest pygmy blue whale BIA (migration) is 173km from Operational Area 1.* *c. Santos refers to and repeats its response to paragraph 2 above. Santos has remained open during the consultation phase to considering additional measures (and has considered measures where proposed}.* *Based on all information available to Santos about the level of impact and risk to marine fauna from the proposed Activity, Santos does not consider any additional measures (in addition to those already proposed) to be necessary. An ALARP evaluation of all potential control measures (adopted and not adopted) to reduce impacts to marine fauna will be presented in the EP for assessment by the Regulator/s. In relation to the measure proposed by the ACF, this measure is not relevant to the activity proposed under this EP, which does not include build operations.* *Santos otherwise refers ACF to its response in the third row of the Annexure to Santos' 7 August 2024 correspondence. In accordance with Section 22 (15) of the OPGGS Regulations, the EP will contain an implementation strategy to enable appropriate consultation with the ACF should concerns arise during operations.*	Potential impacts to marine species are assessed in Sections 6.1, 6.2, 6.4,6.7,6.8 and 7.3 of the EP. Control measures to minimise impacts to marine species are: BAO-CM-6.1.1 BAO-CM-6.1.2 BAO-CM-6.6.6 Additional control measures to manage impacts to marine fauna are evaluated in Section 6.1.3
The ACF asserted that compliance with the Safeguard Mechanism does not address	Santos has considered the matters raised by ACF in this EP and provided a response to ACF.	*Santos refers ACF to paragraphs 6 and 7 of the Annexure to Santos' 13 June 2024 correspondence and Santos' response in the second row of the Annexure to Santos' 7 August 2024 correspondence.*	Section 6.3.

Barossa's exported emissions. It also stated that Santos does not have accountability measures in place to ensure end users meet Paris Agreement obligations. The ACF stated that it questioned the legitimacy of any claim that the Barossa Project is compliant with a 1.5 degree aligned pathway under the Paris Agreement.	It is correct to say that the Safeguard Mechanism does not address emissions associated with sold product. In evaluating the acceptability of Scope 3 emissions from the Activity, it is important to recognise the global consensus of the Paris Agreement under which countries have agreed to manage and reduce their own emissions with the aim to limit the global temperature increase in this century to 2°C, while pursuing efforts to limit the increase even further to 1.5°C. The EPOs and control measures for the Activity have regard to the UNFCCC framework which sets out the responsibility of each country to manage and reduce its emissions and the autonomy of each country in determining its pathway to achieve its emissions reduction targets. Acceptable levels of indirect (Scope 3) emissions from the Activity within Australia are set by the Safeguard Mechanism Baseline on Barossa facility emissions, in line with the Australian Government's NDCs under the Paris Agreement. Acceptable levels of indirect (Scope 3) emissions from the Activity outside of Australia are set by customer countries within the context of their own NDCs under the Paris Agreement or mid-century net zero commitments and associated emissions reduction policies and regulations, noting that the emissions would arise regardless of the source of the gas being consumed (i.e. if gas was not supplied from Barossa, it would be supplied from elsewhere to meet customer and customer country demand). In any event, Santos has since considered and adopted further control measures in relation to scope 3 emissions of end users (see BAO-CM-6.3.23 and BAO-CM-6.3.24)	*Santos reiterates that:* • *Santos will be required to comply with the Safeguard Mechanism, which is the regime that implements Australia's commitment to the Paris Agreement in relation to industrial emissions; and* • *Santos will only sell gas to customers from countries that are signatories to the Paris Agreement or that have a net-zero commitment as at the date of the relevant contract of sale, and therefore, Santos' international customers are subject to the requirements their respective governments set to achieve their Paris Agreement commitments.* *NOPSEMA, in the exercise of its functions as Regulator, will consider whether Santos has demonstrated how the requirements applicable to the activity will be met.*	EPO 11 BAO-CM-6.3.19 BAO-CM-6.3.23 BAO-CM-6.3.24
The ACF stated that its functions, interests or activities include: • engaging with investors across Australia who have an interest in preserving the environment and safeguarding climate; and • monitoring and engaging with government and businesses on climate change and emissions reduction measures.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF.	*Santos acknowledges ACF's functions, interests and activities. Santos is of the view that sufficient information has been provided to ACF to allow ACF to make an informed assessment of the possible consequences of the activity to be carried out under the EP on any of ACF's functions, interests or activities. See, in particular, Santos' response in the second row of the Annexure to Santos' 7 August 2024 correspondence.* *Santos' compliance with the SGM is a matter for Australia's Clean Energy Regulator to determine. Santos confirms that it will comply with the SGM using offsets or direct abatement. Santos continues to pursue carbon capture and storage opportunities which would provide direct abatement.*	Not applicable.
The ACF sought further information on Santos' compliance with the Safeguard Mechanism, including: • the Baseline scenarios it will comply with across the life of the project; and • specific details of how it intends to comply with the Safeguard Mechanism across the life of the project, including abatement options, purchase of carbon credits, emissions reduction strategies, financial assessments for future credit purchases, and the projected percentage of abatement it expects to achieve through ACCUS/SMCs.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Barossa will meet its Safeguard Mechanism compliance obligations, set by the CER in accordance with Australian Government policy and emissions reduction targets, including through the purchase and/or generation of ACCUs or SMCs. Santos considers that the information requested is not necessary for the ACF to make an informed assessment of the possible consequences of the activity on any of its functions, interests or activities. Santos views that ACF has been provided sufficient information and a reasonable period of time to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	*Santos refers ACF to paragraph 1 of the Annexure to Santos' 13 June 2024 correspondence and Santos' response in the second row of the Annexure to Santos' 7 August 2024 correspondence.* *Santos reiterates that the treatment of the Barossa project under the Safeguard Mechanism is a matter for the Clean Energy Regulator.* *Notwithstanding this, Santos notes that it will be required to comply with the applicable baseline for the Barossa project in each compliance year, and there are various options available to meet a baseline {including direct abatement and acquiring offsets, in addition to mechanisms available under the Safeguard Rules such as borrowing adjustments and multi-year monitoring periods).* *It is a matter for Santos to determine how it will achieve compliance with the Safeguard Mechanism. This information is not necessary for the ACF to make an informed assessment of the possible consequences of the activity on any of its functions, interests or activities.*	GHGEMP is summarised in Section 8.3.2.13 EPO 11 Section 6.3. contains the following control regarding emissions reduction: BAO-CM-6.3.9 BAO-CM-6.3.10 BAO-CM-6.3.11 BAO-CM-6.3.12 BAO-CM-6.3.19
ACF correspondence to Santos on 30 September 2024 The ACF acknowledged Santos' response on 20 September 2024 and expressed its disagreement with Santos' position that it has provided sufficient information, but did not further elaborate on the complaint. The ACF foreshadowed follow up correspondence before 14 October 2024.	As at 19 December 2024 ACF had not provided follow up correspondence. Santos does not agree with the ACF's claim that it has not been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	**Santos correspondence to ACF on 19 December 2024** *Your 30 September correspondence was in response to our letter of 19 September 2024 where we noted that:* • *Santos remained of the view that sufficient information, and more than a reasonable amount of time, had been provided to ACF to allow ACF to make an informed assessment of the possible consequences of the activity to be carried out under the EP on any of ACF's functions, interests or activities; and* • *that Santos was finalising the EP for submission to NOPSEMA.*	Section 6.3.

		Given that no further correspondence was received by 14 October, or since, and having regard to the elapsing of time, Santos has proceeded on the basis that the ACF does not intend to provide any further feedback and that consultation for preparation of environment plans relating to Barossa Production Operations activities is complete. *As always, while Reg 11A consultation is complete, Santos remains open to engagement with our stakeholders and any input on our activities that you may have. We will also continue to engage in accordance with our post-implementation consultation plan once the Environment Plan is in force.* *Santos would like to thank you for your responses and any input provided to date.*	
ACF correspondence to Santos on 20 December 2024 ACF stated in the email that it will provide it to Santos early next week.	A total 12 weeks has elapsed since the ACF stated on 30 September 2024 that it would be providing follow-up correspondence to Santos by 14 October 2024. Santos remains of the view that sufficient information, and more than a reasonable amount of time, had been provided to ACF to allow ACF to make an informed assessment of the possible consequences of the activity to be carried out under the EP on any of ACF's functions, interests or activities. Santos also advised the ACF in the same communication on 19 December 2024 that the EP was being finalised for submission to NOPSEMA. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.
ACF correspondence to Santos on 23 December 2024. ACF stated that its letter raised concerns about the content of the EP version dated 24 September 2024 and set outs issues Santos should address in an amended EP.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Refer below for assessment of matters raised. For completeness, Santos confirms that the ACF's comments were made in relation to Rev 1 of the EP, and Santos' response was based on Rev 2 of the EP.	*Santos correspondence to ACF on 31 January 2025.* *The ACF's 23 December letter sets out issues that the ACF proposes should be addressed by Santos in an amended EP. In this regard, we note that the ACF's comments in that letter refer to the EP on 24 September 2024 (the 24/9/2024 Version).* *An updated version of the EP was provided to NOPSEMA on 23 December 2024 (the Current Version). The distinction is made to explain Santos' responses to your letter of 23 December at Appendix A.*	Not applicable.
[4] – [5] ACF stated the 23/9/2024 version of the EP is deficient in material respects, resulting in non-compliance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos does not agree that the EP is deficient or otherwise non-compliant with the Regulations.	*Santos notes that whether or not the EP is deficient or otherwise non-compliant with the Regulations, is a matter NOPSEMA will consider and determine in the exercise of its functions.*	Not applicable.
[7] ACF stated that it's concerns on impacts and protection of marine fauna, raised during the meeting on 9 July 2024, had not been accurately characterised in the EP. [8] ACF also stated it had not been provided with sufficient information to inform its assessment, specifically alleging: 1. Emissions estimates provided changed over time without specification or explanation, 2. Santos refused to model the impact of emissions on MNES; 3. Santos refused to engage regarding compliance with the Safeguard Mechanism, including regarding offsets; and 4. Data provided to inform impacts (particularly on fauna) was insufficient and of low-quality.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos disagrees with the assertion that ACF's concerns regarding impacts and protection of marine fauna, raised in the 9 July meeting, have not been accurately characterised in the EP. These concerns are captured in Con 5212 and 5117 and have been consistently reflected and considered in this EP. Regarding point [8.1], Santos acknowledges that the GHG emissions estimates in the EP are lower than the estimates provided in the information booklet for the reasons explained in Santos' response to ACF. In circumstances where the GHG emissions estimates in the EP are lower than the estimates provided in the information booklet, Santos does not consider this has affected the ACF's ability to make an informed assessment of the possible consequences of GHG emissions on the ACF's functions, interests or activities. Santos' assessment relating to ACF's allegations on each of the items listed in [8.2] – [8.4] of the 23 December letter are assessed in relevant sections below. Santos considers it has provided sufficient information to the ACF, and that section 25 consultation requirements have been met, including for the reasons given in response to the ACF.	*Santos has considered the ACF's views as to the sufficiency of information provided to date and remains of the view that Santos has properly consulted with the ACF to the standard required under section 25 of the Regulations.* *Regarding point 1, Santos confirms that the GHG emissions estimates in the EP are lower than the estimates provided in the information booklet for the 25 year lifecycle of Barossa production operations (inclusive of commissioning, start-up and steady state operations), and are based on best available information about the Activity at time of submission of the EP. As the annual emissions estimates provided in the information booklet preceded the finalisation of the EP for submission to NOPSEMA, they were conservative (if extrapolated at a flat rate for 25 years of production operations) when considering that annual emissions are expected to reduce over the life of the Activity as production rates decline.* *For further discussion relating to emissions estimates and to each of the other items listed in [8.2] – [8.4] of the 23 December letter inclusive, please see further discussion in the relevant sections below.*	Section 6.3
[9] – [21] ACF stated the following in relation to infrastructure design being responsive to changing weather:	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos disagrees that there is any lack of clarity as to how long operations will be undertaken. The EP identifies the duration of activities, and addresses the substance of the concerns raised by	*As identified in Section 2.3 of the 24/9/2024 Version of the EP, the total duration of FPSO steady state operations is approximately 25 years.* *The design of the Barossa facilities has considered climate change risks and associated changes in weather patterns, and these have been incorporated into the project design across the 25-year facility design life. (Note: the facility design life of 25 years aligns with the currently planned 25 years of*	Section 2.3 Section 2.4.1.1 Section 2.10

• it is unclear from the 23/9/2024 version of the EP how long operations will be undertaken for;
• The infrastructure design needs to account for environmental changes (including emissions, temperature and climate change scenarios) that will occur at least until 2050.
• In relation to the FPSO, the EP does not deal with the consequences of a potential mooring line failure;
• The risk of a condensate spill is not appropriately assessed in light of increasingly extreme weather events
• The 23/9/2024 Version of the EP does not satisfy the Regulations because it fails to include:
  ○ comprehensive consideration of changing weather patterns;
  ○ design responses and contingency plans in response to such changing weather patterns; and
  ○ detail regarding use of support vessels in the event of extreme weather under the above scenarios.
	the ACF. In any case, to avoid any uncertainty, Santos has made consequential amendments to Rev 3 of the EP in order to clarify the matters raised by the ACF. Santos considers the EP satisfies regulatory requirements. The EP has considered climate change and climate influence on the design of surface infrastructure, including for the reasons given in the response to ACF, and:
	- a credible spill scenario considered a FPSO mooring failure as part of a subsea release of gaseous hydrocarbon unplanned event, noting that the risk assessment is based on a worst-case scenario release from a pipeline rupture.
	- the impacts and risks of a loss of unplanned liquid hydrocarbon release scenarios, including vessel collision for a HFO, MDO and MGO release have been considered.
	Santos has control measures to ensure integrity management of the FPSO and subsea infrastructure (BAO-CM-6.1.3) and a Pipeline Integrity Management Plan (BAO-CM-7.6.3).
	In addition, the Barossa FPSO Facility Safety Case (Safety Case) includes measures to ensure safe operations and ongoing integrity of all facilities and vessels (including support vessels) during adverse weather conditions.
		operations. Operations beyond this period would be subject to detailed design life extension assessments.)
		In any case, Santos notes the EP is required to be revised every five years and there will therefore be at least four opportunities for Relevant Person consultation and regulator assessment and acceptance of the revised EPs before the design life of 25 years is reached.
		Cyclonic events are the dominant climatic influence on the design of surface infrastructure. During project definition, a cyclonic event dataset was developed and subjected to a range of modelled sensitivities to account for extreme weather conditions (winds, waves, currents) which resulted in modelled 10,000 year cyclonic storm conditions. This dataset informed the facility mooring system design against survivability acceptance criteria for a 10,000 yr return period cyclonic event, and a 100 yr return period cyclone event with a single mooring line failure as described in Sections 2.4.4.1 and 2.10 of the 24/9/2024 Version. The conservatism in the FPSO mooring system design survivability acceptance criteria is sufficient to account for changing weather patterns due to climate change, over the design and operational life of the Barossa facilities.
		*In the event there is the potential for offshore operations to be impacted by extreme weather events, the Barossa FPSO Facility Safety Case (**Safety Case**) includes measures to ensure safe operations and ongoing integrity of all facilities and vessels (including support vessels) during adverse weather conditions. The Safety Case is subject to assessment by NOPSEMA under the Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009 (Cth).*
		*Notwithstanding, the 24/09/2024 version of the EP evaluates impacts and risks of a loss of marine diesel oil (**MDO**) from a support or other Activity vessel, caused by a vessel collision (Section 7.7.10). The EP considers poor/adverse weather conditions as a contributing factor for a vessel collision event, and includes proposed control measures to reduce impacts and risks from a vessel loss of containment event to ALARP and acceptable levels.*
			Section 7.6.1
			Section 7.7
			Section 7.7.9
			Section 7.7.10
			Section 7.7.11
			BAO-CM-6.4.10
			BAO-CM-7.6.3

[22] – [24] ACF stated the scope of the activity is unclear in relation to condensate offtake and cited contradiction in the offtake process once the offtake tanker is disconnected from the FPSO but still in the Operational Area	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos has made consequential amendments to the EP to clarify the uncertainty raised by the ACF.	1. *Offtakes will be periodic, approximately one every 3 months (described in Section 2.7.4.1).* 2. *The EP defines the Operational Areas with coordinates in Section 2.2.3 and Figure 2-1.* 3. *Section 2.7.4.1 describes the offtake activities. For clarity, the operations of the offtake tanker constitute part of Santos' petroleum activities (for the purposes of the Regulations) under this EP when the tanker is under Santos' navigational control in Operational Area 1 (OA1), and when the offtake tanker is connected to the FPSO.* 4. *Santos has assessed the planned impacts and unplanned event risks associated with offtake tanker operations within the OA1. (Refer Section 6.1, 6.2, 6.3 and 6.6 of the 24/9/2024 Version in relation to impacts from planned activities and Section 7.7 in relation to impacts and risks from unplanned hydrocarbon release events.)*	Section 2.7.4.1 Section 7.7.8.1
[25] – [30] ACF stated the following in relation to spill risk: • The statement in the 23/9/2024 Version of the EP that the maximum credible release of condensate due to rupture or leak of offtake equipment is 465m3 is not credible and not compliant with the requirement to identify and evaluate risk. • The lack of credibility arises from the details of the 20 March 2022 spill Santos was responsible for at Varanus Island • The 23/9/2024 Version of the EP does not explain what "major loss" means nor how the detection would occur or how detection would result in "instantaneous" shutdown. • Given the Varanus spill the EP needs to particularise this and address the Varanus situation specifically. The 23/9/2024 Version of the EP indicates production flowlines can be monitored for pressure drops indicating leaks. The EP should consider applying this to offtake lines.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos considers that the concerns raised by the ACF in relation to Varanus Island Operations do not affect the reliability of the calculation of the maximum credible release of condensate under this EP, for the reasons given in response to the ACF. Santos is confident with this calculation and with its evaluation of this risk. In any case, Santos has considered and evaluated the control measure proposed by the ACF (being the suggestion that offtake lines be monitored for pressure drops indicating leaks). Santos has determined not to adopt this control measure, for the reasons given in section 7.7.8.3. Santos has adopted BAO-CM-7.7.8.5, noting that the reference to BAO-CM-042 (now BAO-CM-6.8.5) included in the response to ACF was incorrect.	*This EP does not cover Varanus Island Operations which are regulated by another regulator and different legislation and regulations.* *The 24/9/2024 Version sets out the basis on which the maximum credible release of condensate from offtake equipment has been calculated. The incident referred to by the ACF has no bearing on this calculation because the offtake operations for the Barossa FPSO are materially different than those at the Varanus Island Operations. The offtake hose on the BW Opal is reeled on the FPSO and deployed for offtakes. In the case of an unplanned event, and the release of condensate from the hose, the release would be on the sea surface, as the hose is floating.* *In contrast, as identified in the extract cited by the ACF, the release of condensate at Varanus Island occurred from a torn subsea hose (that is, underwater and on the seabed). The extracts at p 730 of the 24/9/2024 Version identified by the ACF are based on the fact that the Barossa offtake hose is floating and clearly visible.* *In particular, as set out in the EP, offtake hook-up & condensate offloading will commence during daylight hours (control measure BAO-CM-042 [now BAO-CM-6.8.5]), enabling visual observation at the commencement of offtake operations and visual detection of an unplanned release. The volume and flow rates are also metered at both the FPSO and offtake tanker during offtake operations, providing further means of detection of an unplanned release.*	Section 7.7.8, especially section 7.7.8.3 BAO-CM-7.7.8.5

[31] – [34] ACF stated Santos needs to explain incongruity in the 23/9/2024 Version of the EP with regard to a Petroleum Safety Zone being used to reduce the potential for vessel interaction and collision. ACF stated the incongruity arises because the EP states that third-party vessels are not permitted to enter the PSZ but, if condensate is to be taken off by third party vessels, they will need to enter the PSZ.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos has made consequential amendments to the EP to clarify that the offtake tanker is permitted access to the PSZ. BAO-CM-6.6.2 has been modified to clarify that offtake tankers can enter the PSZ.	*Further to Santos' response above to paragraphs [22]-[24] of the ACF's 23 December letter, whilst the offtake tanker is a third-party vessel, it is permitted access to the PSZ (within OA1), after requirements of the Santos permit to work authorisation process have been met (which are managed via radio communications between the third-party operated offtake tanker and the FPSO). As noted above, Santos has considered the impacts and risks associated with the presence of the offtake tanker within OA1 and the PSZ.*	BAO-CM-6.6.2
[35] – [53] ACF stated there is no detail provided in the 23/9/2024 Version of the EP as to how off-take tankers, as third-party vessels, will be vetted, where and when that will occur and by whom, what the criteria are and who will be the parties to the agreement referred to. ACF stated its assumption is that guidelines referred to are the Oil Companies International Marine Forum Guidelines for Offshore Tanker Operations but it is not clear that the guidelines cover the operation in the way the 23/9/2024 Version of the EP describes. ACF stated it is also concerned that reliance is placed on guidelines written by industry that are not subject to Australian government oversight. ACF stated the movement of offtake activities is a risk of the activity and hence must be detailed, evaluated and control measures specified; at a minimum the offtake tankers when approaching the FPSO and within OA1 should be considered part of the activity and treated accordingly for the purposes of the EP.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos disagrees that there is any deficiency in Santos' evaluation of risks relating to offtake tankers, for the reasons given in response to the ACF. Risks relating to offtake operations are comprehensively evaluated in Section 7.7.8, Section 7.7.9 and Section 7.7.11 Santos has made consequential amendments to the EP control measure BAO-CM-6.6.2 to clarify the uncertainty raised by the ACF in relation to offtake tankers being permitted within the PSZ in OA1. The offtake activity and presence of the offtake tanker has been added to Table 2-6 planned timing of production operations activities.	*Santos confirms that the reference on p 939 of the 24/9/2024 Version to 'Guidelines' is a reference to the Oil Companies International Marine Forum Guidelines for Offshore Tanker Operations, referred to immediately above and to the left of the statement extracted by the ACF.* *The relevant detail (that provides for reducing associated risk of unplanned hydrocarbon release) as contained in the Oil Companies International Marine Forum Guidelines (and, by extension, the vessel vetting process) is included in the 24/9/2024 Version of the EP, this being "tankers with double hulls and fully segregated ballast tanks is a requirement of the vetting process as well as a MARPOL requirement that is monitored by way of regular statutory inspections". (refer to Section 2.7.4.1)* *The unplanned hydrocarbon release risk associated with condensate offtake operations, inclusive of the presence of the offtake tanker within**OA1**, is assessed and considered in the 24/9/2024 Version. (Also see Santos' above response to paragraphs [22]-[24] and [31]-[34] of the ACF's 23 December letter.)* *Santos:* • *has properly considered the impacts, risks and management measures included in the EP to address the risk of a loss of containment; and* • *notes this is properly a matter for NOPSEMA to consider and determine in the exercise of its regulatory functions*	Section 2.7.4.1 Section 7.7.8 Section 7.7.9 Section 7.7.11 BAO-CM-6.6.2 Table 2-6
[54] ACF stated it is not obvious where the information on support and offtake vessel interactions is in the 23/9/2024 Version of the EP.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos has corrected the typographical error identified by the ACF.	*The reference to Section 2.8.6 identified by the ACF is a typographical error. The correct reference is to Section 2.7.4.1 (Offtake Operations), which details the role of support vessels in offtake operations, noting: 'at least one support vessel is on location to provide static tow of the offtake tanker and assisting in berthing and disconnect'.*	Section 2.7.4.1
[55] – [57] ACF stated the Barossa Terminal Handbook is referenced in the 23/09/2024 Version of the EP in relation to several control measures intended to reduce the risk of hydrocarbon spill and should form part of the EP and be provided to Relevant Persons.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos does not agree that a copy of the Handbook needs to form part of the EP or be provided to Relevant Persons, for the reasons given in response to the ACF.	*The EP is required to describe how the suite of proposed control measures are sufficient to reduce identified impacts and risks of the Activity to ALARP and acceptable levels. On p 768 of the 24/9/2024 version, the 'environmental benefit' of BAO-CM-7.7.8.4 (ie. the Barossa Terminal Handbook) describes the function of the Handbook in reducing the risk of a vessel collision that may lead to an unplanned release of condensate from the FPSO. This is sufficient for the purpose of NOPSEMA's assessment against the requirements of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (the Regulations) for an EP.* *Santos' obligation is to describe the measure sufficiently in the EP to explain its purpose and function as a control measure for identified impacts and risks. Please note that in addition to information provided on p 768 of the 24/9/2024 Version, the function of the Barossa Terminal Handbook as a control measure (BAO-CM-7.7.8.4) for the EP is further described on p 851 of the EP.* *Santos considers that the information included in the EP provides sufficient detail in relation to the role of the Handbook in reducing impacts and risks to a level that is ALARP and acceptable. NOPSEMA will have opportunities to assess proper implementation and effectiveness of the Barossa Terminal Handbook as a control measure during compliance inspections of the accepted EP.BAO-CM-7.7.8.4*	BAO-CM-7.7.8.4
[58] – [67] ACF stated the following in relation to Greenhouse Gas Emission characterisation in the 23/09/2024 Version of the EP: • The categorisation of Scope 3 emissions is assumed by ACF to be based on The Greenhouse Gas Protocol A Corporate Accounting and	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos does not agree with the ACF's characterisation of scope 1 and 3 emissions, for the reasons given in response to the ACF. Santos considers that its GHG emissions estimates and the delineation between scope 1 and 3 emissions remain accurate.	*Santos has calculated the anticipated Scope 1 emissions of the Activity consistent with the methods it uses to calculate and report its reporting entity emissions under the NGER regime. Under that regime, a corporation is required to report on emissions under its operational control (section 19, NGER Act). A person has operational control over a facility if the person has the authority to introduce and implement operating, health and safety, and environmental policies (section 11).* *Emissions from sources such as "support vessels" and "transport of condensate" are not under the operational control of the Barossa Joint Venture and, therefore, will not be included as Scope 1 (or Scope 2) emissions for NGER reporting purposes.*	Section 6.3

Reporting Standard Revised Edition but this needs to be clarified. • The definition of scope 1 under the "NGER regime" is inaccurate • The EP should adopt the Australian definition of scope 1, 2 and 3, applying that support vessels emissions are Scope 1 and the same is true of the transport of condensate and business travel. • The EP incorrectly determines emission scope by reference to the concept of "reporting entity", without explanation. • The 23/9/2024 Version also incorrectly determines emission scope by reference to ownership and control. The 23/9/2024 Version requires revision so the GHG emissions figures are accurate.		*The definition of Scope 3 emissions in the GHG Protocol was adopted because there is no "Australian definition" of this concept under the NGER regime (which relates to Scopes 1 and 2 emissions only).*	
[68] – [89] ACF stated the following in relation to Santos' evaluation of the impact of changes in climate: • It has not seen any documentation whereby Santos sufficiently addresses the evaluation of impacts of its emissions on the climate or how it will address the climate impacts of its scope 1 and 3 emissions. • No detail has been provided on how Santos will address the direct or indirect consequences on the environment, including matters of national environmental significance, from the release of greenhouse gases. • Santos should model the temperature increases that will occur as a result of the GHG emissions from Barossa (scope 1 and 3) and assess the impacts of that temperature increase upon the environment. • Santos refuses to engage meaningfully on the matter and its approach to provision of information during the consultation phase was not consistent with the Regulations. • Santos failed (despite ACF's requests) to provide an assessment of the consequences on Australia of the pollution that the project will generate, specifically the greenhouse gas emissions. • The 23/9/2024 Version of the EP is non-compliant with the Regulations and this needs to be addressed before NOPSEMA makes a decision on the EP under reg 33. It is possible, and required, to evaluate the impact on Australia of the GHG emissions the Activity will cause.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. As outlined above, Santos notes that the ACF's comments were made in relation to Rev 1 of the EP, and Santos' response was based on Rev 2 of the EP. Since both of these revisions, changes have been made to Section 6.3, including to Santos' evaluation of the impacts of GHG emissions. In relation to the ACF's specific objections: • Santos considers that its evaluation of GHG emissions is comprehensive and appropriate for the reasons given in Section 6.3 and in response to the ACF; • Santos has provided detail, both to the ACF and in Section 6.3 of the EP, as to the control measures proposed to be adopted in order to reduce both scope 1 and scope 3 emissions from the Activity to a level that is ALARP and acceptable. Since Santos' response to the ACF, further controls have been adopted. • Santos does not consider that it is necessary or appropriate to undertake the modelling proposed by the ACF, for the reasons given in Section 6.3 and in response to the ACF. Santos has included in Section 6.3.2.4 a calculation of the theoretical contribution of emissions from the Activity to Australian and global net carbon budgets and has identified that the net GHG emissions from Barossa production operations comprise a nominal amount in the overall scheme of the national and international carbon budgets and will not materially or substantially contribute to Australia's GHG emissions or global emissions levels. In any event, carbon budgets are made up of both additions and subtractions to cumulative GHG emissions. Accordingly, these are theoretical calculations for indicative purposes only. • Santos disagrees with the assertion that its engagement on this issue has not been meaningful. Santos considers that it has discharged its obligations to consult with the ACF under s 25, including in relation to GHG emissions, including providing responses to queries raised by the ACF and evaluating information and proposed measures suggested by the ACF. • Santos disagrees with the assertion that it has failed to provide an assessment of the consequences of GHG emissions. Santos has consulted with the ACF in relation to its evaluation of GHG emissions, and the ACF has had access to Santos' evaluation of GHG emissions in Rev 1 of the EP since around September 2024. • Santos considers that the EP complies with the obligations of the Regulations, for the reasons given in this EP.	*International frameworks, namely the Paris Agreement, have been developed to facilitate an orderly approach to what is a global problem. This framework recognises, and is premised on, the fact that climate change is a global issue – there is no correlation between where GHG emissions are released and where climate change impacts are felt.* *For this reason, Australia sets and reports against its emissions reduction targets in 'net' terms, not by individual sectors or projects. The Australian Government is aware of planned production in the Barossa gas field and has considered this in its emissions reduction targets outlined in its Nationally Determined Contribution (NDC) under the Paris Agreement. The Offshore Project Proposal was previously approved by NOPSEMA and a production licence conferring rights to extraction of the gas resource on the Barossa joint venture has already been granted.* *Domestically, GHG emissions are regulated through Australia's NDC and the Safeguard Mechanism, and Santos has legal obligations to ensure that the Activity operates in accordance with that framework.* *Physical impacts of climate change on environmental receptors are the result of global GHG emissions from a multitude of sources (minus the GHG sinks) that have accumulated in the atmosphere. The impacts of climate change cannot be attributed to one specific sector or activity.* *In the context of evaluating potential impacts and risks that may be associated with GHG emissions from all sources globally, including from this Activity, Santos has considered the physical impacts of climate change (Section 6.3.2.6 of the 24/9/2024 Version).* *Santos considers the ACF's summary of engagement on this issue outlined in the 23 December letter, reproduced in the 'ACF assertion' column to the left, is incomplete and inaccurate. The summary does not refer to all relevant engagement from Santos.*	Section 6.3 Section 6.3.2.4

	• Santos considers that the impact of GHG emissions has been considered and evaluated consistent with Santos' obligations under the Regulations.		
[90] – [91] ACF stated the activity is inconsistent with the Paris Agreement and with limiting warming to 1.5 degrees and that Santos' reasoning on this issue is flawed, in that compliance with the Safeguard Mechanism does not necessarily ensure compliance with a 1.5 degree scenario. ACF further stated Santos has not expressed any credible solution to this issue, nor engaged with ACF on potential solutions. ACF stated that potential solutions could include: 1. Ensuring Santos' customers are using products to displace coal and not on-selling to other nations. 2. Limiting sales to customers using on-site abatement (CCS) in their gas-fired power stations. 3. Not selling to customers prior to ensuring that their countries have legitimate and credible policy pathways to meet their NDCs.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos has evaluated control measures directed to scope 3 emissions including measures that substantially align with those suggested by ACF – see Section 6.3.3. Since the ACF's review of the EP, Santos has proposed additional control measures directed at engagement with / supporting customers in relation to GHG emissions management/reduction. (BAO-CM-6.3.23 and BAO-CM-6.3.24). For the reasons given in Section 6.3 and in response to the ACF, Santos considers that the EP demonstrates that GHG emissions have been reduced to ALARP and are of an acceptable level.	*Australia has a well-established legislative framework under which certain GHG emissions from Barossa production operations will be regulated or managed to further Australia's transition to net zero emissions by 2050. This includes:* • *GHG emissions reporting under the NGER Act and the National Greenhouse and Energy Reporting (Measurement) Determination 2008* • *the Emissions Reduction Fund (Australian Carbon Credit Units Scheme)* • *the Safeguard Mechanism to keep net emissions below an established baseline and require net-zero reservoir emissions for new gas fields that feed LNG projects. The Safeguard Mechanism currently applies to facilities that emit more than 0.1 MtCO2-e per annum.* *Compliance with the Safeguard Mechanism is of primary importance in ensuring that GHG emissions associated with the Activity are as low as reasonably practicable and acceptable. GHG emissions at or below the baseline and the Safeguard Mechanism's future decline rates are already anticipated and thus accounted for under Australia's NDCs under the Paris Agreement.* *Unlike Scope 1 emissions, there is no compliance framework for Scope 3 emissions management in Australia. This is because Scope 3 emissions are the Scope 1 and Scope 2 emissions of upstream suppliers and downstream users. The international system for GHG regulation, underpinned by the UNFCCC and Paris Agreement, recognises that responsibility lies with the countries in which those emissions are generated. NDCs, including that of Australia, are consistent with this approach. Accordingly, Scope 3 emissions commitments made by companies are generally voluntary.* *Santos, in its capacity as an independent company, has implemented a multi-faceted corporate plan to address Scope 3 emissions across its operations. The actions to address Scope 3 emissions include:* • *continue engaging our suppliers to deepen our understanding of their emissions* • *provide guidance and education to support our suppliers to improve the accuracy of their emissions calculation* • *work with suppliers to develop mutually beneficial emissions reduction initiatives* • *continue engaging with our industrial customers, LNG customers and regional emitters to provide carbon management solutions, including progressing our current MOUs, and* • *investment in carbon capture and storage, and other technologies to advance the development of low carbon fuels.* *These corporate commitments as an independent company will be applied to suppliers and to Santos' customers in respect of the Barossa Development. This approach ensures that Scope 1 emissions for Barossa will be managed in accordance with legislative compliance obligations (which include consideration of best practice in their formulation) and that a proactive and collaborative voluntary approach is taken to addressing Scope 3 emissions through Santos' broader corporate initiatives as an independent company and not in its capacity as Operator of the Barossa JV.* *Additional control measures addressing Scope 3 emissions have been considered but not adopted for various reasons, including that they are the Scope 1 and 2 emissions of other countries, who have their own nationally determined contributions and targets under the Paris Agreement, in accordance with their own national pathways for emissions reduction.*	Section 6.3.3 – 6.3.6 BAO-CM-6.3.23 BAO-CM-6.3.24
[92] – [97] ACF stated there is a lack of adequate (including independent, peer-reviewed) research informing the impact analysis of the operations upon the marine environment, particularly as it relates to marine megafauna and the claims around distribution of migratory species within OA1 and OA2. ACF further stated this undermines the legitimacy of Santos' claims around the consequences of its operations upon the marine environment and further reinforces the need for further research and more fulsome cumulative impact analysis to be undertaken. The ACF objected to the mitigation measures proposed by Santos in relation to marine species, including specifically in relation to Sea Snakes, the Dusky Sea Snake (which is now endangered), Brydes & Omura whales, and the Pygmy Blue Whale). ACF stated that no additional control measures have been taken since its last	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos disagrees with ACF's comments for the reasons given in response to ACF. Santos considers its evaluation of impacts and risks to marine species, including in respect of the Dusky Sea Snake, Brydes Whale, Omura Whale and Pygmy Blue Whale is appropriate. Santos' evaluation of impacts and risks is informed by a wide array of peer-reviewed scientific papers, extensive baseline field studies, the EPBC protected matters database, conservation management plans, conservation advice and recovery plans where applicable. As previously responded to ACF (refer above to meeting with ACF on 9 July 2024 and Santos correspondence to ACF on 7 August 2024), Santos reiterates that scientific information available on biologically important areas for protected marine species have been considered in the evaluation of impacts and risks on whales and turtles. BIAs for fish, sharks and rays, marine mammals, marine reptiles, and seabirds and shorebirds are addressed in Section 3.5.6 of the EP. Regarding ACF's objection to mitigation measures, Santos maintains that its proposed control measures in relation to marine species, including the Dusky Sea Snake, Brydes Whale, Omura Whale and Pygmy Blue Whale, are sufficient. Santos has evaluated	*Santos has conducted extensive baseline field studies at the activity location, and considered regionally relevant contemporaneous information from a wide array of peer-reviewed scientific papers to inform the impact assessment. The management of potential impacts is aligned with conservation advice, and conservative control measures have been adopted to mitigate any potential impacts. OA1 is located where there are no known significant feeding, breeding, or aggregation areas for marine mammals, largely attributable to the 250-metre depth.* *Santos' assessment is that the proposed control measures are sufficient having regard to the nature and scale of the activity and existing proposed control measures, including vessel speed restrictions within 500m of the FPSO and other vessel operations within Operational Areas (BAO-CM-6.6.6BAO-CM-6.6.6).* *Section 7 of the EP assesses that potential impacts and risks associated with marine fauna interaction are expected to be limited to individuals and/ or small groups transiting the Operational Areas, without impacts at a population level. The environment performance outcome commits to zero incidents of injury/ mortality of cetaceans/ marine reptiles from collision with project vessels operating within the project area (EPO-03) to ensure impacts are limited to acceptable levels.* *To inform evaluation of impacts and risks to marine species, and appropriateness of proposed control measures, Santos has not relied solely on regional desktop literature and the EPBC protected matters database, as demonstrated through the Barossa marine field studies program for the Barossa Development OPP. The Barossa marine field studies program was an extensive and robust environmental baseline studies program, designed to characterise the marine environment values and sensitivities within the Project area. The results of the marine studies program have been critical in supplementing published literature at a regional scale with information that is specific to the activity location. With regard to the specific marine fauna species highlighted by the ACF:*	Section 3 (baseline field studies) Table 3-13 (conservation advice dusky sea snake) Section 3.5.6 (Biologically important areas and habitats) Section 6.1 Section 6.1.3 Section 6.3 Section 7 Section 7.3.2 BAO-CM-6.1.1 BAO-CM-6.6.6 EPO-03

consultation with Santos and submitted the following: • In the absence of adequate data, installation and operation should not happen during peak migration or periods of ecological sensitivity. • Vessel operations should only occur with an observer on board and activities should only be undertaken during daylight hours when marine fauna can be accurately observed and mitigation measures applied.	the control measures proposed by ACF (see section 7.3.2 and also section 6.1.3) (excluding the control measure regarding installation, which is not an activity authorised under this EP).	• *The Dusky Sea Snake was identified as potentially occurring within the EMBA (associated with a loss of hydrocarbon event), but not within the Operational Areas where planned activities will occur. Locations where Dusky Sea Snakes may be present are situated several hundred kilometres from the Activity OAs.* • *The Barossa Marine Studies program did identify presence of Brydes whales, Omura whales and Pygmy Blue whales in the vicinity of OA1, albeit in limited numbers. On the basis of these results, it is acknowledged in the EP that impacts from the Activity, such as underwater noise or unplanned vessel interactions, have the potential to impact individuals that may transit OA1. These impacts and risks have been considered in the EP.* *The above information has informed the evaluation of impacts and risks from the Activity and appropriateness of proposed control measures.* *Regarding ACF's request that vessel operations should only occur with an observer on board, proposed control measure BAO-CM-6.1.1 provides for vessel crew to act as wildlife observers and record sightings of cetaceans and turtles. The EP evaluates a potential control measure of restricting vessel operations to daylight hours, however this was not adopted due to the limited potential environmental benefit given only limited numbers of marine species are expected in OA1 (as evidenced by the number of marine fauna sightings (<10) during drilling and installation activities).*	
[98] – [105] ACF stated it has repeatedly asked about Barossa's compliance with the Safeguard Mechanism and have been repeatedly told that it is not a matter for ACF. ACF stated the 23/9/2024 Version of the EP provides no evidence that the titleholder can meet the requirements of the SGM in terms of the availability and cost of Australian Carbon Credit Units or Safeguard Mechanism Credits and provides no comfort that the necessary volume of offsets will exist through the 25-year design life.	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos disagrees with the ACF's comments for the reasons given in response to the ACF. In addition, the responsible Commonwealth minister has communicated to the Barossa joint venture partners on a number of occasions that he anticipates there being ACCUs available for this project Santos considers that the ACF has been provided sufficient information to enable the ACF to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities. Santos considers that the EP demonstrates how Santos will comply with the Safeguard Mechanism.	*Regarding the ACF's concerns about Santos' failure to adequately attempt to demonstrate compliance with the Commonwealth Safeguard Mechanism, Santos notes that the ACF has previously raised similar claims in correspondence to Santos on 9 April 2024 and 9 September 2024 and in the meeting on 9 July 2024.* *Santos' obligation is to demonstrate compliance with the Commonwealth Safeguard Mechanism to the Clean Energy Regulator.* *Santos re-iterates the following points:* • *Barossa Production Operations Scope 1 emissions will be managed in accordance with the applicable baseline under the Safeguard Mechanism, which has been developed by the Australian government with regard to Australia's Paris Agreement targets and associated emissions budget. The NT emissions budget is accounted for in Australia's national emissions budget.* • *The treatment of the Barossa project under the Safeguard Mechanism is a matter for the Clean Energy Regulator. Santos will abide by the Clean Energy Regulator's final determination.* • *There are various options available to meet legislative requirements under the Safeguard Mechanism rules. Compliance with obligations under the Safeguard Mechanism may be achieved through (among other things) the purchase or surrender of Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs.* *The availability of ACCUs over the next decade is supported by analysis of the balance between supply, holdings, and cancellation rates (Reputex, 2024. Market Outlook Australian Carbon Price, Supply & Demand Outlook September 2024). Throughout the decade, ACCU supply is projected to steadily increase, surpassing 30 million annually by 2030, alongside rising cancellation rates to meet Safeguard Mechanism requirements. By 2027, supply is forecasted to fall into deficit due to growing annual cancellations, which are expected to result in ACCUs being withdrawn from inventory until new supply comes into the market. Modelling shows ACCU holding inventory will continue to rise from approximately 36 million in 2024 to around 50 million by 2027, providing sufficient coverage for the deficit. Additionally, growing demand will send price signals to incentivise new ACCU supply.* *The Safeguard Mechanism is administered by the Clean Energy Regulator and any failure to comply would result in the Clean Energy Regulator imposing penalties***.**	Section 6.3 Appendix C
[106] – [115] ACF stated that while the 23/9/2024 Version of the EP says CCS is not part of the Activity for this EP, it is apparent from other public documents released by Santos (note: examples are cited by ACF) that CCS is part of the Barossa project and the EP activity. ACF further stated the EP needs to address this in order to comply with the Regulations, specifically regulations 21(1)(c) and (d) and 21(4)	Santos has considered the matters raised by ACF in this EP and provided a response to ACF. Santos has confirmed to the ACF that CCS is not part of the Activity under this EP.	*Santos notes that the ACF has previously raised similar claims regarding CCS in correspondence on 9 April 2024 and 9 September 2024 and in the meeting on 9 July 2024.* *Santos re-iterates that while it is exploring CCS opportunities at Bayu-Undan and elsewhere, these CCS projects are not owned or controlled by the Barossa joint venture (nor Santos in its sole capacity), are not part of the Barossa development, and are not within the scope of the EP.* *It is subject to a different regulatory regime and pursued by a different proponent. Santos is one of the joint venture parties for the Bayu-Undan CCS and has committed funding to it. Santos hopes that the project proceeds, but this is reliant on approvals from a foreign government (Timor-Leste) and the Australian government, and final investment decisions by the proponents of that project. If the Bayu-Undan CCS project proceeds, the Barossa Joint Venture hopes to be a customer of it.* *CCS is not a viable control measure for inclusion in the EP because it is not currently available. Potential CCS developments such as the proposed Bayu-Undan CCS project require regulatory frameworks, policies and approvals (from a different jurisdiction to the Activity) to be in place prior to taking final investment decisions. Therefore, it is not possible to rely on them for GHG emissions abatement.*	Section 6.3.3
ACF correspondence to Santos on 24 March 2025 ACF claimed Santos' correspondence of 31 January 2025 had not sufficiently addressed the matters ACF had raised in its letter of 23	Santos has considered the matters raised by the ACF and remains satisfied that its response to the ACF's letter of 23 December 2024 is comprehensive and appropriate. Santos has provided extensive responses to ACF's queries concerning compliance with the Safeguard Mechanism, including in	**Santos correspondence to ACF on 31 March 2025 in response to ACF correspondence of 24 March 2025.** *We refer to your letter of 24 March 2025 (24 March letter), and to all other correspondence to date between Santos and the Australian Conservation Foundation (ACF) in respect of the Barossa Production Operations Environment Plan (EP).*	Section 6.3

December 2024, in particular how Santos will comply with the Safeguard Mechanism. ACF claimed the EP has numerous deficiencies in the overall approach to risk assessment and lacks sufficient information on environmental features that would be impacted. ACF claimed the (OPGGSR) Regulations and best practice require that Santos should undertake the following (refer 1-9 below) before the EP can be accepted by NOPSEMA:	response to the ACF's letter of 23 December 2024. This matter is also addressed in section 6.3 of the EP. Santos acknowledges the ACFs objections and claims regarding the content of the EP, noting that they are expressed broadly without detailing specifics and that these objections are raised in relation to Revision 1 of the EP (which has since been amended in response to NOPSEMA feedback). The ACF has not identified any specific information in relation to the environment that has been omitted from the EP, and Santos remains satisfied that its description of the environment in the EP is comprehensive and appropriate. Santos has assessed the specific objections and claims raised by the ACF below.	*Santos has considered the 24 March letter and notes each of these matters has been considered and appropriately addressed by Santos previously in correspondence with the ACF or in the content of the EP. For the reasons given previously to the ACF, and set out in the EP, Santos remains satisfied that the EP meets the requirements of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (Cth), including that its evaluation of impacts and risks is comprehensive and appropriate.*	
1. Conduct a comprehensive long-term and cumulative impact assessment regarding potential effects on marine ecosystems	The EP, and associated consultation materials, has assessed the impacts and risks of the full life cycle (25 years) of the proposed Activity. These matters were also considered in the Barossa Development OPP. Cumulative impacts to the marine environment and species have been considered and assessed as described in the EP for all known and confirmed concurrent activities that are planned or may occur within the same Activity operational area, for example, concurrent drilling and FPSO hook-up and commissioning activities in Operational Area 1 (OA1), and this assessment will be supported by ongoing monitoring undertaken as part of Santos' implementation strategy.		Sections 2, 6 and 8
2. More accurately estimate the likelihood or consequence of environmental impacts in the risk assessment	Santos considers its estimation of risks is appropriate, both in its methodology (section 5) and in how that methodology has been applied to the impacts and risks identified (sections 6 and 7). Santos' evaluation of impacts and risks is informed by a wide array of peer-reviewed scientific papers, extensive baseline field studies, the EPBC protected matters database, conservation management plans, conservation advice and recovery plans where applicable. A number of these data sources are quantitative in nature and are used by Santos wherever possible to inform evaluation of impacts and risks from the proposed Activity.		Section 3 and 5
3. Evaluate impacts on specific marine species, particularly threatened and migratory species, in greater detail	Santos considers its evaluation of impacts and risks to listed and protected marine species is appropriate. Santos' evaluation of impacts and risks is informed by a wide array of peer-reviewed scientific papers, extensive baseline field studies, the EPBC protected matters database, conservation management plans, conservation advice and recovery plans where applicable.		Sections 6 and 7
4. Create robust long-term plans for monitoring of the project's ecological impacts on the marine environment	The EP includes for a comprehensive ongoing environmental monitoring program over the life of the Activity, both with respect to monitoring of emissions and discharges from facilities operations and monitoring of the receiving environment (water and sediment quality, marine fauna presence/interactions). For completeness, Santos notes that further detail has been added to the EP on this topic since Rev 1, on which the ACF's comments are based. Santos considers its environmental monitoring program is appropriate.		Section 8, Appendices I and J
5. Improve the EP's proposed control measures,	The proposed control measures, and supporting EPSs and measurement criteria, are considered sufficiently detailed and specific and address all identified impacts and risks from the Activity. For completeness, Santos notes that control measures, EPSs and measurement criteria have been revised since Rev 1, on which the ACF's comments are based, including to increase specificity. In any event, the ACF does not address any specific control measure which is said to require improvement.		Sections 6, 7 and 8
6. Properly assess long-term and cumulative impacts of greenhouse gas and atmospheric emissions	The EP, and associated consultation materials, has assessed the impacts and risks of the full life cycle (25 years) of the proposed Activity. Activity GHG emissions have been considered in the context of cumulative global GHG emissions (See section 6.3). The EP considers current published literature regarding climate science, Australian government GHG emissions reporting and projections, and other relevant contemporary literature from government and non-government sources. An acceptability evaluation for each identified impact and risk forms part of the EP, which considers		Sections 6.3 and 6.4

	consistency of the EP with principles of ecological sustainable development, which in turn includes consideration of the precautionary principle. The EP contains control measures to keep net emissions at or below the legislated Safeguard Mechanism baseline and additional control measures to monitor and further reduce atmospheric and GHG emissions to as low as reasonably practicable.		
7. Revise the assessments for unplanned releases and improve long-term ecological monitoring plans	The EP is supplemented by the Barossa Production Operations Oil Pollution Emergency Plan (OPEP) which addresses spill response activities for identified credible unplanned release scenarios. The EP includes a risk assessment for the worst case, unplanned releases based on spill modelling, and assesses the environment that may be affected, areas of high environmental value and hot spots. The nature and scale of hydrocarbon spills on the environment that may be affected from entrained, dissolved and floating hydrocarbons are also assessed. Santos considers that the ACF's claim that the assessment of unplanned releases is inadequate, has no merit. The OPEP is also accompanied by the Operational and Scientific Monitoring Bridging Implementation Plan, that describes a comprehensive operational and scientific monitoring program to be implemented in the unlikely event of an unplanned hydrocarbon release event. The operational monitoring component provides short term situational awareness of a hydrocarbon spill, enabling a timely assessment of the effectiveness of the spill response. Scientific Monitoring is the principle tool for determining the extent, severity and persistence of environmental impacts from a hydrocarbon spill over the longer term and for informing associated remediation activities (if required). Santos considers its environmental monitoring program is appropriate.		Section 7.7, Barossa Production Operations Oil Pollution Emergency Plan, Operational and Scientific Monitoring Bridging Implementation Plan: Northern Australia
8. Conduct more detailed analysis on cumulative impacts on marine fauna from multiple vessels, consider impacts on smaller cetaceans and pinnipeds, and properly consider seasonal variations in migratory bird presence	Potential for cumulative impacts are assessed for all known and confirmed concurrent activities that are planned or may occur within the same Activity operational area, for example, concurrent drilling and FPSO hook-up and commissioning activities in OA1. Concurrent Barossa vessel activities are only planned to occur in OA1, which is not adjacent any cetacean or marine turtles biologically important areas (BIAs) or known foraging, breeding, calving or migrating areas, with the nearest designated cetacean BIA (pygmy blue whale migration) greater than 170km away and the nearest marine turtle BIA (flatback turtle internesting) 50km away. Any unplanned marine fauna interactions are therefore unlikely to affect a large number of cetaceans or marine turtles nor affect any key life-cycle processes. This assessment is equally valid for smaller cetaceans and migratory birds that may be present in OA1. Pinnipeds are not associated with tropical marine waters and as such are not expected to be present in the EMBA for this EP.		Sections 2 and 6
9. Improve assessment of impacts from operational discharges, providing more specific targets for emissions reductions and more detailed assessment of long-term climate change impact.	All planned and contingency emissions and discharges from the proposed Activity have been assessed in the EP. Potential for cumulative impacts are assessed for all known and confirmed concurrent activities that are planned or may occur within the same Activity operational area, for example, concurrent drilling and FPSO hook-up and commissioning activities in OA1. The EP includes for a comprehensive ongoing environmental monitoring program over the life of the Activity, to monitor emissions from facilities operations and to evaluate effectiveness of control measures, such as the GHG emissions management plan, to reduce emissions to ALARP over the life of the Activity. For completeness, Santos notes that further detail has been added to the EP on this topic since Rev 1, on which the ACF's comments are based.		Sections 6, 7 and 8

Australian Marine Conservation Society - NT branch (AMCS NT)

Summary of consultation effort:

- On 9 February 2024 Santos emailed AMCS NT branch to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]

- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed AMCS NT branch further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos called AMCS NT regarding consultation for Barossa Production Operations EP activities and reminded AMCS NT of the deadline for providing input. AMCS NT advised that it had forwarded the previous emails to AMCS head office in Brisbane.
- On 8 May 2024, Santos emailed AMCS NT branch further to previous correspondence to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from AMCS NT. [Con-4021]
- On 10 July 2024 Santos emailed AMCS NT branch to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised AMCS NT branch that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Australian Marine Conservation Society.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Australian Marine Conservation Society.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Australian Parents for Climate Action Darwin and NT (APCAD)

Summary of consultation effort:

- On 9 February 2024 Santos emailed APCAD to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed APCAD further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 8 May 2024, Santos emailed APCAD further to previous correspondence, to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from APCAD. [Con-4022]
- On 10 July 2024 Santos emailed APCAD to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised APCAD that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from APCAD.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Australian Parents for Climate Action Darwin and NT.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Climate Action Darwin

Summary of consultation effort:

- On 9 February 2024 Santos emailed Climate Action Darwin to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Climate Action Darwin further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos called Climate Action Darwin to remind Climate Action Darwin of the deadline for providing input. Santos was advised the message would be passed to the appropriate personnel.
- On 8 May 2024, Santos emailed Climate Action Darwin further to previous correspondence to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Climate Action Darwin [Con-4023].
- On 10 July 2024 Santos emailed Climate Action Darwin to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Climate Action Darwin that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Climate Action Darwin.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Climate Action Darwin.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Conservation Council of WA (CCWA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed CCWA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed CCWA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos called CCWA and left a message regarding consultation for Barossa Production Operations EP activities with a team member.
- On 8 May 2024, Santos emailed CCWA further to previous correspondence to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from CCWA [Con-4031].
- On 10 July 2024 Santos emailed CCWA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from CCWA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from CCWA.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Doctors for the Environment Australia

Summary of consultation effort:

- On 9 February 2024 Santos emailed Doctors for the Environment Australia to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed Doctors for the Environment Australia further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 4 April 2024 Santos called Doctors for the Environment Australia and left voice mail message regarding consultation for Barossa Production Operations EP activities.
- On 2 May 2024, Santos emailed Doctors for the Environment Australia further to previous correspondence to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Doctors for the Environment Australia. [Con-4013]
- On 10 July 2024 Santos emailed Doctors for the Environment Australia to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Doctors for the Environment Australia that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Doctors for the Environment Australia.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Doctors for the Environment Australia.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Greenpeace Australia Pacific

Summary of consultation effort:

- On 9 February 2024 Santos emailed Greenpeace to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Greenpeace further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos called and spoke to a team member regarding consultation for Barossa Production Operations EP activities who confirmed that previous correspondence had been received.
- On 8 May 2024, Santos emailed Greenpeace further to previous correspondence to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Greenpeace. [Con-4032]
- On 10 July 2024 Santos emailed Greenpeace to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Greenpeace that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Greenpeace.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Greenpeace.	Santos considers it has provided sufficient information and a reasonable period of time for consultation.	No response required.	Not applicable.

	Santos considers Section 25 consultation requirements to have been met.		

Jubilee Australia Research Centre (JARC)

Summary of consultation effort:

- On 9 February 2024 Santos emailed JARC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed JARC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 8 May 2024, Santos emailed JARC further to previous correspondence to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from JARC. [Con-4025]
- On 10 July 2024 Santos emailed JARC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised JARC that it considered consultation now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 10 September 2024 Jubilee emailed Santos stating a transboundary environmental impact assessment (EIA) for the Barossa Gas Project regarding the Arafura and Timor Seas (ATS), is needed as part of the consultation process for the Productions Operations EP. [Con-5643]
- On 20 September 2024, Santos wrote to Jubilee in response to Jubilee's letter of 10 September 2024. Santos explained the Australian regulatory framework of this EP and advised Jubilee that the international regulatory framework of the Arafura and Timor Seas is outside the scope of consultation for this activity. [Con-5645]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from JARC.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
Jubilee correspondence to Santos on 10 September 2024 Jubilee provided information on regulatory and environmental developments concerning the Arafura and Timor Seas. It stated that the Barossa Gas Project warrants the need for a transboundary environmental impact assessment.	Santos has considered the matters raised by Jubilee in the EP and provided a response to Jubilee. The international regulatory framework of the Arafura and Timor Seas is outside the scope of consultation for the Barossa Production Operations activity.	**Santos correspondence to Jubilee on 20 September 2024** *Thank you for your letter of 10 September 2024 and your organisation's interest in the Barossa Gas Project. Santos has considered the matters you have raised.* *The Barossa Development Offshore Project Proposal was accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in March 2018. Santos complies with all Australian and international laws to the extent that they are applicable to the Barossa Gas Project.* *The Barossa Production Operations Environment Plan will be submitted to NOPSEMA for assessment in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023. The EP will detail the environmental impacts and risks associated with Barossa Production Operations activity and demonstrate how these will be reduced to as low as reasonably practicable and to an acceptable level through implementation of a suite of control measures.* *The international regulatory framework of the Arafura and Timor Seas is outside the scope of consultation for the Barossa Production Operations activity. If Jubilee Australia believes transboundary environmental impact assessment should be introduced, this is a public policy matter to be raised with the relevant sovereign governments.*	Not applicable.

Keep Top End Coasts Healthy

Summary of consultation effort:

- On 9 February 2024 Santos emailed Keep Top End Coasts Healthy to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Keep Top End Coasts Healthy further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos called Keep Top End Coasts Healthy regarding consultation for Barossa Production Operations EP activities and remind it of the 9 April deadline to provide comments.
- On 9 May 2024, Santos emailed Keep Top End Coasts Healthy further to previous correspondence to advise it had extended the consultation period for the EP until 23 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Keep Top End Coasts Healthy. [Con-4033]

- On 10 July 2024 Santos emailed Keep Top End Coasts Healthy to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Keep Top End Coasts Healthy that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Keep Top End Coasts Healthy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Keep Top End Coasts Healthy.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Sea Turtle Foundation

Summary of consultation effort:

- On 9 February 2024 Santos emailed Sea Turtle Foundation to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Sea Turtle Foundation further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos called the Sea Turtle Foundation regarding consultation for Barossa Production Operations EP activities and reminded it of the 9 April deadline to provide comments
- On 8 May 2024, Santos emailed Sea Turtle Foundation further to previous correspondence to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from the Sea Turtle Foundation. [Con-4026]
- On 10 July 2024 Santos emailed Sea Turtle Foundation to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Sea Turtle Foundation that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Sea Turtle Foundation.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Sea Turtle Foundation.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

West Timor Care Foundation

Summary of consultation effort:

- On 9 February 2024 Santos emailed West Timor Care Foundation to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed West Timor Care Foundation further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 8 May 2024, Santos emailed West Timor Care Foundation further to previous correspondence to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from West Timor Care Foundation. [Con-4028]
- On 10 July 2024 Santos emailed West Timor Care Foundation to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised West Timor Care Foundation that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 14 November 2024 Santos attempted to phone West Timor Care Foundation but was unable to be connected. Santos followed-up with an email seeking final confirmation that the organisation had no comments on the EP and OEMP. Santos included the previously provided information and stated any comments should be provided by 29 November 2024. [Con-5985]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from West Timor Care Foundation.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from West Timor Care Foundation.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Wilderness Society

Summary of consultation effort:

- On 9 February 2024 Santos emailed the Wilderness Society to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed the Wilderness Society further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos called the Wilderness Society and left a voicemail message regarding consultation for Barossa Production Operations EP activities.
- On 2 May 2024, Santos emailed Wilderness Society further to previous correspondence to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Wilderness Society. [Con-4014]
- On 10 May 2024, the Wilderness Society emailed Santos to advise it is a Relevant Person for the purposes of the Offshore Petroleum and Greenhouse Gas Storage Act 2006, however it will not provide feedback on this activity at this time. The Wilderness Society requests to be kept updated as this activity progresses and advised it may seek to provide feedback into the future. [Con-4034] The Wilderness Society was added to the distribution list for the Barossa Quarterly Update.
- On 10 July 2024 Santos emailed Wilderness Society to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no additional comments or input were received on this EP from Wilderness Society.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
Wilderness Society advised it considered itself a Relevant Person for the purposes of	Santos considers it has provided sufficient information and a reasonable period of time for consultation.	No response required.	Not applicable.

the *Offshore Petroleum and Greenhouse Gas Storage Act 2006*, however it will not provide feedback on this activity at this time.	Santos considers Section 25 consultation requirements to have been met.		
Wilderness society requested that Santos keep it updated as the activity progressed as it may wish to provide feedback in the future.	Santos provides quarterly project updates to the Wilderness Society.	No response required.	Notifications to the Wilderness Society are in Section 8.4.9

WorldFish Timor-Leste

Summary of consultation effort:

- On 9 February 2024 Santos emailed WorldFish Timor-Leste to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed WorldFish Timor-Leste further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 4 April 2024 Santos called WorldFish Timor-Leste regarding consultation for Barossa Production Operations EP activities but was unable to leave a message.
- On 2 May 2024, Santos emailed WorldFish Timor-Leste further to previous correspondence to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from WorldFish Timor-Leste. [Con-4011]
- On 10 July 2024 Santos emailed WorldFish Timor-Leste to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised WorldFish Timor-Leste that it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 14 November 2024 Santos phoned WorldFish seeking final confirmation that the organisation had no comments on the EP and OEMP. The representative confirmed they would not be providing any comments [Con-5986]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no additional comments or input were received on this EP from WorldFish Timor-Leste.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from WorldFish Timor-Leste.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

World Wildlife Fund (WWF)

Summary of consultation effort:

- On 9 February 2024 Santos emailed WWF to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed WWF further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned WWF regarding consultation for Barossa Production Operations EP activities and spoke to a team member who confirmed that the emails previously sent had been provided to its marine team.
- On 6 May 2024, Santos emailed WWF further to previous correspondence to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from WWF. [Con-4018]
- On 10 July 2024 Santos emailed WWF to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised WWF that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from WWF.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from WWF.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Environment Centre NT (ECNT)
Summary of consultation effort: • On 9 February 2024 Santos emailed the ECNT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787] • The email advised that Santos was seeking information to better understand: - *if you are from a government Department or agency, how the proposed Barossa Production Operations activities may be relevant to your department or agency; and* - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Barossa Production Operations activities.* • The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024. • On 8 March 2024 the ECNT wrote to Santos explaining why it is a Relevant Person for this EP, requesting confirmation that Santos considered the ECNT as a Relevant Person, and requesting a meeting with Santos to discuss information gaps relating to this EP. [Con-4002] • On 11 March 2024 Santos emailed the ECNT to advise that the formal consultation period for the EP had commenced. Santos provided links to the Barossa Production Operations Activity Information Booklet, the Barossa Production Operations section of Santos' website, and NOPSEMA's Brochure: 'Consultation on offshore petroleum environment plans – Information for the Community'. Santos advised that consultation period closes on 9 April 2024. [Con-3793] • On 25 March 2024 the ECNT wrote to Santos requesting further information on a range of topics related to the EP. The ECNT also raised concerns regarding the consultation period timeline being too short for it to make an informed assessment of the Activity on its functions, interests or activities. [Con-4003] • On 28 March 2024 Santos wrote to the ECNT in response to the ECNT's letter of 8 March 2024. Santos provided links to the consultation materials and further details regarding the purpose and process of consultation, including the type of information being sought from the ECNT. Santos confirmed that it is willing to meet with the ECNT, and that it is willing to accommodate reasonable requests from the ECNT to consult in an alternative manner. [Con-4004] • On 9 April 2024 the ECNT wrote to Santos and raised concerns about the consultation process to date, including that it had not been provided with sufficient information to make an informed assessment of the possible consequences of the Activity on its functions, interests, or activities. The ECNT also raised concerns about a range of risks and impacts associated with the EP. The ECNT advised that it had commissioned expert reports to assist in identifying the impacts of the Activity on the ECNT's functions, interests or activities, and stated that it would detail a timeline for the provision of these expert reports once it receives the information it requires from Santos. [Con-4008] • On 30 April 2024 Santos wrote to the ECNT in response to the ECNT's letter of 25 March 2024. Santos responded to each of the ECNT's information requests, as well as its concerns regarding the consultation process. Santos also provided the ECNT with notice of an update to the information booklet and factsheet. Santos requested ECNT provide its availability for a meeting. [Con-4009] • On 2 May 2024, the ECNT emailed Santos in relation to its availability for a meeting. [Con-4010] • On 3 May 2024, Santos emailed the ECNT confirming Santos was available to meet in Darwin on 20 May 2024. Santos requested the ECNT circulate an agenda by 13 May 2024 setting out the issues which the ECNT would like to discuss at the meeting. [Con-4017] • On 7 May 2024, the ECNT emailed Santos to confirm the ECNT were available to meet at 2pm on 20 May 2024, and that it would circulate a meeting agenda by 13 May 2024. [Con-4020] • On 13 May 2024, the ECNT provided Santos with a list of meeting attendees and an agenda with two items: ECNT's concerns regarding consultation process to date; an outline of the relevance of key information gaps to ECNT's functions, interests, and activities. The ECNT also noted that Santos has not responded to some of the ECNT's correspondence, and the ECNT advised that it proposes to engage technical experts to assist in its consideration of the how the Activity impacts its functions, interests and activities once it receives a substantive reply to its letter of 9 April 2024. [Con-4036] • On 14 May 2024 Santos emailed ECNT to thank it for the agenda and list of attendees and advised that it will meet ECNT on Monday, 20 May 2024. In the email Santos also responded to ECNT's letter of 9 April 2024, responding to each of the ECNT's concerns, as well as its concerns regarding the consultation process. [Con-4030] • On 20 May 2024 Santos and the ECNT met at Santos' Darwin Office located at Charles Darwin Centre. The meeting ran for approximately 15 minutes. The ECNT advised that it was still considering responses from Santos' letter dated 14 May 2024. Santos answered the ECNT's questions and provided the ECNT with another opportunity to ask any further questions about the EP. No further questions were asked. [Con-5213] • On 28 May 2024 the ECNT wrote to Santos advising that it is still preparing a response to Santos's letter dated 14 May 2024, including engaging experts to assist in its assessment of the Barossa Production Operations activity's impact on its functions, interests or activities. The ECNT also noted that no further information was received at the meeting held on Monday 20 May 2024, and raised concerns regarding the consultation process. [Con-4214] • On 12 June 2024 Santos wrote to the ECNT to acknowledge its letter of 28 May 2024 and requested that if the ECNT wishes to provide any additional input for this EP (including, if it considers that there are additional measures to be included), Santos requires this by no later than Thursday, 20 June 2024. [Con-5033] • On 20 June 2024 the ECNT wrote to Santos to provide further input on the EP, which primarily focused on GHG emissions related to the Activity. In its letter, the ECNT asserted that Santos has not consulted with the ECNT in a meaningful way and has not discharged its regulatory consultation obligations. The ECNT raised concerns that Santos has not answered all its questions and is withholding information from the ECNT. [Con-5035] • On 7 August 2024, Santos wrote to ECNT in response to ECNT's letter of 20 June 2024. Santos responded to the matters raised by ECNT. Santos thanked ECNT for its comments and submissions in respect of the risks, impacts, and potential controls in relation to the activity. Santos advised ECNT that Santos was finalising the EP for submission in coming weeks. [Con- 5282] • On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982] • On 25 November 2024 ECNT wrote to Santos to again express concerns over the consultation process undertaken by Santos and to raise concerns about inconsistencies in emissions estimates provided and Santos' compliance with the Safeguard Mechanism [Con-6013] • On 27 November 2024 NOPSEMA provided Santos with a letter that ECNT had provided separately to NOPSEMA on 22 October 2024. • On 20 December 2024 Santos wrote to ECNT in response to ECNT's correspondence of 25 November 2024. In the letter Santos also addressed comments and assertions made by ECNT in the letter it had separately sent to NOPSEMA on 22 October 2024. [Con-6032] • On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036] • On 24 January 2025 the ECNT wrote to Santos in response to Santos' letter of 20 December 2024. The ECNT rejected the matters raised in Santos' letter of 20 December 2024, reiterated its concerns regarding consultation to date, GHG emissions and compliance with the Safeguard Mechanism, and requested information regarding the DLNG facility. The ECNT enclosed a letter dated 4 December 2024 sent from ECNT to NOPSEMA raising ECNT's concerns about the DLNG facility (to which Santos was not copied), as well as a bundle of documents received under FOI relating to that facility. [Con-6037] • On 6 March 2025 Santos wrote to ECNT in response to the matters raised by ECNT in its correspondence of 24 January 2025. [Con-6039] • In NOPSEMA's RFFWI dated 24 March 2025, NOPSEMA enclosed a letter sent from ECNT to NOPSEMA dated 13 March 2025, and noted that the correspondence was provided by NOPSEMA to Santos in keeping with procedural fairness 'as it may contain information that is relevant to the EP'. Santos has considered this letter and is satisfied with the content of the EP, including that the evaluation of impacts and risks from indirect emissions of the Activity in the EP and proposed control measures, remains appropriate. Santos is also satisfied with the assessment of the merits of the issues which have been previously raised by the ECNT with Santos during consultation. The ECNT's 13 March 2025 letter to NOPSEMA is not addressed in this consultation report because it does not fall within s 25 or 24(b) of the Regulations.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
ECNT correspondence to Santos on 8 March 2024			
ECNT identified itself as a Relevant Person and requested a meeting with Santos to discuss information gaps in the EP.	Santos has considered the matters raised by ECNT in the EP. Santos met with the ECNT on 20 May 2024.	**Santos' correspondence to ECNT on 28 March 2024 in response to ECNT's letter of 8 March 2024** *Thank you for your correspondence of 8 March 2024 and 25 March 2024 and your organisation's interest in the Barossa Project. We set out below our response to your letter of 8 March 2024. Santos will respond separately to your correspondence of 25 March 2024.* ***Consultation materials*** *We confirm that we provided links to the following in our emails dated 9 February 2024 and 13 March 2024:* *1. a booklet containing information about the activities proposed under the Production Operations Environment Plan (**EP**) (Commonwealth waters) and the Operations Environmental Management Plan (**EMP**) (Northern Territory waters) (**Information Booklet**); and* *2. an information booklet published by National Offshore Petroleum Safety and Environmental Management Authority (**NOPSEMA**) titled 'Consultation on offshore petroleum environment plans' (NOPSEMA information booklet) that provides information regarding the purpose of consultation and contains guidance for potential Relevant Persons in respect of consultation on offshore petroleum activities.* *The Information Booklet provides a comprehensive overview of the proposed activities to allow the reader to make an informed assessment of the possible consequences (if any) of the proposed activities on their functions, interests or activities.* *Each of these documents is also available on Santos' website, together with additional information about the Barossa Gas Project and the proposed activities: https://www.santos.com/barossa/production-operations/* *We understand from your correspondence that the ECNT is aware of this webpage and has reviewed the Information Booklet.* *For convenience, we reattach a link to the NOPSEMA information booklet.*[43] ***Santos' consultation process*** *Santos has been consulting on the EP and EMP since 11 March 2024.* *The commencement of Santos' formal consultation period followed:* *1. correspondence on 9 February 2024 to identified potentially Relevant Persons, including the ECNT:* *a. outlining the upcoming consultation on the EP and EMP;* *b. requesting that they contact Santos at the earliest opportunity if they considered they may be a Relevant Person;* *c. inviting them to direct Santos to any additional persons with whom they considered Santos should consult; and* *2. extensive consultation on previous environmental approvals for the Barossa Gas Project since 2016, concerning construction and installation activities associated with the same project, including with the ECNT.* *Santos will consult with the ECNT as part of its comprehensive consultation campaign in respect of the EP and EMP. That consultation campaign will run until 9 April 2024, as previously advised in our email to ECNT dated 9 February 2024. This consultation timeframe is fair and reasonable having regard to Santos' regulatory obligations and scheduling in respect of the broader Barossa Gas Project.* *To ensure that consultation is meaningful and transparent, Santos has included below a summary of the purpose of consultation and the information sought during consultation.* ***Purpose of consultation*** *As is set out in the NOPSEMA information booklet, the purpose of consultation includes to further ascertain, understand and assess:* *1. the values and sensitivities of the environment that may be affected by the proposed activities;* *2. the potential environmental impacts and risks of the proposed activities; and* *3. any control measures proposed to reduce the environmental impacts and risks of the proposed activities to as low as reasonably practicable and an acceptable level.* *Consultation provides an opportunity to communicate to Santos any knowledge of the environment, or risks or impacts to it, including information that Santos would otherwise not be aware of. Information received will be considered by Santos in the preparation of the EP and EMP, and by the regulator in its assessment of the EP and EMP. If you consider that you have information which should inform the preparation of the EP and EMP, please communicate this to Santos as soon as possible so that Santos has an opportunity to consider this information and ensure that any information you may have that is not already known to, or addressed by Santos, is reflected in the EP and/or EMP.*	Not applicable

[43] https://www.nopsema.gov.au/sites/default/files/documents/Consultation%20in%20the%20course%20of%20preparing%20an%20Environment%20Plan%20guideline_1.pdf

		Information sought *Having regard to the purpose of consultation and consistent with the requirements of s 25 of the Regulations, Santos is seeking information through consultation as to any:* *1. values or sensitivities of the environment that may be affected by the proposed activities (noting that 'environment' includes social, economic and cultural features);* *2. potential impacts to the environment;* *3. potential risks to the environment;* *4. particular measures that the ECNT thinks Santos should consider adopting because of the ECNT's consultation input; and* *5. other persons or organisations with whom the ECNT considers Santos should consult.* *The information you provide will be used for the development of the following documents:* *1. an Environment Plan for the activity in Commonwealth waters, which will be assessed by NOPSEMA; and* *2. an Operations Environmental Management Plan for the activity in Northern Territory coastal waters, which will be assessed by the Energy Division within the Northern Territory Department of Industry, Tourism and Trade (**DITT**).* *The information you provide will be included in documentation submitted to NOPSEMA and DITT for assessment. This will include Santos' assessment of, and response to, the information you provide.* *Santos will handle your information in accordance with our Offshore Western Australia and Northern Territory Consultation Privacy Policy. You may request that particular information you provide not be published in the EP. If requested, Santos will include your information in a separate report which will not be published on NOPSEMA's website.* ***Next steps*** *Santos will separately respond to your letter of 25 March 2024.* *Following that response, Santos' consultation team will make themselves available to meet with the ECNT in person in Darwin or via Microsoft Teams.* *In the meantime, to the extent that the ECNT has any information of the type sought by Santos (as outlined above), Santos requests that the ECNT provide this information to Santos as soon as possible.* *As identified above, the consultation period in respect of the EP and the EMP will end on 9 April 2024. Santos will endeavour to respond to your letter of 25 March 2024 as expeditiously as possible in order to facilitate further consultation during this period. Santos requests that the ECNT provide the information sought and make itself available to meet with Santos' consultation team within this consultation period.* *This approach to, including the period for consultation is appropriate and reasonable having regard to Santos' regulatory obligations, Santos' previous consultation in respect of the Barossa Project with the ECNT and to the ECNT's understanding of the Barossa Gas Project, including through its involvement in the Stop Barossa Gas campaign.[44]* *Santos will accommodate reasonable requests by the ECNT to consult in an alternative manner.*	
ECNT's correspondence to Santos of 25 March 2024			

[44] https://stopbarossagas.org/about-us/

A number of concerns were raised in relation to Santos' consultation process, including that:
• the consultation deadline of 9 April 2024 set by Santos would not provide a reasonable period for consultation for the ECNT and other Relevant Persons;
• the Information Booklet does not provide sufficient information for the ECNT to make an informed assessment of the possible consequences of the Production Operations activity on its functions, interests or activities; and
• the consultation timeframe is inconsistent with the principles set out in NOPSEMA's Guideline "Consultation in the course of preparing an environment plan".
• The ECNT sought confirmation that that the 9 April 2024 deadline will not be imposed, and that Santos will engage with ECNT to discuss a reasonable process and timeline to occur with the ECNT
	Santos has considered the matters raised by ECNT in the EP and provided a response to ECNT.
	Santos has provided the ECNT with sufficient information and a reasonable period to assess any possible impacts of the Activity for this EP on the ECNT's functions, interests and activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.
		Santos' correspondence to ECNT on 30 April 2024 in response to ECNT's letter of 25 March 2024
		We note your comments regarding Santos' consultation process and timeframe for consultation on the Production Operations Environment Plan (EP).
		As you are aware, Santos commenced its preliminary consultation process with the ECNT in respect of the EP on 9 February 2024 and has been formally consulting on the EP since 11 March 2024. As previously set out in our letter of 28 March 2024, this consultation process has included:
		• *correspondence on 9 February 2024 to identify potentially Relevant Persons (including the ECNT), and:*
		  • *a. outlining the then-upcoming consultation on the EP;*
		  • *b. providing links to all relevant information booklets;*
		  • *c. requesting that potentially Relevant Persons contact Santos at the earliest opportunity if they considered they may indeed be a Relevant Person; and*
		  • *d. inviting them to direct Santos to any additional persons with whom they considered Santos should consult; and*
		• *further correspondence on 13 March 2024:*
		  • *a. again explaining the consultation (including the consultation period);*
		  • *b. expressly inviting relevant input for the EP; and*
		  • *c. again providing links to all relevant information booklets, together with a link to NOPSEMA's brochure entitled 'Consultation on offshore petroleum environment plans: Information for the community.'*
		We note that the above has followed extensive consultation (including with the ECNT) commencing in 2016 in respect of previous environmental approvals for activities associated with the Barossa Gas Project. We also note that the information contained in the Production Operations Information Booklet addresses the same activity scope, as relevant to the operations phase of the Barossa Gas Project, that was presented and assessed in the Barossa Development Offshore Project Proposal (OPP). Consultation with stakeholders on the OPP occurred during 2017 and included an eight-week public comment period prior to submission of the OPP to NOPSEMA for assessment. As such, information about the Production Operations activity has been publicly available for over six years.
		Santos' consultation timeframe for the EP is fair and reasonable having regard to matters including the extended period of time information about the Production Operations activity has been publicly available in the OPP, Santos' regulatory obligations, Santos' previous consultation in respect of the Barossa Project with the ECNT and the ECNT's understanding of the Barossa Gas Project (including through its involvement in the Stop Barossa Gas campaign).
		…
		As noted in our letter of 28 March, Santos considers that the information provided to date is sufficient for the ECNT to make an informed assessment of any potential consequences of the activity on its functions, interests or activities, and encourages the ECNT to meet with Santos to consult constructively in line with the purpose of s 25 consultation.
			Not applicable

• In light of the concerns that the ECNT raised regarding the lack of detail in the Information Booklet, the ECNT requested drafts of the EP or any of its addenda, including specific plans, methodologies, underlying modelling, or raw data that may assist in its assessment of how the Activity relates to its functions, interests, and activities.	Santos' assessment is that the information booklet is sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*… we note your request at paragraph 21 for:* *any drafts of the EP or any of its addenda, including specific plans, methodologies, underlying modelling, or raw data that may assist in our assessment of how the Activity relates to our functions, interests, and activities.* *Consultation is undertaken 'in the course of preparing an environment plan' (s 25 of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (Regulations)). As we advised in our letter of 28 March 2024, the purpose of consultation is to inform the preparation of the EP. Provision of a draft of the EP is not necessary in order for the ECNT to make an informed assessment of the possible consequences of activities the subject of the proposed EP on its functions, interests, or activities.* *Once preparation of the EP has been completed, including completion of the consultation process, Santos will submit the EP to NOPSEMA for its assessment. Once NOPSEMA has undertaken its completeness check the EP is published on its website, should the ECNT wish to view it then.*	Not applicable
The ECNT raised concerns in relation to the information provided in the Information Booklet and requested further information regarding: • how the control measures originally proposed in the OPP relating to FPSO processes have been adopted or not adopted for the EP (para 22(a) of letter); and • the flow processes and technology of the FPSO (22(b)).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The information booklet includes proposed control measures specific to the Activity for this EP and provides an overview of the FPSO processing equipment and systems. Santos responded to ECNT describing that the EPOs in the OPP are carried through to the EP and considers that the further information requested by ECNT is not required for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	**[22(a)]** *The Environmental Performance Outcomes (EPOs) in respect of FPSO processes are set out in Table 7.1 of the OPP at this link [pp. 454, 457, 458]. In accepting the OPP, NOPSEMA was satisfied that the EPOs are consistent with the principles of ecologically sustainable development (see reg 5D(6)(c)(i) of the Regulations then in force).* *These EPOs will be carried through to the Production Operations EP, with EP-specific control measures and performance standards also developed and incorporated. Santos has developed the specific control measures presented in a summary format in the Production Operations information booklet which has been provided to the ECNT (see in particular the sections titled 'How will Santos manage impacts' in respect of each identified risk and impact).* *These control measures have been developed in order to achieve the EPOs set out in the OPP and Santos considers that they are fit for purpose. Consistent with our 28 March 2024 letter to the ECNT, Santos encourages the ECNT to raise any control measures that it considers may be appropriate to adopt for Santos' consideration when preparing the EP for submission to NOPSEMA.*	Appendix D of the EP is a concordance table that outlines the EPOs from the OPP and how they have been adopted in the EP. Environmental performance outcomes, and control measures are listed in Section 8.8.1 and 8.1.2

		The EP will contain an assessment of all potentially viable control measures relevant to identified impacts and risks, including which measures were not adopted/adopted, for assessment by the Regulator/s. [**22(b)**] *The Environmental Performance Outcomes (EPOs) in respect of FPSO processes are set out in Table 7.1 of the OPP at this link [pp. 454, 457, 458]. In accepting the OPP, NOPSEMA was satisfied that the EPOs are consistent with the principles of ecologically sustainable development (see reg 5D(6)(c)(i) of the Regulations then in force).* *These EPOs will be carried through to the Production Operations EP, with EP-specific control measures and performance standards also developed and incorporated. Santos has developed the specific control measures presented in a summary format in the Production Operations information booklet which has been provided to the ECNT (see in particular the sections titled 'How will Santos manage impacts' in respect of each identified risk and impact).* *These control measures have been developed in order to achieve the EPOs set out in the OPP and Santos considers that they are fit for purpose. Consistent with our 28 March 2024 letter to the ECNT, Santos encourages the ECNT to raise any control measures that it considers may be appropriate to adopt for Santos' consideration when preparing the EP for submission to NOPSEMA.* *The EP will contain an assessment of all potentially viable control measures relevant to identified impacts and risks, including which measures were not adopted/adopted, for assessment by the Regulator/s.*	
The ECNT raised concerns in relation to the GHG emission information provided in the Information Booklet and requested further information regarding: • Santos' GHG Management Plan (22(c)); • the breakdown of emissions by source (22(d)); • clarification of emissions calculations, including for each year of operation (22(e)); • confirmation the emissions estimates have been updated since OPP was accepted (22(f)); • discrepancies in emission estimates between Barossa approval documentation (22(g)); • details of the improvements made to the FPSO (22(h)); • how CO_2 will be removed from Barossa gas and emissions (22(i)); • how much CH_4 will leak, be vented, and be combusted at the FPSO and the total associated GHG emissions (22(j)); • details of the marine fuels used for FPSO processes (22(k)); • details of FPSO design to enable CCS (22(l)); • GHG control measures (22(m)).	Santos has considered the matters raised by ECNT in this EP responded to ECNT's requests for further information about GHG emissions. The EP includes a description of the GHGEMP. Santos considers that the ECNT does not require a breakdown of emissions by source in order to make an informed assessment of the potential consequences of the activity on any of its functions, interests or activities. The EP does include a breakdown of estimated Scope 1 emissions for the purpose of Regulatory assessment. The ECNT were provided additional detail that is included in the EP as follows: • the FPSO design features that the Barossa JV have adopted, which have resulted in >50% reduction in Scope 1 operational emissions than were estimated in the accepted Barossa OPP. • CO_2 removal. • marine fuels to be used. • GHG reporting. Santos confirmed to the ECNT that CCS is not part of the Activity under the EP. Accordingly, CCS matters have been excluded from the EP as Bayu Undan CCS project is subject to separate framework & approvals by a different joint venture. Santos considers that the further information requests by ECNT are not required for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/ or additional proposed control measures for consideration by Santos in the course of preparing the EP.	**[22(c)]** *The Production Operations information booklet provides a description of the purpose of the Greenhouse Gas (GHG) Management Plan. Santos notes ECNT's request for a copy of the GHG Management Plan but does not consider the ECNT requires a copy in order to make an informed assessment of the potential consequences of the activity on any of its functions, interests or activities (FIAs).* *The Production Operations information booklet details the potential risks and impacts related to GHG. Santos understands from previous consultation that the ECNT is familiar with these potential risks and impacts.* *Please refer to Santos' letter to ECNT of 28 March 2024 for information about the purpose of consultation and information sought from ECNT during consultation. Santos encourages the ECNT to raise any control measures that it considers may be appropriate to adopt for Santos' consideration when preparing the EP for submission to NOPSEMA, including in relation to GHG emissions.* [**22(d)**] As you have identified, the *Production Operations information booklet contains a breakdown of emissions estimates similar to that provided for the DPD SER as relevant to Production Operations emissions. Please note that the DPD SER provided emissions estimates for both construction and operations sources, while the Production Operations EP does not provide emissions estimates for construction activities as these activities are not the subject of this EP and are authorised under other Barossa EPs which have previously considered these emissions.* *In any event, Santos considers that the ECNT does not require a breakdown of emissions by source in order to make an informed assessment of the potential consequences of the activity on any of its FIAs. To the extent that the there is any potential impact on the ECNT's FIAs as a result of GHG emissions, the ECNT is able to make an informed assessment of that impact on the basis of the total annual estimates associated with the project.* **[22(e)]** Santos response to the ECNT in relation to this request is reproduced as follows: *i. The Production Operations information booklet provides estimates for annual Scope 1 and 3 emissions. Scope 2 emissions are not applicable to the Production Operations activity.* *ii. FPSO flaring represents approximately 5% of total estimated Scope 1 emissions. The EP will contain a breakdown of estimated Scope 1 emissions (fuel, flare, vent) sources, for assessment by the Regulator/s.* *In any event, Santos considers that the ECNT does not require a further breakdown of emissions on an annual basis for each year of operation or confirmation of the proportion of scope 1 emissions that will be from flaring from the FPSO, in order to make an informed assessment of the potential consequences of the activity on any of its FIAs.* *To the extent that the there is any potential impact on the ECNT's FIAs as a result of GHG emissions, the ECNT is able to make an informed assessment of that impact on the basis of the total annual estimates associated with the Barossa project which are set out in the information booklet.* **[22(f)]** *i. The annual emissions estimate from the OPP, as it relates to Production Operations activities, has been updated for the preparation of the EP and is provided in Production Operations information booklet.* *ii. Please see response to 22f(i)* **[22(g)]** *Please see response to 22d and 22f(i).* **[22(h)]** *A number of FPSO design features have been adopted that have resulted in >50% reduction in Scope 1 operational emissions than were estimated in the accepted Barossa OPP. These include:* • *Pilotless low pressure (**LP**) flare and nitrogen (gas-free) purge;* • *Vapour recovery units to prevent planned flaring of low pressure vented gas;*	Section 8.3.2.13 of the EP contains a description of the Operations GHGEMP. Section 2.7 provides an overview of FPSO operations Section 6.3 assesses the impact of GHG emissions Control measures to manage GHG emissions include: -BAO-CM-6.3.1 to BAO-CM-6.3.24

		• *Full electrification of the facility, with highly efficient combined cycle power generation;* • *Supply of process heating via waste heat recovery;* • *Destruction of methane emissions in the CO_2 permeate stream by a thermal oxidiser.* *In any event, the adoption of these design features has been factored into the assessment of environmental impact and risk, as presented in the in the Production Operations information booklet.* **[22(i)]** *i. The gas export stream sent to DLNG will contain 6% CO_2 and be vented at DLNG. The remainder of the CO_2 in the extracted gas (12%) will be removed from the gas and vented at the FPSO.* *ii. The FPSO has adopted two stage membrane CO_2 removal technology. All emissions associated with CO_2 removal and processing are accounted for in the Scope 1 emissions estimate provided for in the Production Operations information booklet.* *Although CCS operations will be the subject of a separate environmental approvals process, and is not part of the Barossa gas project approvals process, Santos is working towards having CCS operational as soon as possible.* *The Bayu-Undan CCS development will reduce Scope 1 emissions from the Barossa field, making it a low emissions intensity project and a net-zero reservoir emissions project from 2028. The Barossa joint venture is in negotiations with the Bayu Undan CCS joint venture, with a view to being a foundation customer of the project.* **[22(j)]** *The Scope 1 emissions estimate provided under the heading "GHG Emissions" in the Production Operations information booklet is informed by an analysis of all potential sources of CH4 and includes consideration of combustion sources (planned and unplanned), vented (planned and unplanned) and fugitive leaks (unplanned only). Therefore, ECNT requests 22j(i) and 22j(ii) are addressed in the Scope 1 emissions estimate provided in the Production Operations Information Booklet.* *As outlined above in response to 22(d), Santos considers that the ECNT is able to make an informed assessment of any potential consequence on its FIAs by reference to the total estimates set out in the information booklet.* **[22(k)]** *Fuel gas will be used for normal operations. Marine gas oil (or equivalent fuels e.g. marine diesel oil) will be used for startup operations and as backup fuel for FPSO operations when fuel gas is unavailable.* *The Scope 1 emissions estimate provided in the Production Operations information booklet accounts for emissions from all fuel sources.* **[22(l)]** *Justification of the future feasibility of exporting CO_2 for CCS is outside the scope of and not required for the Production Operations EP.* *Nevertheless, Santos confirms that the FPSO is designed with sufficient gas treatment and compression capacity for export (high pressure liquid transfer) of 6% CO_2 to DLNG from start of operations. Future export of additional CO_2 (up to 20%) to a CCS facility is within FPSO design limits.* **[22(m)]** *i. Equivalency of Paris Agreement Policies refers to a net zero commitment.* *ii. Reporting against all Barossa EP commitments will be addressed in Annual Environmental Performance reports submitted to the Regulator.*	
The ECNT raised concerns in relation to how Santos would comply with the Safeguard Mechanism and requested further information regarding: • how the scope 1 emissions from the Activity fit within carbon budgets (22(n)); • whether the Barossa project is a 'new facility' (22(o)); • how Santos will calculate Barossa's baseline (22(p)); • production variables applicable to Barossa (22(q)); • modelling of baseline emissions estimates (22(r)); • how Santos intends to avoid exceed emission situations (22(s)) • how it intends to source ACCUs (22(t); • the percentage Barossa emissions that are expected to be reduced by CCS (22(u)); • the percentage of Barossa's estimated excess emissions expected to be reduced by CCS each year (22(v)).	Santos has considered the matters raised by ECNT in this EP and responded to the ECNT queries. The EP describes and includes the information below in relation to GHG emissions: • Scope 1 emissions will be managed in accordance with the applicable baseline under the Safeguard Mechanism in accordance with Australia's Paris agreement targets and associated emissions budget. • the Activity will comply with the Safeguard Mechanism, noting that treatment of Barossa GHG emissions is still to be finalised by the CER. Implementation and enforcement of the Safeguard Mechanism is the responsibility of the CER. • Santos will be required to comply with the applicable baseline each year, and the JVs determine how to achieve compliance. These information requests relate to Santos' compliance with the Safeguard Mechanism. Consistent with Santos' obligations, the EP demonstrates how Santos will comply with the requirements of the Safeguard Mechanism, as regulated by the Clean Energy Regulator. . Santos confirmed to the ECNT that CCS is not part of the Activity under the EP. Accordingly, ECNT queries about CCS are outside the scope of this EP and therefore have not been considered further.	**[22(n)]** *Barossa Production Operations Scope 1 emissions will be managed in accordance with the applicable baseline under the Safeguard Mechanism in accordance with Australia's Paris agreement targets and associated emissions budget. The NT emissions budget is accounted for in Australia's national emissions budget.* **[22(o)]** *The treatment of the Barossa project under the Safeguard Mechanism is a matter for the Clean Energy Regulator. Santos will abide by the Clean Energy Regulator's final determination.* **[22(p)]** *There are various options available to meet a baseline (including direct abatement and acquiring offsets, in addition to mechanisms available under the Safeguard Rules such as borrowing adjustments and multi-year monitoring periods). Santos is not in a position to indicate now whether in any given year or years (which may be decades in the future) it may apply for a borrowing adjustment, trade-exposed baseline-adjusted facility determination or multi-year monitoring period.* *Santos will be required to comply with the applicable baseline for the Barossa project in each compliance year. It is a matter for Santos to determine how it will achieve this compliance. This information is not necessary for the ECNT to make an informed assessment of the possible consequences of the activity on any of its FIAs.* **[22(q)]** *Please see response to 22o. Santos will comply with its Safeguard compliance obligations. Management of Santos' Safeguard compliance obligations, including identification of applicable production variables under the Safeguard Rule, will be addressed between Santos and the CER.* **[22(r)]** *Please see response to 22o. Santos will comply with its Safeguard compliance obligations.* *Management of Santos' Safeguard compliance obligations will be addressed between Santos and the Clean Energy Regulator.* *This information is not necessary for the ECNT to make an informed assessment of the possible consequences of the activity on any of its FIAs and Santos considers that it is outside the scope of consultation for this EP.* **[22(s)]** *Please see response to 22p.*	Section 6.3. The following EPO has been adopted- EPO 11. The following controls have been included regarding ACCUs BAO-CM-6.3.10 BAO-CM-6.3.11

	Santos views that ECNT has been provided sufficient information to enable the ECNT to make an informed assessment of any potential consequences of the Activity on its functions, interests or activities.	*Santos is not required to provide details of how it intends to meet its baseline under the Safeguard Mechanism. Santos is required to comply and there are various mechanisms available to achieve compliance.* **[22(t)]** *Please see response to 22s.* **[22(u)]** *Whilst Santos has committed to explore CCS opportunities at Bayu-Undan and elsewhere, CCS is not part of the Barossa development. Barossa will continue to engage with the Bayu-Undan CCS development and other potentially viable CCS developments, as a potential option for sequestration of Barossa's reservoir CO_2, shall any of them achieve the necessary regulatory approvals and final investment decision.* *Regardless of the above, and as outlined in our response to 22p, Santos is not required to provide details of how it intends to meet its baseline under the safeguard mechanism. Santos is required to comply and there are various mechanisms available to achieve compliance.* **[22(v)]** *Please see response to 22p.*	
The ECNT raised concerns in relation to how Santos would manage produced water at the FPSO and requested further information regarding: • the standards Santos used for assessing the risks of produced water, including impacts on marine species (22(w)); • concentrations of hazards within the produced water and processes for treatment (22(x)); • the 6 kilometre mixing zone (22(y)); • concentration discharge limits (22(z)); • chemicals used for dehydration of gas, hydrogen-sulphide removal, and chemicals to inhibit hydrates (22(aa)); • how produced water volumes may grow (22(bb)); • the standard used to process and treat produced water (22(cc)); • the impact of produced water to the Arafura Shelf and other biologically important areas (22(dd)); • ongoing testing of marine discharges (22(ee)); • the potential ecotoxicological impact of produced water (22(dd)); • the potential dispersion and dilution of produced water (22(gg)); • the impacts of produced water to marine turtles (22(hh)).	Santos has considered the produced water management matters raised by ECNT in this EP and provided a response to ECNT. The EP describes and includes the information below in relation to produced water management: • Relevant standards including ANZG 2018 (BAO-CM-6.8.7, BAO-CM-6.8.10, BAO-CM-6.8.11 and BAO-CM-6.8.12) and recovery plans (Table 3-13). • Discharge modelling using the approach in the accepted OPP that sets a conservative mixing zone which does not overlap sensitive features or BIAs and verification of the discharge modelling once the facility is operational (BAO-CM-6.8.7, BAO-CM-6.8.11 and BAO-CM-6.8.12). • Produced water monitoring (flowrate, OIW, mercury, ecotoxicity and chemical characterisation) and a water and sediment quality monitoring regime (BAO-CM-6.8.3, BAO-CM-6.8.8, BAO-CM-6.8.9, BAO- CM-6.8.10 and BAO-CM-6.8.11). • Inclusion of the Produced Water Adaptive Management Plan in the EP (BAO-CM-6.8.7). • Treatment of produced water via primary and tertiary treatment stages to reduce OIW and mercury concentrations to within discharge limits and performance targets within the OPP produced water specification (BAO-CM-6.8.1, BAO-CM-6.8.2, BAO-CM- 6.8.3, BAO-CM- 6.8.4 and BAO-CM- 6.8.5). • Performance targets for mercury and OIW to be reviewed after 12 months of steady state operations (BAO-CM-6.8.2) to determine if targets can be further reduced. • Application of Santos' chemical selection process for production chemicals discharged in PW (BAO-CM-6.7.5) Santos considers it has provided sufficient detail for ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration in the course of preparing the EP.	**[22(w)]** *The Production Operations information booklet provides a summary of assessment of the impacts of produced water discharges.* *In assessing impacts and risks of produced water discharge, as presented in the Production Operations information booklet, Santos has considered relevant standards including relevant species:* • *protection and environmental value protection thresholds per Australia and New Zealand Water Quality Guidelines; and* • *recovery plans, conservation advice, wildlife conservation plans and management actions such as the Recovery Plan for Marine Turtles in Australia 2017–2027.* *The adequacy of the impact assessment will be assessed by the Regulator when assessing the EP.* **[22(x)]** *Please see the response to 22w.* **[22(y)]** *As discussed in the Production Operations information booklet, the 6-kilometre mixing zone is based on conservative modelling inputs of up to 20,000 barrels per day of produced water throughput. In contrast, produced water throughput during normal operations will be in the order of 3500 to 5000 barrels per day.* *As explained in the Production Operations information booklet, due to water depths, the absence of marine turtle biologically important areas within OA1 (the location of produced water discharge), and no significant seabed habitat in the mixing zone, marine turtles would be expected to traverse OA1 very infrequently. As a result, even if individual marine turtles did traverse the mixing zone under these worst case mixing conditions, they will not be exposed to the produced water for enough time for contaminants to accumulate within their body.* **[22(z)]** *As outlined in the Production Operations Information booklet, the adopted concentration discharge limit is 30 mg/l over any 24-hour period.* **[22(aa)]** *The impacts and risks of chemicals used in the production process are addressed in the 'Produced Water' section of the Production Operations Information booklet.* *Implementation of Santos' chemical selection process requires that all operational chemicals used on the FPSO (including those that may end up in the produced water discharge) are risk-assessed under the UK based Offshore Chemical Notification Scheme (OCNS). Chemicals are ranked according to their calculated hazard quotients by the chemical hazard assessment and risk management (CHARM) mathematical model, which uses aquatic toxicity, biodegradation and bioaccumulation data. Chemical selection in accordance with Santos' process ensures only environmentally acceptable chemicals are used on the FPSO and discharged with the produced water.* *The ECNT is able to make an informed assessment of any potential consequences of the activity on its FIAs by reference to the information on impacts and risks already provided. Consistent with our 28 March 2024 letter, Santos invites the ECNT to suggest any particular control measures that may be appropriate to adopt in respect of these risks and impacts.* **[22(bb)]** *Best available technology in the form of produced water tertiary treatment has been adopted for the FPSO, which is leading practice for Santos and other comparable industry facilities.* [**22(dd)]** *Although OA1 occurs within the bounds of the 'Shelf break and slope of the Arafura Shelf' KEF, the ecological values associated with this unique seafloor feature (i.e., patch reefs and hard substrate pinnacles) were not observed during the Barossa marine studies program, nor are these topographically distinct features evident from the data derived from multiple surveys undertaken across this area.* *As per the response to 22y, the predicted mixing zone based on dispersion modelling is conservatively set at 6km. This zone does not overlap any biologically important areas, and the features of the Shelf Break and slope of the Arafura Shelf KEF are not present in the mixing zone.* **[22(ee)]** *As noted in the Production Operations Information booklet, a water quality monitoring regime, which will include ongoing testing of produced water discharges, will be implemented under a Produced Water Adaptive Management Plan.* *This will be managed through a combination of discharge sampling and monitoring, and receiving environment sampling and monitoring, to inform effectiveness of existing mitigations and if any further mitigations are required.*	The produced water treatment and discharge system is described in Section 2.7.2.6 The assessment of impacts and risk of produced water discharges is provided in Section 6.8 The Produced Water Adaptive Management Plan and the Water and Sediment Quality Monitoring Plan are provided in Appendices I and J, respectively) The following control measures manage PW discharges: BAO-CM-6.8.1 BAO-CM-6.8.2 BAO-CM-6.8.3 BAO-CM-6.8.4 BAO-CM-6.8.5 BAO-CM-6.8.6 BAO-CM-6.8.7 BAO-CM-6.8.8 BAO-CM-6.8.9 BAO-CM-6.8.10 BAO-CM-6.8.11 BAO-CM-6.8.12 BAO-CM-6.4.10 BAO-CM-6.7.5

		[22(ff)] *As noted in the response for 22aa, chemicals considered for use (that may form part of the produced water discharge stream) are ranked according to their calculated hazard quotients by the chemical hazard assessment and risk management (CHARM) mathematical model, which uses aquatic toxicity, biodegradation and bioaccumulation data, to limit potential for ecotoxicological impacts.* *Based on the absence of significant marine fauna habitat or activity within the predicted produced water mixing zone, and the combination of best available produced water treatment technology and Santos' chemical selection process to select chemicals with the least aquatic toxicity, ecotoxicological impacts from produced water are not expected (as presented in the Production Operations information booklet).* *Notwithstanding the above, the potential for longer term ecotoxicological impacts from produced water discharge at OA1 will be assessed through a combination of discharge sampling and monitoring and receiving environment sampling and monitoring. The results of this assessment will inform if additional mitigations are required to limit potential ecotoxicological impacts to acceptable levels.* **[22(gg)]** *Please see the response to 22w, 22aa and 22ff.* **[22(hh)]** *Please see response to 22w and 22y.*	
The ECNT requested further information regarding marine impacts of the Activity, including: • environmental objectives and values for the marine environment (22(ii)); • compliance with the North Marine Bioregional Plan (22(jj)); • vessel impacts to marine fauna (22(kk)); • cumulative impacts of FPSO discharges (22(ll)); • potential impacts and controls measures to protect flatback turtles (22(mm)); • light emission impacts on marine turtles and hatchings (22(nn)); • potential impacts and controls measures to protect migratory and threatened species (22(oo)); • potential impacts and proposed control measures to protect all species with BIAs (22(pp)); • an underwater acoustic assessment (22(qq)); • details regarding noise pollution (22(rr)); • ballast water management and anti-fouling systems (22(ss)).	Santos has considered the matters raised by ECNT in this EP and responded to ECNT's requests for further information about potential marine impacts associated with the Activity. The EP describes and includes the information below in relation to marine impacts: • Relevant requirements of the Marine Bioregional Plan for the North Marine Region • Water and sediment quality monitoring • Potential impacts to listed species associated with light, including light spill modelling from the Barossa FPSO for flaring and non-flaring scenarios (Worley, 2025) • Proposed control measures to protect listed species associated with planned events. Santos considers this provides sufficient detail for ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration in the course of preparing the EP.	**[22(ii)]** *The Production Operations information booklet provides a summary of the existing environment (Regional Existing Environment Summary) against which impacts were assessed.* **[22(jj)]** *Where relevant to activity impacts and risks, relevant requirements of the Marine Bioregional Plan for the North Marine Region will be considered and addressed in the EP, to ensure management of the Activity and associated impacts and risks are consistent with requirements of the Marine Bioregional Plan for the North Marine Region.* *In relation to how the Minister has considered this plan, this consultation does not relate to any decision of a Minister. For clarity, the EP will be assessed by NOPSEMA. There is no ministerial decision in respect of the EP***.** **[22(kk)]** *Operational area speed restrictions refer to limits on vessel speeds within the operational area/s to maintain safe operations.* *More generally, as noted in the Production Operations information booklet, requirements of the Environment Protection and Biodiversity Conservation Regulations 2000 are to be complied with in regard to marine fauna approach distances and vessel speeds, reducing the likelihood of unplanned marine fauna interactions.* **[22(ll)]** *As noted in the Production Operations information booklet, all planned discharges will be managed in accordance with maritime industry standards and MARPOL requirements to reduce the potential for significant cumulative impacts.* *Potential for longer term cumulative impacts will be assessed through water and sediment quality monitoring during production operations and need for any additional mitigations assessed.* **[22(mm)]** *The Production Operations information booklet considers potential impacts to marine turtles, and more specifically where the BIA flatback turtle overlaps OA2.* *Please refer to Noise Sources and Light Sources sections within the Production Operations information booklet, which identifies proposed control measures for managing impacts from noise and light sources.* *The potential impacts to marine turtle BIAs that overlap OA2 are greatly reduced by the infrequent (3 yearly) IMMR vessel activity in OA2.* **[22(nn)]** *See response to 22mm.* *The Production Operations information booklet considers potential impacts from light emissions to marine turtles in OA2. Impacts and risks to marine turtles from light emissions in OA2 are considered low risk due to infrequent IMMR vessel activity ie. approximate duration of 2-3 weeks once every three years. It is also worth noting that IMMR vessels are smaller than construction vessels and have smaller light emissions, further reducing the risk to marine turtles.* *All considered control measures (adopted and not adopted) will be presented in the EP for assessment by the Regulator/s.* **[22(oo)]** *The Production Operations information booklet contains proposed (adopted) control measures as relevant to potential impacts to migratory and threatened species. All considered control measures (adopted and not adopted) will be presented in the EP for assessment by the Regulator/s.* **[22(pp)]** *The Production Operations information booklet contains proposed (adopted) control measures as relevant to potential impacts where BIAs overlap OA2 (no BIA overlap with OA1). To the extent that BIAs overlap parts of the EMBA and/or MEVA, this is considered in the proposed control measures for unplanned events in the Production Operations information booklet and will also be addressed in the Production Operations Oil Pollution Emergency Plan to be submitted to NOPSEMA.* *In any event, potential risks and impacts in respect of the EMBA and MEVA (as distinct from the OAs) arise predominately by virtue of the remote risk of a hydrocarbon spill during the activity. The ECNT has sufficient information to identify BIAs within the EMBA by reference to the graphics of the EMBA provided in the Production Operations information booklet and publicly available information on BIAs, and Santos considers that the ECNT has sufficient information to understand the potential risks and impacts within the EMBA, to the extent that these risks or impacts are relevant to the ECNT's functions, interest or activities.*	Sections 3.2,3.4 3.5,6.1, 6.2, 6.6, 6.7, 6.8 and 7. Barossa Production Operations Oil Pollution Emergency Plan.

		[22(qq)] *The Production Operations information booklet presents a summary of the results of underwater acoustic assessments for noise sources relevant to the scope of this EP.* *Further details about the underwater acoustic assessments for production operations activities will be provided in the EP for assessment by the Regulator.* **[22(rr)]** *The FPSO will be a 'continuous' or 'non-impulsive' noise source, but at lower levels than impulsive noise sources. FPSO noise sources are predominantly from machinery and equipment on the deck and in the hull, therefore not a source of underwater noise.* *The potential for 'short term' behaviour change is associated with impulsive noise sources e.g. safety flaring, support vessels, helicopters.* **[22(ss)]** *All ballast water management and anti-fouling systems for the FPSO and other vessels, will be managed in accordance with maritime industry standards and MARPOL requirements.* *All marine vessels will be compliant with maritime law. Consistent with regulatory requirements, the EP will set out the requirements applicable to the activity and how Santos will comply with these requirements*	
The ECNT requested further information regarding spill impacts of the Activity, including: • stochastic modelling for hydrocarbon and condensate spill scenarios (22(tt)); • impacts on particular marine areas (22(uu)); • whether there is risk of a severe oil spill in the area of the Arafura Shelf (22(vv)); • impacts on traditional fishing practices (22(ww)); • details of the ecotoxicity of the various substances for which a spill scenario was modelled (22(xx)).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT's requests for further information relating to hydrocarbon spill modelling and the potential associated impacts in the event of an unplanned release associated with the Activity. The EP describes and includes the information below on spill impacts: • Details of spill toxicity. • Details on the spill EMBA. • OPEP spill response strategies. Santos considers this provides sufficient detail for ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration in the course of preparing the EP.	**[22(tt)]** *The EMBA and MEVA as presented in the Production Operations information booklet is informed by scholastic modelling.* *As the Production Operations information booklet explains (in detail under section "Environment that may be affected (EMBA)"), the EMBA represents a conservative depiction of the greatest geographical extent of an unplanned spill event.* *Santos welcomes input from ECNT about any information regarding values and sensitivities within the EMBA or MEVA that may be affected by the Activity, and associated impacts or risks.* **[22(uu)]** *The Production Operations information booklet presents information about values and sensitivities that may be affected by unplanned spill events relevant to the proposed Activity, that fall within the EMBA or MEVA.* *In preparing this EP, Santos has identified the presence of Ashmore Reef and Cartier Island within the EMBA, the Oceanic Shoals Marine Park in the MEVA, the Continental Slop Demersal Fish Communities within the EMBA and NT coastline communities within the MEVA.* *Santos welcomes input from ECNT about any information about values and sensitivities within the EMBA or MEVA that may be affected by the Activity, and associated impacts or risks.* **[22(vv)]** *In preparing the EP, Santos has identified the presence of the Arafura Shelf within the MEVA that could be affected by an unplanned spill event. This receptor, along with other relevant receptors, will be considered when identifying areas that require particular protection when developing appropriate spill response strategies for the OPEP, which will be assessed by the regulator.* **[22(ww)]** *In preparing the EP, Santos has identified commercial marine fisheries and traditional fishing practices that overlap with the EMBA and MEVA. Fishing interests within the MEVA are considered when identifying potential priorities for protection when developing appropriate spill response strategies for the OPEP, which will be assessed by the Regulator.* *In any event, having regard to the ECNT's FIAs, as described by the ECNT in its letter and on the ECNT's website, these impacts do not appear to be relevant to any potential consequence of the activity on the ECNT's FIAs.* **[22(xx)]** *The impacts and risks presented in the Production Operations information booklet have taken into account the relevant properties of the various substances for which a spill scenario has been modelled, including ecotox data where available for Barossa-condensate and industry fuels. These properties were considered when assessing potential impacts to values and sensitivities of the environment that may be affected, as presented in the Production Operations information booklet.* *The ECNT is able to make an informed assessment of any potential consequences of the activity on its FIAs by reference to the information on impacts and risks already provided. As noted previously, Santos invites the ECNT to suggest any particular control measures that may be appropriate to adopt in respect of these risks and impacts.* *Further, the OPEP spill response strategies as relevant to credible unplanned spill scenarios consider the impacts and risks from use of dispersant, where proposed as an appropriate response strategy for specific unplanned spill scenarios. The information contained in the OPEP will be assessed by the Regulator against the requirements of the Regulations.*	Section 3 and Sections 7.6 to 7.7. Barossa Production Operations Oil Pollution Emergency Plan.
ECNT correspondence to Santos on 9 April 2024			
Reiterated concerns in relation to Santos' consultation process, including the adequacy of information provided, and manner in which the ECNT is being consulted with compared to other relevant stakeholders (paragraphs 1-6 of letter).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos has provided the ECNT with sufficient information and a reasonable period to assess any possible impacts of the Activity for this EP on the ECNT's functions, interests and activities, and to provide any feedback it may have.	**Santos' correspondence to ECNT on 14 May 2024 in response to ECNT's letter of 9 April 2024** *Noting that we have already responded to your first and second letters, Santos has provided responses to your concerns and requests for further information in your third letter (dated 9 April 2024), where possible and reasonable, in the attached Annexure.* *More broadly, and as was set out in our letters of 28 March and 30 April 2024:* • *The purpose of the consultation is to understand:* • *the values and sensitives of the environment that may be affected;*	

		• *the potential environmental risks and impacts of the proposed activities; and* • *any control measures proposed to reduce the environmental impacts and risks of the proposed activities to as low as reasonably practicable and an acceptable level.* • *Santos has provided the ECNT with sufficient information to provide this type of feedback in accordance with regulation 25 of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (Regulations);* • *Santos has been consulting, and will continue to consult, with the ECNT so that Santos can obtain feedback as to any potential consequences which the proposed activity on the ECNT's functions, interests and activities.* *Santos considers that the information provided in this letter and the Annexure hereto, as well as our letter dated 30 April 2024, together with the previously shared information booklet and factsheet, are sufficient to inform an adequate assessment of the impacts of the activity of the EP on the ECNT's functions, interests and activities.* *Santos notes the ECNT has expressed concerns that it is being treated in a manner that is distinct from other stakeholders. However, the legislative framework and regulatory guidance makes it clear that the consultation process should be undertaken in a manner appropriate for the person or organisation having regard to their functions, interests and activities that may be affected by our proposed activity. With respect to the ECNT specifically, Santos has:* *a) provided ECNT with links to the relevant information booklet and factsheet on 9 February 2024 as part of the preliminary consultation process;* *b) been formally consulting with the ECNT about this EP and OEMP since 11 March 2024;* *c) responded to ECNT correspondence on 28 March and 30 April 2024; and* *d) responded to the ECNT's request for a meeting, now confirmed for 20 May 2024.* *Santos considers that it has been consulting with the ECNT in a manner which is consistent with the regulatory guidance, including giving the ECNT reasonable time to consider the consultation materials and to provide input for the EP.* *Santos looks forward to meeting with the ECNT in Darwin on Monday, 20 May 2024. The meeting is an opportunity for the ECNT to provide further input (if any) for Santos to consider in preparing the EP.*	
Reiterated concerns in relation to Santos' discrepancies in GHG emission estimates provided in three separate Barossa approval documents (paras 7-9).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT including clarification in relation to their reiterated concerns about apparent discrepancies in emissions estimates in separate approval documents in its letter of 14 May 2024. The EP includes for the GHG emissions forecast including the underpinning assumptions. Santos considers the information provided in the information booklet sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*The scope 1 emissions estimate presented in the Barossa Offshore Project Proposal (OPP) is higher than the estimate provided in the Production Operations Information Booklet (Booklet).* *This is as a result of reductions in the operational emissions achieved during detailed engineering design undertaken since the OPP was accepted. This is explained in Santos' letter dated 30 April 2024 - refer response to #22g and #22h.* *The annual emissions estimates included in the Booklet are applicable to the Production Operations Activity (Activity). The annual emissions estimates provided in the Booklet are conservative (when extrapolated for 25 years of production operations) given annual emissions are expected to reduce over the life of the Activity as production rates decline.* *As explained above, discrepancies between emissions estimates can be a product of improved engineering definition over the course of project development, the different metrics that can be used to present emissions estimates, and/or the fact that emissions vary from year to year as production changes over the life of a production facility.* *For the purpose of the Activity, the ECNT should focus its review on the information provided in the Booklet.* *As previously advised in Santos' letter dated 30 April 2024, to the extent that there is any potential impact on the ECNT's function, interests or activities (FIAs) as a result of GHG emissions, the ECNT is able to make an informed assessment of that impact with the information set out in the Booklet.*	GHG emissions forecast is presented in Section 6.3.
Asserted that Santos has not adopted an OPP control measure of using fuel gas instead of marine diesel and marine gas oil (para 10).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT that ECNT has incorrectly interpreted the content in the information booklet, which was clarified by Santos in its response to the ECNT.	*The reference from pp. 339 of the OPP refers to fuel gas as the preferred fuel for FPSO hydrocarbon processing and utilities operations. This control measure has not been rejected and is consistent with the basis for the EP.* *The references in the Booklet to marine diesel oil (MDO) or marine gas oil (MGO) are not to be confused with the reference from pp. 339 of the OPP and refer to:* • *use of MDO as a fuel source for support vessels and IMMR vessels; and* • *MGO as a backup or emergency fuel if the FPSO fuel gas system is offline/unavailable.*	Section 6.4 Control measures BAO-CM-6.3.16- BAO-CM-6.3.9
Asserted that Santos has not provided sufficient detail regarding emissions profile of the project (para 11).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP includes for the GHG emissions forecast including the underpinning assumptions. Santos' assessment is that the information booklet is sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*Santos has addressed the request for additional emissions estimate detail previously in our letter dated 30 April 2024.* *Regarding the differences with the DPD SER emissions estimate, see response to #8, which refers to an explanation for this.*	GHG emissions forecast is presented in Section 6.3.

Asserted that Santos should provide the ECNT (and other Relevant Persons) with the details of the full range of GHG emission assessments it has undertaken for the project (para 12).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP includes for the GHG emissions forecast including the underpinning assumptions. Santos' assessment is that the information booklet is sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*Santos has assessed and defined the full range of potential GHG emissions sources relevant to the activity for this EP, taking account of detailed engineering design undertaken since the OPP, and this is accurately reflected in the Booklet as relevant to the EP.*	GHG emissions forecast is presented in Section 6.3.
Asserted that Santos has failed to identify the impacts of the activity over the lifecycle of the project, relying on a limited period of 5 years of impacts (paras 13-21).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP identifies the impacts of the activity over the lifecycle of the Activity fit for purpose given the EP is for the first 5 years of the Activity and includes relevant detail for hookup, commissioning, start up and steady state operations. The ECNT assertion is incorrect. Santos has identified the impacts of the activity over the lifecycle of the Project, which was clarified by Santos in its response to the ECNT.	*The EP will assess the risks and impacts of the Activity for the lifecycle of the project. Correspondingly, the Booklet sets out the risks and impacts of the Activity that are anticipated to arise for the lifecycle of the project.*	The impact and risks of the activity over the life cycle of the project are assessed in Sections 6 and 7 of the EP.
Asserted that the ECNT is unable to assess the impacts to the environment from the Activity due to lack of clarity regarding GHG emissions of the project (paras 22-23).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP includes for the GHG emissions forecast including the underpinning assumptions. Santos' assessment is that the information book*let al*ong with the many responses described and provided within this section are sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*Further to the responses provided to ECNT items #7-21, Santos has clarified the actual extent of greenhouse gas emissions from the Activity and rejects this claim.*	GHG emissions forecast is presented in Section 6.3.
Asserted that Santos has failed to appropriately contextualise and evaluate the GHG emissions of the project (para 24).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The contribution of GHG emissions from the Activity has been contextualised against Australian and global carbon budgets. International frameworks, namely the Paris Agreement, have been developed to facilitate an orderly approach to what is a global problem. The nature, quantity and timeframe of each country's contribution and the pathways to achieve UNFCCC obligations vary widely, including having regard to the particular circumstances of each country. This framework recognises, and is premised on, the fact that climate change is a global issue – there is no correlation between where GHG emissions are released and where climate change impacts are felt. Santos' assessment is that the information booklet is sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*ECNTs claim is noted, as advised in Santos' letter dated 30 April 2024, to the extent that there is any potential impact on the ECNT's FIAs as a result of GHG emissions, the ECNT is able to make an informed assessment of that impact with the information set out in the Booklet.* *Santos will provide further definition of the acceptable levels of impact from GHG emissions in the EP, with consideration for Australia's legislated emissions reduction targets, for assessment by the Regulator against the requirements of the Regulations.*	GHG emissions forecast is presented in Section 6.3.
Reiterated concerns regarding Santos' approach of assessing environmental impacts from the project's emissions, including in the national and international context, as well as cumulative impacts (paras 25-28 and 30-31).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP acknowledges the linear relationship between cumulative anthropogenic CO_2 emissions and global warming. The EP references the latest commentary from the IPCC on the causes and impacts of climate change. It is not possible to draw a link between GHG emissions from the Activity and any specific climate related impact on any specific element of the Australian environment which may result from any net increase to cumulative GHG emissions globally. By keeping the Project emissions under the Safeguard Mechanism baseline, the Project's incremental contribution to global warming is within acceptable limits as determined by reference to Australia's NDC under the UNFCCC. Santos' assessment is that the information booklet is sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*Environmental impacts of GHG emissions from the Activity will be evaluated against acceptable levels of acceptable impact defined in the EP, for assessment by the Regulator against the requirements of the Regulations.* *As outlined in the Booklet, as a result of the complex nature of the global emissions system, climate change impacts cannot be meaningfully linked to any one activity or emissions source.* *As previously advised in Santos' letter dated 30 April 2024, to the extent that there is any potential impact on the ECNT's FIAs as a result of GHG emissions, the ECNT is able to make an informed assessment of that impact with the information set out in the Booklet. Santos understands from previous consultation that the ECNT is familiar with these potential risks and impacts related to GHG emissions. Santos reiterates its invitation to the ECNT to raise any control measures that it considers may be appropriate to adopt for Santos' consideration when preparing the EP for submission to NOPSEMA, including in relation to GHG emissions.* … *Refer the covering letter and Santos' letter dated 30 April 2024. Santos welcomes the ECNT's input in accordance with the legislative purpose of s 25 consultation and is meeting with the ECNT. As highlighted in our letter of 30 April 2024, Santos considers that the information about GHG emissions provided in the consultation materials sent to ECNT on 9 February 2024 is sufficient in order for ECNT to make an informed assessment of the potential consequences of the Activity on any of its FIAs.*	Environmental impacts of GHG emissions are assessed in Section 6.3. Environmental impact of atmospheric emissions is assessed in Section 6.4

Concerns were raised in relation to the impacts to listed threatened species from climate change (para 29-30).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP acknowledges the linear relationship between cumulative anthropogenic CO_2 emissions and global warming. The EP references the latest commentary from the IPCC on the causes and impacts of climate change. It is not possible to draw a link between GHG emissions from the Activity and any specific climate related impact on any specific element of the Australian environment which may result from any net increase to cumulative GHG emissions globally. By keeping the Project emissions under the Safeguard Mechanism baseline, the Project's incremental contribution to global warming is within acceptable limits as determined by reference to Australia's NDC under the UNFCCC. The predicted GHG emissions associated with the Activity comprise a nominal amount in the overall scheme of the national and international carbon budgets and will not materially or substantially contribute to existing and future predicted Australian and global GHG emissions. Conservatively the associated potential environmental impacts to Threatened, Migratory or local fauna (e.g. seabirds) is assessed as I – Negligible. Santos' assessment is that the information booklet is sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*The EP will consider all relevant conservation advice, and threatened species recovery and management plans, in defining acceptable levels of impact and evaluation of activity GHG emissions related impacts and risks, for assessment by the Regulator against the requirements of the Regulations.*	Impacts associated with climate change are assessed in Section 6.3 Relevant conservation advice, and threatened species recovery and management plans are outlined in Section 3
Reiterated concerns that Santos has not demonstrated how it will meet its legislative requirements under the Safeguard Mechanism (paras 32-39).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos has considered these concerns. Santos can confirm that it will comply with the Safeguard Mechanism, noting that treatment of Barossa GHG emissions is still to be finalised by the CER. Implementation and enforcement of the Safeguard Mechanism is the responsibility of the CER.	*Santos will be required to comply with the applicable baseline for the Barossa project in each compliance year, including net-zero reservoir emissions from first gas. It is a matter for Santos to determine how it will achieve this compliance. The EP will demonstrate how requirements applicable to the Activity will be met, which will be considered by NOPSEMA in the exercise of its functions as Regulator. This information is not necessary for the ECNT to make an informed assessment of the possible consequences of the Activity on any of its FIAs.*	Section 6.3 EPO 11
Reiterated concerns that Santos has not demonstrated that the GHG emissions of the project have been reduced to ALARP and are acceptable (paras 40-45 and to 58).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos has considered the concerns raised. Santos considers that GHG emissions have been reduced to ALARP and are acceptable for the reasons set out in Section 6.3.5 and Section 6.3.6.	*The extent to which the EP demonstrates that the impacts and risks from Activity GHG emissions have been reduced to ALARP and acceptable levels, is a matter for the Regulator to assess against the requirements of the Regulations.*	Section 6.3.5 Section 6.3.6
Concerns raised regarding whether a future CCS project constitutes a component of the Activity, including whether CCS will be a mitigation and control measure for GHG emissions of the project at some point over its lifecycle (paras 46-56).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos again confirmed to the ECNT that CCS is not part of Activity under the EP. ECNT queries about CCS are therefore not considered further as CCS opportunities at Bayu Undan are outside the scope of this EP.	*As previously advised in our letter dated 30 April 2024, while Santos has committed to explore CCS opportunities at Bayu-Undan and elsewhere, CCS is not part of the Barossa development, and not within the scope of the Production Operations EP.*	Not applicable
Asserted that Santos has no viable control measures capable of meaningfully mitigating its scope 1 GHG emissions for the Activity, without CCS being a component of the Barossa project (para 57).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP describes the reductions in Scope 1 operational emissions for the Activity, and the Scope 1 emissions will be reduced to ALARP and acceptable levels through compliance with the Safeguard Mechanism, including the imposition of net zero reservoir emissions requirement and facility design and operations emissions reduction measures. ECNT queries about CCS are not considered further as CCS opportunities at Bayu Undan are outside the scope of this EP.	*As previously advised in the response to #46, CCS is not part of the Barossa development.* *As explained in Santos' letter dated 30 April 2024 (refer response to #22h), Santos has achieved significant reductions in Scope 1 operational emissions since the Barossa Development OPP. Santos will comply with the requirements of the Safeguard Mechanism.* *In any event, the extent to which the EP demonstrates that the impacts and risks from Activity GHG emissions have been reduced to ALARP and acceptable levels, is a matter for the Regulator to assess against the requirements of the Regulations.*	Control measures relating to managing GHG emissions are outlined in Section 6.3.3
Asserted that Santos has made no attempt to properly define the impacts of indirect emissions from the project (para 59).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP considers the issues raised. The EP acknowledges the linear relationship between cumulative anthropogenic CO_2 emissions and global warming. The EP references the latest commentary from the IPCC on the causes and impacts of climate change. The Activity's projected emissions are contextualised against established emissions budgets (national and global). Climate change is a global problem with the solution being led at the international level. Acceptable levels of indirect (Scope 3) emissions from the Activity within Australia are set by the Safeguard Mechanism Baseline on Barossa facility emissions, in line with the Australian Government's NDCs under the Paris Agreement, whilst the acceptable levels of indirect (Scope 3) emissions from the	*Santos rejects ECNT's claim that Santos has made no attempt to properly define the impacts of these indirect emissions nor to account for the ways these impacts could be reduced or mitigated. Page 14 of the Booklet identifies:* • *the indirect impacts of climate change on the Australian environment, associated with GHG emissions (Scope 1 and 3) from the Activity; and* • *a proposed control measure to mitigate impacts from indirect (Scope 3) emissions from the Activity.* *In any event, the extent to which the EP demonstrates that the impacts and risks from Activity indirect (Scope 3) GHG emissions have been reduced to ALARP and acceptable levels, is a matter for the Regulator to assess against the requirements of the Regulations.* *See also Santos' response to #8 above.*	GHG ALARP assessment 6.3.5

	Activity outside of Australia are set by customer countries within the context of their own NDCs under the Paris Agreement or mid-century net zero commitments and associated emissions reduction policies and regulations, noting that the emissions would arise regardless of the source of the gas being consumed (ie if gas was not supplied from Barossa, it would be supplied from elsewhere to meet customer and customer country demand). Assuming the emissions from the Activity will cause an equivalent net increase in cumulative Australian and global emissions, this increase comprises a nominal amount in the overall scheme of the national and international carbon budgets; and there is no correlation between where GHG emissions are released and where climate change impacts are felt. The Barossa JV has adopted environmental performance outcomes and control measures directed to minimising the GHG emissions from the Activity. A range of controls have been considered for both direct (Scope 1) and indirect (Scope 3) emissions. Santos considers that GHG emissions have been reduced to ALARP and are acceptable for the reasons set out in section 6.3.5 and 6.3.6.		
Asserted that Santos has not described how scope 3 GHG emissions will be reduced to ALARP and acceptable levels, and that the Activity poses an unacceptable risk to the environment (paras 60-61 and 64).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP considers the issues raised. The EP acknowledges the linear relationship between cumulative anthropogenic CO_2 emissions and global warming. The EP references the latest commentary from the IPCC on the causes and impacts of climate change. The Activity's projected emissions are contextualised against established emissions budgets (national and global). Climate change is a global problem with the solution being led at the international level. Acceptable levels of indirect (Scope 3) emissions from the Activity within Australia are set by the Safeguard Mechanism Baseline on Barossa facility emissions, in line with the Australian Government's NDCs under the Paris Agreement, whilst the acceptable levels of indirect (Scope 3) emissions from the Activity outside of Australia are set by customer countries within the context of their own NDCs under the Paris Agreement or mid-century net zero commitments and associated emissions reduction policies and regulations, noting that the emissions would arise regardless of the source of the gas being consumed (ie if gas was not supplied from Barossa, it would be supplied from elsewhere to meet customer and customer country demand). Assuming the emissions from the Activity will cause an equivalent net increase in cumulative Australian and global emissions, this increase comprises a nominal amount in the overall scheme of the national and international carbon budgets; and there is no correlation between where GHG emissions are released and where climate change impacts are felt. The Barossa JV has adopted environmental performance outcomes and control measures directed to minimising the GHG emissions from the Activity. A range of controls have been considered for both direct (Scope 1) and indirect (Scope 3) emissions. Santos considers that GHG emissions have been reduced to ALARP and are acceptable for the reasons set out in Section 6.3.5 and Section 6.3.6	*The extent to which the EP demonstrates that the impacts and risks from Activity indirect (Scope 3) GHG emissions have been reduced to ALARP and acceptable levels, is a matter for the Regulator to assess against the requirements of the Regulations.* *The EP demonstration that the impacts and risks from Activity GHG emissions (direct and indirect) have been reduced to ALARP and acceptable levels is performed in the context of the Australian Government's interim (2030) and longer term (2050) emissions reduction targets, and associated regulations such as the Safeguard Mechanism. Ultimately, it is a matter for the Regulator to assess the acceptability of Santos' demonstration against the requirements of the Regulations.*	GHG ALARP assessment Section 6.3.5 GHG acceptability evaluation Section 6.3.6
Asserted that neither Japan nor South Korea are on track to meet Paris Agreement commitments in the period to 2030 (para 63).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT.	*Noted.*	Not applicable
Asserted that Santos has made no attempt to define the impact of methane emissions (para 65).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Methane emissions are accounted for in the GHG emissions estimate. Section 6.3 of the EP details the facility design and operations measures to reduce Scope 1 emissions to ALARP, inclusive of sources of methane emissions.	*Although methane emissions represent a minor contribution to Activity Scope 1 GHG emissions, they are accounted for in the Scope 1 GHG emissions estimate provided in the Booklet.* *The EP demonstration that the impacts and risks from Activity GHG emissions (direct and indirect) have been reduced to ALARP and acceptable levels is performed in the context of the Australian Government's interim (2030) and longer term (2050) emissions reduction targets, and associated regulations such as the Safeguard Mechanism. Ultimately, it is a matter for the Regulator to assess the acceptability of Santos' demonstration against the requirements of the Regulations.*	Section 6.3.
Asserted that the Activity is inconsistent with Commonwealth Recovery Plan for Marine Turtles (para 66).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos has assessed the Activity impacts and risks and does not consider the Activity to be inconsistent with the Recovery Plan for Marine Turtles.	*Santos notes and refutes ECNT's claim, which we address below.*	Sections, 6.2, 6.7, 6.8, 7.1, 7.4 to 7.7.12.

	Consistency with the recovery plan for marine turtles is demonstrated in the following Sections, 6.2, 6.7, 6.8, 7.1, 7.4 to 7.7.12.		
Asserted Santos' spill response plans are not finalised and do not provide sufficient details regarding harm to turtles (para 68).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos has a number of accepted spill response (thereby finalised) plans for Barossa related activities which include for response strategies to reduce harm to turtles. Santos has considered the requirements of the Recovery Plan for Marine Turtles (2017) to ensure the Barossa Production Operations Oil Pollution Emergency Plan is consistent with the requirements of the recovery plan.	*Page 9 of the Booklet acknowledges the various conservation management plans and advice, including recovery plans, that have been considered in development of the EP (including the Oil Pollution Emergency Plan (OPEP)). In assessing the potential impacts from an unplanned spill event, Santos has considered the requirements of the Recovery Plan for Marine Turtles (2017) to ensure the proposed control measures are consistent with the requirements of the recovery plan.* *The OPEP includes an objective to identify environmental sensitivities at risk and conduct operational Net Environmental Benefit Analysis (**NEBA**). The NEBA process is used by the Incident Management Team during an oil spill response operation so the most effective response strategies with the least detrimental environmental impacts can be identified. As a component of the incident action planning process, in the event of a spill, a NEBA is applied to achieve the following:* • *Identify sensitivities within the area potentially affected by a spill at that time of the year (noting that the sensitivity of some key receptors, such as birdlife and turtles, varies seasonally).* • *Assist in prioritising and allocating resources to sensitivities with a higher protection and response priority.* • *Assist in determining appropriate response strategies with support of real-time metocean conditions, oil spill tracking and fate modelling.* *Consistent with the requirements of the Regulations, Santos plans are not finalised at the time of consultation and won't be finalised until plans are submitted to the Regulator for assessment.* *The extent to which Santos has demonstrated Activity impacts and risks are consistent with the Recovery Plan for Marine Turtles (2017) is a matter for the Regulator to assess against the requirements of the Regulations.*	Sections 7.6 and 7.7. Barossa Production Operations Oil Pollution Emergency Plan
Further information requested to ensure that Barossa operations are not inconsistent with artificial lighting requirements for marine turtles (para 71).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos notes that impacts to marine turtles from Activity lighting are not expected to occur, primarily due to the infrequent and short duration of vessel planned inspection activities at OA2. Marine turtle biologically important areas do not overlap with OA1 and do not overlap with light spill contours associated with behavioural impacts (modelled for the Barossa FPSO non-flaring and flaring scenarios (Worley, 2025)). Barossa operations are consistent with artificial lighting requirements for marine turtles.	*Planned vessel inspection and maintenance activities along the Barossa GEP in OA2 would occur at a frequency of approximately once every 3 years, for a duration of approximately several weeks across the full extent of the pipeline. Vessel presence at any one location (during vessel inspection and maintenance activity periods) would be approximately 2-3 days in any one specific location.* *As stated in the Booklet, impacts to nesting females or hatchlings are not expected to occur, primarily due to the infrequent and short duration of vessel inspection activities, as explained above.*	Section 6.2.2 and 6.2.3
Asserted that Santos has failed to identify cumulative water quality impacts on marine turtles (para 72).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP considers and assesses cumulative impacts from concurrent activities in OA1 for all relevant environmental aspects, including potential impacts to water quality and associated potential impacts to marine turtles. Given the absence of marine turtle BIAs in OA1, and proposed control measures for planned discharges, Santos considers the potential water quality impacts to marine turtles from the Activity to have been reduced to ALARP and acceptable levels.	*Santos has identified the Recovery Plan for Marine Turtles (2017) as a relevant consideration during preparation of the EP. The chemicals that may be present in the discharged water have properties that are non-bioaccumulative, are biodegradable and breakdown quickly.* *Given the potential exposure times for turtles that may transit through the area, they are not there long enough to experience acute toxic effects.* *The adequacy of Santos' evaluation of the impacts and risks to marine turtles from the Activity, is a matter for the Regulator to assess against the requirements of the Regulations.*	Cumulative impacts of water quality on marine fauna is assessed in Section 6.8.2.6
Asserted that Santos needs to further assess impacts to important marine turtle foraging grounds, migratory corridors, mating areas and habitat for hatchling dispersal (para 73).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos has considered all reasonably ascertainable information of relevance to assessment of potential impacts to marine turtles from the Activity.	*The evaluation of impacts and risks to marine turtles as presented in the Booklet has considered Department of Climate Change, Energy, the Environment and Water published biologically important areas (BIAs) as relevant to foraging, mating, nesting, interesting, and has also considered best available information on migration pathways. As noted in the Booklet, OA2 overlaps a portion of the flatback turtle inter-nesting BIA.* *Santos reiterates that the information provided in the Booklet is sufficient in order for ECNT to make an informed assessment of the potential consequences of the Activity on any of its FIAs.*	Throughout Section 6.
Asserted that Santos has failed to consider compliance with the Threat Abatement Plan for the impacts of marine debris on vertebrate marine life (para 74).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP considers the Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (CoA, 2018) when evaluating potential threats to marine turtles from the Activity.	*Santos has considered the Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (CoA, 2018) when evaluating potential threats to marine turtles from the Activity, and this has informed the Booklet.* *The EP assesses the scale of impact associated with dropped objects. Santos will comply with legislation for the prevention of garbage disposal from vessels. Given the limited quantities and likely objects, as well as the control measures proposed, the potential impacts from the Activity to species identified in relevant species recovery plans, conservation advice, wildlife conservation plans and management actions will be minimised. Ultimately, the adequacy of Santos' proposed control measures is a matter for the Regulator to assess against the requirements of the Regulations.*	Section 7.1. BAO-CM-7.1.1 BAO-CM-7.1.2 .
Asserted that Santos has not sufficiently assessed the potential impacts to marine species (para 75).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT.	*ECNT's observations about the difference between the level of marine species information provided between OA1 and OA2 is reflective of the difference in nature and scale of activities between the different operational areas. OA1 will comprise infrastructure with an ongoing presence both below and above the waterline and includes*	Sections 6 and 7.

	The EP considers and assesses potential impacts to marine species, as appropriate to the nature and scale of planned activities at OA1 and OA2 and associated impacts and risks.	*continuous support vessel activities. In contrast, OA2 comprises a subsea pipeline located on the seabed, with non-continuous infrequent inspections (approximately every 3 years) and maintenance activity via a vessel.* *The EMBA and MEVA described in the EP are associated with potential impacts from an unplanned event – namely a hydrocarbon spill. The likelihood of a hydrocarbon release is unlikely.*	
Asserted that Santos failed to provide sufficient information on potential noise impacts on marine mammals (paras 76-78).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP describes the noise emissions associated with the Activity. The information contained in the information booklet about potential noise impacts on marine mammals is sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*a. The EP describes the noise emissions associated with the Activity and commissioned a Noise Impacts on Marine Fauna to support the noise emissions impact assessment presented.* *b. Support vessels will transit from OA1 and OA2 to Darwin. Given OA2 extends along the Barossa GEP from the FPSO to Darwin, Santos considers noise impacts in the wider area have been considered.* *Santos' evaluation of impacts and risks to marine mammals from noise emissions will be a matter for the Regulator to assess against the requirements of the Regulations.*	Section 6.1. BAO-CM-6.1.1 BAO-CM-6.1.2
Asserted that Santos failed to provide sufficient information on potential Vessel collisions and other interactions on marine mammals (para 79).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos' assessment is that the information presented in the information booklet about unplanned marine fauna interactions is sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*Santos has considered relevant management actions, policy advice and legislation when evaluating potential threats to marine mammals from the Activity, and this has informed the information presented in the EP and the information Booklet (including as to control measures proposed to be implemented). The OA does not overlap the migration route of the pygmy blue whale.* *Santos confirm that vessels will be required to comply with its Protected Marine Fauna Interaction and Sighting Procedure, which ensures compliance with Part 8 of Environment Protection and Biodiversity Regulations 2000 which includes controls for minimising the risk of collision with marine fauna.* *Ultimately, the adequacy of Santos' proposed control measures is a matter for the Regulator to assess against the requirements of the Regulations.*	Section 7.3. BAO-CM-6.1.2 BAO-CM-6.1.1 BAO-CM-6.6.6 BAO-CM-6.4.5
Asserted that Santos has dismissed the potential impacts to migratory seabirds and shorebirds (para 80).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos has assessed potential impacts to migratory seabirds and shorebirds appropriate to the nature and scale of activities, and the locations of planned activities in OA1 and OA2, relative to the presence and extent of seabird or shorebird BIAs.	*There are no seabird or shorebird BIAs that overlap with either OA1 or OA2, which has informed the presentation of environmental impacts and risks in the Booklet.* *EPBC Act listed seabird or shorebird species that could occur in the EMBA (associated with potential impacts from an unplanned event – namely a hydrocarbon spill) will be considered in the EP but represent lower environmental risk due to the low likelihood (unlikely) of an unplanned event.*	Sections 6 and 7.
Asserted that the Information Booklet failed to provide sufficient information on the project's risks and impacts on bird species, including flaring and venting excess gas and light pollution (para 81).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos has assessed potential impacts to migratory seabirds and shorebirds appropriate to the nature and scale of activities, and the locations of planned activities in OA1 and OA2, relative to the presence and extent of seabird or shorebird BIAs; and Santos considers the information presented in the information booklet is sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*See response to para #80.* *The EP will assess all potential impacts to seabirds and migratory birds associated with flaring activity.* *There are no seabird or shorebird BIAs that overlap with either OA1 or OA2, which has informed the presentation of environmental impacts and risks in the Booklet.* *The EP will assess the potential attraction of birds to the gas flare.*	The impact of flaring and venting on bird species is assessed in Section 6.4 The impact of light on bird species is assessed in Section 6.2.
Asserted that Santos missed potential impacts on fish and other marine species with habitats beyond the boundaries of OA1 and OA2, including impacts from support vessels travelling to and from Darwin (para 82).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos has assessed potential impacts to fish and other marine species from planned activities within OA1 and OA2 and from unplanned events in the broader environment that may be affected.	*The EP assesses the potential noise emission impacts on fish and other marine species associated with support vessels.* *Support vessels will transit from OA1 and OA2 to Darwin. Given OA2 extends along the Barossa GEP from the FPSO to Darwin, Santos considers noise impacts in the wider area have been considered in the EP.*	Sections 6 and 7. .
Asserted that Santos' has failed to adequately assess the potential risks and impacts to fish and other marine life resulting from discharges (para 83).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos has assessed potential impacts to fish and other marine species from planned activities within OA1 and OA2 and from unplanned events in the broader environment that may be affected.	*The chemicals (process) that may be present in the discharged water have properties that are non-bioaccumulative, biodegradable and breakdown quickly. Santos will undertake a full suite of WET testing of the produced water discharges in accordance with ANZECC & ARMCANZ (2000) guidelines once production commences.* *Given the potential exposure times for plankton, fish, invertebrates and sharks that may transit through the area, they are not there long enough to experience acute toxic effects.* *The adequacy of Santos' evaluation of impacts and risks to fish and other marine life and any related control measures will be a matter for the Regulator to assess against the requirements of the Regulations.*	Sections 6.7 and 6.8. BAO-CM-6.7.5
Asserted that the Information Booklet does not provide sufficient information on the chemical composition of produced water (para 85).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The potential composition of produced water was appended to the accepted OPP for the Activity. Santos will routinely verify the produced water composition through laboratory chemical characterisation (BAO-CM-6.8.10). Santos considers that the information about composition of produced water in the information booklet is sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the	*Page 20 of the Booklet does provide a general description of the composition of produced water, and Santos refers ECNT to its response in its letter dated 30 April 2024 (request 22aa).*	Section 6.8. BAO-CM-6.8.10

	Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.		
Asserted that the Information Booklet does not provide a sufficient explanation for the: • forecast produced water rate (para 86); and • produced water treatment stages (para 87).	Santos has considered and addressed the matters raised by ECNT in this EP and provided a response to ECNT. Santos considers that the information booklet does provide sufficient information about forecast produced water rates and treatment stages for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	**[86]** *The forecast produced water rate over time is merely a reflection of the Barossa reservoir properties and is included to emphasise the conservatism in the design capacity of the FPSO to process produced water volumes of up to 20,000 bbl/day.* *In any event, a further explanation is not required in order for ECNT to make an informed assessment of any potential consequences of the Activity on its FIAs by reference to the impacts and risks already provided.* *The produced water treatment system is a multi-stage treatment process that progressively removes hydrocarbons and other contaminants to reduce oil in water concentrations that are acceptable for discharge.* **[87]** *The produced water treatment and discharge system consists of multiple stages of de-oiling, solids removal and pumping equipment. The system consists of a:* • *produced water surge drum* • *hydrocyclone* • *floatation vessel (induced gas flotation unit)* *tertiary produced water treatment unit – macro-porous polymer extraction (MPPE).*	Section 6.8.
Asserted that there is insufficient information provided regarding the chemical selection process, or details of the chemical compounds used as additives in produced water discharges (para 88).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. As per the response on 30 April 2024, implementation of the chemical selection process requires that all operational chemicals used on the FPSO (including those that may end up in the produced water discharge) are risk-assessed under the UK based Offshore Chemical Notification Scheme (OCNS). Chemicals are ranked according to their calculated hazard quotients by the chemical hazard assessment and risk management (CHARM) mathematical model, which uses aquatic toxicity, biodegradation and bioaccumulation data. Chemical selection in accordance with this process ensures only environmentally acceptable chemicals are used on the FPSO and discharged with the produced water. Santos considers that it has provided sufficient information about the performance requirements of Santos' chemical assessment and selection process for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*Santos refers ECNT to our letter dated 30 April 2024 (request 22aa).*	Section 6.8. BAO-CM-6.7.5
Asserted that there is insufficient information provided regarding produced water monitoring (para 89).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP describes and includes the information below in relation to produced water monitoring and management: • Relevant standards including ANZG 2018 (BAO-CM-6.8.7, BAO-CM-6.8.10, BAO-CM-6.8.11 and BAO-CM-6.8.12) and recovery plans (Table 3-13). • Discharge modelling using the approach in the accepted OPP that sets a conservative mixing zone which does not overlap sensitive features or BIAs and verification of the discharge modelling once the facility is operational (BAO-CM-6.8.7, BAO-CM-6.8.11 and BAO-CM-6.8.12). • Produced water monitoring (OIW, mercury, ecotoxicity and chemical characterisation) and water / sediment quality monitoring regime (BAO-CM-6.8.3,BAO-CM-6.8.8, BAO-CM-6.8.9, BAO- CM-6.8.10 and BAO-CM-6.8.11). • Inclusion of the Produced Water Adaptive Management plan in the EP (Appendix I; BAO-CM-6.8.7). • Treatment of produced water via primary and tertiary treatment stages to reduce OIW and mercury concentrations to within discharge limits and performance targets within the OPP PW specification (BAO-CM-6.8.1 BAO-CM-6.8.2, BAO-CM- 6.8.3, BAO-CM- 6.8.4 and BAO-CM- 6.8.5). • Performance targets for mercury and OIW to be reviewed after 12 months of steady state operations (BAO-CM-6.8.2) to determine if targets can be further reduced. • Application of Santos' chemical selection process for production chemicals discharged in PW (BAO-CM-6.7.5)	*As stated in the Booklet, if the produced water stream does not meet the specifications for discharge it is routed to a dedicated storage tank, for subsequent re-processing in the produced water treatment system until the concentrations meet the acceptable limit of 30mg/L over 24-hours. See also Santos' letter dated 30 April 2024 (request 22z).*	Section 6.8. The following control measures manage PW discharges: BAO-CM-6.8.1 BAO-CM-6.8.2 BAO-CM-6.8.3 BAO-CM-6.8.4 BAO-CM-6.8.5 BAO-CM-6.8.6 BAO-CM-6.8.7 BAO-CM-6.8.8 BAO-CM-6.8.9 BAO-CM-6.8.10 BAO-CM-6.8.11 BAO-CM-6.8.12 BAO-CM-6.4.10 BAO-CM-6.7.5 Appendix I. Appendix J

	Santos considers it has provided sufficient information about the performance requirements for produced water treatment and discharge quality controls for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.		
Concerns raised regarding the cumulative impacts of produced water in light of the '30 mg/l over any 24- hour period limit' (para 90).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. As per the letter dated 30 April 2024, the potential for longer term ecotoxicological impacts (including cumulative impacts) from produced water discharge at OA1 will be assessed through a combination of produced water sampling and analysis (BAO-CM-6.8.10), and receiving environment sampling and monitoring (BAO-CM-6.8.11). The results of this assessment will inform if additional mitigations are required to limit potential ecotoxicological impacts to acceptable levels as per the Produced Water Adaptive Management Plan (Appendix I; BAO-CM-6.8.7). Santos considers that with the correspondence to ECNT and the information booklet does contain sufficient information about the performance requirements for produced water treatment and discharge quality controls for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*Santos refers ECNT to our letter dated 30 April 2024 (request 22gg).*	Section 6.8. Appendix I Appendix J BAO-CM-6.8.7 BAO-CM-6.8.10 BAO-CM-6.8.11
Concern raised that the produced water adaptive management plan has not been made available (para 92).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The Produced Water Adaptive Management Plan is appended to the EP (Appendix I). Santos considers the information presented in the information booklet about produced water impacts and proposed management of impacts and risks is sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*The produced water adaptive management plan will be described in the EP and will be a matter for the Regulator to assess against the requirements of the Regulations.* *Santos considers the ECNT is able to make an informed assessment of any potential consequences of the Activity on its FIAs by reference to the information on impacts and risks already provided.*	Section 6.8. Appendix I
Concern raised that no lists or tables of chemical species being tested for has been provided (para 93).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. As per correspondence on 30 April 2024, the management of produced water takes into consideration protection and environmental value protection thresholds per Australia and New Zealand Water Quality Guidelines (ANZG 2018), this includes for the potential chemical species being tested for in produced water as outlined within the Produced Water Adaptive Management Plan (Appendix I). Santos considers that it has provided sufficient information about the performance requirements of Santos' chemical assessment and selection process for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*Santos refers ECNT to our letter dated 30 April 2024 (request 22aa).*	Section 6.8 Appendix I BAO-CM-6.7.5
Concern raised that no information has been provided about the specific composition of the drilling fluids that will feed into produced water discharges (para 94).	Santos has considered the matters raised by ECNT and provided a response to ECNT. Drilling activity is outside the scope of this EP and regulated through a separate EP and will not feed into the produced water discharges.	*Drilling fluids associated with drilling operations will not form part of the produced water stream and were addressed in the accepted Drilling and Completions Environment Plan.*	Section 6.8.
Concerns raised about certain produced water matters in the OPP, which the ECNT asserts should be addressed in the EP, including chemical concentration levels and cumulative impact issues (para 95(a)-(f)).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos has appropriately addressed produced water impacts in the EP. Santos notes that the potential for cumulative impacts will be assessed and evaluated through Santos' Water and Sediment Quality Monitoring Plan (Appendix J; BAO-CM-6.8.11), and managed (if required) through the Produced Water Adaptive Management Plan (Appendix I; BAO-CM-6.8.7).	*Responding to each of the ECNT's numbered paragraphs:* *a. Further detail will be provided in the EP as required for the Regulator to assess the Activity impacts and risks against the requirements of the Regulations.* *b. The produced water treatment system is designed to remove low levels of mercury. This impact/risk will be addressed in the EP for assessment by the Regulator against the requirements of the Regulations.*	Section 6.8. Appendix I Appendix J BAO-CM-6.8.7 BAO-CM-6.8.10 BAO-CM-6.8.11

	Santos will routinely assess the chemical concentrations within PW through its produced water sampling and analysis regime (BAO-CM-6.8.10).	*c. Santos refers ECNT to our letter dated 30 April 2024 (request 22aa).* *d. Drilling fluids associated with drilling operations will not form part of the produced water stream and were addressed in the accepted Drilling and Completions Environment Plan.* *e. Drilling fluids associated with drilling operations will not form part of the produced water stream and were addressed in the accepted Drilling and Completions Environment Plan.* *f. The OPP was accepted by NOPSEMA in March 2018. The EP will be subject to a separate NOPSEMA assessment process and the EP will consider applicable cumulative impacts.* *Cumulative impacts are unlikely due to the non-bioaccumulative and rapid biodegradation properties of the chemicals typically used in production. In addition, any hydrocarbons from produced water would begin to breakdown as soon as they enter the water through a complex mix of processes such as evaporation, oxidation, and biodegradation.*	
Meeting with ECNT on 20 May 2024			
The ECNT asserted that the information Santos has provided to date is not adequate to understand the impacts of the Activity on its functions, interests or activities.	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos has provided the ECNT with sufficient information and a reasonable period to assess any possible impacts of the Activity for this EP on the ECNT's functions, interests and activities, and to provide any feedback it may have.	Santos noted this concern.	
The ECNT queried whether Santos's compliance measures to meet the Safeguard Mechanism requirements will be included in the Environment Plan.	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The EP includes control measures to reduce Scope 1 GHG emissions. Santos agrees that the EP must demonstrate compliance with the Safeguard Mechanism.	Santos explained that the assessment of Safeguard Mechanism is under the remit of the Clean Energy Regulator. However, it agreed that the Environment Plan must demonstrate compliance with the Safeguard Mechanism.	Section 6.3. EPO 11
The ECNT sought confirmation that CCS is not included in the Barossa Production Operations Environment Plan.	Santos has considered the matters raised by ECNT and provided a response to ECNT. Santos confirmed that CCS was not part of the Activity under the EP.	Santos confirmed CCS is not included in the Barossa Production Operations Environment Plan.	Not applicable

ECNT correspondence to Santos on 28 May 2024			
The ECNT: • reiterated concerns regarding adequacy of information ECNT have received in relation GHG emissions; • asserted that Santos has indicated it will only provide detailed information to NOPSEMA in the draft EP, but not to the ECNT, which the ECNT claims is inconsistent with the consultation requirements under the Regulations; • inferred that that Santos is referring the ECNT to information in the OPP, which the ECNT claims does not fulfil Santos' consultation obligations under the Regulations. • stated that it was engaging experts to assist in its assessment of how the activity may impact its functions, interests or activities.	Santos has considered the matters raised by ECNT in this EP and provided a response to the ECNT. To date it is noted that the ECNT has not provided any new information that had not already been provided to Santos. Santos has provided the ECNT with sufficient information and a reasonable period to assess any possible impacts of the Activity for this EP on the ECNT's functions, interests and activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	**Santos' correspondence to ECNT on 12 June 2024 in response to ECNT's letter of 28 May 2024** *Santos acknowledges that the ECNT is still preparing a response to its letter dated 14 May 2024.* *Santos understands the ECNT is seeking information about the GHG Management Plan. That plan includes management controls for Scope 1 GHG emissions at the FPSO including but not limited to flaring management, fugitive emissions management, emissions monitoring and adaptive management, emissions and reduction opportunity identification processes.* *There has been extensive correspondence exchanged over the course of consultation for the EP and EMP which commenced in February 2024. Santos has responded to requests for information from the ECNT on 28 March and 14 May. Since that time, Santos has also met with the ECNT on 20 May 2024. At that meeting, Santos answered the ECNT's questions and provided the ECNT with another opportunity to ask any further questions about the EP. No further questions were asked.* *In those circumstances, if the ECNT wishes to provide any additional input for this EP (including, if it considers that there are additional measures to be included), Santos requires this by no later than Thursday, 20 June 2024, noting this is 30 days following the meeting with Santos on 20 May 2024.* *If and when you provide any further input, please let us know if you request particular information you provide during consultation not be published. If you make this request, the information will not be published as part of the plan, in accordance with relevant legislation. Sensitive information we need to give to the regulator to assess our plan will be provided in a separate report, rather than in the published plan. Santos will handle your information in accordance with our Barossa Gas Project Consultation Privacy Policy.*	The operations GHGEMP is described in Section 8.3.2.13 of the EP Section 6.3 of the EP contains control measures to manage GHG emissions (see BAO-CM-6.3.1 to BAO-CM-6.3.24).
ECNT correspondence to Santos on 20 June 2024			

The ECNT reiterated concerns that it has been prevented from providing necessary input on the EP because Santos has not consulted in a meaningful way and has not discharged its regulatory consultation obligations. For example, the ECNT alleged that Santos has not provided the ECNT with sufficient:
1. time to effectively engage in consultation; and
2. information to fully understand the potential consequences of the Activity on its functions, interests or activities.
 	
The ECNT's specific concerns included:
• alleging Santos is withholding information from ECNT in a way that is inconsistent with consultation requirements;
• alleging Santos has not engaged in the substance of the ECNT's concerns, and the majority of the ECNT's questions remain unanswered;
• alleging Santos' letters of 30 April and 14 May 2024 did not provide sufficient information in response to a number matters relevant to the ECNT's functions, interests or activities – those matters include:
  ○ risks, impacts and control measures related to GHG emissions;
  ○ risks and impacts related to produced water; and
  ○ noise impacts on marine fauna.
(Paras 6 - 38)
	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT.
	The following sections of the EP assess impacts and risks related to produced water, GHG emissions and noise impacts to marine fauna; Section 6.8, Section 6.3 and Section 6.1
	Santos has provided the ECNT with sufficient information and a reasonable period to assess any possible impacts of the Activity for this EP on the ECNT's functions, interests and activities, and to provide any feedback it may have.
		Santos correspondence to ECNT on 7 August 2024
		[**Cover letter**]
		Thank you for your letter of 20 June 2024.
		Santos has considered the detailed contentions and further matters raised or restated by the ECNT.
		*For convenience, in the **attached** Annexure, we set out a response to the matters raised, including where and when Santos has previously provided information addressing the concerns and requests set out in your most recent letter. Santos is of the view that sufficient information has been provided to ECNT to allow ECNT to make an informed assessment of the possible consequences of the activity to be carried out under the proposed Production EP on any of ECNT's functions, interests or activities.*
		Santos thanks ECNT for its comments and submissions in your letter of 20 June 2024, and in previous correspondence and our meeting, in respect of the risks, impacts, and potential controls in relation to the activity. The matters raised by ECNT demonstrate that it has been able to engage comprehensively in the consultation process on the basis of the information provided by Santos. ECNT's complaints in respect of Santos' compliance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 are properly matters that will be before NOPSEMA for its consideration as expert Regulator.
		Santos is finalising the Production EP for submission in the coming weeks.
		[**Annexure**]
		• **[Paras [4]-[15]]** *Santos considers that sufficient information has been provided to ECNT to date to allow ECNT to make an informed assessment of the possible consequences of the proposed activity to be carried out under the Production EP on any of ECNT's functions, interests or activities.*
		As you would expect, Santos has carefully considered relevant decisions of the Federal Court of Australia and the Consultation Guideline. Santos disagrees with your apparent position that all information intended to be provided to NOPSEMA is required to be provided to ECNT in order to discharge the consultation requirement. Santos also disagrees with your contentions that ECNT has had insufficient time to consider the information provided, or that the process of consultation has otherwise been deficient.
		• **[Para [16]]** *The information set out in those paragraphs of the Annexure to Santos' 30 April 2024 correspondence identified in paragraph 16 of the ECNT Correspondence is information about the estimated annual Scope 1 and Scope 3 emissions associated with the proposed activity, and their management, in particular the information provided in the Production Operations information booklet on that topic. Contrary to paragraph 16, the reasoning is quite clear, which is that the ECNT can, using its specialist knowledge and the information provided about GHG emission estimates, make an informed assessment of the potential consequences with information at the level of detail already provided.*
		• **[Paras [17-20]]** *Thank you for this description of ECNT's functions, interests and activities. As the description makes clear, the central concern of ECNT in the present context is the identification of sources of GHG emissions, advocacy so as to avoid or reduce those emissions, and advocacy to describe and address any consequential climate change. ECNT evidently has specialist knowledge in the areas of GHG emissions and climate change. It is certainly the position that Santos has provided sufficient information about GHG*
			Section 6.1 Section 6.3 and section 6.8.

		emissions estimated to be associated with the activities to be carried out under the Production EP, so as to allow ECNT to make an informed assessment of the possible consequences of those activities. *Santos will be required to comply with the applicable baseline under the Safeguard Mechanism for the Barossa project set by the Australian Government in furtherance of Australia's Paris Agreement targets and associated emissions budget. The acceptability of environmental impacts of GHG emissions from the Activity will be evaluated in the EP, for assessment by the Regulator against the requirements of the Regulations. Santos' methodology for this evaluation of acceptability will be broadly consistent with the methodology adopted for previous Barossa EPs, as an example refer section 5.1 of the Barossa Subsea Infrastructure Installation Environment Plan.* *Further, Santos appreciates that your correspondence is largely directed to setting out numerous reasons why it advocates that the Production EP is likely to be deficient and that the Barossa Project should not proceed at all (for example, see [47]). Those matters have been considered by Santos. However, contrary to the tenor of ECNT's correspondence, the consultation requirement in ss 25(1)(d) and 25(2) does not require Santos to respond to all the objections raised, or to persuade ECNT of the merits of the proposal.* • **[Para [21]]** *Santos has provided ECNT with information in sufficient detail about each of the eight items identified specifically in paragraph 21. To the extent that additional or more detailed information has been prepared or is in the course of preparation in respect of the matters set out in those paragraphs of the Annexure to Santos' 30 April 2024 correspondence identified in paragraph 21 of the ECNT Correspondence, they are matters that (in Santos' view) are for Santos to present to NOPSEMA and for NOPSEMA to assess.* • **[Para [22](a)]** *Santos refers ECNT to paragraph 22c of the Annexure to Santos' 30 April 2024 correspondence in relation to the matters raised in paragraph 22(a) of the ECNT Correspondence, which refers to the information provided about GHG emissions and associated risks and impacts, and describes the GHG management plan.* • **[Para [22](b)]** *Santos refers ECNT to paragraph 22d of the Annexure to Santos' 30 April 2024 correspondence in relation to the matters raised in paragraph 22(b) of the ECNT Correspondence.* *In respect of ECNT's request for emissions breakdown by emission-type for the FPSO and DLNG facilities, raised in paragraph 22(b) of the ECNT Correspondence, Santos refers ECNT to paragraphs 22d and 22e of the Annexure to Santos' 30 April 2024 correspondence which responds to substantially identical requests for an emissions breakdown.* • **[Para [22](c)]** *Santos refers ECNT to paragraph 22aa of the Annexure to Santos' 30 April 2024 correspondence and Part VIII of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 22(c) of the ECNT Correspondence.* • **[Para [22](d)]** *Santos refers ECNT to paragraph 22ll of the Annexure to Santos' 30 April 2024 correspondence in relation to the matters raised in paragraph 22(d) of the ECNT Correspondence.* *Santos further refers ECNT to paragraph 83 of the Annexure to Santos' 14 May 2024 correspondence.* • **[Para [22](e)]** *Santos refers ECNT to paragraphs 22x and 22w of the Annexure to Santos' 30 April 2024 correspondence and Part VIII of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 22(e) of the ECNT Correspondence.* • **[Para [23](a)]** *Santos refers ECNT to paragraph 22cc of the Annexure to Santos' 30 April 2024 correspondence in relation to the matters raised in paragraph 23(a) of the ECNT Correspondence.* • **[Para [23](b)]** *Santos refers ECNT to paragraphs 22i, 22p, 22u, 22ff and 22gg of the Annexure to Santos' 30 April 2024 correspondence in relation to the matters raised in paragraph 23(b) of the ECNT Correspondence.* • **[Para [23](c)]** *Santos refers ECNT to paragraph 46 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 23(c) of the ECNT Correspondence.* • **[Para [23](d)]** *Santos refers ECNT to paragraph 22p of the Annexure to Santos' 30 April 2024 correspondence and Part C of the Annexure to Santos' 14 May 2024 in relation to the matters raised in paragraph 23(d) of the ECNT Correspondence.* • **[Para [23](e)]** *Santos refers ECNT to paragraph 22u of the Annexure to Santos' 30 April 2024 correspondence in relation to the matters raised in paragraph 23(e) of the ECNT Correspondence.* *Santos further refers ECNT to Part C of the Annexure to Santos' 14 May 2024 correspondence.* • **[Para [25]]** *Santos refers ECNT to paragraph 8 of the Annexure to Santos' 14 May 2024 correspondence and paragraphs 22g and 22h of the Annexure to Santos' 30 April 2024 correspondence in relation to the matters raised in paragraph 25 of the ECNT Correspondence.* • **[Para [26]]** *Santos refers ECNT to paragraph 12 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 26 of the ECNT Correspondence.* • **[Para [27]]** *Santos refers ECNT to paragraphs 13 and 21 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 27 of the ECNT Correspondence.* • **[Para [28](a)]** *Santos refers ECNT to paragraph 12 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 28(a) of the ECNT Correspondence.* *Santos further refers ECNT to Santos' response to paragraph [22](b) above.* • **[Para [28](b)]** *Santos refers ECNT to Santos' response to paragraph [22](a) above.* • **[Para [28](c)]** *Santos refers ECNT to paragraph 32 and Part C of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 28(c) of the ECNT Correspondence.* *Santos further refers ECNT to Santos' response to paragraph [22](d) and (e) above.*	

		• **[Para [28](d)]** *Santos refers ECNT to paragraph 65 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 28(d) of the ECNT Correspondence.* • **[Para [28](e)]** *Santos refers ECNT to Santos' response to paragraph [23](c), (d) and (e) above.* • **[Para [28](f)]** *Santos refers ECNT to paragraphs 32 and 36 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 28(f) of the ECNT Correspondence.* *Compliance with Santos' obligations under the Safeguard Mechanism may be achieved through (among other things) purchase or surrender of ACCUs or SMCs. Santos refers ECNT to page 22 of Santos' 2023 Annual Report, which provides further information on our generation and acquisition of carbon credits as follows:* *In 2023, Santos executed agreements to build a portfolio of projects supporting the development of five nature-based projects across Queensland, Alaska and Papua New Guinea, to generate carbon credits. Further, in 2023 Santos entered into forward contracts for the purchase of 2.5 million ACCUs at fixed prices to be delivered and paid between December 2023 and January 2027.* • **[Para [28](g)]** *Santos refers ECNT to paragraph 22m of the Annexure to Santos' 30 April 2024 correspondence in relation to the matters raised in paragraph 28(g) of the ECNT Correspondence.* • **[Para [28](h)]** *Santos refers ECNT to paragraph 32 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 28(h) of the ECNT Correspondence.* *Santos further refers ECNT to paragraph 22m of the Annexure to Santos' 30 April 2024 correspondence.* • **[Para [28](i)]** *Santos refers ECNT to paragraph 46 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 28(i) of the ECNT Correspondence.* *Santos further refers ECNT to paragraphs 22i and 22u of the Annexure to Santos' 30 April 2024 correspondence.* • **[Para [29]]** *Santos refers ECNT to paragraph 27 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 29 of the ECNT Correspondence.* • **[Para [30]]** *Santos refers ECNT to paragraphs 27 and 31 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 30 of the ECNT Correspondence.* • **[Para [31]]** *Santos refers ECNT to paragraphs 40, 60 and 61 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 31 of the ECNT Correspondence.* • **[Para [32](a)]** *Santos refers ECNT to paragraphs 8, 13-21 and 40 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 32(a) of the ECNT Correspondence.* • **[Para [32](b)]** *Santos refers ECNT to paragraphs 32 and 37 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 32(b) of the ECNT Correspondence.* • **[Para [32](c)]** *Santos refers ECNT to paragraph 65 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 32(c) of the ECNT Correspondence.* *Santos further refers ECNT to Santos' response to paragraph [28](d) above.* • **[Para [32](d)]** *Santos' consultation materials provide details of GHG emissions over the life of the project. The Australian Government via mechanisms such as the Safeguard Mechanism sets the controls on emissions within Australia, which Santos must comply with.* *Santos' international customers' home jurisdictions are signatories to the Paris Agreement. Therefore, Santos' international customers must comply with the requirements their respective governments set to achieve their Paris Agreement commitments.* *Santos has provided the ECNT with sufficient information to allow it to make an informed assessment of the possible consequences of the activity to be carried out under the proposed Production EP on any of ECNT's functions, interests or activities.* • **[Para [32](e)]** *Santos refers ECNT to paragraph 22m of the Annexure to Santos' 30 April 2024 correspondence and our response to [32](d) above in relation to the matters raised in paragraph 32(e) of the ECNT Correspondence.* • **[Para [32](f)]** *Santos refers ECNT to paragraphs 25 and 37 of the Annexure to Santos' 14 May 2024 correspondence and our response to [32](d) above in relation to the matters raised in paragraph 32(f) of the ECNT Correspondence, which respond to substantially identical requests in relation to emissions reduction targets.* • **[Para [32](g)]** *Santos refers ECNT to Santos' response to paragraphs [23](d) and [28](f) above.* • **[Para [32](h)]** *Santos refers ECNT to paragraph 22u of the Annexure to Santos' 30 April 2024 correspondence and paragraph 32 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 32(h) of the ECNT Correspondence in relation to the matters raised in paragraph [32](h) of the ECNT Correspondence.* • **[Para [32](i)]** *Santos refers ECNT to Santos' response to paragraph [29] above.* • **[Para 33]** *The GHG emissions associated with the end use of Barossa products are expected to be managed under the emissions framework each customer country has agreed through their Paris Agreement NDCs and/or net zero commitments.* *Santos has not made and does not make any comment with respect to whether South Korea and Japan are on track to meet Paris Agreement commitments.* • **[Para 34]** *Santos refers ECNT to Santos' response to paragraph [22](d) above.* • **[Para 35]** *Santos refers ECNT to paragraphs 22qq and 22rr of the Annexure to Santos' 30 April 2024 correspondence and paragraph 78 of the Annexure to Santos' 14 May 2024 correspondence in relation to the*	

		matters raised in paragraph 35 of the ECNT Correspondence, which responds to similar requests in relation to noise impacts of the activity. *Santos further refers ECNT to the Santos Dorado Development Offshore Project Proposal, published on NOPSEMA's website in July 2021, which contains at Attachment 11 the Noise Impacts on Marine Fauna document.* • **[Para 36]** *Santos refers ECNT to paragraph 22aa of the Annexure to Santos' 30 April 2024 correspondence and paragraph 85 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 36 of the ECNT Correspondence.* • **[Para 37]** *Santos refers ECNT to Santos' response to paragraph [21] above.* • **[Para 38]** *Santos refers ECNT to Santos' response to paragraph [16] above.* • **[All remaining paragraphs]** *The remaining paragraphs do not raise any requests for information.* *As per the response to paragraphs 17 to 20 above, Santos has considered the remaining matters in your correspondence. The consultation requirement in ss 25(1)(d) and 25(2) does not otherwise require Santos to respond to all of the objections raised, or to persuade ECNT of the merits of the proposal.*	
The ECNT reiterated concerns that, in the ECNT's view, the environmental impacts and risks of the GHG emissions associated with the Activity have not been reduced to ALARP or acceptable levels for the following reasons:	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The Activity's projected emissions are contextualised against established emissions budgets (national and global). Climate change is a global problem with the solution being led at the international level. The impacts on the climate cannot be attributed to one specific sector or activity. Management of the emissions from the Activity and in accordance with the Safeguard Mechanism will ensure that this Activity does not have an unacceptable impact on climate change, as the Scope 1 GHG emissions of the Activity are being considered as part of Australia's NDC and, therefore, also into the global trajectory to limit global warming in line with the Paris Agreement targets. Santos' assessment is that it has reduced impacts and risks from Activity GHG emissions to ALARP and acceptable levels.	*Santos has considered* [these] *matters.*	Section 6.3. BAO-CM-6.3.9 BAO-CM-6.3.10 BAO-CM-6.3.11 BAO-CM-6.3.12 BAO-CM-6.3.19 BAO-CM-6.3.20
The Activity is not consistent with warming limit scenarios and carbon budgets - in particular, the goals of the Paris Agreement and achievement of net zero by 2050 (paras 41 – 47);	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos has adopted environmental performance outcomes and control measures directed to minimising the potential of the Activity to contribute to the accumulation of GHG emissions globally. Even assuming that emissions from the Activity will cause an equivalent net increase in cumulative Australian and global emissions, this increase is comprises a nominal amount in the overall scheme of the national and international carbon budgets; and there is no correlation between where GHG emissions are released and where climate change impacts are felt.	*Santos has considered* [these] *matters.*	Section 6.3. BAO-CM-6.3.11 BAO-CM-6.3.12 BAO-CM-6.3.19 BAO-CM-6.3.20
Santos has not adequately assessed the indirect impacts of GHG emissions to climate change, including cumulative impacts (paras 48 – 55);	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The Barossa JV has adopted environmental performance outcomes and control measures directed to minimising the GHG emissions from the Activity. A range of controls have been considered for both direct (Scope 1) and indirect (Scope 3) emissions. Santos considers that GHG emissions have been reduced to ALARP and are acceptable for the reasons set out in section 6.3.5and 6.3.6. The EP addresses the concerns raised.	*Santos has considered* [these] *matters.*	Section 6.3. BAO-CM-6.3.9 BAO-CM-6.3.10 BAO-CM-6.3.11 BAO-CM-6.3.12 BAO-CM-6.3.19 BAO-CM-6.3.20
The ECNT asserted that Santos has not considered the physical risks to the project itself from climate change, given physical climate change effects are expected to worsen over the life of the project (para 56);	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Section 2.1 details that the FPSO and mooring system facility remain on station for the 25 year design life of the facility and is designed to withstand 10,000-year cyclonic metocean conditions.	*Santos has considered* [these] *matters.*	Section 2.1
Santos incorrectly interpreted the meaning 'significant impact' in the context of considering the project's GHG emissions impact on the environment (paras 57 – 60);	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos disagrees with this ECNT statement. The contribution of emissions from the Activity in this EP are contextualised against Australian and global net carbon budgets.	*Santos has considered* [these] *matters.*	Section 6.3
It is unclear what FPSO facilities have been optimised and how reduction of GHG emissions has occurred (paras 61 – 62);	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. As per correspondence provided on 8 March 2024 to ECNT – "A number of FPSO design features have been adopted that have resulted in >50%	• **[Para 62]** *Santos refers ECNT to paragraph 22h of the Annexure to Santos' 30 April 2024 correspondence in relation to the matters raised in paragraph 62 of the ECNT Correspondence, which responds to substantially identical requests in relation to FPSO emissions. Santos confirms that the Production EP Information Booklet is the most up to date information on expected Barossa reservoir emissions (noting that these are required to be net zero from start-up pursuant to the Safeguard mechanism obligations Santos is subject to).*	Section 6.3. BAO-CM-6.3.9 BAO-CM-6.3.10

	reduction in Scope 1 operational emissions than were estimated in the accepted Barossa OPP., which also listed what these were. Section 6.3 of the EP details the facility design and operations measures to reduce Scope 1 emissions to ALARP.	• **[All remaining paragraphs]** *The remaining paragraphs do not raise any requests for information.* *As per the response to paragraphs 17 to 20 above, Santos has considered the remaining matters in your correspondence. The consultation requirement in ss 25(1)(d) and 25(2) does not otherwise require Santos to respond to all of the objections raised, or to persuade ECNT of the merits of the proposal.*	
Santos has not proposed mitigation measures sufficient for the project's expected scope 1 and 3 GHG emissions. (paras 63 – 67);	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. The Barossa JV has adopted environmental performance outcomes and control measures directed to minimising the GHG emissions from the Activity. A range of controls have been considered for both direct (Scope 1) and indirect (Scope 3) emissions. The EP demonstrates that the proposed mitigation measures do reduce the potential impacts associated with GHG emissions to ALARP. Management of the emissions from the Activity and in accordance with the Safeguard Mechanism will ensure that this Activity does not have an unacceptable impact on climate change, as the Scope 1 GHG emissions of the Activity are being considered as part of Australia's NDC and, therefore, also into the global trajectory to limit global warming in line with the Paris Agreement targets. Santos' assessment is that the information booklet is sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP. In any event, since the ECNT's review of the EP, Santos has proposed additional control measures in relation to GHG emissions.	• **[Para 63]** *Santos refers ECNT to paragraph 25 of the Annexure to Santos' 14 May 2024 correspondence in relation to the matters raised in paragraph 63 of the ECNT Correspondence.* • **[All remaining paragraphs]** *The remaining paragraphs do not raise any requests for information.* *As per the response to paragraphs 17 to 20 above, Santos has considered the remaining matters in your correspondence. The consultation requirement in ss 25(1)(d) and 25(2) does not otherwise require Santos to respond to all of the objections raised, or to persuade ECNT of the merits of the proposal.*	Section 6.3. BAO-CM-6.3. 1 to BAO-CM-6.3.24
Santos has not clarified how it intends to comply with the Safeguard Mechanism, including but not limited to: • whether the FPSO and DLNG facility will be treated as the same facility or different facilities; • which production variables the best practice emissions intensity number or the defaults emissions intensity number will apply to; • the quantum of ACCUs it has purchased to date and expects to purchase for the project; (paras 68 – 77);	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos can confirm that it will comply with the Safeguard Mechanism, noting that treatment of Barossa GHG emissions is still to be finalised by the CER. Implementation and enforcement of the Safeguard Mechanism is the responsibility of the CER. The FPSO and DLNG facilities are separate joint ventures and are treated as separate facilities under the Safeguard mechanism and both must comply.	*Santos has considered* [these] *matters.*	Section 6.3. BAO-CM-6.3.9 BAO-CM-6.3.10 BAO-CM-6.3.11
Santos has not clarified the role of CCS/CCUs with regard to the Activity (paras 78 – 85); and	Santos has considered the matters raised by ECNT and provided a response to ECNT. Santos disagrees that there is any lack of clarity as to the position regarding CCS. Santos has confirmed to the ECNT that CCS is outside the scope of this EP.	*Santos has considered* [these] *matters.*	N/A
Santos has not clarified its approach to obtaining offsets under the Safeguard Mechanism, including whether these are removal, abatement or avoidance offsets (paras 86 – 94).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos can confirm that it will comply with the Safeguard Mechanism, noting that treatment of Barossa GHG emissions is still to be finalised by the CER. Implementation and enforcement of the Safeguard Mechanism is the responsibility of the CER.	*Santos has considered* [these] *matters.*	Section 6.3. BAO-CM-6.3.9 BAO-CM-6.3.10 BAO-CM-6.3.11
The ECNT asserted that compliance with the Safeguard Mechanism should not be considered a control measure (para 96).	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos can confirm that it will comply with the Safeguard Mechanism, noting that treatment of Barossa GHG emissions is still to be finalised by the CER. Implementation and enforcement of the Safeguard Mechanism is the responsibility of the CER.	*Santos has considered* [these] *matters.*	Section 6.3.
The ECNT asserted that the EP should not be submitted until Santos: • provides clarity regarding the application of the Safeguard Mechanism on the Barossa project, including:	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Acceptable levels of indirect (Scope 3) emissions from the Activity within Australia are set by the Safeguard Mechanism Baseline on Barossa facility emissions, in line with the Australian Government's NDCs under the Paris Agreement, whilst the acceptable levels of indirect (Scope 3) emissions from the Activity outside of Australia are set by customer countries within	*Santos has considered* [these] *matters.*	Section 6.3.

• clarification as to how the Safeguard Mechanism applies to the Barossa facilities and baselines for each facilities; • the means in which it will manage excess emissions requirements under the scheme; • disclosing details regarding the offsets it has already obtained for scope 1 GHG emissions; and • clarifies the role of CCS/CCUS. (para 97).	the context of their own NDCs under the Paris Agreement or mid-century net zero commitments and associated emissions reduction policies and regulations, noting that the emissions would arise regardless of the source of the gas being consumed (ie if gas was not supplied from Barossa, it would be supplied from elsewhere to meet customer and customer country demand). Santos can confirm that it will comply with the Safeguard Mechanism, noting that treatment of Barossa GHG emissions is still to be finalised by the CER. Implementation and enforcement of the Safeguard Mechanism is the responsibility of the CER.CCS is outside the scope of this EP.		
ECNT correspondence to Santos on 25 November 2024			
ECNT re-stated it is the peak community sector environment organisation in the Northern Territory. ECNT re-stated it is a Relevant Person for the purposes of reg 11A(1) of the OPGGS(E)R and its function to advocate for the nature, climate and environment of the NT, part of which is geographically covered by the EMBA of the draft EP. Asserted that it has been unable to make an informed assessment of the possible consequences of the activity on its functions, interests or activities.	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos' does not agree with ECNT's assertion that it has been unable to make an informed assessment of the possible consequences of the activity on its functions, interests or activities. Santos has made genuine attempts to consult constructively with the ECNT on this EP since February 2024, notwithstanding that: • the ECNT's stated objective to 'Stop Barossa Gas' and that its interests and activities appear directed to stopping the activity under the EP from occurring at all which is inconsistent with the purpose of the consultation and the object of the legislation. • ECNT's action in both delaying the 25 November letter to Santos and in withholding information raised in its 22 October letter to NOPSEMA – indicate that ECNT has failed to engage in a meaningful two-way conversation and consult in good faith in line with the purpose of consultation. Santos has repeatedly invited the ECNT to provide to provide input and information relevant to the mitigation of environmental impacts and risks, which Santos may not be aware of, and to provide any comments it may have in relation to potential measures that the ECNT wishes Santos to consider adopting in order to mitigate environmental impacts and risks; the ECNT has largely not engaged. Further, the ECNT has not demonstrated how its functions, interests and activities may be affected by the relevant activities. Santos has, nonetheless, continued its efforts to consult and engage constructively with the ECNT regarding the relevant activities, including now engaging with the information that the ECNT has withheld from Santos. Santos has provided the ECNT with sufficient information and a reasonable period to assess any possible impacts of the Activity for this EP on the ECNT's functions, interests and activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	**Santos' correspondence to ECNT on 20 December 2024 in response to ECNT's letter of 25 November 2024 as well as correspondence sent by ECNT separately on 22 October 2024 to NOPSEMA.** ***ECNT's letter to NOPSEMA*** *During the course of NOPSEMA's assessment of Revision 1 of the EP, Santos has been provided with a copy of a letter from the ECNT to NOPSEMA dated 22 October 2024 (22 October letter to NOPSEMA).* *We observe as follows:* *1. Prior to the 25 November letter to Santos, Santos' last correspondence with the ECNT in relation to the EP was on 7 August 2024.* *2. During the 3.5 months between 7 August 2024 and 25 November 2024, Santos received no response from the ECNT in relation to its letter of 7 August 2024.* *3. Santos was not copied on the ECNT's 22 October letter to NOPSEMA, nor did the ECNT subsequently provide Santos with a copy.* *4. More than a month later, the ECNT sent its 25 November letter to Santos.* *5. The majority of that 25 November letter to Santos contains the same content (with minimal amendments) from the ECNT's 22 October letter to NOPSEMA. That is, there are no substantively new assertions made by ECNT in the 25 November letter to Santos that were not made in the 22 October letter to NOPSEMA.* *6. In fact, substantive comments and assertions regarding the EP which were made by the ECNT in the 22 October letter to NOPSEMA were not included by the ECNT in its 25 November letter to Santos.* *7. Further, the 22 October letter to NOPSEMA contains comments and assertions which have never been made by the ECNT to Santos in any of the consultation across more than 6 months – including five substantive exchanges of letters between the ECNT and Santos regarding the EP. These comments and assertions in the 22 October letter to NOPSEMA include that:* *a. Santos has failed to adequately account for fugitive methane emissions at the DLNG plant in the EP, including that Santos:* *i. has failed to engage with recent research findings regarding the under-reporting of fugitive methane emissions; and* *ii. is required, at a minimum, to commit to both direct (at the offshore facility) and indirect (at DLNG) fugitive emissions monitoring for the activity, as well as become a signatory to the Oil & Gas Methane Partnership 2.0; and* *b. there must be a case made in the EP that the environmental impacts and risks of the activity will not forego the health, diversity and productivity of the environment for future generations, as required by a consideration of ESD principles, and that because Santos has failed to account for climate change impacts which partially result from the GHG emissions generated by the activity, it has failed to do so.* *8. Additionally, in the 22 October letter to NOPSEMA, the ECNT has referred to various reports and scientific research which it considers relevant to the assessment of GHG emissions associated with the activities the subject of the EP. Such materials were not referred to in previous correspondence with Santos, or raised during consultation, despite Santos previously inviting the ECNT to provide information and raise control measures which it considers would be appropriate to adopt when preparing the EP for submission to NOPSEMA.* *9. The first time that Santos was made aware of the 22 October letter to NOPSEMA was on 27 November 2024, when Santos was provided with a copy by NOPSEMA.* *Santos is concerned that the matters above – including most notably the ECNT's action in both delaying the 25 November letter to Santos and in withholding information raised in its 22 October letter to NOPSEMA – indicate that ECNT has failed to engage in a meaningful two-way conversation and consult in good faith in line with the purpose of consultation.*	N/A

		As the ECNT has itself identified, a core purpose of consultation under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (Cth) (Regulations) is to ensure that Relevant Persons have an opportunity to provide input and information relevant to the mitigation of environmental impacts and risks, which titleholders and NOPSEMA may otherwise not be aware of. Santos has repeatedly invited the ECNT to provide any such information, and to provide any comments it may have in relation to potential measures that the ECNT wishes Santos to consider adopting in order to mitigate environmental impacts and risks. *The ECNT has largely not engaged with this invitation, and asserts in its 25 November letter to Santos that the quality of information provided by Santos during consultation has:* *'prevented ECNT from fully understanding the potential consequences of the Activity on its FIAs and from effectively engaging in the consultation process and allowing us to provide the necessary input, including regarding additional control measures, needed to fulfil the content requirements of Santos' Production EP.'* *More than a month before making this assertion to Santos, the ECNT suggested in the 22 October letter to NOPSEMA that Santos ought to commit to direct (at the offshore facility) and indirect (at DLNG) fugitive emissions monitoring. That is, the ECNT has, in effect, suggested to NOPSEMA that an additional control measure be considered. The ECNT has made no effort to raise this potential control measure with Santos.* *Santos reiterates that throughout the course of consultation with the ECNT on the EP, since February 2024, Santos has made genuine attempts to consult constructively with the ECNT, notwithstanding the ECNT's stated objective to 'Stop Barossa Gas' and that its interests and activities appear directed to stopping the activity under the EP from occurring at all which is inconsistent with the purpose of the consultation and the object of the legislation.* *In particular the object of the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth) is to provide an effective regulatory framework for petroleum exploration and recovery and the object of the Regulations is to ensure that any petroleum activity carried out in an offshore area is:* • *carried out in a manner consistent with the principles of ecologically sustainable development set out in section 3A of the EPBC Act; and* • *carried out in a manner by which the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable; and* • *carried out in a manner by which the environmental impacts and risks of the activity will be of an acceptable level.* *The ECNT's conduct in relation to consultation and its role in the "Stop Barossa Gas" Campaign is indicative of a broader objective to materially either delay or prevent the Barossa Gas Project from proceeding as opposed to reducing the environmental impacts and risks of the relevant activities to as low as reasonably practicable and acceptable. Further, the ECNT has not demonstrated how its functions, interests and activities (FIA) may be affected by the relevant activities.* *Santos has, nonetheless, continued its efforts to consult and engage constructively with the ECNT regarding the relevant activities, including now engaging with the information that the ECNT has withheld from Santos.*	

ECNT provided a summary of its consultation with Santos:
 	
Asserted that publication of the Draft EP on NOPSEMA's website is the first time ECNT has had access to certain information of sufficient particularity informing its ongoing assessment of the possible consequences of the activity and proposed control measures.
 	
Asserted that Santos has repeatedly refused to answer its requests for specific information, instead referring ECNT to its information booklet or the Offshore Project Proposal.
 	
Asserted that Santos previously indicated it would only consult with ECNT between 11 March and 9 April 2024 and had refused to extend this consultation period at ECNT's requests.
 	
Asserted that Santos had, by meeting with ECNT on 20 May 2024 and on 12 June 2024 inviting further feedback by 20 June 2024, unilaterally changed the timeframes in which ECNT could engage in consultation, which was not in line with
	Santos has responded to ECNT.
	Santos remains of the view that Santos has properly consulted with the ECNT to the standard required under section 25 of the Regulations.
	Santos has made genuine attempts to consult constructively with the ECNT on this EP since February 2024 and has repeatedly invited the ECNT to provide to provide input and information relevant to the mitigation of environmental impacts and risks, which Santos may not be aware of, and to provide any comments it may have in relation to potential measures that the ECNT wishes Santos to consider adopting in order to mitigate environmental impacts and risks; the ECNT has largely not engaged.
	The EP has been publicly available to the ECNT since 1 October 2024 when the ECNT, together with all other recipients of the Barossa Quarterly Project Update, received a link to the EP as published on NOPSEMA's website in the October Quarterly Update circulated on 15 October 2024.
	It is evident from the content on ENCT's recent letters to Santos and NOPSEMA that he ECNT had considered the substance of the published EP and even with this additional information, the ECNT did not provide Santos any input regarding additional control measures, but in bad faith chose to raise such matters with NOPSEMA.
	Santos has made genuine attempts to consult constructively with the ECNT on this EP since February 2024, this included continuing to consult with ECNT on dates set out as well as other dates as set out in this EP.
	Santos has provided the ECNT with sufficient information and a reasonable period to assess any possible impacts of the Activity for this EP on the ECNT's functions, interests and activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP
		Consultation in preparation of EP
		Each of the ECNT's letters conveys the ECNT's views as to the adequacy of consultation to date. Santos has considered the ECNT's views and remains of the view that Santos has properly consulted with the ECNT to the standard required under section 25 of the Regulations.
		In particular:
		• *Santos generally disagrees with the matters alleged at paragraphs 5 and 7-10 of the 25 November 2024 letter to Santos, and notes that many of these matters are plainly incorrect or misleading on the face of consultation to date. For example:*
		  ○ *the record of consultation set out at paragraph 5 of the 25 November letter to Santos is incomplete and fails to mention various other correspondence and the meeting between Santos and the ECNT on 20 May 2024. For a full summary of consultation up until September 2024, please see pages 350-351 of the EP; and*
		  ○ *contrary to paragraph 9 of the 25 November letter to Santos, Santos provided further information in response to queries from the ECNT on numerous occasions, including in letters dated 30 April 2024, 14 May 2024 and 7 August 2024.*
		• *Santos generally disagrees with the allegations at paragraphs 7 and 8-9 of the 25 November letter to Santos. We note that in any event, the EP has been publicly available to the ECNT since on or around 1 October 2024. The ECNT, together with all other recipients of the Barossa Quarterly Project Update, received a link to the EP as published on NOPSEMA's website in the October Quarterly Update circulated on 15 October 2024.*
		• *Further, the comments included in the 25 November letter to Santos indicate that the ECNT has engaged with the contents of the EP. Indeed it is evident from the content replicated between the ECNT's 22 October letter to NOPSEMA and 25 November letter to Santos that by at least 22 October 2024, the ECNT had considered the substance of the published EP. Santos notes that even with this additional information, the ECNT did not provide or foreshadow to Santos any input regarding additional control measures (as is suggested at paragraph 10 of the 25 November letter to Santos), but in bad faith chose to raise such matters with NOPSEMA.*
			N/A

NOPSEMA's Consultation Guidelines. Asserted that, because of Santos' approach, ECNT has been prevented from effectively engaging in consultation and been prevented from being able to seek input from experts. Asserted that the primary information ECNT has had available to it is Santos' 36-page booklet, despite repeated advice to Santos that the booklet did not contain information of sufficient specificity for ECNT to make an informed assessment about the impacts of the Activity and Santos had refused to provide further information. Asserted that information Santos has provided has been vague, evasive and lacking in sufficient detail for ECNT to be adequately informed of the environmental impacts and risks of the Activity and this had prevented it from effectively engaging in the consultation process			
ECNT asserted that the information provided by Santos during consultation was in many cases inconsistent with that provided in the Draft EP. Asserted that information related to the greenhouse gas emissions of the Activity is contradictory, both within the draft EP and from the information provided in the Information Booklet. (**Note**: ECNT included a table in its letter which is provided in in entirety in the Sensitive Information Report attached to this EP). Asserted that the table provided indicates the EP contains inconsistent estimates of the greenhouse gas GHG emissions of the activity. Asserted that the Scope 3 emissions estimates are so different as to potentially indicate a substantial flaw or uncertainty in emissions figures calculations. Asserted that this discrepancy reflects a broader failure to appropriately consult us on this matter and a failure to meet the requirements of the EP.	Santos has responded to ECNT. Santos accepts that different estimates have been provided in the information booklet and in the EP, but considers the allegations that: • the estimates are 'inconsistent'; and • the different impacts has impacted the ECNT in consultation, have no merit. This is because the annual emissions estimates provided in the information booklet are conservative and prepared for the purpose of impact and risk assessment. The EP includes greenhouse gas estimates for both Scope 1 and scope 3 emissions including the assumptions that underpin the estimates. In any event, in circumstances where the GHG emissions estimates in the EP are lower than the estimates provided in the information booklet, the ECNT has been able to make an informed assessment of any potential consequences of GHG emissions on its functions, interest or activities because the GHG emissions of the activity are actually less than what ECNT understood them to be. It is not clear what impact any such discrepancy has had on the ECNT's understanding of potential consequences of GHG emissions, and it is notable that the ECNT has not identified the basis of any such impact.	***Information provided during consultation*** *Regarding the ECNT's claim that "information provided during consultation is in many cases inconsistent with that provided in the EP", Santos notes that the ECNT has previously raised similar claims in correspondence to Santos on 25 March 2024 and 9 April 2024 to which Santos responded in letters to the ECNT on 30 April 2024 and 14 May 2024 respectively.* *Further to responses provided in previous correspondence to the ECNT, Santos re-iterates the following points:* • *The annual emissions estimates included in the Production Operations information booklet are applicable to the Production Operations Activity (Activity). The annual emissions estimates provided in the information booklet are conservative (when extrapolated for 25 years of production operations) given annual emissions are expected to reduce over the life of the Activity as production rates decline.* • *Emissions estimates provided in the information booklet and the EP are prepared for the purpose of the impact and risk assessment and control measure evaluation, based on the best available information and assumptions at the time of preparing the EP, but are not a definitive forecast of future actual emissions. Actual emissions during production operations will be reported as per applicable regulatory requirements of the National Greenhouse and Energy Reporting Act 2007 (Cth) (NGER Act).* • *While the ECNT's observations about apparent discrepancies between GHG emissions in the information booklet and the EP are noted and have been considered by Santos, to the extent that there is any potential impact on the ECNT's FIAs as a result of GHG emissions, the ECNT is able to make an informed assessment of that impact with the information set out in the information booklet, which adopted more conservative assumptions.* • *In any event, the simple fact is that the GHG emissions estimates in the EP are lower than the estimates provided in the information booklet, for the 25 year lifecycle of Barossa production operations (commissioning and steady state operations). We assume that the ECNT is not suggesting that it has not been able to make an informed assessment of any potential consequences of GHG emissions on its FIAs because the GHG emissions of the activity are actually less than what ECNT understood them to be. It is not clear what impact any such discrepancy has had on the ECNT's understanding of potential consequences of GHG emissions, and it is notable that the ECNT has not identified the basis of any such impact.* *In any event, the ECNT explicitly notes at paragraph 40 of its 22 October letter to NOPSEMA that its views as to the acceptability of GHG emissions from Barossa are the same 'regardless of which estimate is used', again indicating that the ECNT has no intention of consulting in good faith or for the proper purpose of consultation under the Regulations..*	Estimated direct (Scope 1) emissions and estimated indirect (Scope 3) emissions is provided in Section 6.3
0	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. Santos responded to previous ECNT requests for the GHGEMP and considers sufficient information has been provided in the information booklet and the EP. Section 8.3.2.13 of the EP describes the GHGEMP, which includes for: • emissions performance target setting	*Regarding the ECNT's request for a copy of the GHG Emissions Management Plan (GHGEMP), Santos notes that the ECNT has previously raised similar claims in correspondence to Santos on 25 March 2024 and 9 April 2024 to which Santos responded in letters to the ECNT on 30 April 2024 and 14 May 2024 respectively.* *Further to responses provided in previous correspondence to the ECNT, Santos re-iterates the following points:* • *The Production Operations information booklet (and the EP) provide a description of the purpose of the GHGEMP. The EP also describes the measures that will be adopted in the GHGEMP to keep direct emissions to ALARP and acceptable levels and in accordance with Santos' obligations under the Safeguard Mechanism. Accordingly, Santos does not consider the ECNT requires a copy in order to make*	A summary of the Operations GHGEMP is provided in Section 8.3.2.13 Estimated direct (Scope 1) emissions and estimated indirect (Scope 3) emissions is provided in Section 6.3

	• critical equipment maintenance • Methane Emissions Management • Decarbonisation opportunity management Further, for the reasons set out in the row above, Santos does not agree with ECNT's claim that certain differences in greenhouse gas emissions estimates provided in the Information Booklet and in the EP are such that ECNT requires a copy of the GHGEMP in order to make an informed assessment of the potential consequences of the activity on any of its FIAs.	*an informed assessment of the potential consequences of the activity on any of its FIAs which remain unspecified.* *The Production Operations information booklet (and the EP) detail the potential risks and impacts related to GHG emissions. The ECNT is necessarily familiar with these potential risks and impacts. through previous consultation with Santos on other activities for Barossa.*	BAO-CM-6.3.12
ECNT requested clarity relating to the use of CCS and whether it is expected to be used as an emissions mitigation technology at any point over the lifecycle of the Activity.	Santos has considered the matters raised by ECNT in the EP and provided a response to ECNT. It is noted that Santos has previously responded to ECNT's request for information regarding CCS as a mitigation technology. Santos re-iterates that CCS projects are not owned or controlled by the Barossa joint venture, and not considered within the EP. Control measures and their evaluation including consideration of their adoption or not as a control are in Table 8-2, which includes the evaluation of CCS. The EP does not describe or include undertaking CCS activity.	*Regarding the ECNT's requests for further information about use of CCS as a control measure, Santos notes that the ECNT has previously raised similar claims in correspondence to Santos on 25 March 2024, 9 April 2024 and 20 June 2024 to which Santos responded in letters to the ECNT on 30 April 2024, 14 May 2024 and 7 August 2024 respectively; and at a meeting between the ECNT and Santos on 20 May 2024.* *Further to responses provided in previous correspondence to the ECNT, Santos re-iterates that while Santos is exploring CCS opportunities at Bayu-Undan and elsewhere, these CCS projects are not owned or controlled by the Barossa joint venture, are not part of the Barossa development and are not within the scope of the Production Operations EP.*	The impact and risk assessment and proposed management of GHG is in Section 6.3 Evaluation of control measures are in Table 8-2.
ECNT asserted that Santos had failed to demonstrate compliance with relevant legislation, including the Commonwealth Safeguard Mechanism and related rules and regulations. Asserted that the only attempt made by Santos to demonstrate compliance with the Safeguard Mechanism is the claim that DCCEEW has provided an assurance that sufficient ACCUs or SMCs are available until 2035. Asserted that Santos has not demonstrated how many offsets will be required to be purchased, the source of these offsets, nor the integrity of these offsets. If the Proponent proposes to purchase offsets for the duration of the lifecycle of the Activity, information should be provided regarding the source and guarantees as to the integrity of these offsets. Asserted that a representative of Santos had stated before the Middle Arm Industrial Precinct Senate Inquiry that Santos had only secured forward contracts for the purchase of 2.5 million ACCUs at fixed prices to be delivered and paid between December 2023 and January 2027. Asserted that this amount of ACCUs is not sufficient to fully offset reservoir and reduce other Scope 1 emissions for the first two years of the life of the Activity according to Santos' estimates for the lifetime of the Activity. Stated that ECNT wrote to Santos on 25 March 2024 seeking clarity regarding the ability for the Activity to be compliant with the Safeguard Mechanism but Santos had not answered its queries and this, is failure to demonstrate compliance with relevant legislation.	Santos has considered the matters raised by ECNT in this EP and provided a response to ECNT. It is noted that the ECNT has previously raised similar claims regarding concerns about Santos' failure to adequately attempt to demonstrate compliance with the Commonwealth Safeguard Mechanism, which Santos has previously responded to. Santos confirms that it will comply with the Safeguard Mechanism, noting that treatment of Barossa GHG emissions is still to be finalised by the CER. Implementation and enforcement of the Safeguard Mechanism is the responsibility of the CER. Section 6.3 provides a summary of the Safeguard mechanism and how Santos will comply. Environmental performance outcomes and control measures have been adopted including: • EPO-11 Undertake the Activity in a manner that is compliant with the requirements of the Safeguard Mechanism. • BAO-CM-6.3.10 Net -zero reservoir emissions through the purchase and/or surrender of Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs) • BAO-CM-6.3.11 Purchase and/or surrender of Australian carbon credit units or SMCs required under the NGER (Safeguard Mechanism) Regulation Rule 2015 (as may be amended from time to time) for any non-reservoir emissions from the Barossa facility above the annual baseline, as determined by the Clean Energy Regulator.	*Regarding the ECNT's concerns about Santos' failure to adequately attempt to demonstrate compliance with the Commonwealth Safeguard Mechanism, Santos notes that the ECNT has previously raised similar claims in correspondence to Santos on 25 March 2024, 9 April 2024 and 20 June 2024 to which Santos responded in letters to the ECNT on 30 April 2024, 14 May 2024 and 7 August 2024 respectively; and at a meeting between the ECNT and Santos on 20 May 2024. In any case, it is not a requirement of the consultation process for Santos to demonstrate compliance with the Commonwealth Safeguard Mechanism to the ECNT. Santos' obligation is to demonstrate compliance with the Commonwealth Safeguard Mechanism to the Clean Energy Regulator.* *Further to responses provided in previous correspondence to the ECNT, Santos re-iterates the following points:* • *Barossa Production Operations Scope 1 emissions will be managed in accordance with the applicable baseline under the Safeguard Mechanism, which has been developed by the Australian government with regard to Australia's Paris Agreement targets and associated emissions budget. The NT emissions budget is accounted for in Australia's national emissions budget.* • *The treatment of the Barossa project under the Safeguard Mechanism is a matter for the Clean Energy Regulator. Santos will abide by the Clean Energy Regulator's final determination.* • *There are various options available to meet legislative requirements under the Safeguard Mechanism rules. Compliance with obligations under the Safeguard Mechanism may be achieved through (among other things) the purchase or surrender of Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs). In 2023, Santos entered into forward contracts for the purchase of 2.5 million ACCUs at fixed prices to be delivered and paid between December 2023 and January 2027.* *Santos is not required by the law to indicate now whether in any given year or years (which may be decades in the future) it may apply for a borrowing adjustment, trade-exposed baseline-adjusted facility determination or multi-year monitoring period. Santos will be required to comply with the applicable baseline for the Barossa project in each compliance year, as determined by the Clean Energy Regulator.*	Section 6.3 describes the safeguard mechanism and how Santos will comply EPO-11 has been adopted The following control measures have been included regarding the Safeguard Mechanism BAO-CM-6.3.10 BAO-CM-6.3.11
ECNT requested further consultation with Santos to seek further clarity on the concerns outlined in its letter (of 25 November 2024).	Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT. Santos has made genuine attempts to consult constructively with the ECNT on this EP since February 2024 and has repeatedly invited the ECNT to provide to provide input and information relevant to the mitigation of environmental impacts and risks, which Santos may not be aware of, and to provide any comments it may have in relation to	*Santos notes the ECNT's request at paragraph 27 of the 25 November letter to Santos for further consultation in order to seek clarity on the concerns set out in the ECNT's letter. For the reasons set out above, Santos disagrees that there is any uncertainty impacting the ECNT's ability to make an informed assessment of any consequences of the activity under the EP on any of its FIAs. Nor is it clear to Santos what further consultation is sought. Indeed, it is a matter of longstanding and extensive public record that the ECNT has already formed an unequivocal assessment about the Barossa Development and associated activities. As just one of many examples, the website stopbarossagas.org clearly states, among other things, in relation to the Barossa Gas Project, that "our planet*	N/A

	potential measures that the ECNT wishes Santos to consider adopting in order to mitigate environmental impacts and risks; the ECNT has largely not engaged. Santos has provided the ECNT with sufficient information and a reasonable period to assess any possible impacts of the Activity for this EP on the ECNT's functions, interests and activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*can't afford another huge gas development." The website also states that the Stop Barossa Gas campaign is a collaboration between the ECNT, Jubilee Australia Research Centre, Solutions for Our Climate (KO) and Japan Centre for a Sustainable Environment and Society.* *Having regard to the matters outlined above in relation to the ECNT's 22 October letter to NOPSEMA, Santos does not consider that the ECNT's request for further consultation is genuine or required. The ECNT is acutely aware that Santos is targeting commencing operations under the EP in 2025. Santos has been transparent about its (more than reasonable) timeframes for consultation.*	
The following are comments and assertions made in ECNT's correspondence to NOPSEMA on 22 October 2024 that were not included in ECNT's letter to Santos on 25 November 2024.			
[7] The publication of the EP is the first time the ECNT has been provided with information of sufficient particularity to be able to make an informed assessment of the possible consequences of the activity and proposed control measures.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT. Santos' assessment is that the information booklet is sufficient for the ECNT to assess impacts of the Activity on its functions, interests or activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP. The EP has been publicly available to the ECNT since 1 October 2024 when the ECNT, together with all other recipients of the Barossa Quarterly Project Update, received a link to the EP as published on NOPSEMA's website in the October Quarterly Update circulated on 15 October 2024. It is evident from the content on ENCT's recent letters to Santos and NOPSEMA that the ECNT had considered the substance of the published EP and even with this additional information, the ECNT did not provide Santos any input regarding additional control measures, but in bad faith chose to raise such matters with NOPSEMA. Santos also notes that in the 22 October letter to NOPSEMA, the ECNT confirms that the ECNT was provided with the information in the EP, and that information is 'of sufficient particularity to be able to make an informed assessment of the possible consequences of the activity and proposed control measures'. Santos has made genuine attempts to consult constructively with the ECNT on this EP since February 2024, notwithstanding that: • the ECNT's stated objective to 'Stop Barossa Gas' and that its interests and activities appear directed to stopping the activity under the EP from occurring at all which is inconsistent with the purpose of the consultation and the object of the legislation. • ECNT's action in both delaying the 25 November letter to Santos and in withholding information raised in its 22 October letter to NOPSEMA – indicate that ECNT has failed to engage in a meaningful two-way conversation and consult in good faith in line with the purpose of consultation. Santos has provided the ECNT with sufficient information and a reasonable period to assess any possible impacts of the Activity for this EP on the ECNT's functions, interests and activities, and to provide input to Santos about the environment that may be affected by the Activity and/or additional proposed control measures for consideration by Santos in the course of preparing the EP.	*Santos notes that in the 22 October letter to NOPSEMA, the ECNT confirms that the ECNT was provided with the information in the EP, and that information is 'of sufficient particularity to be able to make an informed assessment of the possible consequences of the activity and proposed control measures'.* *The equivalent paragraph in the 25 November letter to Santos has been amended such that it no longer contains this confirmation, with the ECNT maintaining (to Santos) that it still does not have sufficient information.* *While Santos maintains that information provided to the ECNT during consultation (before the publication of the EP) met Santos' regulatory obligations, Santos notes that in any event, the ECNT by at least 22 October 2024 considered it had sufficient information to make an informed assessment of the potential consequences of the activity on its FIAs.* *It is a matter of longstanding and extensive public record that the ECNT has already formed an unequivocal assessment about the Barossa Development and associated activities. As just one of many examples, the website stopbarossagas.org clearly states, among other things, that "Our planet can't afford another huge gas development." The website also states that the Stop Barossa Gas campaign is a collaboration between the ECNT, Jubilee Australia Research Centre, Solutions for Our Climate (KO) and Japan Centre for a Sustainable Environment and Society.*	N/A
[19] It would be unlawful for NOPSEMA to accept the EP.	It is not appropriate for ECNT or Santos to comment, NOPSEMA must accept the EP if it is reasonably satisfied that the EP meets the EP acceptance criteria.	*It is not a matter for the ECNT to determine or opine on whether or not it would be unlawful for NOPSEMA to accept the EP. Santos considers such a statement to constitute an implied threat to NOPSEMA (and therefore Santos) that the ECNT may litigate if NOPSEMA decides to accept the EP in any circumstances.* *Under the law, NOPSEMA must accept the EP if it is reasonably satisfied that the EP meets the EP acceptance criteria. There is no requirement under the law for the ECNT to be satisfied.*	N/A
[21-[24] There are a number of inconsistencies, deficiencies and inadequacies in the EP that demonstrate that the EP cannot be accepted by NOPSEMA.	It is not appropriate for ECNT or Santos to comment, NOPSEMA must accept the EP if it is reasonably satisfied that the EP meets the EP acceptance criteria.	*It is not a matter for the ECNT to determine or opine on why the EP cannot be accepted by NOPSEMA. Santos considers such a statement to constitute an implied threat to NOPSEMA (and therefore Santos) that the ECNT may litigate if NOPSEMA decides to accept the EP.* *Under the law, NOPSEMA must accept the EP if it is reasonably satisfied that the EP meets the EP acceptance criteria. There is no requirement under the law for the ECNT to be satisfied.* *Consultation under section 25 does not require a titleholder to demonstrate to a Relevant Person that the acceptance criteria in section 34 have been satisfied. Nor is NOPSEMA required to demonstrate this to a Relevant Person.*	N/A

[31] As the existence of the GHGEMP is a key control measure, it is unacceptable that it is not included in the EP itself and is not yet finalised or approved. These factors render the plan unsuitable as a control measure.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT. Santos responded to previous ECNT requests for the GHGEMP and considers sufficient information has been provided in the information booklet, the correspondence and the EP. Section 6.3.3 of the EP provides an assessment of the environmental benefits, potential costs or issues and evaluation of control measures. A control measure (BAO-CM-6.3.12) has been adopted to implement a GHGEMP to manage and reduce direct emissions from facility operations to ALARP over the life of the Activity. Section 8.3.2.13 of the EP describes the GHGEMP, which includes: • Emissions performance target setting • Critical equipment maintenance • Methane emissions management • Decarbonisation opportunity management	*The suitability or otherwise of the GHGEMP is a matter for NOPSEMA to consider in its assessment of the EP. As outlined in the EP at sections 6.3.5.2 and 8.8.9, the GHGEMP governs management of GHGs more broadly than in relation to activities which will be regulated under the EP and accordingly which are within NOPSEMA's jurisdiction.* *In any event, it is common for titleholders to give effect to control measures under EPs through policies or documents which are not themselves included in the EP.* *The fact that the GHGEMP itself is not included in the EP does not render it ineffective as a control measure. BAO-CM-013sets out the key measures that the GHGEMP will implement (which are described in considerable detail in Section 8.8.9), which Santos will be bound to comply with as a control measure under the EP.* Note: Section references have been updated after the letter was sent, refer to EP reference column for updated reference.	Section 6.3.3 environmental performance outcomes and control measures BAO-CM-6.3.12 Section 8.3.2.13 implementation strategy for the GHGEMP
[32] Santos has not adequately accounted for fugitive emissions in the EP. Santos has not attempted to account for fugitive emissions at DLNG.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT. Santos does not agree that it has not adequately accounted for fugitive emissions in the EP. Fugitive emissions from pressurised equipment, emitted by infrequent operational activities or unplanned equipment leaks have been considered. Section 6.3.2 provides a table listing Scope 1 fugitive emissions estimates during steady state operations and maintenance. Santos will implement an Operations GHG Emissions Management Plan (BAO-CM-6.3.12) to reduce facility direct GHG emissions to ALARP over the life of the Activity, inclusive of methane (fugitive) emissions management. In addition further EPSs have been added which provide further commitments regarding monitoring of fugitive emissions. Section 6.3 acknowledges that emissions associated with processing Barossa gas at DLNG are scope 3 emissions of the Activity, and evaluates these emissions accordingly. While GHG, including fugitive, emissions associated with Barossa gas are evaluated in this EP, DLNG is owned and operated by a separate joint venture to the Barossa joint venture and does not form part of the Activity to be authorised in this EP. As set out in Section 6.3, fugitive emissions at DLNG are reported by the operator of that facility in accordance with the requirements of the NGER Act and the National Greenhouse and Energy Reporting (Measurement) Determination 2008. In any event, since the ECNT's review of the EP, Santos has proposed an additional control measure (BAO-CM-6.3.23) by which GHG emissions data will be sought from DLNG and used to verify GHG emissions estimates and track performance.	*The EP outlines the sources of fugitive emissions and the basis of estimates in numerous sections of the EP (refer to sections 6.3.1, 6.3.2.1, 6.3.2.1.1, 6.3.2.7.2 and 6.3.2.8). The information provided pertains to the likely sources of fugitive emissions at the FPSO; fugitive emissions as an estimated total of Scope 1 emissions over a 25 year period; as well as the estimated percentage of total emissions (at steady state operating).* *With respect to fugitive emissions at DLNG, these are Scope 3 emissions at a facility owned by a different joint venture. The Barossa JV does not own or control DLNG. The DLNG facility, is outside the scope of the EP). The information included in the EP relating to DLNG is based on information provided by DLNG.*	Sections 6.3.1, 6.3.2.1.1, 6.3.2.1.2 and 6.3.2.7 provides information on fugitive emissions Section 6.3.2.7 provides the regulation of DLNG facility scope 1 emissions BAO-CM-6.3.12 BAO-CM-6.3.23 BAO-CM-6.3.24
[33] As the GHGEMP is not included in the EP, no attempt has been made to reduce risks and impacts of fugitive emissions.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT. The GHGEMP is not attached to the EP, however adequate information has been provided in Section 6.3 of the EP and a control measure (BAO-CM-6.3.12) adopted to implement a GHGEMP to manage and reduce direct emissions from facility operations to ALARP over the life of the Activity. Section 8.3.2.13 of the EP describes the implementation strategy of the GHGEMP, which includes: • Emissions performance target setting • Critical equipment maintenance; • Methane emissions management • Decarbonisation opportunity management • Santos does not agree that no attempt has been made to reduce risk and impacts of fugitive emissions. Control measures and environmental performance standards have been adopted to reduce risks and impacts of fugitive emissions: • BAO-CM-6.4.10 FPSO Facilities and vessels planned maintenance system. This ensures equipment is maintained, which will perform a function in the minimisation of fugitive emissions.	*Santos refers to its response above.* *Potential fugitive emissions have been factored into the direct emissions of the Activity. It is incorrect to suggest that "no attempt has been made to reduce risks and impacts of fugitive emissions". Numerous control measures have been proposed that relate to the installation, monitoring and maintenance of plant and equipment, each of which will perform a function in the minimisation of fugitive emissions.*	Section 6.3.3 environmental performance outcomes and control measures BAO-CM-6.3.12 Section 8.3.2.13 implementation strategy for the GHGEMP Table 8-2 BAO-CM-6.4.10 planned maintenance system

	• BAO-CM-6.3.12 GHGEMP to be implemented and reviewed annually, supported by EPSs relating to fugitive emissions management.		
[34] Santos has not engaged with research that industry under-reports fugitive emissions, nor with evidence of uncontrolled methane leakage at its own facilities.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the ECNT. Santos takes into consideration a wide range of research, including the IEEFA research referred to by the ECNT, and to the extent that it is valid and relevant, takes it into account in its management of fugitive emissions. Fugitive emissions are reported for all operating assets in accordance with requirements of the NGER Act and the National Greenhouse and Energy Reporting (Measurement) Determination 2008. All emissions (including fugitives) from the Barossa project will also be reported in compliance with these legislative requirements. Loss of containment, such as methane leakage poses a personal safety and facility integrity risk as well as loss of saleable product, as such maintaining equipment and facility integrity, monitoring and repairing any leaks are a top priority for the Barossa JV. Section 8.3.2.13 of the EP describes the implementation strategy of the GHGEMP, which includes methane emissions management. See also Santos' consideration of and response to these matters below, in response to ECNT's letter to Santos of 24 January 2025.	*Santos reviews and engages extensively with a wide range of research, including the IEEFA research referred to by the ECNT, and to the extent that it is valid and relevant, takes it into account in its management of fugitive emissions. Where there is evidence of methane leakage (for instance, during an unforeseen loss of containment) Santos always takes steps to learn from such incidents and improve its equipment and/ or procedures as relevant.* *Santos currently reports fugitive emissions from all operated assets in accordance with requirements of the NGER Act and the National Greenhouse and Energy Reporting (Measurement) Determination 2008. All emissions (including fugitives) from the Barossa project will also be reported in compliance with these legislative requirements. Santos notes that the Clean Energy Regulator would also be aware of the IEEFA research referred to by the ECNT.* *Methane leakage, also known as Loss of Containment, at oil and gas facilities pose a risk to personal safety and facility integrity well as the environment and represents a loss of saleable product. Therefore, maintaining equipment and facility integrity, monitoring and repairing any leaks are a top priority for Santos.*	Section 8.3.2.13 implementation strategy for the GHGEMP
[35] At a minimum, the Proponent should be required to commit to direct and indirect fugitive emissions monitoring for the Activity, as well as being a signatory to the Oil & Gas Methane Partnership 2.0.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT. Control measures and environmental performance standards have been adopted to reduce risks and impacts of fugitive emissions: • BAO-CM-6.4.10 FPSO Facilities and vessels planned maintenance system . • BAO-CM-6.3.12 GHGEMP to be implemented and reviewed annually, supported by EPSs relating to fugitive emissions management. This ensures equipment is maintained, which will perform a function in the minimisation of fugitive emissions. The GHGEMP describes processes for methane emissions management.	*Santos refers to its response above in relation to fugitive emissions.* *In any event, signing a corporate initiative is not a control measure and this appears to be inconsistent with other statements the ECNT has made about suitable control measures and performance objectives.*	Table 8-2 BAO-CM-6.4.10 planned maintenance system BAO-CM-6.3.12
[36]-[38] Santos' reasoning as to why GHG emissions from the Activity will be ALARP and acceptable is flawed, including due to reliance on the WAM scenario.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT. The reference to the Australian carbon budget to 2050 is based on Australia's Emissions Projections 2024 and the Annual Climate Change Statement 2024, published by the Department of Climate Change, Energy, the Environment, and Water (DCCEEW). These documents provide an emissions trajectory forecast to 2050, which outlines Australia's commitment to achieving net zero by 2050, in line with the Paris Agreement (i.e. net zero). Santos considers the 'net' GHG emissions of the Activity to reflect the true contribution of the Activity to Australia's carbon budget, given that reservoir emissions will be required to be net zero in accordance with existing requirements under the NGER Act and the Safeguard Mechanism. Santos has considered both Scope 1 and Scope 3 contributions to this budget. This is a matter for NOPSEMA to determine, not the ECNT.	*This is a matter for NOPSEMA to determine, not the ECNT.* *Notwithstanding this, the reference to the Australian carbon budget to 2050 is* ***based*** *on Australia's* ***Emissions Projections 2023*** *and the* ***Annual Climate Change Statement 2023****, published by the Department of Climate Change, Energy, the Environment, and Water (DCCEEW). These documents provide an emissions trajectory forecast to 2050, which outlines Australia's commitment to achieving net zero by 2050, in line with the Paris Agreement (i.e. net zero).* ***The 'with additional measures' scenario*** *corresponds to the modelled emissions trajectory included in the Emissions Projections 2023. This scenario reflects policies such as the 82% renewable energy target by 2030 and Safeguard Mechanism reforms, which are consistent with Australia's net zero commitments. The linear extrapolation from 2030 to 2050 used to develop the net carbon budget (7966 Mt CO_2-e) aligns with the framework outlined in these documents, comprising gross economy-wide emissions (additions) less total carbon sequestration volumes (subtractions).* *Santos considers the 'net' GHG emissions of the Activity to reflect the true contribution of the Activity to Australia's carbon budget, given that reservoir emissions will be required to be net zero in accordance with existing requirements under the NGER Act and the Safeguard Mechanism. Santos has considered both Scope 1 and Scope 3 contributions to this budget.* *Additionally, when calculating a percentage, it's crucial that the numerator and denominator are consistent in scope. If the denominator is expressed in net terms (i.e., it reflects deductions or adjustments), then the numerator must also represent net values to ensure alignment and maintain logical and mathematical consistency This prevents any "double counting" or inaccuracies.* **Note:** Santos subsequently provided the following update to this response on 6 March 2025. *We note for completeness that in Revision 3 of the Production Operations EP, Santos has updated its contextual consideration of GHG emissions within national carbon budgets and projections to account for the latest data published by DCCEEW.[45] This analysis has resulted in the following figures:* ***Australian Carbon Budget***	N/A

[45] *DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2024). Australia's emissions projections 2024, https://www.dcceew.gov.au/sites/default/files/documents/australias-emissions-projections-2024.pdf*

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As reflected in Australia's NDC under the Paris Agreement and the Climate Change Act 2022, Australia is committed to a single year target to reduce greenhouse gas emissions to 43% below 2005 levels by 2030 and net-zero by 2050.

Based on a 43% reduction by 2030, the net carbon budget for this period is 4,377 Mt CO_2-e (DCCEEW, 2024). Assuming a further linear decline between 2030 and 2050 (the full activity lifecycle for this EP), this creates a net carbon budget of 7,262 Mt CO_2-e. The net carbon budget comprises gross economy wide emissions (additions) less total carbon sequestration volumes (subtractions).

For the avoidance of doubt, the updated figures do not result in any change to Santos' environmental impact evaluation.

<table>
<tr><th rowspan="2">Stage</th><th rowspan="2">Lifecycle gross emissions ($MtCO_2e$)</th><th rowspan="2">Lifecycle net emissions ($MtCO_2e$)</th><th>Barossa Production Operations Net GHG Emissions Contribution (%)</th></tr>
<tr><th>Australian carbon budget (Mt CO_2e)[1]</th></tr>
<tr><td></td><td colspan="3">Scope 1</td></tr>
<tr><td>Operations and maintenance[2]</td><td>53.96</td><td>19.17</td><td>0.3%</td></tr>
<tr><td></td><td colspan="3">Scope 3</td></tr>
<tr><td>Operations at DLNG and support operations</td><td>32.46</td><td>32.46</td><td>0.4%</td></tr>
<tr><td>Product transport and end use</td><td>188.52</td><td>188.52</td><td>NA[3]</td></tr>
<tr><td>Totals</td><td>274.94</td><td>240.15</td><td>0.7% [4]</td></tr>
</table>

[1] Out to 2050

[2] Net-zero reservoir emissions

[3] End-user combustion will occur outside Australia

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<td>[39] It is more appropriate GHG emissions to be put in the context of the relevant sectoral budget. Doing so results in the activity constituting around 4% of the relevant sectoral budget.</td>
<td>Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT.

GHG emissions contribution from the Activity have been contextualised against Australian and global carbon budgets. International frameworks, namely the Paris Agreement, have been developed to facilitate an orderly approach to what is a global problem.

This is a matter for NOPSEMA to determine, not the ECNT.</td>
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This is a matter for NOPSEMA to determine, not the ECNT.

Santos has sought to contextualise the contribution of emissions from the Activity in this EP against Australian and global carbon budgets. International frameworks, namely the Paris Agreement, have been developed to facilitate an orderly approach to what is a global problem. The nature, quantity and timeframe of each country's contribution and the pathways to achieve UNFCCC obligations vary widely, including having regard to the particular circumstances of each country. This framework recognises, and is premised on, the fact that climate change is a global issue – there is no correlation between where GHG emissions are released and where climate change impacts are felt.

For this reason, Australia sets and reports against its emissions reduction targets in 'net' terms, not by individual sectors or projects. The Australian Government is aware of planned production in the Barossa gas field and has considered this in its emissions reduction targets outlined in its NDC under the Paris Agreement.

Furthermore, the inclusion of this calculation demonstrates ECNT's ability to engage with the information provided by Santos. Notably, this calculation could have been performed by the ECNT on the basis of the estimates provided in the information booklet in March 2024.

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<td>[40] Regardless of which estimate is used, it is unacceptable for a single project to compose such a significant amount of Australia's remaining emissions budget.</td>
<td>Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT.
This may be a view of the ECNT, but it is not a fact. The acceptability of GHG emissions is a matter for NOPSEMA to determine, not the ECNT.</td>
<td>

This may be a view of the ECNT, but it is not a fact. The acceptability of GHG emissions is a matter for NOPSEMA to determine, not the ECNT. Such acceptability must be considered in the context that the Offshore Project Proposal was previously approved by NOPSEMA and a production licence conferring rights to extraction of the gas resource on the Barossa joint venture has already been granted. The GHG emissions from the Activity have already been considered in Australia's NDC under the Paris Agreement.

The ECNT's response explicitly notes that its view remains the same 'regardless of which estimate is used'. That is, it was open to the ECNT to provide this response on the basis of the original estimates provided in March 2024. This directly contradicts with the ECNT's assertion that it has insufficient information about GHG emissions to make an informed assessment of the consequence of GHG emissions.

It is a matter of longstanding and extensive public record that the ECNT has already formed an unequivocal assessment about the Barossa Development and associated activities. As just one of many examples, the website stopbarossagas.org clearly states, among other things, that "Our planet can't afford another huge gas development." The website also states that the Stop Barossa Gas campaign is a collaboration between the ECNT, Jubilee Australia Research Centre, Solutions for Our Climate (KO) and Japan Center for a Sustainable Environment and Society.

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<td>[41] Santos has failed to engage with the</td>
<td>Santos has reviewed and engaged with the Sector Pathways Review. However, this review is not relevant to the Activities covered by this EP.</td>
<td>*Santos has reviewed and engaged with the Sector Pathways Review. However, this Review is not relevant to GHG emissions management for the activities covered by this EP. The purpose of consultation for this EP is to*</td>
<td>N/A</td>
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Climate Change Authority's 2024 Sector Pathways Review.	The Sector Pathways Review also acknowledges that 'gas will be required for some time for firming and back-up supply' (page 26). Notwithstanding, Santos has considered the matters raised by the ECNT and provided a response to the issue/s raised by ECNT.	*seek feedback and input to assist the proponent in minimising environmental risks and impacts in the course of carrying out the activities covered by the EP.* *In any event, it is acknowledged in the review that "Ultimately, there are many sets of sector pathways that can combine to achieve net zero by 2050. Like nations under the Paris Agreement, sectors can be thought of as having 'common but differentiated responsibilities and respective capabilities' when it comes to meeting Australia's national targets. This report does not recommend specific emissions reduction targets for each sector. Instead, it sets out the abatement potential of each sector on Australia's pathway to net zero emissions by 2050." (page 9).* *The Sector Pathways Review also acknowledges that 'gas will be required for some time for firming and back-up supply' (page 26).*	
[42] Santos has omitted the CCA's scenarios from the EP.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT. The CCA scenarios reflect technology transitions and emission pathways to support Australia's transition to net zero emissions by 2050. Santos confirms that it will comply with the Safeguard Mechanism, noting that treatment of Barossa GHG emissions is still to be finalised by the CER. Implementation and enforcement of the Safeguard Mechanism is the responsibility of the CER. Compliance with the Safeguard Mechanism will ensure that net emissions generated from the Activity are congruent with the targets modelled in the CCA scenarios.	*The CCA scenarios reflect technology transitions and emission pathways to support Australia's transition to net zero emissions by 2050. The modelling, undertaken by the CSIRO, presents two scenarios in the review which set out potential technological and operational changes in each sector that if taken together could potentially deliver Australia's reduction targets.* *Australia has a well-established legislative framework under which certain GHG emissions from Barossa production operations will be regulated or managed to further Australia's transition to net zero emissions by 2050. This includes:* • *GHG emissions reporting under the NGER Act and the National Greenhouse and Energy Reporting (Measurement) Determination 2008* • *the Emissions Reduction Fund (Australian Carbon Credit Units Scheme)* • *the Safeguard Mechanism to keep net emissions below an established baseline and require net-zero reservoir emissions for new gas fields that feed LNG projects. The Safeguard Mechanism currently applies to facilities that emit more than 0.1 $MtCO_2$-e per annum.* *Compliance with the Safeguard Mechanism is of primary importance in ensuring that GHG emissions associated with the Activity are as low as reasonably practicable and acceptable levels. GHG emissions at or below the baseline and the Safeguard Mechanism's future decline rates are already anticipated and thus accounted for under Australia's NDCs under the Paris Agreement. Thus, the net emissions generated from the Activity are congruent with the targets modelled in the CCA scenarios*	Section 6.3 describes the safeguard mechanism and how Santos will comply EPO-11 has been adopted The following control measures have been included regarding the Safeguard Mechanism BAO-CM-6.3.10 BAO-CM-6.3.11
[43] The CCA has suggested CCS and electrification as possible emissions reductions control measures, both of which have been rejected by Santos. This is an unacceptable inconsistency with best available modelling of emissions reductions pathways.	Santos has considered the matters raised by the ECNT and provided a response to the issue/s raised by ECNT. Table 6-19 of the EP describes emission reduction technology that was adopted, including full electrification of the FPSO processing equipment, with combined cycle gas turbine power generation. Santos has not adopted CCS in this EP on the basis that there is no immediately available CCS option for the Barossa Gas Project. However, Santos is exploring CCS opportunities and.the Darwin Pipeline Duplication was undertaken to facilitate the proposed Bayu Undan CCS project.	*As part of facility design aimed to reduce Scope 1 emissions, full electrification of the FPSO processing equipment, with combined cycle gas turbine power generation has been adopted. Details on this adoption, as well as several other design measures, are outlined in table 6-23 (note: now table 6-20) of the Barossa EP.* *Carbon capture and storage has been rejected by Santos because it is not an available option for emissions reduction. Santos considered CCS to reroute reservoir emissions as a control measure, as outlined in table 6-22 (note: now Table 6-19) of the EP, but it could not be adopted on the basis that these projects do not exist as yet. Potential CCS developments such as the proposed Bayu-Undan CCS project require regulatory frameworks, policies and approvals (from a different jurisdiction to the Activity) to be in place prior to taking final investment decisions. Therefore, it is not possible to rely on them for GHG emissions abatement. Santos is currently exploring CCS opportunities at Bayu-Undan and elsewhere. The Darwin Pipeline Duplication for the Barossa Gas Project was undertaken to facilitate the proposed Bayu-Undan CCS project. Front End Engineering and Design is continuing and the operator of that project is actively engaging with a range of stakeholders to progress the development.*	Table 6-19
[44] Various research and reports support that emissions from the Activity will undermine the Paris Agreement targets and Australia's net zero emissions by 2050 goal.	The acceptability of GHG emissions is a matter for NOPSEMA to determine, not the ECNT. Notwithstanding, Santos has considered the matters raised by the ECNT and provided a response to the issue/s raised by ECNT. It must be acknowledged that there are multiple viable pathways to achieve climate goals, depending on technological developments, policy decisions, economic conditions, and societal choices. These scenarios are tools to explore policy options and inform decision-making. They are not definitive or exclusive blueprints for the global climate response. The Paris Agreement under the UNFCCC framework is the most comprehensive global agreement for climate response.	*Santos reviews and engages extensively with a wide range of research, including the IEA Net Zero Roadmap referred to by the ECNT and to the extent that it is valid and relevant, takes it into account in its management of GHG emissions.* *The acceptability of GHG emissions is a matter for NOPSEMA to determine, not the ECNT. Such acceptability must be considered in the context that the Offshore Project Proposal was previously approved by NOPSEMA and a production licence conferring rights to extraction of the gas resource on the Barossa joint venture has already been granted, and in the context that the GHG emissions from the Activity have already been considered in Australia's NDC under the Paris Agreement.* *In any event, the scenarios presented by the International Energy Agency (IEA), Intergovernmental Panel on Climate Change (IPCC), and the Climate Council are not prescriptive pathways. Rather, they illustrate a range of potential strategies to meet global emission reduction targets, such as those set out in the Paris Agreement and they rely on a range of assumptions about technology, human behaviour and other factors that must all be met to achieve the outcome of the pathway.* *There are multiple viable pathways to achieve climate goals, depending on technological developments, policy decisions, economic conditions, and societal choices. These scenarios are tools to explore policy options and inform decision-making. They are not definitive or exclusive blueprints for the global climate response. The Paris Agreement under the UNFCCC framework is the most comprehensive global agreement for climate response.* *As stated by the IEA:*	N/A

		" These scenarios are not predictions – the IEA does not have a single view on the future of the energy system…Our scenario analysis is designed to inform decision makers as they consider options, not to predict how they will act, and none of the scenarios should be viewed as a forecast." *Similarly, the IPCC emphasizes:* *"Scientists use computer models to simulate the emissions of greenhouse gases that would be consistent with different levels of warming. The different possibilities are often referred to as 'greenhouse gas emission pathways'. There is no single, definitive pathway to limiting warming to 1.5°C. This perspective underscores the diversity of approaches available to address climate change, allowing for flexibility and adaptation to local contexts."*	
[45]-[48]Santos' assertion that it is neither appropriate nor possible to quantify or attribute any specific impact on climate change to emissions from an individual project is incorrect, including having regard to the definition of environmental impact under the Regulations, outdated and unsound scientific research, and the intergenerational principle.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT. International frameworks, namely the Paris Agreement, have been developed to facilitate an orderly approach to what is a global problem. The nature, quantity and timeframe of each country's contribution (including Australia) and the pathways to achieve UNFCCC obligations vary widely, including having regard to the particular circumstances of each country. This framework recognises, and is premised on, the fact that climate change is a global issue – there is no correlation between where GHG emissions are released and where climate change impacts are felt.	*International frameworks, namely the Paris Agreement, have been developed to facilitate an orderly approach to what is a global problem. The nature, quantity and timeframe of each country's contribution and the pathways to achieve UNFCCC obligations vary widely, including having regard to the particular circumstances of each country. This framework recognises, and is premised on, the fact that climate change is a global issue – there is no correlation between where GHG emissions are released and where climate change impacts are felt.* *For this reason, Australia sets and reports against its emissions reduction targets in 'net' terms, not by individual sectors or projects. The Australian Government is aware of planned production in the Barossa gas field and has considered this in its emissions reduction targets outlined in its NDC under the Paris Agreement. The Offshore Project Proposal was previously approved by NOPSEMA and a production licence conferring rights to extraction of the gas resource on the Barossa joint venture has already been granted.* *Physical impacts of climate change on environmental receptors are the result of global GHG emissions from a multitude of sources (minus the GHG sinks) that have accumulated in the atmosphere. The impacts of climate change cannot be attributed to one specific sector or activity. In the context of evaluating potential impacts and risks that may be associated with GHG emissions from all sources globally, including from this Activity, Santos has considered the physical impacts of climate change, as outlined in section 6.3.2.1 of the EP.*	Section 6.3.2.6 (formerly 6.3.2.7)
[49] There are no appropriate environmental performance outcomes, standards or measurement criteria for [BAO-CM-6.3.19] (Barossa products generated from the Activity will only be sold to customers from countries that are signatories to the Paris Agreement, as at the date of the relevant contract of sale).	Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT. This is a matter for NOPSEMA to consider in its assessment of the EP.	*This is a matter for NOPSEMA to consider in its assessment of the EP.*	Section 8.1.2
[50] Santos' rejection of CCS as a control measure contravenes statements made to the ASX and on Santos' website, as well as the information booklet. Santos has not explained this inconsistency.	Santos re-iterates that CCS projects are not owned or controlled by the Barossa joint venture. ECNT queries about CCS are outside the scope of this EP. Notwithstanding, Santos has considered the matters raised by the ECNT and provided a response to the issue/s raised by ECNT.	*Santos rejects this assertion in its entirety.* *Santos has made clear that Barossa would be a potential customer of the proposed Bayu-Undan CCS project if the project were to proceed. However, the project has not yet taken a final investment decision and, notwithstanding, this is unrelated to the Activity and it would be improper to link the two in the EP. It is subject to a different regulatory regime and pursued by a different proponent. Santos is one of the joint venture parties for Bayu-Undan CCS and has committed funding to it. It hopes that the project proceeds, but this is reliant on approvals from a foreign government (Timor-Leste) and final investment decisions by the proponent of that project. If the Bayu-Undan CCS project proceeds, the Barossa JV hopes to be a customer of it. Again, though, this is beyond the control of Santos or the Barossa JV.* *Linking the delivery of the Activity to an unrelated, potential future project via a control measure is wholly inappropriate, as it would be grossly disproportionate to the benefit gained (see section 3.6.3 of NOPSEMA's Environment Plan Content Requirements Guidance Note) and could unnecessarily result in the Barossa Gas Project not proceeding in circumstances where there are viable alternatives for emissions offsets and reductions*	N/A
[51]-[53] It is insufficient for Santos to rely on the NT EPA's assessment at DLNG to demonstrate atmospheric emissions are ALARP and acceptable. NOPSEMA should not be satisfied that risks and impacts from atmospheric emissions from DLNG are ALARP and acceptable.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT. This is a matter for NOPSEMA to determine, not the ECNT. Santos notes that NOPSEMA does not regulate DLNG and, in an orderly regulatory framework, it should be able to rely on the assessment of another Australian regulator to the extent that the issue is relevant to its consideration of the activities covered by this EP.	*This is a matter for NOPSEMA to determine, not the ECNT.* *Santos notes that NOPSEMA does not regulate DLNG and, in an orderly regulatory framework, it should be able to rely on the assessment of another Australian regulator to the extent that the issue is relevant to its consideration of the activities covered by this EP*	N/A
[54] Santos does not adequately account for risks of a condensate spill, nor acknowledge its own history of spills resulting in unacceptable impacts to marine life, without which engagement with spill risk is incomplete.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT. Santos does not agree that a condensate spill has not been adequately assessed in the EP. The acceptability of the risk assessment is a matter for NOPSEMA to determine, not the ECNT. Santos has covered risks of accidental condensate spills in Section 7.7 including seven different scenarios and undertaken associated environmental impact assessments to reduce the risk to ALARP.	*Santos has covered risks of a condensate spill at section 7.7 of the EP.* *Previous condensate spills at other facilities have been regulated in accordance with the relevant legislation and approvals documents, and, as is always the case, Santos has implemented learnings from previous spills and implements continuous improvement measures to prevent and mitigate future spills. The learnings from previous condensate spills have been used by Santos to inform processes for preventing and mitigating condensate spills relevant to the activities covered by this EP.*	Section 7.7

66] Assertion of future compliance with applicable legislation is not in itself a control measure to mitigate environmental risks, nor is mere assertion sufficient to demonstrate ALARP and acceptability.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the issue/s raised by ECNT. Santos does not agree that compliance with applicable legislation is not in itself a control measure to mitigate environmental risk, nor is a mere assertion to demonstrate ALARP and acceptability. Santos has considered the matters raised by the ECNT and provided a response.	*All approvals processes in Australia are given in anticipation of the proponent's compliance with the legislative and common law frameworks of the relevant jurisdiction. Across jurisdictions, there are a range of assessment processes to determine if the proponent is a suitable person to be carrying out an activity and there are also a range of financial and other assurances. In the case of Barossa, financial assurance requirements are in place and suitability assessments were required when the production licence was granted.* *In addition, applicable legislation generally includes reporting, monitoring and enforcement provisions to achieve required outcomes.*	N/A
ECNT correspondence to Santos on 24 January 2025			
The ECNT rejected suggestions that ECNT's consultation has not been in good faith, which it described as 'specious and unfounded'.	Santos disagrees with the ECNT's characterisation of Santos' response. Santos' letter of 20 December 2024 included the foundations of each of Santos' views.	**Santos' correspondence to ECNT on 6 March 2025 in response to ECNT's letter of 24 January 2025** *Santos has considered the ECNT's response regarding the matters raised in Santos' letter of 20 December 2024. Santos maintains that it has provided sufficient information for the ECNT to make an assessment of the impact of the activities on the ECNT's functions, interests and activities, and to provide input to the development of the Production Operations Environment Plan. Further, Santos has made genuine attempts to address the concerns of the ECNT in the development of the Production Operations EP.*	N/A
In response to Santos' observation that ECNT delayed its 25 November 2024 letter to Santos, and that letter did not contain information raised in its 22 October 2024 letter to NOPSEMA, ECNT said that: • the complaints were unfounded; • ECNT engaged with NOPSEMA because the EP was being considered by NOPSEMA, which is neither unusual nor unreasonable; and • the ECNT made new comments to NOPSEMA because it now had the benefit of information in the Draft EP.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the ECNT.		
ECNT alleged that, contrary to Santos' letter of 20 December 2024, ECNT had described the impact of the EP on its functions, interests and activities in previous correspondence to Santos, and Santos had never previously asserted any failure by ECNT to demonstrate how it was affected.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the ECNT. Santos notes that the ECNT has a different view to Santos on the extent to which the ECNT has demonstrated that the Activity has any consequence on any of its functions, interests or activities. In any event, notwithstanding the comments made to ECNT, Santos has consulted with ECNT extensively as a Relevant Person.		
The ECNT said that its concerns about environmental impacts from GHG emissions are not alleviated by the fact that GHG emissions estimates are lower in the Draft EP than those provided in consultation. In contrast, the ECNT alleged that this raises queries about the veracity of information provided in consultation and how the estimates have been lowered, emphasising the ECNT's concerns about lack of transparency and its calls for the GHGEMP to be published.	Santos has considered the matters raised by the ECNT in this EP and provided a response to the ECNT. Santos considers that sufficient information has been provided to the ECNT. The fact that the ECNT's concerns about environmental impacts have not been alleviated is a separate issue. The point is that the ECNT has been provided with sufficient information in order to form those concerns. Otherwise, Santos relies on its previous consideration of these issues, which were raised by the ECNT in its letter of 25 November 2024 and are considered above.	*Santos has previously responded to the ECNT's assertions regarding the GHGEMP, the Safeguard Mechanism and consultation and maintains those responses.* *We note for completeness that in Revision 3 of the Production Operations EP, Santos has updated its contextual consideration of GHG emissions within national carbon budgets and projections to account for the latest data published by DCCEEW.[46] This analysis has resulted in the following figures:* ***Australian Carbon Budget*** *As reflected in Australia's NDC under the Paris Agreement and the Climate Change Act 2022, Australia is committed to a single year target to reduce greenhouse gas emissions to 43% below 2005 levels by 2030 and net-zero by 2050.* *Based on a 43% reduction by 2030, the net carbon budget for this period is 4,377 Mt CO_2-e (DCCEEW, 2024). Assuming a further linear decline between 2030 and 2050 (the full activity lifecycle for this EP), this creates a net carbon budget of 7,262 Mt CO_2-e. The net carbon budget comprises gross economy wide emissions (additions) less total carbon sequestration volumes (subtractions).* *For the avoidance of doubt, the updated figures do not result in any change to Santos' environmental impact evaluation.*	Section 6.3 Appendix C BAO-CM-6.3.10 BAO-CM-6.3.11
The ECNT alleged that Santos is required under the Regulations to describe the requirements applying to the project and how those requirements will be met, including the Safeguard Mechanism.	Santos accepts that this is correct and notes that this obligation has been discharged – see Section 6.3 and Appendix C. Santos notes that it has previously confirmed to ECNT that the EP must demonstrate how Santos will comply with the Safeguard Mechanism – most recently in its letter of 20 December 2024. This is also clear from the Draft EP, to which the ECNT has had access since around September 2024.		
The ECNT alleged that its interests include: • seeing the NT and Commonwealth comply with emissions targets; and • ascertaining whether the Activity poses a threat to the NT and	Santos has considered the matters raised by the ECNT in this EP and provided a response to the ECNT. Santos notes that the ECNT considers that it has interests which are affected by the Activity in the manner described. As outlined immediately above, Santos agrees that the EP must describe the requirements of the Safeguard Mechanism and demonstrate how those requirements will be met. Also as outlined above, Section 6.3 provides this detail and		

Stage	*Lifecycle gross emissions ($MtCO_2e$)*	*Lifecycle net emissions ($MtCO_2e$)*	*Barossa Production Operations Net GHG Emissions Contribution (%)*
			Australian carbon budget (Mt CO_2e)[1]
	Scope 1		

[46] *DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2024). Australia's emissions projections 2024, https://www.dcceew.gov.au/sites/default/files/documents/australias-emissions-projections-2024.pdf*

<table>
<tr>
<td>Commonwealth's compliance with these legislated emissions reduction commitments.</td>
<td>demonstration in relation to the Safeguard Mechanism. For completeness, Santos confirms that:
• the Safeguard Mechanism is administered by the Clean Energy Regulator; and
• compliance with the Safeguard Mechanism is itself a proposed control measure under this EP (see BAO-CM-6.3.10 and BAO-CM-6.3.11), in respect of which compliance may be monitored by NOPSEMA.</td>
<td>
<table>
<tr><td>Operations and maintenance[2]</td><td>53.96</td><td>19.17</td><td>0.3%</td></tr>
<tr><td></td><td colspan="3">Scope 3</td></tr>
<tr><td>Operations at DLNG and support operations</td><td>32.46</td><td>32.46</td><td>0.4%</td></tr>
<tr><td>Product transport and end use</td><td>188.52</td><td>188.52</td><td>NA[3]</td></tr>
<tr><td>Totals</td><td>274.94</td><td>240.15</td><td>0.7% [4]</td></tr>
</table>
[1] Out to 2050

[2] Net-zero reservoir emissions

[3] End-user combustion will occur outside Australia
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<td>The ECNT enclosed a bundle of documents it had obtained under Freedom of Information (FOI)regarding the DLNG facility and a letter from ECNT to NOPSEMA dated 4 December 2024 regarding the FOI documents. The ECNT's letter to NOPSEMA made various assertions about the FOI documents, the DLNG facility and NOPSEMA's assessment of the Production Operations EP, including that:
1. [5] the FOI documents indicate that there is an ongoing methane leak at the DLNG storage tank, with no apparent intention to repair before processing Barossa gas. The size of the leak is unclear but subsequent surveys indicate different and potentially larger amounts of fugitive methane emissions, and that methane emissions are larger than has been reported or estimated;
2. [6] ECNT's understanding based on publicly available information is that the DLNG tank will continue to leak when used to store Barossa gas;
3. [7]-[11], [23] atmospheric emissions from the processing of Barossa gas at the DLNG facility are indirect consequences of the Activity under the Production Operations EP;
4. [12(a)], [26]-[27] there may be safety risks at DLNG that are not dealt with in the EP. In other jurisdictions leaks have been required to be repaired and communities evacuated in the meantime;
5. [12(c)-(d)] Santos may have misled NOPSEMA through omitting 'critical relevant information' from the Draft EP, and has also failed to provide important information to the public and Relevant Persons;
6. [13]-[15], [31]-[32] NOPSEMA</td>
<td>Although these assertions were made by the ECNT to NOPSEMA (rather than being raised with Santos directly), Santos h4as considered and evaluated the matters raised by ECNT, to the extent relevant to the Activity under this EP.

Santos acknowledges that the EP includes an evaluation of Scope 3 emissions, and that the Scope 1 emissions at DLNG (including fugitive emissions at DLNG) form part of that evaluation. See Section 6.3 of this EP.

As outlined in section 6.3.2.7, the DLNG facility is owned by a different joint venture to the Barossa Development and its operation is outside the scope of the Activity and outside the control of the Barossa Joint Venture. The framework by which DLNG is regulated is relevant to the evaluation of downstream emissions. That framework includes the reporting and management of fugitive emissions in accordance with requirements of the NGER Act and the National Greenhouse and Energy Reporting (Measurement) Determination 2008. That framework also includes regulation by the NT EPA.

Further in relation to the particular concerns raised with NOPSEMA:
1. Santos notes the ECNT's interpretation of the FOI documents which relate to the DLNG facility.
2. DLNG has confirmed that independent third-party experts have conducted a comprehensive review of the LNG storage tank and confirmed that it remains fit and safe for service for the life of the Barossa gas project. DLNG has confirmed that all regulatory approvals (including a Safety Case) are in place and that, in line with regulatory requirements, tank emissions are monitored as part of an ongoing program.
3. Section 6.3 acknowledges that emissions associated with processing Barossa gas at DLNG are scope 3 emissions of the Activity and evaluates these emissions accordingly.
4. Operations at DLNG do not form part of the Activity. In any event, DLNG has confirmed that all regulatory approvals (including a Safety Case) are in place and an ongoing monitoring program is being implemented.
5. Santos denies that it has omitted critical relevant information in the draft EP. Emissions from DLNG (including fugitive emissions) are addressed as scope 3 emissions in the EP and were referred to in consultation materials. Fugitive emissions are reported and managed in accordance with requirements of the NGER Act and the National Greenhouse and Energy Reporting (Measurement) Determination 2008.
6. Santos disagrees with the ECNT's assertions, and considers that the identification, evaluation and mitigation of GHG emissions in the EP (including scope 3 emissions) is appropriate having regard to the matters above, and that the EP acceptance criteria has been satisfied in relation to GHG emissions. In any case, whether or not the EP meets the acceptance criteria is ultimately a matter for NOPSEMA to consider according to its reasonable satisfaction.
7. The EP comprehensively evaluates the impact of GHG emissions, including scope 3 fugitive emissions. Noting the inherent uncertainty in the quantification of fugitive emissions</td>
<td>Santos notes ECNT's request for the disclosure of further details to the regulator regarding 'loss of containment'. The DLNG facility is owned and operated by a separate joint venture to the Barossa Joint Venture and is not regulated by NOPSEMA. All regulatory approvals for the DLNG facility are in place and in line with regulatory requirements, tank emissions are monitored as part of an ongoing program.

As outlined in the Production Operations EP, emissions from the DLNG facility are separately managed in accordance with the Safeguard Mechanism, including emissions reporting in accordance with the National Greenhouse and Energy Reporting (NGER) determination. The NGER determination includes a component for fugitive emissions. The Scope 3 emissions estimates included in the Production Operations EP in respect of the operation of the DLNG facility are based on a holistic forecast of DLNG emissions in processing Barossa feed gas, which also includes a component for fugitive emissions.

Santos maintains that the emissions estimates included in the Production Operations EP are appropriate. The matter is subject of ongoing regulatory engagement with the relevant regulators and being managed in accordance with applicable regulatory requirements and approvals.</td>
<td>Section 4
Section 6.3
Section 6.3.2.7
Section 6.4.2.3
Section 8

BAO-CM-6.3.12
BAO-CM-6.3.23
BAO-CM-6.3.24</td>
</tr>
</table>

should not accept the EP because as a result of the EP's failure to disclose the information in the FOI documents, the EP does not meet the EP acceptance criteria; 7. [16] increased methane emissions is an indirect impact and risk that is not disclosed in the EP or demonstrated to be ALARP and acceptable; 8. [12(b)], [17] while the calculation of scope 3 emissions in the EP is unclear, atmospheric emissions from DLNG are likely to exceed the estimates included in the EP and therefore to affect the conclusions regarding Australia's carbon budget and the assessment of negligible consequences; 9. [18], [24] the EP also does not consider localised impacts at DLNG from methane, including potential health impacts from air quality; 10. [19], [25], [31], [32(b)-(c)] the EP addresses various approvals at DLNG but these approvals do not deal with the issue, nor is it clear that appropriate action has been taken under the approvals. NOPSEMA cannot defer to the assessment of an NT regulator and in any event the NT assessment did not consider the leak; 11. [20] it is not sufficient for monitoring of ongoing fugitive emissions to be dealt with in the GHGEMP and not in the EP; 12. [21] the extent of the methane leak is unclear and the emissions estimate must be clarified by Santos; 13. [22] the implementation strategy in the EP does not meet the requirements of the Regulations because it does not provide for sufficient monitoring and recording of fugitive emissions at DLNG; 14. [28]-[30] Santos' failure to consult in relation to the methane leak at DLNG means consultation with Relevant Persons is incomplete and unacceptable, and Relevant Persons may not have been identified and consulted by Santos; 15. [33]-[35] ECNT is considering next steps including making reports to relevant NT authorities.	and that on the best estimates available (including those reflected in the FOI documents), the figures are a fractional component of DLNG's overall emissions (which are themselves a fraction of the emissions from the Activity), the levels are materially consistent with the estimates used in this EP. As such, Santos' evaluation that GHG emissions have been reduced to a level that is ALARP and acceptable is not affected. 8. As set out immediately above, the EP comprehensively evaluates the impact of GHG emissions, including scope 3 fugitive emissions. Noting the inherent uncertainty in the quantification of fugitive emissions and that on the best estimates available (including those reflected in the FOI documents), the figures are a fractional component of DLNG's overall emissions (which are themselves a fraction of the emissions from the Activity), the levels are materially consistent with the estimates used in this EP. As such, Santos' evaluation that GHG emissions have been reduced to a level that is ALARP and acceptable is not affected. 9. Impacts of methane emissions are a relevant consideration for global GHG concentrations and associated potential impacts/risks of climate change. Potential impacts to local air quality from DLNG emissions, and associated potential health impacts, are regulated by the NT EPA, and acknowledged accordingly in Section 6.4.2.3 of the EP. 10. Santos disagrees with the ECNT's assertions and considers it is entirely appropriate for the EP to address the regulatory context for DLNG. As noted above, while GHG emissions associated with Barossa gas are evaluated in this EP, operations at DLNG do not form part of the Activity to be authorised in this EP. 11. Santos has previously responded to the ECNT's assertions regarding the content of the GHGEMP, and remains of the views expressed in those responses. In any case, since the ECNT's review of Revision 1 of the EP, further EPSs have been added which provide further commitments regarding monitoring of fugitive emissions. 12. As outlined above, the EP comprehensively evaluates the impact of GHG emissions, including scope 3 fugitive emissions. Noting the inherent uncertainty in the quantification of fugitive emissions and that on the best estimates available (including those reflected in the FOI documents), the figures are a fractional component of DLNG's overall emissions (which are themselves a fraction of the emissions from the Activity), the levels are materially consistent with the estimates used in this EP. As such, Santos' evaluation that GHG emissions have been reduced to a level that is ALARP and acceptable is not affected. In any event, since the ECNT's review of the EP, Santos has proposed an additional control measure (BAO-CM-6.3.23) by which GHG emissions data will be sought from DLNG and used to verify GHG emissions estimates and track performance. 13. Santos disagrees that there is any deficiency in relation to the implementation strategy included in section 8 of the EP. In any event, as set out in s 6.3, fugitive emissions at DLNG are reported by the operator of that facility in accordance with the NGER Act. 14. Santos considers that it has met its obligations under s 25, including to consult with Relevant Persons and to provide Relevant Persons with sufficient information. As identified above, fugitive emissions at DLNG are a component of Santos' scope 3 emissions, which have been the subject of consultation. 15. Santos notes ECNT's comments.		
The ECNT noted its belief as to the seriousness of an uncontained methane leakage, and asked Santos to confirm:	Santos has considered the matters raised by the ECNT in this EP and provided a response to the ECNT.		

• whether the leak discussed in the documents has been fixed; and • what steps were being taken to monitor and prevent future leaks. The ECNT asserted that Santos ought to disclose the matter to NOPSEMA because the matter has consequences for NOPSEMA's assessment of the EP.	Santos refers to and repeats its detailed consideration of the matters raised in the ECNT's letter to NOPSEMA, immediately above. In any event, the ECNT's letter (including the enclosed FOI documents and the letter to NOPSEMA) will be included in the sensitive information part of the EP for NOPSEMA's consideration, to the extent NOPSEMA considers the matters raised by the ECNT are relevant.		
The ECNT alleged that its consultation to date has been genuine and it has engaged with integrity, and it remains committed to consulting.	Santos notes the ECNT's response. Santos disagrees for the reasons expressed above and in Santos' letter of 20 December 2024. In any event, with the exception of the queries above about the DLNG facility, the ECNT has not specified what further consultation is sought.	*Santos maintains that the Production Operations EP includes a comprehensive evaluation of impacts and risks from the Activity, and the ECNT has received sufficient information to make an informed assessment of the consequences of the activity on any of its functions, interests or activities.* *For the avoidance of doubt, Santos maintains that it considers consultation with ECNT is complete and that Santos has discharged its obligations under s 25 in respect of ECNT.*	N/A

4.7.7 Commercial Fishing (Commonwealth / NT / WA managed)

Table 4-17: Consultation Summary Table - Commercial Fishing (Commonwealth / NT / WA managed)

Section 25(1)(d) of the OPGGS(E)R: Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan			
Commercial Fishing: Commonwealth-managed fisheries			
Northern Prawn Fishery (NPF) Licence Holders			
Licence-Holders are consulted via their representative body, Northern Prawn Fishery Industry Pty Ltd. Where an NPF Licence Holder is also an NT Commercial Fishing Licence Holder they are also consulted via the NT Seafood Council. Refer to NPFI, NTSC entries in Table 4-20 (Industry associations) and licence holder entries in Table 4-15 (Commercial fishing) for the summary of consultation effort.			
Southern Bluefin Tuna/ Western Skipjack Tuna and Western Tuna and Billfish Fisheries Licence Holders			
Licence Holders are consulted via their representative body, the ASBTIA. Refer to ABSTIA entry in Table 4-20(Industry associations) for the summary of consultation effort.			
North-West Slope Trawl Fishery Licence Holders			
Licence Holders are consulted via their representative body, CFA. Refer to CFA entry in Table 4-20 (Industry associations) for the summary of consultation effort.			
Torres Strait Fishery			
Licence Holders are consulted via their representative body, the CFA. Refer to CFA entry in Table 4-20 (Industry associations) for the summary of consultation effort.			
Commercial Fishing: WA-managed fisheries Licence Holders (entitled to fish in the EMBA) - Abalone Fishery, Kimberley Crab Fishery, Kimberley Prawn Fishery, Mackerel Managed Fishery, Marine Aquarium Fishery, Northern Demersal Scalefish Managed Fishery, Pilbara Crab Fishery, South-West Costal Salmon Fishery, Specimen Shell Fishery, West Coast Deep Sea Crustacean Fishery			
Licence Holders are consulted via their representative body, the WAFIC. Refer to WAFIC entry in Table 4-20 (Industry associations) for details.			
Commercial Fishing: NT-managed fisheries Licence Holders (entitled to fish in the EMBA) - Aquarium Fishery, Coastal Line Fishery, Demersal Fishery, Development Fishery (Small Pelagic), Offshore Net and Line Fishery, Pearl Oyster Fishery, Spanish Mackerel Fishery, Timor Reef Fishery			
Licence Holders are consulted via their representative body, NTSC, and directly where a Licence Holder has requested. In addition to the entries below, also refer to the NTSC entry in this table.			
A. Raptis and Sons			
Summary of consultation effort: • On 9 February 2024 Santos emailed A. Raptis & Sons to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787] • The email advised that Santos was seeking information to better understand: - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and* - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.* • The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024. • On 11 March 2024 Santos emailed A. Raptis & Sons further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793] • On 3 April 2024 Santos phoned A. Raptis & Sons which advised that it would not be commenting. • On 6 May 2024, Santos emailed A. Raptis & Sons further to previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from A. Raptis & Sons. [Con-3867] • On 10 July 2024 Santos emailed A. Raptis & Sons to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised A. Raptis & Sons that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130] • On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982] • On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036] • Notwithstanding the information provided and the steps described above, no comments or input were received on this EP by A. Raptis & Sons.			
Summary of response by Relevant Person	**Assessment of merits**	**Santos' Response Statement**	**EP reference**
No response was received from A. Raptis & Sons.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Austfish

Summary of consultation effort:

- On 9 February 2024 Santos emailed Austfish to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Austfish further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned Austfish and a representative advised that the message would be passed to the appropriate personnel.
- On 6 May 2024, Santos emailed Austfish further to previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Austfish. [Con-3868]
- On 10 July 2024 Santos emailed Austfish to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Austfish that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP by Austfish.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Austfish.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Austral Fisheries Pty Ltd

Summary of consultation effort:

- On 9 February 2024 Santos emailed Austral Fisheries to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and
- what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Austral Fisheries further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 21 March 2024 Santos met with Austral Fisheries to provide further information on the Barossa petroleum safety zones (PSZ). Santos indicated that these are the zones granted for the PSZ application for drilling activities and will be the zones in the PSZ application for subsea installation activities which will be submitted shortly. Austral Fisheries indicated that the zones were acceptable.
- On 22 March 2024 Santos emailed Austral Fisheries and provided presentation slides from the meeting on 21 March 2024, and confirmed that these are the zones granted for our PSZ application for drilling activities and would be the zones in Santos' PSZ application for subsea installation activities. Santos sought re-affirmation that previous feedback that the zones were acceptable to Austral. [Con-3860]
- On 3 April 2024 Austral Fisheries responded via email confirming that the PSZs will not impact its operations. [Con-4993]
- On 3 May 2024, Santos emailed Austral Fisheries further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Austral Fisheries. [Con-3865]
- On 10 July 2024 Santos emailed Austral Fisheries to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence has been received from Austral Fisheries.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
Austral Fisheries responded that the establishment of the PSZs would not affect its operations.	Santos notes Austral Fisheries' response	No response required.	Not applicable.

Australia Bay Seafoods			
Summary of consultation effort: • On 9 February 2024 Santos emailed Australia Bay Seafoods to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787] • The email advised that Santos was seeking information to better understand: - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and* - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.* • The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024. • On 11 March 2024 Santos emailed Australia Bay Seafoods further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793] • On 3 April 2024 Santos phoned Australia Bay Seafoods which advised it did not have any comments. • On 8 May 2024, Santos emailed Australia Bay Seafoods further to the phone call on 3 April 2024, to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Australia Bay Seafoods. [Con-3928] • On 10 July 2024 Santos emailed Australia Bay Seafoods to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Australia Bay Seafoods that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130] • On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982] • On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036] • Notwithstanding the information provided and the steps described above, no comments or input were received on this EP by Australia Bay Seafoods.			
Summary of response by Relevant Person	**Assessment of merits**	**Santos' Response Statement**	**EP Reference**
No response was received from Australia Bay Seafoods.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Clipper Pearls

Summary of consultation effort:

- On 9 February 2024 Santos emailed Clipper Pearls to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Clipper Pearls further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned Clipper Pearls who advised they would not be impacted by the proposed activities.
- On 6 May 2024, Santos emailed Clipper Pearls further to its response on 3 April 2024, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Clipper Pearls. [Con-3866]
- On 10 July 2024 Santos emailed Clipper Pearls to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Clipper Pearls that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP by Clipper Pearls.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Clipper Pearls.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Fischer Wholesale Pty Ltd/H & T Investment Pty Ltd/Commercial Catamarans Pty Ltd

Summary of consultation effort:

- On 9 February 2024 Santos emailed Fischer Wholesale/H & T Investment/Commercial Catamarans to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Fischer Wholesale/H & T Investment/Commercial Catamarans further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned Fischer Wholesale Pty Ltd/H & T Investment Pty Ltd/Commercial Catamarans Pty Ltd and left a voicemail.
- On 2 May 2024, Santos emailed Fischer Wholesale Pty Ltd/H & T Investment Pty Ltd/Commercial Catamarans Pty Ltd further to previous correspondence to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Fischer Wholesale Pty Ltd/H & T Investment Pty Ltd/Commercial Catamarans Pty Ltd. [Con-3864]
- On 10 July 2024 Santos emailed Fischer Wholesale Pty Ltd/H & T Investment Pty Ltd/Commercial Catamarans Pty Ltd to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Fischer Wholesale Pty Ltd/H & T Investment Pty Ltd/Commercial Catamarans Pty Ltd that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP by Fischer Wholesale Pty Ltd/H & T Investment Pty Ltd/Commercial Catamarans Pty Ltd

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Fischer Wholesale Pty Ltd/H & T Investment Pty Ltd/Commercial Catamarans Pty Ltd.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Northern Wildcatch Seafood Australia (NWSA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed NWSA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed NWSA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned NWSA who advised they would send an email response.
- On 4 April 2024, NWSA emailed Santos and confirmed that NWSA would not be providing feedback. [Con-3863]
- On 8 May 2024, Santos emailed NWSA, further to its response on 4 April 2024, to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from NWSA. [Con-4359]
- On 10 July 2024 Santos emailed NWSA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised NWSA for its input and advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]

- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence has been received from NWSA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
NWSA responded that it would not be participating in the consultation process.	Santos has considered the matters raised in the EP.. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Paspaley Pearling Company

Summary of consultation effort:

- On 9 February 2024 Santos emailed Paspaley Pearling Company to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 16 February 2024 Paspaley Pearling Company emailed Santos to advise that it did not have additional comment in relation to this EP. In its email, Paspaley Pearling Company reiterated information relevant to Darwin Pipeline Duplication construction activities. Santos has previously provided commitments to Paspaley Pearling Company related to these activities [Con-3840]
- On 8 March 2024 Santos emailed Paspaley Pearling Company to enquire if a meeting in Darwin the following week would be convenient for an update. [Con-3858]
- On 8 March 2024 Santos emailed a further email to Paspaley Pearling Company to provide contact details. [Con-3859]
- On 11 March 2024 Santos emailed Paspaley Pearling Company further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 25 March 2024 Santos emailed Paspaley Pearling Company to enquire whether it would like to meet over Teams. In the email Santos provided updated information relevant to DPD construction activities in NT waters. [Con-3861]
- On 25 March 2024 Paspaley Pearling Company thanked Santos for providing further information and advised that it does not require a meeting at this stage. [Con-3862]
- On 7 May 2024, Santos emailed Paspaley Pearling Company further to previous correspondence related to the Barossa Production Operations EP, to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Paspaley Pearling. [Con-3926]
- On 10 July 2024 Santos emailed Paspaley Pearling Company to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence has been received from Paspaley Pearling Company.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
Paspaley Pearling Company responded that it would not be participating in the consultation process.	Santos has considered the matters raised in the EP..	No response required.	Not applicable.

	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.		

WA Seafoods

Summary of consultation effort:

- On 9 February 2024 Santos emailed WA Seafoods to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed WA Seafoods further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned WA Seafoods and a representative said the message would be provided to the appropriate person.
- On 6 May 2024, Santos emailed WA Seafoods to advise further to previous correspondence, it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from WA Seafoods. [Con-3869]
- On 10 July 2024 Santos emailed WA Seafoods to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised WA Seafoods that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP by WA Seafoods.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from WA Seafoods.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

4.7.8 First Nations People and Groups

Table 4-18: Consultation Summary Table – First Nations People and Groups

First Nations People and groups: Representative organisations – Northern Territory			
Larrakia Nation Aboriginal Corporation (LNAC)			
Summary of consultation effort: • On 13 February 2024 Santos emailed LNAC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-4053]. The email advised that Santos was seeking information to better understand: - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and* - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.* • The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions, links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024. • In the email Santos asked LNAC if it knew of any other organisations that should be contacted. Santos also advised LNAC that it would be happy to provide consultation sessions for LNAC staff and Board members as well as Larrakia family members. • On 12 March 2024 Santos emailed LNAC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-4052] • In the email Santos also advised LNAC that it would be happy to provide consultation sessions for LNAC staff and Board members as well as Larrakia family members. Santos also advised that it would be holding Larrakia specific consultation sessions, as previously requested by LNAC, and would send information to the LNAC on these soon. • Between 25 March 2024 and 2 April 2024 Santos liaised with LNAC on arrangements for Larrakia People attending the planned sessions being held in Darwin on 23 April 2024. • On 27 March 2024 Santos emailed LNAC details of the Barossa Production Operations EP and OEMP consultation sessions being held for Larrakia People in Darwin on 23 April and asked for the organisation to share the information with its Larrakia networks and post on notice boards and relevant social media channels. [Con- 6021] • On 2 April 2024 LNAC confirmed via response email that the information had been posted to its Facebook and LinkedIn social media networks [Con-5234] • See entry for Larrakia People in this Table for summaries of the consultation sessions held on 23 April 2024. • On 2 April 2024 Santos emailed LNAC by way of reminder that the consultation is closing on April 9 and asked LNAC to contact Santos as soon as possible if it has any feedback. [Con-4082] • On 2 May 2024 Santos emailed LNAC further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from LNAC. [Con-4994] • On 17 May 2024 Santos emailed LNAC details of the Barossa Production Operations EP and OEMP consultation sessions being held for Larrakia People in Darwin on 12 June 2024 and asked for the organisation to share the information with its Larrakia networks and post on notice boards and relevant social media channels. [Con- 6022] • See entry for Larrakia People in this Table for summaries of the consultation sessions held on 17 May 2024 • LNAC was invited (by Larrakia Development Corporation) to a meeting between Larrakia Development Corporation and Santos on 20 June 2024 but did not attend. See LDC entry in this table for a summary of the meeting. • On 10 July 2024 Santos emailed LNAC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5119] • On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982] • On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036] • Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from the LNAC. • Additional to formal consultation on the Production Operations EP and OEMP, Santos has continued to make a range of efforts to engage on an ongoing basis with NT First Nations People, both directly and through their representative organisations. See Section 8.4.11 Post-acceptance Consultation Implementation Strategy.			
Summary of response by Relevant Person	**Assessment of merits**	**Santos' Response Statement**	**EP reference**
No response was received from LNAC	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.
Northern Land Council (NLC)			
Summary of consultation effort: • On 13 February 2024 Santos emailed NLC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3971]. The email advised that Santos was seeking information to better understand: - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and* - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.* • The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions, links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024. • In the email Santos asked NLC if it knew of any other organisations that should be contacted. Santos also advised NLC that it would be happy to provide consultation sessions for NLC staff, Board and members. • On 12 March 2024 Santos emailed NLC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3972] • On 12 March 2024 NLC emailed Santos to advise that it has forwarded the information to its Principal Legal Officer to follow-up. [Con-3973]			

- On 2 April 2024 Santos emailed NLC by way of reminder that the consultation is closing on April 9 and asked NLC to contact Santos urgently if it would like a consultation session or had any questions on the information provided. [Con-3974]
- On 2 May 2024 Santos emailed NLC further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from NLC [Con-3978]
- During the consultation period for this EP, Santos also consulted with First Nations Consultative Committees (FNCCs) and/or Clan Groups representing the interests of First Nations people in coastal areas of the NLC regions of East Arnhem, West Arnhem, Darwin/Daly/Wagait and Victoria River District. See the separate entries in this table for the outcomes of consultation with each FNCC/Clan Group.
- On 10 July 2024 Santos emailed NLC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Santos advised NLC it would appreciate its support in passing on the information to Council Members/Representatives. [Con-5122]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-5982]
- On 14 November 2024 Santos phoned the NLC seeking confirmation that it had no comments on the EP and OEMP. The NLC responded via phone on 15 November 2024 to confirm it had no comments. [Con-5988].
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from NLC

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from NLC	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Tiwi Land Council (TLC)

Summary of consultation effort:

- On 6 February 2024 Santos met with the TLC as part of a regular series of meetings to provide activity updates, share information and discuss any potential concerns. Santos provided updates on a range of topics including the next round of consultation sessions with Tiwi clan groups. [Con-4668]
- On 13 February 2024 Santos emailed TLC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-4058]. The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions, links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- In the email Santos also advised TLC that it would be happy to provide consultation sessions for TLC staff, Board and Council members. Santos also attached the notification for the next round of Tiwi Consultation sessions, at which this EP would be discussed and asked the TLC to post the notification on its noticeboard.
- During the consultation period, the TLC and members who were also Clan Trustees were consulted on proposed meeting dates and confirmed dates and/or when any postponements were required. Some elected members of the TLC were often in attendance at the consultation sessions with their respective Clan Groups.
- On 12 March 2024 Santos emailed TLC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-4059]
- In the email Santos also advised TLC that it would be happy to provide a consultation session for TLC staff and will be holding Tiwi Clan meetings in early April to close-out the consultation on this EP.
- On 2 April 2024 Santos emailed TLC by way of reminder that the consultation is closing on April 9 and asked TLC to contact Santos as soon as possible if TLC would like a consultation session or has any questions on the below information. [Con-4078]
- On 2 May 2024 Santos emailed TLC further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from TLC. [Con-4110]
- On 10 July 2024 Santos emailed TLC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Santos advised TLC it would appreciate its support in passing on the information to the Land Council (Trustee and Directors) for them to share with their clans. [Con-5120]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from TLC.
- Additional to formal consultation on the Production Operations EP and OEMP, Santos has continued to make a range of efforts to engage on an ongoing basis with NT First Nations People, both directly and through their representative organisations. See Section 8.4.11 Post-acceptance Consultation Implementation Strategy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from TLC	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Wickham Point Deed liaison committee (WPDLC)

Summary of consultation effort:

- The Production Operations EP activities have been a regular agenda item at quarterly Wickham Point Deed liaison committee meetings since November 2021. As per the entry in this table for the liaison committee, consultation with respect to activities within this EP was held on 7 March 2024.

- On 7 March 2024 Santos held a consultation session with the Wickham Point Deed liaison committee. The following information related to this EP was presented and discussed: [Con-4047]
  - The Commonwealth Government and NT Government regulations and approvals required
  - The activities covered by the EP
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The information booklet and NOPSEMA consultation brochure were also provided at the consultation session.
- The activities were conducted in person and visual aids, maps, videos and animations were also to present information regarding the Activity and the project more generally.
- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. [Con-6015] Refer below "Summary of response by Relevant Persons" below for further detail of specific questions answered at the meeting and the general topics/themes discussed.
- In addition, a question on underwater cultural heritage management in NT waters was outside the scope of this EP and a response was separately provided. Questions on how to access Santos' employment and education opportunities or seek funding from Santos for community projects are managed outside the EP consultation process.
- On 12 March 2024 Santos emailed Wickham Point Deed liaison committee members thanking them for attending the consultation session. Links to the information that had been provided at the session were included in the email which also advised that consultation is open until Tuesday 9 April 2024. Santos encouraged the committee members to share the information with their Larrakia family and friends. [Con-4995]
- On 27 March 2024 Santos emailed Wickham Point Deed liaison committee members details of the Barossa Production Operations EP and OEMP consultation sessions being held for Larrakia People in Darwin on 23 April and asked for them to share the information with their Larrakia networks and post on notice boards and relevant social media channels. [Con- 6021]
- On 10 July 2024 Santos emailed Wickham Point Deed liaison committee members to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Santos advised Wickham Point Deed liaison committee members it would appreciate its support in passing on the information to their families. [Con-5123]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from the Wickham Point Deed liaison committee
- Additional to formal consultation on the Production Operations EP and OEMP, Santos has continued to make a range of efforts to engage on an ongoing basis with NT First Nations People, both directly and through their representative organisations. See Section 8.4.11 Post-acceptance Consultation Implementation Strategy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
Following discussion on consultation material, there were questions and comments received in relation to the matters set out below: • Composition of Barossa gas • Assessment of water currents and marine mammal movement • Management of solid waste on vessels. Santos answered those questions and there were no responses raised for consideration, other than those noted below.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met. The answers provided were based on: • Composition of Barossa gas described in Section 7.6.1. • Water current movements described in Sections 3.3.3.1, 3.3.3.2 and 3.3.3.3 • Marine mammal migration paths described in Section 3.4.3.2 and Section 3.5.6 • Management of solid waste on vessels described in Section 2.7.3.9 for the FPSO, Section 0 for vessel operational discharges and Section 0 for produced water discharges.	Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Section 7.6.1. Sections 3.3.3.1, 3.3.3.2 and 3.3.3.3 Section 3.4.3.2 Section 3.5.6 Section 2.7.3.9 Section 0
A committee representative member asked what residual or by-products will be in the gas coming from the Barossa field to the Darwin LNG facility.	Santos has considered the matters raised in the EP and provided details on residual by products. The answers provided were based on the activity description in Section 2.	Santos addressed this question at the meeting., Santos explained that by-product condensate is removed and processed offshore on FPSO. There will be very little residual or by-product coming through the pipeline from Barossa as dry gas is required for processing at DLNG facility. A small amount of Liquid Petroleum Gas is produced and transported from the facility via road transport.	Section 2
A committee representative member asked if the water currents around the FPSO had been considered when writing the assessment of marine mammal movement and preventative measures.	Santos has considered the matters raised in the EP and provided further detail on water currents and migration paths. The answers provided were based on: • Water current movements described in Sections 3.3.3.1, 3.3.3.2 and 3.3.3.3 • Marine mammal migration paths described in Section 3.4.3.1.2 and Section 3.5.6 • Marine fauna interaction control measures in Table 7-4 .	At the meeting Santos explained that it had detailed information on water currents and migration paths that has been used to help determine how Santos can reduce risk of vessel interaction. By way of example, Santos stated that the FPSO will be located a long way from the Tiwi Islands and turtle nesting areas, and nearby mammals would be transiting only. This means the risk of interaction with transiting vessels would be low.	Sections 3.3.3.1, 3.3.3.2 and 3.3.3.3 Section 3.4.3.1.2 and Section 3.5.6 Table 7-4

A committee representative member asked if the FPSO would be disposing food scraps into the water. Further, the committee representative member asked about Santos' proposed food waste management plan.	Santos has considered the matters raised in the EP and provided further detail on proposed food disposal on the FPSO. The answers provided were based on: Food waste management is described in Section 2.7.3.9.1, Section 6.7.1.2 and control measure BAO-CM-6.7.1.	At the meeting Santos explained that kitchen waste was normally ground up on the vessel before it was sent through an outlet to the ocean.	Section 2.7.3.9.1 Section 6.7.1.2 BAO-CM-6.7.1

First Nations People and groups: First Nations Consultative Committees and coastal clan groups – NT

Larrakia people

Summary of consultation effort:

- -In order to assist with its efforts to reach out to Larrakia people in a culturally sensitive and appropriate way, consistent with NOPSEMA's consultation guidelines (2023, 2024), Santos has previously requested advice and assistance from LNAC, which speaks on behalf of Larrakia people, in relation to appropriate ways to engage with Larrakia people. This is additional to Santos' consultation with LNAC in its own right (see the separate entry for LNAC in Table 4-18).
- The LNAC Board's recommended approach to consultation with Larrakia people, communicated to Santos in December 2023, involved the following:
  - Santos undertake face-to-face consultation
  - Santos advertise in the NT News the face-to face consultation once venue and time is confirmed
  - Larrakia Nation promote face-to-face consultation on social media including opportunity to provide feedback through Santos' toll-free number on 1800 267 600.
  - Larrakia Nation email all LNAC staff to ensure they are aware of the consultation session to be conducted.
- On 23 April 2024 Santos held two consultation sessions in Darwin on the Barossa Production Operations EP and GEP Coastal Waters OEMP with Larrakia people. [Con-4249], [Con-4230]
- On 12 June 2024 Santos held two further consultation sessions in Darwin on this EP and the OEMP with Larrakia people. [Con-4264], [Con-4263]
- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below "Summary of response by Relevant Persons" below for further detail of general topics/themes discussed.
- In addition, questions on how to access Santos' employment and education opportunities or seek funding from Santos for community projects are managed outside the EP consultation process.
- In addition to the consultation efforts described above, Larrakia families are also represented on the Wickham Point Deed liaison committee, which has been separately consulted in relation to this EP and the OEMP – see the separate entry for the liaison committee in this Table. Barossa Production Operations activities have been a regular agenda item at quarterly Wickham Point Deed liaison committee meetings since November 2021. As per the entry in this table for the liaison committee, consultation with respect to activities within this EP and the OEMP was held on 7 March 2024.
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received on the Barossa Production Operations EP and GEP Coastal Waters OEMP from Larrakia People.
- Additional to formal consultation on the Production Operations EP and OEMP, Santos has continued to make a range of efforts to engage on an ongoing basis with NT First Nations People, both directly and through their representative organisations. See Section 8.4.11 Post-acceptance Consultation Implementation Strategy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
Following discussion on consultation material, there were questions and comments received in relation to the matters set out below: Activity • pipeline route • pipeline and FPSO maintenance • monitoring and alarm process for leaks in pipeline • Consultation & communication • Santos' communication with Larrakia people and the general community • consultation process and flow of information to Larrakia People • notification to other marine users, such as fishers, of activities occurring Existing Environment • assessment of water currents and marine life movement • nature of currents and tides & influence of infrastructure presence on marine fauna movement • potential for currents to bring environmental hazards & debris that could impact infrastructure • cyclones and other weather events	The answers provided were based on: • Activity - described in Section **2**, including for the design parameters. • Consultation and communication described in Section **4**, and required notifications in Section 8.4.9 and 8.4.11. • The existing environment described in Section **3**. • The environment risks & impacts as well as the management controls for these described in Sections **6** and **7**. Specific risks and impacts pertinent to the matters raised include: • GHG emissions – Section **6.3** • Atmospheric emissions – Section **6.4** • Physical presence – Section **6.6** • Waste management – Section **6.7** and section **7.1** • Potential impacts to marine life is addressed within a number of subsections in Section **6** and **7**, and also in Section **7.3** • Loss of hydrocarbon management including gas release and spills in Sections **7.6** and **7.7** • The relevant legislative requirements described in Section **1.7**. • Potential cumulative impacts associated with concurrent drilling is described in Section **2.3.1**. Committee members did not raise objections or claims about the adverse impact of each activity to which this EP relates. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Not applicable

Environment impacts & risks • physical presence of infrastructure & vessels – how will these be detected/identified? • effects of activities on marine life • effects of activities on the Tiwi Islands • ghost nets management • incidence of major spills in the EMBA • impact of GHG emissions, other emissions including chemicals • gas emissions from the pipeline • gas supply customers • waste management on vessels • prevention of gas leaks • Other • the approval processes • the AAPA process for identification of sacred sites • drilling campaign details including depths of drilling and timeframe Santos answered those questions and there were no responses raised for consideration, other than those noted below.			
An attendee stated that there were other groups of people around Daly River mouth, including Bungal, Dundee and Crab Claw, and on small islands who should also be consulted.	Santos has considered the matters raised in the EP and provided a response at the meeting. Santos notes the advice provided by the attendee and has consulted people in these areas via First Nations consultative committees.	At the meeting Santos explained that people in the areas named by the individual have been consulted for this EP.	Not applicable
Some attendees stated they and other family members were not aware of the sessions and suggested there be better communication by both Santos and Larrakia representative organisations.	Santos has considered the matters raised in the EP and provided a response at the meeting The answers provided were based on: • Consultation approach for Larrakia people described in Section **4.6.5.1.2**. • Public promotion of Larrakia consultation sessions described in **Table 4-10** • Examples of advertising and public notices in **Appendix F**. Santos notes the advice provided by the attendees and considers it has made reasonable attempts to engage Larrakia people directly and via their representative organisations. Santos provided opportunities for Larrakia people to be involved in the consultation process through a range of ways for this EP as outlined in Section **4.6.5.1.2** and in the entries in this Table for the Northern Land Council (NLC), Larrakia Nation Aboriginal Corporation (LNAC), Gwalwa Daraniki Association (GDA) and Wickham Point Deed liaison committee (WPDlC).	At the meeting Santos explained that activities that had been undertaken to provide consultation opportunities for Larrakia people, including through participation in the Wickham Point Deed liaison committee.	Not applicable
An attendee stated that clan groups were getting confused because of what was in the media, noting differing statements about the environmental impacts of the Barossa Project.	Santos has considered the matters raised in the EP and provided a response at the meeting. The answers provided were based on the consultation approach for Larrakia people described in Section **4.6.5.1.2**. Santos has provided opportunities for Larrakia people to be involved in the consultation process and provide direct input into EP development.	At the meeting Santos explained that: The Barossa Project is heavily regulated by government to ensure that what Santos proposes to do will be acceptable and the risk are appropriately managed.	Not applicable
Cobourg Peninsula Consultative Committee			
Summary of consultation effort: • On 29 April 2024 Santos held a consultation session in the morning with Agalda clan #1 in Jabiru. [Con-4250] • On 29 April 2024 Santos held a consultation session in the afternoon with Agalda clan #2 in Jabiru. [Con-4243] • On 1 May 2024 Santos held a consultation session in the afternoon with the Murran, Ngaindjagar, Madjunbalmi clan groups in Darwin [Con-4252] • On 2 May 2024 Santos held a consultation session in the morning with Agalda clan #3 in Wurrumiyanga. [Con-4254] • The following information related to this EP was presented and discussed at each consultation session: ○ The Commonwealth Government and NT Government regulations and approvals required			

- The activities covered by this EP
- The environmental impacts and risks involved with the planned activities and planned controls to management those risks
- The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
- The regulatory consultation processes and privacy provisions

- The presentation also provided an overview of Santos the company and the Barossa Project overall, including a Project status update as per previous Barossa EPs
- The Production Operations information booklet, Santos Privacy Statement and NOPSEMA consultation brochure was also provided at the consultation session.
- The sessions were conducted in person with the use of visual aids such as AO poster sized maps, AO posters with photos and images, PowerPoint presentation and videos to present information regarding the Activity and the project more generally.
- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below "Summary of response by Relevant Persons" below for further detail of general topics/themes discussed.
- Questions on how to access Santos' employment and education opportunities or seek funding from Santos for community projects are managed outside the EP consultation process.
- On 7 June 2024 Santos emailed a member of the Agalda Clan and Cobourg Peninsula Consultative Committee providing additional information in answer to some questions raised during the consultation session. These questions are addressed below. [Con-4997]
- On 10 July 2024 the consultant engaged by Santos to support establishment of the FN Consultative Committees, emailed the Cobourg Peninsula Consultative Committee, on behalf of Santos, to advise the consultation period for the Barossa Production Operations EP had been completed. In the email Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Committee members were invited to pass the email on to other people in their network. [Con-5201]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from members of the Cobourg Peninsula Consultative Committee.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference

Following discussion on consultation material, there were questions and comments received in relation to the matters set out below:
• Activity
  • stability of the FPSO
  • how underwater maintenance is conducted
  • drilling activity
  • FPSO stability
• Consultation & communication
  • Why did it take so long to do consultation with us on our land?
• Existing Environment
  • environmental baseline studies
  • mapping of water currents around the FPSO
  • There needs to be a base line (for the FPSO), so you know what to do if something was to happen.
• Environment impacts & risks
  • sewage disposal
  • impacts of drilling or the pipeline to groundwater
  • how particular areas within the EMBA could be impacted by a spill
  • how is a spill contained and the timeframe involved
  • compensation for environmental impacts due to a spill
  • impacts and regulation of GHG emissions and purchasing of carbon credits
  • how are spills cleaned up and how long does this take
  • Where does the gas go? will it go into the ozone? Will it increase the temperature that will impact our turtles etc.
  • What happens if the gas escapes (from the FPSO)?
  • Sewerage.
	The answers provided were based on:
	• Activity - described in Section **2**, including for the design parameters.
	• Consultation and communication described in Section **4**, and required notifications are included in Section **8.4.9** and **8.4.11**.
	• The existing environment described in Section **3**, this includes for the baseline studies undertaken.
	• The environment risks & impacts as well as the management controls described in Sections **6** and **7**. Specific risks and impacts pertinent to the matters raised include:
	• GHG emissions – Section **6.3**
	• Atmospheric emissions – Section **6.4**
	• Waste management – Section **6.7** and Section **7.1**
	• Loss of hydrocarbon management including gas release and spills in Sections **7.6** and **7.7**
	• The Barossa Development Drilling and Completions EP – accepted by NOPSEMA in December 2023.
	
	Committee members did not raise objections or claims about the adverse impact of each activity to which this EP relates.
	
	Santos considers it has provided sufficient information and a reasonable period of time for consultation.
	
	Santos considers Section 25 consultation requirements to have been met.
		Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Not applicable

• Where will spills go? Do they impact our area? • Spill response timing • Spill containment • Other • Historic accidents and past incidence of spills in the region • Compensation for those affected • Carbon Capture and Storage process • Access to employment and education opportunities for FN people (including on the FPSO) Santos answered those questions and there were no responses raised for consideration, other than those noted below.			
A committee member asked if Santos benefited financially from purchasing offsets.	Santos has considered the matters raised in the EP and provided a response. Santos provided further details on the potential benefit of purchasing offsets.	Following the meeting in an email on 7 June 2024 Santos explained that: The benefit to Santos from offsets is the ability to use them to address emissions from our facilities. This is the primary purpose for which Santos acquires offsets. Purchase of offsets by Santos is at Santos' cost. The Clean Energy Regulator oversees the generation and use of Australian Carbon Credit Units to offset emissions in accordance with the Safeguard Mechanism under Australian legislation.	Not applicable
A committee member asked what environmental baseline studies had been undertaken.	Santos has considered the matters raised in the EP and provided a response The answers provided were based on: Environmental studies described in Section **3** and summarised in **Table 3-1**.	Following the meeting in an email on 7 June 2024 Santos explained that: Santos has completed ocean water (wind, wave, current, water quality), sediment quality, marine fauna, benthic habitat, noise, fish communities at shoals and shelf and seafloor (geophysical) studies. Santos has also undertaken desktop assessments, such as for turtle activity. These studies are summarised in the EP as part of the assessment by the Regulator. The best sources of information are the Appendices to the Barossa Offshore Project Proposal (OPP) which are publicly available on the NOPSEMA website.	Not applicable
A committee member asked what happens if Santos exceeds the total emissions for the year. As a consequence, would Santos shut down operations.	Santos has considered the matters raised in the EP and provided a response. The answers provided were based on: Control measures BAO-CM-6.3.10 and BAO-CM-6.3.11 (**Table 6-25**).	Following the meeting in an email on 7 June 2024 Santos explained that: The Clean Energy Regulator will set a baseline (Safeguard Mechanism) for Barossa greenhouse gas emissions. Santos will purchase or generate Australian Carbon Credit Units (ACCUs) to offset Barossa's reservoir CO_2 emissions and any emissions above the Safeguard Mechanism baseline. Santos will comply with the Regulator's requirements. Companies which do not comply with the Safeguard Mechanism are subject to significant enforcement penalties from the Clean Energy Regulator.	Not applicable
A committee member asked if there was a limit on how many times Santos can use the flare on the FPSO.	Santos has considered the matters raised in the EP and provided a response. The answers provided were based on: Control measures BAO-CM-6.3.3 (**Table 6-19**).	Following the meeting in an email on 7 June 2024 Santos explained that: The flare on the FPSO will only be used during facility commissioning and start-up, planned maintenance activities and during unplanned facility outages. There is no routine flaring on the FPSO during normal operations. Due to safety and operational requirements, there is no limit on how many times the flare can be used.	Not applicable
A committee member asked if Santos had a map of the currents around the FPSO.	Santos has considered the matters raised in the EP and provided a response. The answers provided were based on: • Information regarding currents in Section **3.3.3.1** and Section **3.3.3.2**. • Appendix J of the Barossa Subsea Infrastructure Installation EP:	Following the meeting in an email on 7 June 2024 Santos explained that: Santos provided information and maps as requested. This information has been provided in previous Barossa Environment Plans and will also be in the Barossa Production Operations EP. Further information is available in Appendix J of the Barossa Subsea Infrastructure Installation EP which is publicly available on the NOPSEMA website.	Not applicable
Kardu Lalangkin (Daly River / Port Keats) Consultative Committee			
Summary of consultation effort:			

- On 18 April 2024 Santos held a consultation session with the Kardu Lalingkin (Daly River/Port Keats) Consultative Committee in Wadeye. [Con-4253]
- The following information related to this EP was presented and discussed:
  - The Commonwealth Government and NT Government regulations and approvals required
  - The activities covered by this EP
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The Production Operations information booklet, Santos Privacy Statement and NOPSEMA consultation brochure was also provided at the consultation session.
- The sessions were conducted in person with the use of visual aids such as AO poster sized maps, AO posters with photos and images, PowerPoint presentation and videos to present information regarding the Activity and the project more generally.
- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below "Summary of response by Relevant Persons" below for further detail of general topics/themes discussed.
- A question raised during the session relating to fishing licences and how these may interact with sea country was not relevant to this EP. Questions on how to access Santos' employment and education opportunities or seek funding from Santos for community projects are managed outside the EP consultation process.
- On 10 July 2024 the consultant engaged by Santos to support establishment of the FN Consultative Committees, emailed the Kardu Lalingkin (Daly River/Port Keats) Consultative Committee, on behalf of Santos, to advise the consultation period for the Barossa Production Operations EP had been completed. In the email Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Committee members were invited to pass the email on to other people in their network. [Con-5201]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from the Kardu Lalingkin (Daly River/Port Keats) Consultative Committee.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference

Following discussion on consultation material, there were questions and comments received in relation to the matters set out below:
• Activity:
  • how the FPSO is moved to the field
  • timeframe for FPSO being in the field
  • depth of the pipeline.
• Consultation & communication
  • notification process in the event of a spill
• Environment impacts & risks
  • spills and spill response
  • planning for the possibility of an accident occurring
Santos answered those questions and there were no responses raised for consideration by Kardu Lalingkin (Daly River/Port Keats) Consultative Committee.
	The answers provided were based on:
	• Activity - described in Section **2**, including for the design parameters.
	• Consultation and communication described in Section **4**, and required notifications are included in Section **8.4.9** and **8.4.11.**
	• The environment risks & impacts as well as the management controls described in Sections **6** and **7**. Specific risks and impacts pertinent to the matters raised include:
	• Loss of hydrocarbon management including gas release and spills in Sections **7.6** and **7.7**
	Committee members did not raise objections or claims about the adverse impact of each activity to which this EP relates.
	Santos considers it has provided sufficient information and a reasonable period of time for consultation.
	Santos considers Section 25 consultation requirements to have been met.
		Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Not applicable

Djulidki (Bradshaw) Consultative Committee

Summary of consultation effort:

- On 19 April 2024 Santos held a consultation session with the Djulidki (Bradshaw) Consultative Committee in Darwin. [Con-4248]
- The following information related to this EP was presented and discussed:
  - The Commonwealth Government and NT Government regulations and approvals required
  - The activities covered by this EP
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The Production Operation information booklet, Santos Privacy Statement and NOPSEMA consultation brochure was also provided at the consultation session.
- The sessions were conducted in person with the use of visual aids such as AO poster sized maps, AO posters with photos and images, PowerPoint presentation and videos to present information regarding the Activity and the project more generally.

- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below "Summary of response by Relevant Persons" below for further detail of general topics/themes discussed.
- A question related to notification in the event of a spill is addressed below. Questions on how to access Santos' employment and education opportunities or seek funding from Santos for community projects are managed outside the EP consultation process.
- On 10 July 2024 the consultant engaged by Santos to support establishment of the FN Consultative Committees, emailed the Djulidki (Bradshaw) Consultative Committee, on behalf of Santos, to advise the consultation period for the Barossa Production Operations EP had been completed. In the email Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Committee members were invited to pass the email on to other people in their network. [Con-5201]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from the Djulidki (Bradshaw) Consultative Committee.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference

Following discussion on consultation material, there were questions and comments received in relation to the matters set out below:
• Consultation & communication
  • notification process in the event of a spill
• Environment impacts & risks
  • biosecurity risk management
  • oil spill management
Santos answered those questions and there were no responses raised for consideration, other than those noted below
	The answers provided were based on:
	• Consultation and communication described in Section **4**.
	• The environment risks & impacts as well as the management controls described in Sections **6** and **7**. Specific risks and impacts pertinent to the matters raised include:
	• Loss of hydrocarbon management including gas release and spills in Sections **7.6** and **7.7**, and required notifications are included in Section **8.4.9** and **8.4.11**.
	Santos considers it has provided sufficient information and a reasonable period of time for consultation.
	Santos considers Section 25 consultation requirements to have been met.
		Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required	Not applicable

A committee member stated that its major concerns were diesel spills and how Santos would let the committee know.	Santos has considered the matters raised in the EP and provided a response at the meeting. Santos provided information on how the Djulidki (Bradshaw) Consultative Committee would be notified in the event of a spill.	At the meeting Santos agreed to notify the Committee Chair of all spills heading towards the Djulidki (Bradshaw) Consultative Committee interests.	Notifications are included in

Ngoy Garmak Consultative Committee

Summary of consultation effort:

- On 28 May 2024 Santos held a consultation session with the Ngoy Garmak Consultative Committee in Galiwin'ku, Elcho Island. [Con-4261]
- The following information related to this EP was presented and discussed:
  - The activities covered by this EP
  - The Commonwealth Government regulations and approvals required
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
  - The regulatory consultation processes and privacy provisions
  - The presentation also provided an overview of Santos the company and the Barossa Project overall, including a Project status update as per previous Barossa EPs
  - The Production Operation information booklet, Santos Privacy Statement and NOPSEMA consultation brochure was also provided at the consultation session.
- The sessions were conducted in person with the use of visual aids such as AO poster sized maps, AO posters with photos, and videos to present information regarding the Activity and the project more generally.
- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below "Summary of response by Relevant Persons" below for further detail of general topics/themes discussed. A request was made by an attendee for a follow up meeting to discuss general matters about whale migration separate to this EP.
- On 10 July 2024 the consultant engaged by Santos to support establishment of the FN Consultative Committees, emailed the Ngoy Garmak Peninsula Consultative Committee, on behalf of Santos, to advise the consultation period for the Barossa Production Operations EP had been completed. In the email Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Committee members were invited to pass the email on to other people in their network. [Con-5201]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 17 December 2024 Santos met with two Ngoy Garmak Consultative Committee members to discuss general matters about whale migration separate to this EP. The matters discussed were of a culturally sensitive nature and information unrelated to this EP was provided on a confidential basis. During those meetings, the committee members each confirmed there were no outstanding matters with respect to this EP. [Con-6025]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference

Following discussion on consultation material, there were questions and comments received in relation to the matters set out below:
• Activity
  • extent of the geographical areas covered by the EP
  • how long the pipeline will be in place
  • Will the currents impact safety?
• Consultation & communication
  • notification process in the event of a spill
• Existing Environment
  • Protect the sea life and the seabed & protect cultural values.
  • Song lines within the EMBA, song lines record everything, rely on these for territorial boundaries and currents.
• Environment impacts & risks
  • risks of a spill to people and the environment
  • how particular areas within the EMBA could be impacted by a spill
  • timeframe for responding to a spill
  • monitoring of impacts to migrating whales.
  • Can condensate harm people or the environment?
  • Is it going to affect the seabed?
  • Whales are important for this community and the spills would need to be monitored to protect them.
• Other
  • EP approval process
  • past incidence of spills in the region
Santos answered those questions and there were no responses raised for consideration, other than those noted below.
	The answers provided were based on:
	• Activity - described in Section **2**, including for the design parameters.
	• The existing environment described in Section **3** including feedback received during the consultation sessions.
	• The environment risks & impacts as well as the management controls described in Sections **6** and **7**. Specific risks and impacts pertinent to the matters raised include:
	• GHG emissions – Section **6.3**
	• Atmospheric emissions – Section **6.4**
	• Seabed disturbance - Section **6.5**
	• Loss of hydrocarbon management including gas release and spills in Sections **7.6** and **7.7**, and required notifications are included in Section **8.4.9** and **8.4.11**
	• Potential impacts to marine life, including whales, is addressed within a number of subsections in Section **6** and **7**, and also in Section **7.3**
	Santos considers it has provided sufficient information and a reasonable period of time for consultation.
	Santos considers Section 25 consultation requirements to have been met.
		Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Not applicable

An attendee affirmed the cultural importance of song lines and stories related to whales migrating to and from the South Pacific. The attendee requested that Santos return to speak at another time to talk about these matters.	Santos has considered the matters raised and closed out the request, noting he matters did not related to the EP. Answers provided in the 28 May meeting generally relating to whales were based on: • Marine mammal migration paths described in Section **3.4.3.1.2** and Section **3.5.6**. • Marine fauna interaction control measures in **Table 7-4** Santos has considered impacts to whales from planned activities and unplanned events in preparing this EP.	At the meeting Santos explained that Santos would organise a meeting with the attendee to talk about these matters. Santos met with the attendee on 17 December 2024 and issues discussed were not related to the EP	Not applicable
Attendees advised of the importance of stories and song lines that run through the area and how information is recorded in the song lines. Song lines are believed to traverse from the bedrock in the land and out to the sea. Queries were raised about protecting the sea life, seabed and cultural values from potential environmental impacts within the EMBA and wanted to understand the timeframe for a spill response.	Santos has considered the matters raised in the EP and provided a response at the meeting. Loss of hydrocarbon management including gas release and spills in Sections **7.6** and **7.7**, and required notifications (including First Nations people and groups) are included in Section **8.4.9** and **8.4.11**. The OPEP outlines timeframes for spill response and includes the arrangements for activating trained Tiwi Rangers to assist with a spill response.	At the meeting Santos explained spill response times and processes.	Not applicable
Miyarrka Consultative Committee			

Summary of consultation effort:

- On 11 June 2024 Santos held a consultation session with the Miyarrka Consultative Committee in Gapuwiyak. [Con-5000].
- The following information related to this EP was presented and discussed:
  - The Commonwealth Government regulations and approvals required
  - The activities covered by this EP
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The Production Operation information booklet, Santos Privacy Statement and NOPSEMA consultation brochure was also provided at the consultation session.
- The sessions were conducted in person with the use of visual aids such as AO poster sized maps, AO posters with photos, PowerPoint presentation, and videos to present information regarding the Activity and the project more generally.
- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below "Summary of response by Relevant Persons" below for further detail of general topics/themes discussed.
- Questions on how to access Santos' employment and education opportunities or seek funding from Santos for community projects are managed outside the EP consultation process.
- On 10 July 2024 the consultant engaged by Santos to support establishment of the FN Consultative Committees, emailed the Miyarrka Consultative Committee, on behalf of Santos, to advise the consultation period for the Barossa Production Operations EP had been completed. In the email Santos \advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Committee members were invited to pass the email on to other people in their network. [Con-5201]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from the Miyarrka Consultative Committee.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference

Following discussion on consultation material, there were questions and comments received in relation to the matters set out below:
• Activity
  • risks posed by natural disasters such as earthquakes and cyclones
  • composition of the gas and condensate
• Environment impacts & risks
  • risks of the gas and condensate to people and the environment?
  • management of planned discharges to water
  • climate change, the vacuum that comes up to the air when you are doing the testing, does that affect the atmosphere
Santos answered those questions and there were no responses raised for consideration, by Miyarrka Consultative Committee.
	The answers provided were based on:
	• Activity - described in Section **2**, including for the design parameters.
	• The environment risks & impacts as well as the management controls for these are described in Sections **6** and **7**. Specific risks and impacts pertinent to the matters raised include:
	• GHG emissions – Section **6.3**
	• Atmospheric emissions – Section **6.4**
	• Planned discharges – section **6.7**
	• Loss of hydrocarbon management including gas release and spills in sections **7.6** and **7.7**
	Santos considers it has provided sufficient information and a reasonable period of time for consultation.
	Santos considers Section 25 consultation requirements to have been met.
		Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Not applicable

Maningrida Regional Consultative Committee

Summary of consultation effort:

- On 6 June 2024 Santos held a consultation session with the Maningrida Regional Consultative Committee in Maningrida. [Con-4262]
- The following information related to this EP was presented and discussed:
  - The activities covered by this EP
  - The Commonwealth Government regulations and approvals required
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The Production Operation information booklet, Santos Privacy Statement and NOPSEMA consultation brochure was also provided at the consultation session.
- The sessions were conducted in person with the use of visual aids such as AO poster sized maps, AO posters with photos and images, PowerPoint presentation, and videos to present information regarding the Activity and the project more generally.

- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below "Summary of response by Relevant Persons" below for further detail of general topics/themes discussed.
- On 3 July 2024, Santos held a second consultation session with the Maningrida Regional Consultative Committee in Maningrida. [Con-5052]
- The following information related to this EP was presented and discussed:
  - The activities covered by this EP
  - The Commonwealth Government regulations and approvals required
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The Production Operation information booklet, Santos Privacy Statement and NOPSEMA consultation brochure was also provided at the consultation session.
- The sessions were conducted in person (with two people attending via teams) with the use of visual aids such as AO poster sized maps, AO posters with photos and images, PowerPoint presentation, and videos to present information regarding the Activity and the project more generally.
- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below "Summary of response by Relevant Persons" below for further detail of general topics/themes discussed.
- Questions on how to access Santos' employment and education opportunities and seek funding from Santos for community projects are managed outside the EP consultation process.
- On 10 July 2024 the consultant engaged by Santos to support establishment of the FN Consultative Committees, emailed the Maningrida Regional Consultative Committee, on behalf of Santos, to advise the consultation period for the Barossa Production Operations EP had been completed. In the email Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Committee members were invited to pass the email on to other people in their network. [Con-5201]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from the Maningrida Regional Consultative Committee

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference

Following discussion on consultation material, there were questions and comments received in relation to the following matters:
• Activity
  • maintaining stability of the pipeline
• Consultation & communication
  • Santos should talk to the saltwater ranger team and Outback Spirit.
• Existing Environment
  • Marine pests are natural creatures, there are songlines that sing about marine pests. They have the right to live under water.
• Environment impacts & risks
  • regulation of chemical use
  • safety measures for during movement of materials between vessels
  • biosecurity management
  • regulation of GHG emissions
  • process involved in the event of an accident and a spill needing to be cleaned-up
  • modelling of the EMBA
  • how particular areas within the EMBA could be impacted by a spill
  • tidal pattern means communities along the coast will be heavily impacted. It is just nature
  • concerns that fish (their food source) will ingest hydrocarbons and the potential for illness or death when the fish is eaten
• Other
	The answers provided were based on:
	• Activity – described in Section **2**, including for the design parameters.
	• Santos consultation undertaken described in Section **4**, and required notifications included in Section **8.4.9**
	• The existing environment is described in Section **3**, and includes for feedback received during the consultation sessions.
	• The environment risks & impacts as well as the management controls described in Sections **6** and **7**. Specific risks and impacts pertinent to the matters raised include:
	• GHG emissions – Section **6.3**
	• Interactions with other marine users – Section **6.6**
	• Waste management – Section **6.7** and Section **7.1**
	• Biosecurity management – Section **7.2**
	• Loss of hydrocarbon management including gas release and spills in sections **7.6** and **7.7** and required notifications are included in Section **8.4.9** and **8.4.11**
	• Potential impacts to fish addressed within a number of subsections in Section **6** and **7**, including spills in Sections **7.6** and **7.7**
	
	Carbon Capture Storage will not be undertaken as an activity under this EP.
	
	Santos considers it has provided sufficient information and a reasonable period of time for consultation
		Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Not applicable

• safety of CCS • concerns from an historic event where a freighter travelling across the north of Australia from Liverpool coincided with event of a lot of dead fish, uncertain if there was a chemical spill or not. We didn't know, no one told us. Santos answered those questions and there were no responses raised for consideration by the Maningrida Regional Consultative Committee			

Gapu Maringa Consultative Committee

Summary of consultation effort:

- On 5 June 2024 Santos held a consultation session with the Gapu Maringa Consultative Committee in Milingimbi. [Con-5002]
- The following information related to this EP was presented and discussed:
  - The Commonwealth Government regulations and approvals required
  - The activities covered by this EP
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The Production Operation information booklet, Santos Privacy Statement and NOPSEMA consultation brochure was also provided at the consultation session.
- The sessions were conducted in person with the use of visual aids such as AO poster sized maps, AO posters with photos and images, and videos to present information regarding the Activity and the project more generally.
- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below "Summary of response by Relevant Persons" below for further detail of general topics/themes discussed.
- A question raised during the session relating to the extent of First Nations ownership and control of coastal and inland waters was not relevant to this EP.
- Questions on how to access Santos' employment and education opportunities or seek funding from Santos for community projects are managed outside the EP consultation process.
- On 10 July 2024 the consultant engaged by Santos to support establishment of the FN Consultative Committees, emailed the Gapu Maringa Consultative Committee, on behalf of Santos, to advise the consultation period for the Barossa Production Operations EP had been completed. In the email Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Committee members were invited to pass the email on to other people in their network. [Con-5201]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from the Gapu Maringa Consultative Committee.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference

Following discussion on consultation material, there were questions and comments received in relation to the following matters:
• Activity
  • composition of the gas and condensate
  • What are those pipes there, will they come off in the wind?
• Consultation & communication
  • Notification if there was a crash or spill
• Existing Environment
  • extent of the geographical areas covered by this EP
• Environment impacts & risks
  • wastewater management
  • how particular areas within the EMBA could be impacted by a spill
  • how the risk of vessel collisions is managed
  • oil spill management
	The answers provided were based on:
	• Activity – described in Section **2**, including for the design parameters.
	• Barossa condensate described in Section **7.7.3.1**.
	• Santos consultation undertaken described in Section **4**, and required notifications included in Section **8.4.9** and **8.4.11**.
	• The existing environment described in Section **3**.
	• The environment risks & impacts as well as the management controls described in Sections **6** and **7**. Specific risks and impacts pertinent to the matters raised include:
	• Physical presence – Section **6.6**
	• Waste management – Section **6.7** and section **7.1**
	• Loss of hydrocarbon management including gas release and spills in Sections **7.6** and **7.7**
	• The relevant legislative requirements for the Barossa Production Operations activities described in section **1.7**.
	
	Santos considers it has provided sufficient information and a reasonable period of time for consultation.
	
	Santos considers Section 25 consultation requirements to have been met.
		Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Not applicable

• concerns on gas explosions & potential for gas and rubbish to impact their land • Santos to protect the land and sea and activity is safe. • Concerns on vessel collision and what if spill travels their way • Other • Can the Traditional Owners say yes or no. • Regulator process and penalties for breaches • FN ownership and control of coastal and inland waters Santos answered those questions and there were no responses raised for consideration by the Gapu Maringa Consultative Committee.			

Jindiwi Consultative Committee

Summary of consultation effort:

- On 30 April 2024 Santos held a consultation session with the Jindiwi Consultative Committee in Jabiru. Representatives at this meeting were expected to include Wulna clan representatives, however they were not able to attend on the day. [Con-4251]
- The following information related to this EP was presented and discussed at both consultation sessions:
  - The Commonwealth Government and NT Government regulations and approvals required
  - The activities covered by this EP
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The Production Operations information booklet, Santos Privacy Statement and NOPSEMA consultation brochure was also provided at the consultation session.
- The sessions were conducted in person with the use of visual aids such as AO poster sized maps, AO posters with photos and images, PowerPoint presentation and videos to present information regarding the Activity and the project more generally.
- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below “Summary of response by Relevant Persons” below for further detail of general topics/themes discussed.
- A question was raised at the meeting on potential access to community project funding for monitoring of waters. This question is outside the scope of this EP. At the meeting Santos advised the committee that it would be happy to have further discussions on this and any requests seeking access to funding for community projects.
- Questions on how to access Santos’ employment and education opportunities or seek funding from Santos for community projects are managed outside the EP consultation process.
- On 10 July 2024 the consultant engaged by Santos to support establishment of the FN Consultative Committees, emailed the Jindiwi Consultative Committee, on behalf of Santos, to advise the consultation period for the Barossa Production Operations EP had been completed. In the email Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Committee members were invited to pass the email on to other people in their network. [Con-5201]
- Notwithstanding, the communication on 10 July, the consultation period for the Jindiwi Consultative Committee was subsequently extended to allow an opportunity for the Jindiwi Consultative Committee to share consultation information with and obtain input for the EP (if any) from the Wulna clan members who had not been in attendance at the earlier consultation meeting with the Jindiwi Consultative Committee on 30 April 2024. On 28 July 2024 the consultant engaged by Santos to support establishment of the First Nations Consultative Committees confirmed that:
- The Jindiwi Consultative Committee had previously agreed to Wulna clan participation through the Jindiwi Consultative Committee.
- On 28 July 2024 the consultant, in his role of providing secretariat support to the Jindiwi Consultative Committee, and one of his cultural advisers met with the Wulna clan members who had not been in attendance at the Jindiwi Consultative Committee meeting on 30 April 2024.
- During the 27 July 2024 meeting the Wulna clan members formally accepted membership into the Jindiwi Consultative Committee. The meeting also involved the consultant discussing and providing the Barossa Production Operations consultation materials to the Wulna clan consultative committee members on behalf of the JCC and inviting any input for the EP to pass onto Santos. No concerns were raised by the Wulna clan consultative committee members on the consultation material or the proposed activities. [Con-5280]
- The 27 July meeting occurred as a key role of the consultative committee (as stated in their charters) is for the dissemination of consultation information to First Nations community members of relevance, which was undertaken in this instance with this meeting and the addition of Wulna clam members into the Jindiwi CC.
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos’ contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from the Jindiwi Consultative Committee.

Summary of response by Relevant Person	Assessment of merits	Santos’ Response Statement	EP reference
Following discussion on consultation material, there were questions and comments received in relation to the following matters: • Activity	The answers provided were based on: • Activity- described in Section **2**, including for the design parameters. • The environment risks & impacts as well as the management controls for these described in Sections **6** and **7**. Specific risks and impacts pertinent to the matters raised include:	Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Not applicable

• Existing risks posed by natural disasters such as earthquakes and cyclones
• Environment impacts & risks
  • how particular areas within the EMBA could be impacted by a spill, oil spill management, which area would be affected near Arnhem land?
  • impact of a spill on marine life -what would happen if the wind changes and will it affect the turtles and dugongs?
  • biosecurity management – where will the FPSO be checked for marine life in NT waters or Australian waters?
Santos answered those questions and there were no responses raised for consideration, by the Jindiwi Consultative Committee.
	• Biosecurity management – Section **7.2**
	• Potential impacts to marine life is addressed within a number of subsections in Section **6** and **7**, and also in Section **7.3**
	• Loss of hydrocarbon management including gas release and spills in sections **7.6** and **7.7**
	Santos considers it has provided sufficient information and a reasonable period of time for consultation.
	Santos considers Section 25 consultation requirements to have been met		

Wulna Clan (via the Jindiwi Consultative Committee)

- On 30 April 2024 Santos held a consultation session Jindiwi Consultative Committee in Jabiru. Wulna representatives were expected at this meeting, however, were not able to attend on the day. [Con-4251]
- On 27 July 2024, the consultant engaged by Santos to support establishment of the First Nations Consultative Committees, in his role of providing secretariat support to the Jindiwi Consultative Committee, met with Wulna clan members who had not been able to attend the 30 April meeting. During the 27 July 2024 meeting the Wulna clan members formally accepted membership into the Jindiwi Consultative Committee. The meeting also involved the consultant discussing and providing the Barossa Production Operations consultation materials to the Wulna clan consultative committee members on behalf of the Jindiwi Consultative Committee and inviting any input for the EP to pass onto Santos. No concerns were raised by the Wulna clan consultative committee members on the consultation material or the proposed activities. [Con-5280]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- See also the entry in this Table for the summary of consultation with the Jindiwi Consultative Committee including Wulna clan representatives.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
There were no responses raised for consideration, by the Wulna Clan	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Not applicable

Mulyurrud Consultative Committee (Croker Island)

Summary of consultation effort:

- On 16 April 2024 Santos held a consultation session with the Mulyurrud Consultative Committee in Darwin. [Con-4234]
- The following information related to this EP was presented and discussed:
  - The Commonwealth Government and NT Government regulations and approvals required
  - The activities covered by this EP
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The Production Operations information booklet, Santos Privacy Statement and NOPSEMA consultation brochure was also provided at the consultation session.
- The session was conducted in person with the use of visual aids such as AO poster sized maps, AO posters with photos and images, PowerPoint presentation and videos to present information regarding the Activity and the project more generally.
- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below "Summary of response by Relevant Persons" below for further detail of general topics/themes discussed.
- A copy of the presentation was requested and provided to the committee on 25 June 2024 [Con-5003].
- A cultural advisor helping to facilitate the session noted at the beginning of the consultation session that some words were difficult to understand and that pictures would help. During this meeting, three large (A1 size) maps were adhered to the walls, there were multiple A3 size maps and diagrams handed out, and the presentation which followed made strong use of graphics. At least two FN Consultative Committees cultural advisors were present who were able to translate, and who did so on occasion (i.e during this meeting to address the comment made).
- Separate to the consultation for this EP, the committee requested Santos speak to the committee about purchasing carbon credits and providing funding support for ranger groups. Organisation of this meeting is managed separately to the EP consultation process.
- Separate to the consultation for this EP, an attendee stated that the committee needed time to discuss Santos proposed community investment activities and requested a follow-up discussion. Questions and requests on how to access Santos' employment and education opportunities or seek funding from Santos for community projects are managed outside the EP consultation process.
- On 10 July 2024 the consultant engaged by Santos to support establishment of the FN Consultative Committees, emailed the Mulyurrud Consultative Committee, on behalf of Santos, to advise the consultation period for the Barossa Production Operations EP had been completed. In the email Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Committee members were invited to pass the email on to other people in their network. [Con-5201]

- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- During a call on 5 December 2024 to follow up matter not relating to this EP, the Mulyurrud Consultative Committee chair confirmed that there were no outstanding matters with respect to this EP. [Con-6016]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from the Mulyurrud Consultative Committee.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference

Following discussion on consultation material, there were questions and comments received in relation to the following matters:
• Activity
  • structural integrity of the FPSO during a tsunami, cyclone or natural disaster.
  • what happens to the gas and condensate
• Consultation & communication
  • what is involved in the consultation process
• Existing Environment
  • the environmental studies that have been undertaken by Santos
  • (in the context of marine life in the environment where the FPSO is located) Is it empty? What about migration?
• Environment impacts & risks
  • the environmental impact of the project generally and to marine life
  • how far planned discharges extend from the FPSO
  • impact of exclusion zones on other activities such as fishing or defence patrols - (in the context of the 500m exclusion zone around the FPSO) – affecting fishing. There are a lot of patrols, military exercises/presences, will they be affected?
  • Impacts to marine fauna eg bottlenose dolphins, seen fauna washed up land.
  • Visibilty of vessels and physical presence (buoys & lighting safety)
  • Volumes of carbon dioxide released over the lifetime of the Barossa, where does it go and associated climate change impacts
  • Spill EMBA
  • Spill response preparedness and activities & looking after country, the process and timing for responding to a spill
  • Offsetting of emissions through purchase of carbon credits & Carbon Capture and Storage
• Other
  • what is involved in the drilling process, e.g. depth drilled, size of the drill, can earthquakes or tsunamis be caused by drilling?
  • how a permit area for drilling is determined
  • Santos answered those questions and there were no responses raised for consideration, by Mulyurrud Consultative Committee.
	The answers provided were based on:
	• Activity – described in Section **2**, including for the design parameters.
	• Santos consultation described in Section **4**, and required notifications included in Section **8.4.9** and **8.4.11**.
	• The existing environment described in Section **3**.
	• The environment risks & impacts as well as the management controls described in Sections **6** and **7**. Specific risks and impacts pertinent to the matters raised include:
	• GHG emissions – Section **6.3**
	• Physical presence – Section **6.6**
	• Operational and produced water discharges described in Section **6.7** and **6.8**
	• Potential impacts to marine life is addressed within a number of subsections in Section **6** and **7**, and also in Section **7.3**
	• Loss of hydrocarbon management including gas release and spills in Sections **7.6** and **7.7**
	• The Barossa Development Drilling and Completions EP – accepted by NOPSEMA in December 2023.
	
	Carbon Capture storage will not be undertaken as an activity under this EP.
		Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Not applicable

Rak Badjalarr Consultative Committee
Summary of consultation effort:

- On 17 April 2024 Santos held a consultation session with the Rak Badjalarr Committee at the Rydges Palmerston in Darwin. [Con-4233]
- The following information related to this EP was presented and discussed:
  - The Commonwealth Government and NT Government regulations and approvals required
  - The activities covered by this EP
  - The environmental impacts and risks involved with the planned activities; and planned controls to management those risks and
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks.
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The information booklet and NOPSEMA consultation brochure were also provided at the consultation session.
- The sessions were conducted in person with the use of visual aids such as AO poster sized maps, AO posters with photos and images, PowerPoint presentation and videos to present information regarding the Activity and the project more generally.
- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below "Summary of response by Relevant Persons" below for further detail of general topics/themes discussed.
- Santos provided the committee with videos presented at the meeting following a request from a committee member.
- Santos was requested to send through the videos following the meeting. A Santos staff member sent through the link to the videos on 17 April 2024 via SMS via to the contact phone number for the RBCC member [Con-6004]. During the meeting, information was provided by a committee member on a confidential basis related to a Dreamtime story and the protection of a totem species, which was referred to in the minutes as a sacred site. The issue does not relate specifically to this EP and was the subject of separate discussions with the committee member and Santos' third-party cultural advisors, including an anthropological expert who considered this matter as part of their report on other aspects of the Barossa Project (https://www.santos.com/wp-content/uploads/2024/09/First-Nations-spiritual-and-cultural-values-in-relation-to-the-Darwin-Pipeline-Duplication-Project.pdf) and concluded this matter was not relevant to this EP.
- Questions on how to access Santos' employment and education opportunities or seek funding from Santos for community projects are managed outside the EP consultation process.
- On 10 July 2024 the consultant engaged by Santos to support establishment of the FN Consultative Committees, emailed the Rak Badjalarr Consultative Committee, on behalf of Santos, to advise the consultation period for the Barossa Production Operations EP had been completed. In the email Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Committee members were invited to pass the email on to other people in their network. [Con-5201]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from the Rak Badjalarr Consultative Committee.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference

Following discussion on consultation material, there were questions and comments received in relation to the following matters:
• Activity
  • details of the FPSO, e.g. its size, how it gets to the field and anchored
  • What vessels will be coming through the waters
  • structural integrity of the FPSO during a tsunami, cyclone or natural disaster.
  • the pipeline route and nature of the seabed, does the pipeline go through the marine park?
• Consultation & communication
  • how privacy of FN people and information they provide is protected
• Environment impacts & risks
  • how other marine users are notified of facilities and activities
  • presence of vessels and how do TO hunters know where they are?
  • How an EMBA is determined and modelled, is the oil on top on the water
  • GHG emissions management
• Other
  • how carbon capture and storage works
  • previous incidents and how they are recorded
	The answers provided were based on:
	• Activity – described in Section **2**, including for the design parameters.
	• Santos consultation undertaken in Section **4**, and required notifications are included in Section **8.4.9** and **8.4.11**
	• The existing environment described in Section **3**.
	• The environment risks & impacts as well as the management controls described in Sections **6** and **7**. Specifically
	• GHG emissions – Section **6.3**
	• Physical presence – Section **6.6**
	• Loss of hydrocarbon management including gas release and spills in Sections **7.6** and **7.7**
	Carbon Capture storage will not be undertaken as an activity under this EP.
	Santos considers it has provided sufficient information and a reasonable period of time for consultation.
	Santos considers Section 25 consultation requirements to have been met.
		Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Not applicable

Santos answered those questions and there were no responses raised for consideration, by the Rak Badjalarr Consultative Committee.			

Goulburn Island Consultative Committee

Summary of consultation effort:

- On 30 May 2024 Santos held a consultation session with the Goulburn Island Consultative Committee at the Warruwi (South Goulburn Island) Yagbani Aboriginal Corporation Meeting Room. [Con-5005]
- The following information related to this EP was presented and discussed:
  - The Commonwealth Government regulations and approvals required
  - The activities covered by this EP
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The Production Operation information booklet, Santos Privacy Statement and NOPSEMA consultation brochure was also provided at the consultation session.
- The sessions were conducted in person with the use of visual aids such as AO poster sized maps, AO posters with photos and images, and videos to present information regarding the Activity and the project more generally.
- The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below "Summary of response by Relevant Persons" below for further detail of general topics/themes discussed.
- Questions on how to access Santos' employment and education opportunities or seek funding from Santos for community projects are managed outside the EP consultation process.
- On 10 July 2024 the consultant engaged by Santos to support establishment of the FN Consultative Committees, emailed the Goulburn Island Consultative Committee, on behalf of Santos, to advise the consultation period for the Barossa Production Operations EP had been completed. In the email Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Committee members were invited to pass the email on to other people in their network. [Con-5201]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from the Goulburn Island Consultative Committee.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference

Following discussion on consultation material, there were questions and comments received in relation to the following matters:
• Activity
  • pipeline installation process
  • structural integrity of the pipeline during a tsunami, cyclone or natural disaster.
  • how long the FPSO will be located in the field
• Environment impacts & risks
  • dropped objects
  • process and timing for responding to a spill
  • how particular areas within the EMBA could be impacted by a spill
  • interference of pipeline with fishing
  • how are people advised of facility locations.
Santos answered those questions and there were no responses raised for consideration, by the Goulburn Island Consultative Committee.
	The answers provided were based on:
	• Activity - described in Section **2**, including for the design parameters.
	• Santos consultation described in Section **4**, and required notifications are included in Section **8.4.9** and **8.4.11**
	• The environment risks & impacts as well as the management controls described in Sections **6** and **7**. I. Specifically
	• Physical presence – Section **6.6**
	• Dropped objects - Section **7.1**
	• Loss of hydrocarbon management including gas release and spills in Sections **7.6** and **7.7**
	Santos considers it has provided sufficient information and a reasonable period of time for consultation.
	Santos considers Section 25 consultation requirements to have been met.
		Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Not applicable

First Nations People and groups: Other First Nations organisations – Northern Territory

Aboriginal Sea Company (ASC)

Summary of consultation effort:

- On 12 March 2024 Santos emailed Aboriginal Sea Company advising that it is consulting on the Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters and asks for consideration as to whether their organisation considers itself a Relevant Person. Santos advised that the consultation is open until Tuesday 9 April 2024. [Con-4049]
- On 15 March 2024 Santos met with the ASC in Darwin. At the meeting Santos explained the production operations activities and risks involved. The ASC executive officer advised they had read through the information and did not have any feedback. The officer advised that the ASC typically does not provide comment on environmental matters when approached by oil and gas companies. [Con-6012]
- On 15 March 2024 Aboriginal Sea Company thanked Santos via email for the meeting and provided its Capability Statement. [Con-5235]

- On 5 June 2024 Santos emailed ASC to thank it for meeting and to advise it had passed on the ASC's information to relevant Santos staff. Santos thanked ASC for taking the time to review the information in the context of ASC typically not providing comment on environment plans, and noted it has no specific feedback on this occasion. [Con-4363]
- On 10 July 2024 Santos emailed ASC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from ASC.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from ASC.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Gwalwa Daraniki Association (GDA)

Summary of consultation effort:

- On 12 March 2024 Santos emailed GDA to advise that it had commenced the consultation phase which would run until 9 April 2024. Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-4050]
- On 2 May 2024 Santos emailed GDA further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from GDA. [Con-4102]
- GDA was invited (by Larrakia Development Corporation) to a meeting between Larrakia Development Corporation and Santos on 20 June 2024 but did not attend.
- On 10 July 2024 Santos emailed GDA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 27 and 28 August 2024 Santos attempted to contact GDA via phone to check whether the Association had intended to comment on recent EPs. The calls were not answered and there was no ability to leave message. [Con-5611]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from GDA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from GDA.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Kenbi Rangers

Summary of consultation effort:

- On 13 February 2024 Santos emailed the NLC, which also has responsibility for the Kenbi Rangers, to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP [Con-3971] The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 12 March 2024 Santos emailed the NLC Kenbi Rangers representative further to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3975] Santos sought a meeting with Kenbi Rangers to discuss the information provided. [Con-3976]
- On 2 May 2024 Santos emailed the NLC Kenbi Rangers' representative further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from the NLC Kenbi Rangers' representative. [Con-3977]
- On 10 July 2024 Santos emailed NLC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Santos advised NLC it would appreciate its support in passing on the information to Council Members/Representatives. [Con-5122]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from the NLC Kenbi Rangers' representative.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Kenbi Rangers.	Santos considers it has provided sufficient information and a reasonable period of time for consultation.	No response required.	Not applicable.

	Santos considers Section 25 consultation requirements to have been met.		

Larrakia Development Corporation (LDC)

Summary of consultation effort:

- On 13 February 2024 Santos emailed LDC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-4080]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 14 February an LDC representative responded to Santos via email advising of staffing changes and to provide appropriate contact details. [Con-4081]
- On 27 March 2024 Santos emailed LDC details of the Barossa Production Operations EP and OEMP consultation sessions being held for Larrakia People in Darwin on 23 April and asked for the organisation to share the information with its Larrakia networks and post on notice boards and relevant social media channels. [Con- 6021]
- On 2 April 2024 Santos emailed LDC by way of reminder that the consultation is closing on April 9 and asks to be contacted as soon as possible if it has any feedback. [Con-4079]
- On 2 April 2024 LDC emailed Santos stating it would provide a written response to Santos by COB that week. [Con-4083]. Santos acknowledged the LDC email the same day. [Con-4084] The response was not provided by LDC by the date it had nominated.
- On 2 May 2024 Santos emailed LDC further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from LDC. [Con-4111]
- On 3 May 2024 LDC emailed Santos to advise it would be providing a formal response the following week. [Con-4112]
- On 24 May 2024 LDC emailed Santos and advised that Larrakia people want to have input into the Production Operations Environment Plan (EP). LDC seeks to participate in genuine consultation with meetings with Larrakia representatives and access to independent advice about the nature of the proposal. LDC is working to arrange both of these in close partnership with Larrakia Nation Aboriginal Corporation and Gwalwa Daraniki Association and requests a reasonable opportunity to engage in consultations. LDC also requested financial assistance to obtain independent advice and to arrange meetings. [Con-4216]
- On 24 May 2024 Santos emailed LDC to confirm receipt of its email and advised an official response would follow. [Con-4217]
- On 11 June 2024 Santos emailed LDC inviting it to meet on 17 or 18 June 2024. Santos also advised that we were planning to proceed with the next round of Larrakia consultation sessions for the relevant EPs (which all Larrakia are invited to attend) which are scheduled for Wednesday 12 June at Malak Community Centre. [Con-5007]
- On 12 June 2024 LDC respond to Santos via email stating it could meet on 20 or 21 June 2024. In the email LDC said Larrakia People were not currently resourced to respond to Santos' consultation approach and the consultation meetings Santos had scheduled were not adequate consultation for Larrakia People and should not be relied on as sufficient to meet the requirements for consultation under NOPSEMA guidelines or as discussed in the Tipakalippa court decision. [Con-5008].
- On 20 June 2024 LDC attended a meeting with Santos at which the main topic of discussion was LDC's concerns over engagement with Larrakia people by proponents of all large-scale development in Darwin. [Con-5056]
- At the meeting LDC stated the following:
  - Santos' consultation efforts (for this EP) are not being criticised, but LDC is offering to set up a process that can be used from the outset of consultation that will also meet the expectations of the government regulator
  - the NT Government's proposed Middle Arm industrial development has prompted Larrakia organisations to work with the Government on a framework agreement for engagement with Larrakia people
  - project proponents have significant resources to spend on consultation but Larrakia organisations are not resourced enough to be able to seek independent advice on proposals and respond accordingly.
  - current capacity for LDC to respond is limited and, LDC's priority is Middle Arm.
  - the framework will aim to help redress this imbalance and put Larrakia people on an equal footing with proponents, and ensure they are informed and respected. The framework will set out how Larrakia people will be involved and set out costs
  - the framework is under consideration and will be presented to Larrakia families once ready
  - regarding the EP, it is a complex project and Larrakia have not had access to independent advice because they have not got the resources
  - asked whether Santos have been taking advice from Top End Alliance. Santos responded that their scope excludes Larrakia
- At the meeting Santos stated the following:
  - Santos has made a range of efforts to consult with Larrakia people on this EP, both through their representative organisations and directly with Larrakia people
  - Santos welcomes any input on the current EP, which is being submitted to the government regulator shortly for assessment, another meeting can be set up if required.
  - Santos is committed to having a long-term relationship with Larrakia people and is happy to work with LDC and other organisations to achieve this
  - Santos is supportive in-principle of being involved in such a framework agreement and hearing more about it.
  - regarding the EP, Santos has tried to produce material that is understandable and has taken advice from other First Nations groups about how to present it. Santos wants to hear about possible improvements.
- On 10 July 2024 Santos emailed LDC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5181]
- On 11 July 2024 LDC emailed Santos stating it did not agree that the consultation process was concluded and reiterated its position that proper consultation required the coordinated input of all Larrakia families, the provision of independent expert advice to Larrakia and the resourcing to undertake this entire process. In its email LDC claimed Santos' response did not reflect a genuine commitment to engagement over the life of the project. [Con-5116]
- On 7 August 2024 Santos emailed LDC and clarified that Santos is open to working with LDC to discuss a consultation framework that would help to facilitate future consultation with the Larrakia families, and that it looks forward to receiving a draft framework agreement from LDC once it had concluded consultation with Larrakia families. [Con-5284]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 25 November 2024 LDC advertised a briefing session which would be run together with LNAC and GDA to present the framework to Larrakia families on 25 November 2024, for the purposes of the NT Government consultation [Con-6017]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from LDC. A draft framework agreement had not been received from LDC at the time of EP submission.
- Additional to formal consultation on the Production Operations EP and OEMP, Santos has continued to make a range of efforts to engage on an ongoing basis with NT First Nations People, both directly and through their representative organisations. See Section 8.4.11 Post-acceptance Consultation Implementation Strategy. No further correspondence or feedback was received from LDC.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
An LDC representative stated that consultation on large-scale development in Darwin requires meetings with Larrakia representatives.	Santos has considered the matters raised in the EP and provided a response. For this EP, Santos adopted a multi-faceted approach to providing input and feedback opportunities for Larrakia people, including through representative organisations with a dedicated Larrakia focus, other First Nations organisations,	Santos has consulted with Larrakia people and Larrakia organisations.	Section 4.6.5.1.2

	Santos-coordinated Larrakia consultation sessions and provision of consultation materials with personnel at Santos' Darwin shopfront available to answer queries. These activities were supported by a local public awareness campaign, with the direction and support of representative organisation LNAC (see separate entry this section). Santos considers it has provided sufficient information and a reasonable period of time for consultation with LDC. Santos considers Section 25 consultation requirements to have been met.		
An LDC representative stated that LDC required additional time for consultation and communicated a proposal for a consultation framework (which LDC want to undertake in partnership with Larrakia Nation Aboriginal Corporation and Gwalwa Daraniki Association).	Santos has considered the matters raised in the EP and provided a response. Santos understands the LDC request for additional time for consultation, which was tied to a proposal for a consultation framework. Santos' consultation methodology considers and accommodates preferences expressed by Relevant Persons regarding design of the consultation process, where reasonably practicable and appropriate. Consistent with Santos' consultation methodology, Santos has considered this request but this request has not been accommodated for the purposes of s 25 consultation for this EP because it was not reasonably practicable and appropriate in the circumstances. In particular, it was not reasonably practicable to accommodate this request because: • Santos has invited further information about the proposed framework and a copy of the framework, but did not receive any further information which it could review and consider during the consultation period for this EP. • Santos understands that, as of the present date, the proposed framework still does not have endorsement by Larrakia family groups. Further, the purported framework relates to the facilitation of consultation with Larrakia people in circumstances where: - The LDC does not currently have representative authority to speak broadly to the consultation needs of Larrakia People, noting its role as a commercial organisation that aims to support positive economic outcomes for Larrakia People, and that it is governed by a board of independent directors. - Santos has consulted with Larrakia People in a culturally sensitive and appropriate manner, including (but not limited to) implementing advice from LNAC who represents the Traditional Owners of the Darwin region and speaks on behalf of Larrakia People. - During Santos' consultation with Larrakia people and Larrakia representative bodies, Santos was not advised that the Larrakia People want LDC to represent them for the purpose of consultation for this EP. Santos has provided the LDC with sufficient information and a reasonable period to assess any possible consequences of the Activity in this EP on the LDC's functions, interests and activities, however LDC has not confirmed any consequences for its function, interests and activities. Notwithstanding this, Santos consulted with LDC in its own right, in its capacity as a commercial organisation that supports positive economic outcomes for Larrakia people. Santos included LDC in preliminary and formal consultation commencing in February 2024. LDC was also provided consultation opportunities beyond the formal consultation closing date of 16 May 2024, including in a meeting on 20 June 2024 and follow up email on 7 August 2024. On this basis, Santos considers that it has provided sufficient information and a reasonable period for LDC to participate in the consultation process for this EP. Santos will continue to engage with LDC regarding the Barossa Gas Project. In the event that it delivers a consultation framework, that is supported by all Larrakia family groups, Santos will then have regard to it in relation to ongoing consultation over the life of the Barossa project.	Santos provided opportunities for LDC to participate in consultation and provide input regarding these activities, the environment that may be affected by the proposed activities, and the environmental impacts and risks associated with the proposed activities. Santos will continue to engage with LDC on the consultation framework, and if prepared and supported by all Larrakia family groups, will have regard to it in relation to ongoing consultation.	Not applicable.
An LDC representative stated that LDC's preferred mechanism for government and industry proponents to consult with Larrakia people was for Santos to enter into a consultation framework that would support future engagement.	Santos has considered the matters raised in the EP and provided a response. Santos' consultation methodology considers and accommodates preferences expressed by Relevant Persons regarding design of the consultation process, where reasonably practicable and appropriate.	Santos understood that LDC would provide Santos a draft consultation framework once LDC had completed their engagement with all Larrakia families.	Not applicable.

The representative noted that the framework was under consideration and would be presented to Larrakia families once ready. The representative stated that LDC was working on these matters in close partnership with Larrakia Nation Aboriginal Corporation and Gwalwa Daraniki Association.	Consistent with Santos' consultation methodology, Santos has considered this request but this request has not been accommodated for the purposes of s 25 consultation for this EP because it was not reasonably practicable and appropriate in the circumstances. In particular, it was not reasonably practicable to accommodate this request because: • The request lacked particularity. Santos invited further information and a copy of the consultation framework, but did not receive any further information which it could review and consider during the consultation period for this EP. • Santos understands that, as of the present date, the proposed framework still does not have endorsement by Larrakia family groups. Further, it was not appropriate for Santos to accommodate as it relates to the facilitation of consultation with Larrakia People in circumstances where: • The LDC does not currently have representative authority to speak broadly to the consultation needs of Larrakia People, noting its role as a commercial organisation that aims to support positive economic outcomes for Larrakia People, and that it is governed by a board of independent directors. • Santos has consulted with Larrakia People in a culturally sensitive and appropriate manner, including (but not limited to) implementing advice from LNAC who represents the Traditional Owners of the Darwin region and speaks on behalf of Larrakia people, noting its role as a commercial organisation that supports positive economic outcomes for Larrakia People. • During Santos' consultation with Larrakia people and Larrakia representative bodies, Santos was not advised that the Larrakia people want LDC to represent them for the purpose of consultation for this EP. Santos will continue to engage with LDC regarding the Barossa Gas Project. In the event that it delivers a consultation framework, that is supported by all Larrakia family groups, Santos will then have regard to it in relation to ongoing consultation over the life of the Barossa project.	Santos will continue to engage with LDC on the consultation framework, and if prepared and supported by all Larrakia family groups, will have regard to it in relation to ongoing consultation.	
An LDC representative stated that they required financial assistance in order to obtain independent advice and arrange meetings with Larrakia families, as the current capacity for LDC to respond is limited and its priority is Middle Arm.	Santos has considered the matters raised in the EP and provided a response. Santos notes the LDC's request for financial assistance in order to obtain independent advice for Larrakia People and arrange meetings with all Larrakia families. Santos understands this request was tied to a broader proposal for a consultation framework. Consistent with Santos' consultation methodology, Santos has considered this request but this request has not been accommodated for the purposes of s 25 consultation for this EP because it was not reasonably practicable and appropriate in the circumstances. In particular, it was not reasonably practicable to accommodate this request because: • The request lacked particularity. Santos understands the request was linked to a broader request for Santos to enter into a proposed consultation framework about which Santos invited further information and a copy of the framework, but did not receive any further information which it could review and consider during the consultation period for this EP. • Santos understands that, as of the present date, the proposed framework still does not have endorsement by Larrakia family groups. • Further, the request was not appropriate for Santos to accommodate as it relates to the facilitation of consultation with Larrakia People in circumstances where: - The LDC does not currently have representative authority to speak broadly to the consultation needs of Larrakia People, noting its role as a commercial organisation that aims to support positive economic outcomes for Larrakia People, and that it is governed by a board of independent directors. - Santos has consulted with Larrakia People in a culturally sensitive and appropriate manner, including (but not limited to) implementing advice from LNAC who represents the Traditional Owners of the Darwin region and speaks on behalf of Larrakia people.	Santos understood that LDC, would provide Santos a draft framework once LDC had completed their engagement with all Larrakia families. Santos will continue to engage with LDC on the consultation framework, and if prepared and supported by all Larrakia family groups, will have regard to it in relation to ongoing consultation.	Not applicable.

	- During Santos' consultation with Larrakia people and Larrakia representative bodies, Santos was not advised that the Larrakia people want LDC to represent them for the purpose of consultation for this EP. Santos will continue to engage with LDC LDC regarding the Barossa Gas Project. In the event that it delivers a consultation framework, that is supported by all Larrakia family groups, Santos will then have regard to it in relation to ongoing consultation over the life of the Barossa project. In the event that LDC delivers a framework (as described above), Santos will then consider appropriate financial recompense for meeting attendance and input, and/or access to independent advice that the framework may propose.		

North Australia Indigenous Land and Sea Management Alliance (NAILSMA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed NAILSMA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024 Santos emailed NAILSMA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3794]
- On 4 April 2024 Santos phoned NAILSMA and left a message with phone contact details.
- On 2 May 2024 Santos emailed NAILSMA to follow-up on previous emails and advised of an additional risk associated with the proposed activity and provided a link to the updated booklet and factsheet. Santos advised it had extended the consultation period and requested NAILSMA input by 16 May 2024. [Con-4101]
- On 10 July 2024 Santos emailed NAILSMA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from NAILSMA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from NAILSMA.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Tiwi Islands Clan Groups and Individuals

Summary of consultation effort:

- Santos continued its staged approach to consultation with Tiwi Islands clan groups and individuals.
- Consultation activities were conducted in person at three locations on the Tiwi Islands, primarily through discussions or presentations.
- The sessions were advertised in advance in accordance with a process agreed with the Clan Groups.
- Some elected members of the TLC were often in attendance at the consultation sessions with their respective Clan Groups.
- At the sessions Santos used visual aids, maps, videos, animations to present information regarding the Activity and the project more generally.
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The Production Operation information booklet, Santos Privacy Statement and NOPSEMA consultation brochure were provided at the consultation session.
- The following consultations sessions were held on the Tiwi Islands:
  - On 5 March 2024 with the Marrikawuyanga, Yimpinari and Wulirankuwu Clans at Milikapiti (Social and Sports Club) [Con-4160]
  - On 6 March 2024 with the Mantiyupwi Clan at Wurrumiyanga (Mantiyupwi Motel). [Con-4161]
  - On 6 March 2024 with the Jikilaruwu Clan at Wurrumiyanga (Mantiyupwi Motel). [Con-4162]
  - On 7 March 2024 with the Wurankuwu Clan at Wurrumiyanga (Mantiyupwi Motel). [Con-4163]
  - On 7 March 2024 with the Malawu Clan at Wurrumiyanga (Mantiyupwi Motel) [Con-4164]
  - On 8 April 2024 with the Munupi Clan at Pirlangimpi (Sports and Social Club). [Con-4093]
  - On 9 April 2024 with the Marrikawuyanga and Yimpinari Clans at Milikapiti (Social and Sports Club). [Con-4095]
  - On 10 April 2024 with the Jikilaruwu Clan at Wurrumiyanga (Mantiyupwi Motel). [Con-4097]
  - On 10 April 2024 with the Mantiyupwi Clan at Wurrumiyanga (Mantiyupwi Motel). [Con-4096]

- On 13 May 2024 with the Marrikawuyanga, Yimpinari and Wulirankuwu Clans at Milikapiti (Social and Sports Club). [Con-4255]
- On 15 May 2024 with the Jikilaruwu Clan at Wurrumiyanga (Mantiyupwi Motel). [Con-4256]
- On 15 May 2024 with the Mantiyupwi at Wurrumiyanga (Mantiyupwi Motel). [Con-4257]
- On 16 May 2024 with the Wurankuwu and Malawu Clans at Wurrumiyanga (Mantiyupwi Motel). [Con-4258]
- On 17 May 2024 with the Manupi Clan at Pirlangimpi (Sports and Social Club). [Con-4231]
- On 21 May 2024 with the Manupi Clan at Pirlangimpi (Sports and Social Club) [Con-4259]
- On 22 May 2024 with Wurankuwu and Malawu Clans at Wurrumiyanga (Mantiyupwi Motel). [Con-4260]

- Santos also held three consultation sessions with each Tiwi Clan over an extended consultation period to ensure that information regarding the project was understood, that Clan members had ample opportunity to raise questions or concerns, and to ensure that technical information was explained clearly to relevant Clan members.
- In addition to the sessions held on the Tiwi Islands, sessions were also held in Darwin on 22 March 2024 and 8 April 2024 for any Darwin-based Tiwi People. [Con-4844], [Con-4166]
- The following information related to this EP and was presented and discussed at each Tiwi consultation session:
  - The Commonwealth Government and NT Government regulations and approvals required
  - The activities covered by this EP
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
  - The majority of the engagement with attendees involved discussion to increase their understanding of the proposed activities and the associated risks and impacts, without any objections or claims about the adverse impact of each activity to which this EP relates. Refer below "Summary of response by Relevant Persons" below for further detail of general topics/themes discussed.
  - A number of the questions raised at these sessions related to activities covered by other Barossa EPs (being the DPD, D&C, SURF and GEP EPs) that had also been raised and discussed at previous consultation sessions.
  - Some requests for further information during Tiwi consultation sessions were answered during the meeting. This includes requests for pictures of the Barossa condensate, which were requested during a Jikilaruwu Clan meeting and were provided to clan members on an iPad at a later stage in the meeting. [Con-4097]. Additionally, with respect to requests for the development of a cultural protocol for consultation which were raised during a consultation session with the Munupi Clan, Santos responded by committing to working better with Tiwi Clans and highlighting approaches Santos already takes to consultation with the Tiwi Clans, including its extended consultation timeframes. [Con-4093]. Where a question could not be answered fully at one session further response and information was provided at the next session. This includes with respect to requests for information on relevant environmental studies during a Wurankuwu Clan and Malawu Clan meeting on 7 March 2024 [Con-4163]. During further meetings, including on 16 May 2024 at a Wurankuwu and Malawu Clans meeting [Con-4258], a Manupi Clan meeting on17 May 2024 [Con-4231], a Jilikaruwu Clan meeting on 15 May 2024 [Con-4256] and a Wulirankuwu Clan meeting on 13 May 2024] [Con-4255], Santos addressed previous requests for further information on environmental studies relevant to the project by providing attendees with access to relevant studies on an iPad.
  - Some requests from individual Tiwi Clan members for more detailed information were followed-up via call or email with them directly. These are summarised below:
    - On 30 April 2024 Santos responded via email to questions on carbon capture and storage and provided links to further information. [Con-4099]
    - On 1 May 2024 the individual emailed Santos thanking it for the information provided on 30 April 2024. [Con-4100]
    - On 3 May 2024 Santos responded via email to questions on the compensation process in the event of an oil spill. [Con-4114]
    - On 3 May 2024 Santos responded via email to questions on material safety data sheets and the distance from the project activities to a reef formation. [Con-4113] Response to this information was received via email the same day. In their email the individual explained why they were seeking the data sheets and requested images of the reef formation. [Con-4115]
    - On 13 May 2024 Santos emailed a further response to the individual, providing links to images of the reef formation and stating it would be happy to meet with the individual at the next consultation session. [Con-4119]
    - On 6 May 2024 Santos responded via email to a question on consultation sessions and request to be advised of any further sessions. [Con-5020]
    - On 15 May 2024 Santos emailed a link to a previous Barossa EP (SURF) in response to a request. [Con-5027]
    - On 3 July 2024 Santos responded via phone to a question on its permission to conduct clan meetings on the Tiwi Islands and to follow-up on Santos' consultation. In the discussion, with a Senior Elder of the Munupi Clan, no concerns regarding the Munupi Clan consultation sessions were raised. [Con-5026]
    - On 5 July Santos responded by email to a question on carbon credits and offsets [Con-5021]
  - Questions on how to access Santos' employment and education opportunities and seek funding from Santos for community projects are managed outside the EP consultation process.
  - On 10 July 2024 Santos emailed the Tiwi Land Council to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. Santos advised TLC it would appreciate its support in passing on the information to the Land Council (Trustee and Directors) for them to share with their clans. [Con-5120]

- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Tiwi clans
- Additional to formal consultation on the Production Operations EP and OEMP, Santos has continued to make a range of efforts to engage on an ongoing basis with NT First Nations People, both directly and through their representative organisations. See Section 8.4.11 Post-acceptance Consultation Implementation Strategy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference

Following discussion on consultation material, there were questions and comments received in relation to the following matters:
• Activity
  • Properties of Barossa condensate
  • Inspection and maintenance of facilities
  • Consultation and Communication
  • Consultation process with Tiwi Clans
• Existing Environment
  • Survey of underwater cultural heritage
  • Whale migratory paths
• Environment impacts & risks
  • Oil spill management.
  • Timeframe for cleaning up an oil spill
	The answers provided were based on:
	• The activity in Section **2**, including for the design parameters. Barossa condensate described in Section **7.7.3.1**.
	• The existing environment described in Section **3**.
	• Santos consultation described in Section **4**, and required notifications are included in Section **8.4.9** and **8.4.11**
	• The environment risks & impacts as well as the management controls described in Sections **6** and **7**.v Specifically
	• Noise emissions –Section **6.1**
	• Light emissions – Section **6.2**
	• GHG emissions – Section **6.3**
	• Atmospheric emissions – Section **6.4**
	• Operational and produced water discharges described in Section **6.7** and **6.8**
	• Biosecurity management – Section **7.2**
		Noting that no objection or claims were raised about the adverse impact of each activity to which this EP relates, no further response required.	Not applicable

• Compensation process in the event of oil spill impact • Produce water discharge • Management of lighting impact on marine mammals such as turtles • Biosecurity management • Safe use of chemicals • GHG emissions management & Purchase of carbon credits as offsets • Air quality • Water quality • Noise emissions from the FPSO • Use of helicopters and associated noise. • Other • Commonwealth Government regulatory process • Carbon Capture and Storage Santos answered those questions and there were no responses raised for consideration, other than those noted below.	• Marine Fauna interactions – Section **7.3** • Loss of hydrocarbon management including gas release and spills in Sections **7.6** and **7.7** This response did not raise objections or claims about the adverse impact of each activity to which this EP relates. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.		
A clan member asked where further information can be read about Santos' plans regarding CCS.	Santos has considered the matters raised and provided a response. Santos notes the question from the clan member and has provided separately a response via email.	A response has been provided separate to this EP.	Not applicable.
A clan member asked if CCS worked.	Santos has considered the matters raised and provided a response. Santos notes the question from the clan member and has provided separately a response via email.	A response has been provided separate to this EP.	Not applicable.
A clan member asked when Santos will use CCS for Barossa.	Santos has considered the matters raised and provided a response. CCS is not part of this EP and separate approval will be sought. Santos notes the question from the clan member and has provided separately a response via email.	A response has been provided separate to this EP.	Not applicable.
A clan member asked how far are Barossa activities to the largest formation 75m Pavona clavus?	Santos has considered the matters raised and provided a response. Santos notes the question from the clan member and has provided separately a response via email.	Santos confirmed via email that: The 75m Pavona clavus coral bommie was on Evans Shoal and is 60km west of the Barossa field and 61 km from the project activities. Additional information regarding this formation was set out in the Barossa Offshore Project Proposal appendices, which are available on the NOPSEMA website at A598152 (nopsema.gov.au).	Not applicable.
A clan member asked if an oil spill were to occur, what compensation would the affected Tiwi Island people be entitled to.	Santos has considered the matters raised in the EP and provided a response. Santos notes the question from the clan member and provided a response during the consultation session and further via email.	Santos confirmed via email that: Any compensation would depend on specific circumstances of the incident. As with any claim, assessment and determination would be evidence-based. Santos and its Barossa joint venture partners are required to demonstrate a minimum level of financial assurance to be able to cover costs when responding to a spill event. The offshore regulator, NOPSEMA, will not accept the Production Operations Environment Plan without Santos first demonstrating a minimum level of financial assurance for a spill response. Santos relies on a combination of its own financial resources and insurance to meet its financial assurance requirements, including third party liability insurance for its activities. For each Oil Pollution Emergency Plan there is a comprehensive scientific monitoring program to measure impacts to the physical / biological environment and socio-economic receptors. The results of monitoring inform the extent of impacts.	Not applicable.
Several attendees at Tiwi sessions asked about availability of oil spill response training. One attendee suggested a register should be developed of Tiwi people who undertake the training.	Santos has considered the matters raised in the EP and provided a response. Santos provided information on the availability of oil spill response training.	Santos confirmed that: Spill response arrangements in place that would be activated include mobilisation of people to a spill site. The first training session with Tiwi Rangers has been held. The TLC was nominating additional people to participate in the next round of training.	Refer to Other Measures Section 8.3.3

An attendee at one session asked where oil spill response equipment is stored and whether Port Melville was an option?	Santos has considered the matters raised in the EP and provided a response.	Santos confirmed that: Santos had access to equipment at regional, national and international levels. Stockpiles were located in Australia and around the globe. They are strategically located as they are used not just for oil and gas, but also for shipping companies. Santos also had access to equipment stored in Darwin, Geelong and Fremantle. This equipment was owned by companies that provide this access and they decide where it is stored. Santos would store three rapid assessment kits on the Tiwi Islands which will be used by rangers to assess spills. The rangers would decide on the best location to store this equipment.	Barossa Production Operations Oil Pollution Emergency Plan
An attendee at one session asked where Santos will source carbon credits for offsetting its emissions?	Santos has considered the matters raised in the EP and provided a response. The control measures Santos will apply to reduce GHG emissions to ALARP and acceptable levels, include the purchase and/or surrender of carbon credits are outlined in Section 6.3.2.6.2.	Santos referred them to our latest annual report and comments in that report that outlines further information on our generation and acquisition of carbon credits.	Not applicable
An attendee asked what happens if Santos exceeds the total emissions for the year. As a consequence, would Santos shut down operations.	Santos has considered the matters raised in the EP and provided a response. The answers provided were based on Section 6.3.3 and 6.3.2.6.2 Control measures include BAO-CM-6.3.10 and BAO-CM-6.3.11 (Table 6-21).	Santos confirmed that the Clean Energy Regulator will set a baseline (Safeguard Mechanism) for Barossa greenhouse gas emissions. Santos will purchase or generate Australian Carbon Credit Units (ACCUs) to offset Barossa's reservoir CO_2 emissions and any emissions above the Safeguard Mechanism baseline. Santos will comply with the Regulator's requirements. Companies which do not comply with the Safeguard Mechanism are subject to significant enforcement penalties from the Clean Energy Regulator.	Section 6.3.3 Section 6.3.2.6.2
An attendee at one session claimed that migrating turtles would be impacted by the activity and asked how Santos will stop turtles migrating to the drill rig location.	The response raised a claim that migrating turtles would be impacted by the activity and asked how Santos would stop turtle migrating to the drill rig location (which is within OA1). Barossa Development drilling activities (i.e. use of a drill rig) are not covered in this EP. Santos recognises that marine turtles, including migrating marine turtles have the potential to be impacted by the activity. Santos has considered the distribution and movements of marine turtles in the vicinity of its operational areas (OA1 and OA2) and the Tiwi Islands (Section **3.4.3.3.1**). There are no biologically important areas (BIAs) or migration routes that overlap with OA1. A review of turtle movement data indicates that migratory pathways in the vicinity of the Tiwi Islands are largely restricted to the waters inside of the 100 m depth contour (i.e., waters less than 100 m deep) and do not overlap with OA1 (Pendoley, 2023). Marine turtles east-west migration pathway passes over OA2 (Pendoley, 2023). Given the limited frequency and duration IMMR activities within OA2 and the control measures in place, Santos considers impacts and risks to migrating marine turtles are reduced to ALARP and acceptable levels. Santos does not see merit in stopping marine turtles from migrating and considers this inconsistent with its performance outcomes and control measures which are in place to reduce disturbances to marine turtles.	Santos outlined within the session that OA1 is not in or near a biologically important area and it has assessed impacts to marine turtles in its operational areas from light spill using lighting studies.	Santos includes an assessment of migratory marine turtle movements in the vicinity of Tiwi Islands and its operational area in Section **3.4.3.3.1**. Santos includes control measures to reduce impacts to marine turtles in OA1 and OA2 to ALARP and acceptable levels in Section **6** and **7**.
An attendee/s at one session asked questions regarding helicopters flying over Tiwi and Seagull Island, particularly in relation to: • number of passengers; • clarifying if it was helicopter or plane; • purpose of flights.	Santos has considered the matters raised in the EP and provided details on helicopter flights. The answers provided were based on: • The activity in Section **2**, including for the design parameters. • The environment risks & impacts as well as the management controls described in Sections **6** and **7**. Specifically • Noise emissions –Section 6.1 • Marine Fauna interactions – Section 7.3	Santos responded that: • there would be approximately 12 passengers; • it would use a helicopter; • flights are used to transport workers to and from the FPSO. • Santos had also outlined within the sessions that: • the use helicopters is required to safely transport our workers to and from the FPSO • that helicopters will fly over Tiwi islands on average 3 times per week. • planned flight paths are over the eastern end of Melville Island, at its closest point in 22km from Seagull Island • to manage any potential noise impacts, the Helicopter will fly between 1.8 km to 2.4km above Tiwi islands. • at this height Barossa helicopters are unlikely to be heard any differently than other background air traffic, this is also higher than birds generally fly.	Not applicable
An attendee asked where Santos gets its permission to come to the Tiwi Islands and consult with clan group.	Santos has considered the matters raised in the EP and provided a response. The answers provided were based on:	Santos confirmed that: • Santos received the appropriate permits from the TLC.	Not applicable

The attendee stated that the TLC must consult with and have regard of Traditional Owners and: • ensure they understand any proposal; • ensure any affected Aboriginal community members, including the whole wider community, • ensure they have a chance to say what they think of the proposal and • satisfy itself that the Traditional Owners have consented to the proposal.	Consultation with Tiwi people and clan groups described in Section **4.6.6.1**. Santos notes the statements by the attendee and has responded via a phone call on 3 July 2024 to address statements made at the consultation session, confirming Santos used a culturally appropriate process. In that exchange, no concerns regarding the Manupi Clan consultation sessions were raised. The attendee, who is Senior Elder, thanked Santos for always being "respectful" and going to the Trustee first, with the Trustee then going to Traditional Owners. This consultation process, agreed with the TLC and clan groups, has been followed for the past three Barossa EPs and includes consultation in person at specific locations on the Tiwi Islands, primarily through discussions or presentations with all clans.	• The sessions were notified and advertised in advance in accordance with the usual practice, including via social media.	
An attendee asked how Tiwi people could be sure that the FPSO has been cleaned properly as part of biosecurity precautions.	Santos has considered the matters raised in the EP and provided a response. The answers provided were based on information contained in Section 8.3.2.9 Santos notes the statements by the attendee and committed to providing relevant information to the attendee and their clan once the work has been completed.	Santos confirmed that: Santos would provide the information once the final work had been completed in 2025, prior to the FPSO leaving for Australian waters.	Section 7.2. Section 8.3.2.9 BAO-CM-7.2.1 BAO-CM-7.2.5 BAO-CM-7.2.6 BAO-CM-7.2.7 BAO-CM-7.2.8 BAO-CM-7.2.9
A clan member advised before sea level rise there was one big land mass and we may find giant serpent bones. They would like to be notified if any bones are found.	Santos has considered the matters raised in the EP and provided a response. The answers provided were based on information contained in Section **3.6.9** and Section **6.5**. Santos engaged Cosmos Archaeology to undertake maritime archaeological heritage assessments in OA1 and OA2. There is no known UCH (including First Nations) within the OAs.	Santos confirmed that no bones have been identified to date and if any bones are identified the clan member would be advised.	Refer to Other Measures Section 8.3.3
A clan member raised a query about water quality and if marine life could be affected from an oil spill, such as turtles and dugongs, which they traditionally hunt. A query was also raised if clams and mussels could be monitored as they are filter feeders and information can be used to determine changes in water quality.	Santos has considered the matters raised in the EP and provided a response. The answers were provided based on information contained Section **7.7**.	Santos outlined in the session that an Operational and Scientific Monitoring Plan (as part of the Barossa Production Operations OPEP) would be implemented in the event of a spill.	Barossa Production Operations Oil Pollution Emergency Plan
A clan member raised a query regarding noise emissions from the FPSO affecting turtle hunting.	Santos has considered the matters raised in the EP and provided a response. The answers were provided based on information contained in Section 6.1 and page 16 of the Production Operations information booklet.	Santos outlined in the session that the FPSO has been designed to reduce noise emissions, it does not have an engine and it will be permanently moored and that a maintenance program will be in place to maintain equipment on board the FPSO.	Section 6.1.
A clan member raised a query about sea levels, climate and erosion of land particularly from increased shipping movements that may cause accelerated erosion. They stated this erosion in turn can impact turtle nesting beaches and wanted to know how Santos and Tiwi people could work together.	Santos consider the clan member's claim that increased ship movements causes land erosion, and therefore impact turtle nesting, has no merit. Vessel movements are low during operations. There is no evidence to support the assertion that movements of vessels during the activity would result in erosion of land and impact turtle nesting beaches.	During the session, Santos advised a risk assessment regarding greenhouse gas emissions has been undertaken. The Tiwi clan were shown a map of shipping routes in the region (for all shipping and not limited to Santos), based on the Australian Maritime Safety Authority recorded vessel movements. Santos outlined that Activity vessel movements along the pipeline would not be permanent (in OA2). Santos agreed to talk with the clan member after the session to understand needs, impacts and benefits on working together. The answers were provided based on information contained in Section **2.8**, Section **2.9**, Section **3.6.6** and Section **6.3**.	Not applicable
A clan member requested evidence regarding the environmental studies relevant to the project.	Santos has considered the matters raised in the EP. Santos complied with this request.	During the session, Santos confirmed it would provide relevant environmental studies and evidence relating to the project environmental impacts and risks.	Environmental studies are referenced throughout this EP.

		At subsequent clan meetings Santos provided further information and had the relevant environmental studies available to review on iPads , and confirmed that they were also available online	
A clan member requested a photo of Barossa condensate be provided.	Santos has considered the matters raised in the EP. Santos complied with this request.	During the session, Santos provided an iPad which contained a photo of the condensate.	Not applicable.
A clan member requested the development of a cultural protocol for consultation, requesting Santos to go through the clan Trustee and work with and respect Tiwi people.	Santos has considered the matters raised in the EP and provided a response. This particular request for a cultural protocol has been considered and assessed in context, having regard to the Santos' broader' approach to consultation with Tiwi Clan Groups and Individuals and the development of the existing arrangements. Santos' approach to consultation with Tiwi Clan Groups and Individuals was developed in consultation with Tiwi People on earlier Barossa EPs and includes: - obtaining appropriate permissions to be on Tiwi from the Tiwi Land Council, - scheduling of consultation sessions in conjunction with Clan Trustees/Traditional Owners, the Tiwi Land Council, Tiwi Recourses and Tiwi Enterprises to ensure no clashes with community events, cultural ceremony or "Sorry Business", - providing three consultation sessions per Clan and - providing an extended period of consultation for Tiwi Islands Clan Groups and Individuals. In addition, on 3 July 2024 Santos had a phone discussion with a Senior Elder of the Munupi Clan who made the comments regarding a cultural protocol, to follow-up on Santos' consultation. In that exchange, no concerns regarding the Manupi Clan consultation sessions were raised. The Senior Elder thanked Santos for always being "respectful" and going to the Trustee first with the Trustee then going to Traditional Owners. Consistent with Santos' consultation methodology, Santos has considered this request but, in the circumstances outlined above, determined it was not appropriate to progress it further (beyond the measures already taken) for the purposes of s 25 consultation for this EP. Santos is committed to continuing to work with Tiwi People to continue to consult with them in a culturally appropriate manner.	During the session, Santos reiterated that it is committed to working with Tiwi Clans and was consulting with Tiwi Clans for an extended period. In addition, on 3 July 2024 Santos had a phone discussion with a Senior Elder of the Munupi Clan who made the comments regarding a cultural protocol, to follow-up on Santos' consultation. In that exchange, no concerns regarding the Manupi Clan consultation sessions were raised. The Senior Elder thanked Santos for always being "respectful" and going to the Trustee first with the Trustee then going to Traditional Owners.	Not applicable.
A clan member raised concerns regarding information provided, stating that some information provided to Tiwi Clan members is technical and needs to be simplified.	Santos has considered the matters raised in the EP. Santos notes the statements made by the attendee related to the written material on the power point slides being presented at the meeting. The meeting minutes (Con-4259) show that the information on the slides was not being read-out verbatim and an interpreter was present to further explain the material in language. The minutes also show there was strong engagement from clan members during the meeting, with clan members asking many questions, including to clarify technical information, and Santos' representatives providing clear responses. This was the third consultation session held with the Manupi Clan at which the Barossa Production Operations EP was discussed, the others being on 17 May 2024 (Con-4231) and 8 April 2024 (Con-4093). This consultation sessions were undertaken in line with the consultation process and consultation preferences, which Tiwi People have historically expressed during previous consultation on Barossa Project EPs, as outlined in Section 4.6.5.1.3, Consultation with Tiwi Islands Clans and Individuals.	The Santos representative speaking at the time responded that Santos was trying to share the information with attendees as simply as possible, noting that in the scientific world, some things are not as easy to put things simply. (Con-4259) The Santos representative thanked the clan member for raising the matter and further stated that Santos attendees would be happy to talk to the clan member after the meeting and to get feedback. On 3 July 2024 Santos followed-up by phone with a Senior Elder of the Manupi Clan. This was the same person who had made the comment on written materials at the 21 May 2024 session. The Elder did not advise of any outstanding issues related to the Manupi consultation sessions.	Section 4.6.5.1.3

First Nations People and groups: Representative organisations – Western Australia

Kimberley Land Council (KLC)

Summary of consultation effort:

- On 22 February 2024 Santos emailed KLC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-4037]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Operations activities may be relevant to your department or agency; and*

- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Operations activities.*
- In the email Santos advised it had identified that the KLC – in its capacity as a Representative Body – may have functions, interests or activities that may be affected by these proposed activities and would like to meet with KLC to determine if it wishes to participate in the consultation process. Should KLC be interested Santos can then discuss appropriate consultation methods appropriate to the KLC's information needs and interests.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- Also included was a map of the Environment that May be Affected (EMBA) and a summary of Santos' understanding of how the EMBA related to Aboriginal heritage sites, native title claims or determinations as well as marine park management.
- On 2 May 2024 Santos emailed KLC to follow-up on previous emails and advised of an additional risk associated with the proposed activity and provided a link to the updated booklet and factsheet. Santos advised it had extended the consultation period and requested KLC input by 16 May 2024. [Con-4103].
- On 10 July 2024 Santos emailed KLC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5087]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 14 November 2024 Santos phoned the KLC seeking confirmation that it had no comments on the EP and OEMP. [Con-5987]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from the KLC.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from the KLC.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. The KLC's area of interest includes sea country where non-exclusive native title rights and interests may exist, including within a section of Commonwealth waters within the EMBA. The outermost boundary of the EMBA, however, is approximately 35 km from the WA coastline at its closest point and more than 500 kilometres from the Barossa Field. The KLC's area of interest also includes several Marine Park Management Plans off the Kimberley coast that are located within the outermost boundary of the EMBA. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable

Balanggarra Aboriginal Corporation (BAC)

Summary of consultation effort:

- On 22 February 2024 Santos emailed BAC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-4060]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Operations activities.*
- In the email Santos advised BAC to contact Santos at the earliest opportunity if it considered that it may be a Relevant Person and wished to participate in the consultation process. Should BAC be interested Santos can then discuss appropriate consultation methods appropriate to BAC's information needs and interests.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- Also included was a map of the Environment that May be Affected (EMBA) and a summary of Santos' understanding of how the EMBA related to Aboriginal heritage sites, native title claims or determinations as well as marine park management.
- On 13 March 2024 Santos emailed BAC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. In the email Santos also advised it would try to call BAC as well. [Con-4061]
- On 14 March 2024 BAC advised Santos via email that the information provided by Santos in the 13 March email had been forwarded to the CEO. [Con-4067] The same day the BAC CEO advised Santos via email that the Chair of the BAC Board would seek instructions from the Board as to how to proceed further. [Con-5014]
- On 2 April 2024 Santos sent a reminder to BAC via email that the consultation period for the EP was closing on April 9 and to contact Santos as soon as possible if BAC had any feedback. The information previously provided was again included. [Con-4085]
- On 2 May 2024 Santos phoned and emailed BAC to follow up on the previous emails and advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from BAC. [Con-4105]
- On 28 May 2024 Santos emailed BAC in relation to its responsibilities under the Australian Marine Parks North Management Plan for sea country in the Joseph Bonaparte Marine Park. The email included a map showing the location of the park in relation to Balanggarra country. [Con-4209].
- On 10 July 2024 Santos emailed BAC to advise the consultation period for the Barossa Production Operations EP had been completed. [Con-5127]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback has been received from BAC.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference

No response was received from BAC.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Bardi and Jawi Niimidiman Aboriginal Corporation (BJAC

Summary of consultation effort:

- On 22 February 2024 Santos emailed BJAC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-4038]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Operations activities.*
- In the email Santos advised BJAC to contact Santos at the earliest opportunity if it considered that it may be a Relevant Person and wished to participate in the consultation process. Should Bardi Jawi be interested Santos can then discuss appropriate consultation methods appropriate to BJAC's information needs and interests.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- Also included was a map of the Environment that May be Affected (EMBA) and a summary of Santos' understanding of how the EMBA related to Aboriginal heritage sites, native title claims or determinations as well as marine park management.
- On 13 March 2024 Santos emailed BAC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. In the email Santos also advised it would try to call BAC as well.
- On 2 April 2024 Santos sent a reminder to BJAC via email that the consultation period for the EP was closing on April 9 and to contact Santos as soon as possible if BJAC had any feedback. The information previously provided was again included. [Con-4039]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from BJAC.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from BJAC.	Santos considers it has provided sufficient information and a reasonable period of time for BJAC to advise its relevancy to the activities proposed under this EP. BJAC's area of interest includes sea country where non-exclusive native title rights and interests may exist. The outermost boundary of the EMBA for this EP, however, is several more than 300 kilometres from BJAC's area of interest at its closest point. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Dambimangari Aboriginal Corporation (DAC)

Summary of consultation effort:

- On 22 February 2024 Santos emailed DAC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-4040]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Operations activities.*
- In the email Santos advised DAC to contact Santos at the earliest opportunity if it considered that it may be a Relevant Person and wished to participate in the consultation process. Should DAC be interested Santos can then discuss appropriate consultation methods appropriate to DAC's information needs and interests.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- Also included was a map of the Environment that May be Affected (EMBA) and a summary of Santos' understanding of how the EMBA related to Aboriginal heritage sites, native title claims or determinations as well as marine park management
- On 12 March 2024 a DAC representative advised Santos via email that the DAC Board would be able to meet with Santos to discuss the information during its meeting to be held on 10/11 April 2024. [Con-4048]
- On 12 March 2024 Santos responded to DAC's offer, stating it would check the dates with the appropriate personnel's availability and revert back as soon as possible. [Con-4054]
- On 13 March 2024 Santos emailed DAC to confirm it would be able to meet at any time on 10/11 April as requested by DAC. The email also advised that Santos had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-4065]
- On 19 March 2024 Santos re-confirmed its availability for a meeting during DAC's two-day Board meetings and requested details in order to plan attendance. [Con-4071]
- On 19 March 2024 DAC advised Santos via email that it would provide the agenda as soon as possible and also requested that the deadline for feedback be extended to accommodate feedback arising from the meeting. [Con-4072]
- On 19 March 2024 Santos responded to DAC to advise that feedback received at the meeting would be included. [Con-4074]
- On 26 March 2024 DAC emailed Santos the date and time for the meeting and Santos responded via email the same day. [Con-4075]
- On 2 April 2024 Santos sent a reminder to DAC via email that the consultation period for the EP was closing on April 9 and to contact Santos as soon as possible if DAC had any feedback. The information previously provided was again included. Santos noted in the email that the 9 April feedback deadline would be adjusted to accommodate the meeting with DAC and provision of its feedback. [Con-5016]

- On 10 April 2024 Santos held a meeting with DAC at the DAC offices in Derby, at which the Barossa Productions Operations EP was discussed. During the meeting one question was asked about the composition of Barossa condensate and what a condensate spill would look like. No issues or concerns were raised at the meeting. DAC advised that it would consider the information Santos had provided and get back to Santos if it had any further questions. At the meeting of 10 April 2024 DAC requested a copy of the Santos factsheet providing details of the Barossa Production Operations, and a copy of the information booklet was provided. [Con-4092]
- On 17 April 2024 Santos emailed DAC thanking it for the meeting. [Con-4098]
- On 2 May 2024 Santos emailed DAC to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from DAC. [Con-5015]
- On 10 July 2024 Santos emailed DAC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5126]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from DAC.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
An attendee asked about the composition of Barossa condensate and what a condensate spill would look like.	Santos has considered the matters raised in the EP and provided a response. The answers provided were based on Barossa condensate described in Section **7.7.3.1** Santos notes that the information booklet provided on 10 April 2024 included information on Barossa condensate and spills.	No response required.	Not applicable

Mayala Inninalang Aboriginal Corporation (MIAC)

Summary of consultation effort:

- On 22 February 2024 Santos emailed MIAC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-4041]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Operations activities.*
- In the email Santos advised MIAC to contact Santos at the earliest opportunity if it considered that it may be a Relevant Person and wished to participate in the consultation process. Should MAC be interested Santos can then discuss appropriate consultation methods appropriate to MAC's information needs and interests.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- Also included was a map of the Environment that May be Affected (EMBA) and a summary of Santos' understanding of how the EMBA related to Aboriginal heritage sites, native title claims or determinations as well as marine park management.
- On 14 March 2024 Santos phoned MIAC and, further to the previous correspondence, followed up, later the same day, with an email to advise that it had commenced the consultation phase which would run until 9 April 2024. As reflected in the email, Santos had been instructed on the earlier telephone call to forward the email to another person in the same organisation (forwarding the email was the only matter discussed on that telephone call). [Con- 4068] In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. In the email Santos stated it would be happy to speak via phone again or attend a meeting with MIAC. [Con- 4068]
- On 2 April 2024 Santos sent a reminder to MIAC via email that the consultation period for the EP was closing on April 9 and to contact Santos as soon as possible if MAC had any feedback. The information previously provided was again included. [Con-4088]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from MIAC.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from MIAC.	Santos considers it has provided sufficient information and a reasonable period of time for MIAC to advise its relevancy to the activities proposed under this EP. MIAC's area of interest includes sea country where non-exclusive native title rights and interests may exist. The outermost boundary of the EMBA for this EP, however, is approximately 300 kilometres from MIAC's area of interest at its closest point.	No response required.	Not applicable.

Miriuwung and Gajerrong Aboriginal Corporation (MGAC

Summary of consultation effort:

- On 22 February 2024 Santos emailed MGAC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-4043]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Operations activities.*

- In the email Santos advised MGAC to contact Santos at the earliest opportunity if it considered that it may be a Relevant Person and wished to participate in the consultation process. Should MGAC be interested Santos can then discuss appropriate consultation methods appropriate to MGAC's information needs and interests.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- Also included was a map of the Environment that May be Affected (EMBA) and a summary of Santos' understanding of how the EMBA related to Aboriginal heritage sites, native title claims or determinations as well as marine park management.
- On 13 March 2024 Santos followed-up with a phone call to MGAC and then emailed to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-4062]
- On 13 March 2024 MGAC phoned Santos to advise that the Executive Office, the Chair of the Board, and the Board would be in touch with Santos once they have met and considered the issues. [Con- 4066]
- On 14 March 2024 MGAC attempted to phone Santos and followed-up with an email advising that it would call Santos the next day. [Con-4070]
- On 28 March 2024 Santos held a phone call with the Chair of MGAC, where options for meeting were discussed. It was agreed that MGAC was to get back to Santos with an appropriate date for meeting.
- On 28 March 2024, Santos phoned MGAC and followed up with and email to advise there are a number of potential projects of possible interest to MGAC Corporation and offered various option to meet. [Con-4076]
- On 2 April 2024 Santos sent a reminder to MGAC via email that the consultation period for the Barossa Production Operations EP was closing on April 9 and to contact Santos as soon as possible if MGAC had any feedback. The information previously provided was again included. [Con-4086]
- On 4 April 2024 the Chair of MGAC emailed Santos to advise the Barossa Production Operations EP would be discussed at a Board meeting the following week, after which an outcome would be provided to Santos. [Con-4090]
- On 4 April 2024 Santos emailed MGAC and advised it looked forward to further communication. [Con-4091]
- On 2 May 2024 Santos emailed MGAC to advise it was following up on previous emails and advised of an additional risk associated with the proposed activity and provided a link to the updated booklet and factsheet. Santos advised it had extended the consultation period and requested MGAC input by 16 May 2024. [Con-4107]
- On 28 May 2024 Santos emailed MGAC in relation to its responsibilities under the Australian Marine Parks North Management Plan for sea country in the Joseph Bonaparte Marine Park. The email included a map showing the location of the park in relation to Miriuwung Gajerrong country. [Con-4210]
- On 28 May 2024 MGAC Chair emailed Santos to advise he would get back to Santos once the matter was reviewed. [Con-5233] No response was received.
- On 10 July 2024 Santos emailed MGAC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5124]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from MGAC.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from MGAC.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Wunambal Gaambera Aboriginal Corporation (WGAC)

Summary of consultation effort:

- On 22 February 2024 Santos emailed WGAC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-4044]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Operations activities.*
- In the email Santos advised WGAC to contact Santos at the earliest opportunity if it considered that it may be a Relevant Person and wished to participate in the consultation process. Should WGAC be interested Santos can then discuss appropriate consultation methods appropriate to WAC's information needs and interests.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- Also included was a map of the Environment that May be Affected (EMBA) and a summary of Santos' understanding of how the EMBA related to Aboriginal heritage sites, native title claims or determinations as well as marine park management.
- On 13 March 2024 Santos attempted to call WGAC and then emailed to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. In the email Santos provided phone contact details to receive further information or organise a consultation meeting. [Con-4064]
- On 2 April 2024 Santos sent a reminder to WGAC via email that the consultation period for the EP was closing on April 9 and to contact Santos as soon as possible if MGAC had any feedback. The information previously provided was again included. [Con-4089]
- On 2 May 2024 Santos phoned and emailed WGAC to follow-up on the previous emails and advised of an additional risk associated with the proposed activity and provided a link to the updated booklet and factsheet. Santos advised it had extended the consultation period and requested WAC input by 16 May 2024. [Con-4106]
- On 10 July 2024 Santos emailed WGAC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5125]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from WGAC.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from WGAC.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

4.7.9 Infrastructure Operators

Table 4-19: Consultation Summary Table – Infrastructure Operators

Section 25(1)(d) of the OPGGS(E)R: Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan

BW Digital

Summary of consultation effort:

- On 9 February 2024 Santos emailed BW Digital to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed BW Digital further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned BW digital regarding consultation for Barossa Production Operations EP activities and left a voice mail message.
- On 2 May 2024, Santos emailed BW Digital, to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from BW Digital. [Con-4346]
- On 10 July 2024 Santos emailed BW Digital to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised BW Digital that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from BW Digital.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from BW Digital.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Darwin Port

Summary of consultation effort:

- On 9 February 2024 Santos emailed Darwin Port to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Darwin Port further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Darwin Port and left a message with a team member regarding consultation for Barossa Production Operations EP activities
- On 6 May 2024, Santos emailed Darwin Port to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Darwin Port. [Con-4348]
- On 10 July 2024 Santos emailed Darwin Port to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Darwin Port that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130].
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Darwin Port.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Darwin Port.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

NT Ports and Marine

Summary of consultation effort:

- On 9 February 2024 Santos emailed NT Ports and Marine to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed NT Ports and Marine further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned NT Ports and Marine and left a voice mail message for message regarding consultation for Barossa Production Operations activities.
- On 4 April 2024 NT Ports and Marine emailed Santos and stated that it had no feedback for this consultation process. [Con-3537]
- On 6 May 2024, Santos emailed NT Ports and Marine further to their email of 4 April 2024 to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from NT Ports and Marine. [Con-4381]
- On 10 July 2024 Santos emailed NT Ports and Marine to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from NT Ports and Marine.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
NT Ports and Marine responded that it had no feedback for this consultation process.	Santos notes the response from NT Ports and Marine. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

NT Power and Water Corporation

Summary of consultation effort:

- On 9 February 2024 Santos emailed NT Power and Water Corporation to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed NT Power and Water Corporation further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned NT Power and Water and spoke to a team member regarding consultation for Barossa Production Operations EP activities. The team member advised that NT Power and Water advised that it would not be contributing to the consultation.
- On 6 May 2024, Santos emailed NT Power and Water further to the previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from the NT Power and Water. [Con-4379]
- On 10 July 2024 Santos emailed NT Power and Water to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5086]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]

- No further correspondence or feedback was received from NT Power and Water Corporation.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
NT Power and Water Corporation responded that it would not be participating in the consultation process.	Santos notes the response by NT Power and Water Corporation. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Sun Cable

Summary of consultation effort:

- On 9 February 2024 Santos emailed Sun Cable to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Sun Cable further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 8 May 2024, Santos emailed Sun Cable further to emails sent previously and to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Sun Cable [Con-3996]
- On 23 May 2024, Sun Cable emailed Santos advising that it would like to be consulted on the EP and referred to previous information provided. They also advised they preferred any consultation feedback to remain confidential. [Con-4218]
- On 10 July 2024 Santos emailed Sun Cable to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 5 December 2024 Santos emailed Sun Cable to request a further confirmation that Sun Cable had no comments or input on this EP. Sun Cable responded with confirmation via email the same day. [Con-6011]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Sun Cable.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
Sun Cable requested their response be kept confidential.	Information provided was outside the scope of this EP. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Telstra

Summary of consultation effort:

- On 9 February 2024 Santos emailed Telstra to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Telstra further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Telstra regarding consultation for Barossa Production Operations EP activities and spoke to a team member who confirmed it had received the emails.
- On 6 May 2024, Santos emailed Telstra, to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Telstra. [Con-4349].
- On 10 July 2024 Santos emailed Telstra to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Telstra that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Telstra.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Telstra.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Vocus

Summary of consultation effort:

- On 9 February 2024 Santos emailed Vocus to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Vocus further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Vocus and spoke to a team member regarding Barossa Production Operations EP activities which advised it would check with the relevant Vocus personnel.
- On 4 April 2024 Vocus emailed Santos and advised that the EMBA does cover over the top of the NWCS and if there was to be an incident, Vocus would need to be informed and understand the cleanup process, wanting to ensure there is no disturbance to the sea floor where the cable is located. Vocus noted Santos' documentation already mentioned the NWCS and a crossing Letter of No Objection (LONO) was already in place for the Barossa GEP. Other than receiving the relevant crossing documentation and As Built information upon completion, Vocus stated it had no further concerns about the Barossa Operations. [Con-4315]
- On 8 May 2024, Santos emailed Vocus, to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Vocus. [Con-4351]
- On 10 July 2024 Santos emailed Vocus to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 6 December 2024 Santos advised Vocus via email that its request to be informed in the event of a spill, if clean-up activities may impact its infrastructure, had been included in Santos' formal notification process. [Con-6014]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Vocus.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
Vocus responded that it wished to be informed in the event of a spill if clean-up activities may impact Vocus' infrastructure.	Santos has considered the matters raised in the EP and provided a response. Santos has included Vocus in its formal spill notification process.	Santos advised Vocus that its request had been included in Santos' formal notification process.	Notifications to Vocus are included in Section 8.4.9 and Table 8-26

4.7.10 Industry Associations

Table 4-20: Consultation Summary Table – Industry Associations

Section 25(1)(d) of the OPGGS(E)R: Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan

Australian Southern Bluefin Tuna Industry Association (ASBTIA)

Summary of consultation effort:

- On 15 February 2024 Santos emailed ASBTIA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-4988]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed ASBTIA advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters until Tuesday 9 April 2024 and attached previous correspondence. [Con-3793]
- On 4 April 2024 Santos phoned ASBTIA regarding consultation for Barossa Production Operations EP activities and left a voice mail message.
- On 2 May 2024, Santos emailed ASBTIA, further to previous correspondence to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from ASBTIA. [Con-4353]
- On 10 July 2024 Santos emailed ASBTIA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised ASBTIA that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from ASBTIA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from ASBTIA.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Commonwealth Fisheries Association (CFA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed CFA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed CFA advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters until Tuesday 9 April 2024 and attached previous correspondence. [Con-3793]
- On 4 April 2024 Santos phoned CFA regarding consultation for Barossa Production Operations EP activities and left a voice mail message.
- On 9 May 2024, Santos emailed CFA, further to the previous correspondence, to advise it had extended the consultation period for the EP until 23 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from CFA. [Con-3929]
- On 10 July 2024 Santos emailed CFA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised CFA that it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from CFA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from CFA.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Northern Territory Seafood Council (NTSC)

Summary of consultation effort:

- On 9 February 2024 Santos emailed NTSC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed NTSC advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters until Tuesday 9 April 2024 and attached previous correspondence. [Con-3793]
- On 4 April 2024 Santos phoned NTSC regarding consultation for Barossa Production Operations EP activities and spoke to a team member who advised that NTSC intended to provide input to the consultation.
- On 8 May 2024 emailed NTSC to advise, further to previous correspondence, it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from NTSC. [Con-4360]
- On 10 July 2024 Santos emailed NTSC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised NTSC that it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from NTSC.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from NTSC.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Northern Prawn Fishing Industry (NPFI) Limited

Summary of consultation effort:

- On 9 February 2024 Santos emailed NPFI to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed NPFI advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters until Tuesday 9 April 2024 and attached previous correspondence. [Con-3793]
- On 4 April 2024 Santos phoned NPFI regarding consultation for Barossa Production Operations EP activities and left a voice mail message.
- On 2 May 2024, Santos emailed NPFI to advise, further to previous correspondence, it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from NPFI. [Con-4356]
- On 10 July 2024 Santos emailed NPFI to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised NPFI that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from NPFI.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from NPFI.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Western Australian Fishing Industry Council (WAFIC)

Summary of consultation effort:

- On 9 February 2024 Santos emailed WAFIC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed WAFIC advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters until Tuesday 9 April 2024 and attached previous correspondence. [Con-3793]
- On 4 April 2024 Santos phoned WAFIC regarding consultation for Barossa Production Operations EP activities and left a voice mail message.
- On 2 May 2024, Santos emailed WAFIC advise, further to previous correspondence, it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from WAFIC. [Con-4357]
- On 16 May 2024, WAFIC emailed Santos to clarify that WAFIC does not have an interest in activity in NT waters and asked to continue to receive updates on the Barossa Project. [Con-4220]
- On 10 July 2024 Santos emailed WAFIC to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from WAFIC.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
WAFIC stated that it did not have an interest in activity in NT waters.	Santos acknowledges that WAFIC's stated approach does not require consultation for the activities proposed under this EP.	Santos confirmed the approach with WAFIC.	No reference required.
WAFIC asked to continue to receive updates on the Barossa project.	Santos provides pre-activity notifications and quarterly project updates to WAFIC.	Santos confirmed the approach with WAFIC.	Notifications Section 8.4.9 and Table 8-26

Amateur Fishermen's Association of the Northern Territory (AFANT)

Summary of consultation effort:

- On 9 February 2024 Santos emailed AFANT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed AFANT advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters until Tuesday 9 April 2024 and attached previous correspondence. [Con-3793]
- On 4 April 2024 Santos phoned AFANT regarding consultation for Barossa Production Operations EP activities and left a voice mail message. On 2 May 2024, Santos emailed AFANT, further to the previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from AFANT. [Con-4347]
- On 10 July 2024 Santos emailed AFANT to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised AFANT that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130] On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982] Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from AFANT.
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from AFANT.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from AFANT.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Recfishwest

Summary of consultation effort:

- On 15 February 2024 Santos emailed Recfishwest to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-4989]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*

- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed Recfishwest advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters until Tuesday 9 April 2024 and attached previous correspondence. [Con-3793]
- On 4 April 2024 Santos phoned Recfishwest regarding consultation for Barossa Production Operations EP and spoke to a team member who advised they would contact Santos if they had any feedback.
- On 6 May 2024, Santos emailed Recfishwest, further to the previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Recfishwest. [Con-4314]
- On 10 July 2024 Santos emailed Recfishwest to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Recfishwest that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Recfishwest.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Recfishwest.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Western Australian Game Fishing Association (WAGFA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed WAGFA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed WAGFA advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters until Tuesday 9 April 2024 and attached previous correspondence. [Con-3793]
- On 8 May 2024, Santos emailed WAGFA, further to the previous correspondence, to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from WAGFA. [Con-4361]
- On 10 July 2024 Santos emailed WAGFA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 14 November 2024 Santos phoned the WA Game Fishing Association to seek confirmation that it did not have any comments on the Barossa Production Operations EP or OEMP. An Association representative asked for the information to be re-sent and stated it still wasn't likely to have any comments. [Con-5983] Santos followed-up via email the same day, advising that any comments should be provided by 29 November 2024 [Con-5984]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from WAGFA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from WAGFA.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Northern Territory Guided Fishing Industry Association (NTGFIA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed NTGFIA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed NTGFIA advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters until Tuesday 9 April 2024 and attached previous correspondence. [Con-3793]

- On 4 April 2024 Santos phoned NTGFIA regarding consultation for Barossa Production Operations EP activities and left a detailed message with an office-holder. The office-holder was also a representative of a charter fishing operator (also see separate entry in this Table for Reel Screamin' Barra Fishing)
- On 6 May 2024 Santos emailed NTGFIA, further to the previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from NTGFIA. [Con-4312].
- On 10 July 2024 Santos emailed NTGFIA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised NTGFIA that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from NTGFIA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from NTGFIA.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Assosiasaun Turizmu Maritima iha Timor-Leste

Summary of consultation effort:

- On 9 February 2024 Santos emailed Assosiasaun Turizmu Maritima iha Timor-Leste to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 13 March 2024, Santos emailed Assosiasaun Turizmu Maritima iha Timor-Leste advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters and asks for consideration as to whether their organisation considers itself a Relevant Person. It attaches previous correspondence and advised that the consultation is open until Tuesday 9 April 2024. [Con-3794]
- On 4 April 2024 Santos phoned Assosiasaun Turizmu Maritima iha Timor-Leste regarding consultation for Barossa Production Operations EP activities but was unable to leave a voice message.
- On 2 May 2024, Santos emailed Assosiasaun Turizmu Maritima iha Timor-Leste, further to the previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Assosiasaun Turizmu Maritima iha Timor-Leste. [Con-4352]
- On 10 July 2024 Santos emailed Assosiasaun Turizmu Maritima iha Timor-Leste to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Assosiasaun Turizmu Maritima iha Timor-Leste that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Assosiasaun Turizmu Maritima iha Timor-Leste

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Assosiasaun Turizmu Maritima iha Timor-Leste.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Kimberley Marine Tourism Association (KMTA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed KMTA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed KMTA advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters until Tuesday 9 April 2024 and attached previous correspondence. [Con-3793]
- On 4 April 2024 Santos phoned KMTA regarding consultation for Barossa Production Operations EP activities and left a detailed voice mail message.
- On 2 May 2024, Santos emailed KMTA, further to the previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from KMTA. [Con-4355]
- On 10 July 2024 Santos emailed KMTA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised KMTA that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from KMTA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from KMTA.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Marine Tourism WA (MTWA)

Summary of consultation effort:

- On 9 February 2024 Santos emailed MTWA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed MTWA advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters until Tuesday 9 April 2024 and attached previous correspondence. [Con-3793]
- On 4 April 2024 Santos phoned MTWA regarding consultation for Barossa Production Operations EP activities which advised that Recfishwest and the WA Department of Fisheries should be contacted instead of MTWA.
- On 6 May 2024, Santos emailed MTWA, further to the previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from MTWA. [Con-4316]
- On 10 July 2024 Santos emailed MTWA to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from MTWA.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from MTWA.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Tourism Top End

Summary of consultation effort:

- On 9 February 2024 Santos emailed Tourism Top End to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed Santos emailed KMTA, further to the previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from KMTA. advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters until Tuesday 9 April 2024 and attached previous correspondence. [Con-3793]
- On 4 April 2024 Santos phoned Tourism Top End regarding consultation for Barossa Production Operations EP activities which stated it would call Santos back.
- On 6 May 2024, Santos emailed Tourism Top End, further to the previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Tourism Top End. [Con-4310]
- On 10 July 2024 Santos emailed Tourism Top End to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Tourism Top End that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Tourism Top End

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Tourism Top End.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Chamber of Commerce Northern Territory (CCNT)

Summary of consultation effort:

- On 9 February 2024 Santos emailed CCNT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed CCNT advising that it is now consulting on Barossa Production Operations Environment Plan in Commonwealth and Northern Territory waters until Tuesday 9 April 2024 and attached previous correspondence. [Con-3793]
- On 4 April 2024 Santos phoned CCNT regarding consultation for Barossa Production Operations EP activities and left a detailed voice message.
- On 2 May 2024, Santos emailed CCNT, further to the previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from CCNT. [Con-4354]
- On 10 July 2024 Santos emailed CCNT to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised CCNT that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from CCNT.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from CCNT.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

4.7.11 Local Government Authorities and Recognised Community Reference / Liaison Groups

Table 4-21: Consultation Summary Table – Local Government Authorities and Recognised Community Reference / Liaison Groups

Section 25(1)(d) of the OPGGS(E)R: Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan

Belyuen Community Government Council

Summary of consultation effort:

- On 9 February 2024 Santos emailed the Belyuen Community Government Council to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed the Belyuen Community Government Council further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned the Belyuen Community Government Council and left a voice mail message regarding consultation for Barossa Production Operations EP activities.
- On 2 May 2024, Santos emailed the Belyuen Community Government Council further to previous correspondence to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Belyuen Community Government Council. [Con-4985]
- On 10 July 2024 Santos emailed Belyuen Community Government Council to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Belyuen Community Government Council that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 11 July 2024 Belyuen Community Government Council emailed Santos advising it had not had a great deal of input with the project and requested Santos be available at some stage to provide a summary of the project relating to the people of the Belyuen region. [Con-5115]
- On 23 July 2024 Santos had a phone discussion with a representative of the Council's Executive during which the representative stated they wanted to ensure the Council was involved in discussions on potential community benefits and employment and training opportunities associated with Santos' activities going forward. The representative did not have any specific questions about the Barossa Project's Environment Plans. [Con-5236]
- On 24 July 2024 Santos emailed Belyuen Community Government Council in follow-up to the phone discussion on 23 July 2024 [Con-5214] Santos is progressing discussions with the Council separate to consultation on this EP.
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence has been received from the EP from Belyuen Community Government Council.
- Additional to formal consultation on the Production Operations EP and OEMP, Santos has continued to make a range of efforts to engage on an ongoing basis with NT First Nations People, both directly and through their representative organisations. See Section 8.4.11 Post-acceptance Consultation Implementation Strategy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
Belyuen Community Government Council. stated it wants to be involved in discussions on potential community benefits and employment and training opportunities associated with Santos' activities going forward.	. Santos has considered the matters raised, the matter is outside the scope of this EP. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	Santos has committed to ongoing discussions with the Council on matters that are separate to consultation on this EP.	Not applicable.

City of Darwin

Summary of consultation effort:

- On 9 February 2024 Santos emailed City of Darwin to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed City of Darwin further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned City of Darwin regarding consultation for Community Government Council EP activities and spoke to a team member and was asked to resend the previous emails. Santos sent City of Darwin copies of emails sent on 9 February and 11 March 2024 on the same day. [Con-4149]
- On 5 April 2024 City of Darwin emailed Santos and advised it has no feedback on Barossa Production Operations EP activities. [Con-4986]

- On 7 May 2024, Santos emailed City of Darwin further to previous correspondence to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from the City of Darwin [Con-4159]
- On 10 July 2024 Santos emailed City of Darwin to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence has been received from the City of Darwin.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
City of Darwin responded that it had no feedback on the Production Operations EP.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

East Arnhem Regional Council

Summary of consultation effort:

- On 9 February 2024 Santos emailed East Arnhem Regional Council to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed East Arnhem Regional Council further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned East Arnhem Regional Council and left a voice mail message regarding consultation for Barossa Production Operations EP activities.
- On 2 May 2024, Santos emailed East Arnhem Regional Council further to previous correspondence to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from the East Arnhem Regional Council. [Con-4152]
- On 10 July 2024 Santos emailed East Arnhem Regional Council to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised East Arnhem Regional Council that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from East Arnhem Regional Council.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from East Arnhem Regional Council.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Litchfield Council

Summary of consultation effort:

- On 9 February 2024 Santos emailed Litchfield Council to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Litchfield Council further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned Litchfield Council regarding consultation for Barossa Production Operations EP activities and spoke to a team member who confirmed previously sent emails had been received.
- On 6 May 2024, Santos emailed Litchfield Council further to previous correspondence to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Litchfield Council. [Con-4987]
- On 10 July 2024 Santos emailed Litchfield Council to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Litchfield Council that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Litchfield Council.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Litchfield Council.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

City of Palmerston

Summary of consultation effort:

- On 9 February 2024 Santos emailed the City of Palmerston to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed the City of Palmerston further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned the City of Palmerston regarding consultation with for Barossa Production Operations EP activities and spoke with a team member who asked for the previously sent emails to be resent.
- On 5 April 2024 Santos emailed City of Palmerston copies of emails originally sent on 9 February and 11 March 2024. [Con-4150]
- On 8 April 2024, City of Palmerston emailed Santos and advised they had no feedback on Production Operations EP activities. [Con-4151]
- On 7 May 2024, Santos emailed the City of Palmerston further to previous correspondence to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from the City of Palmerston. [Con-4158]
- On 10 July 2024 Santos emailed City of Palmerston to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence has been received from the City of Palmerston.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
City of Palmerston responded that it had no feedback on the Production Operations EP.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Roper Gulf Regional Council

Summary of consultation effort:

- On 9 February 2024 Santos emailed Roper Gulf Regional Council to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Roper Gulf Regional Council further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned Roper Gulf Regional Council and spoke to a team member regarding consultation for Barossa Production Operations EP activities.
- On 8 May 2024, Santos emailed Roper Gulf Regional Council further to previous correspondence to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Roper Gulf Regional Council. [Con-4223]
- On 10 July 2024 Santos emailed Roper Gulf Regional Council to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Roper Gulf Regional Council that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Roper Gulf Regional Council.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Roper Gulf Regional Council.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Tiwi Islands Regional Council

Summary of consultation effort:

- On 9 February 2024 Santos emailed Tiwi Islands Regional Council to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]

- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Tiwi Islands Regional Council further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Tiwi Islands Regional Council and left a voice mail message regarding consultation for Barossa Production Operations EP activities.
- On 2 May 2024, Santos emailed Tiwi Islands Regional Council further to previous correspondence to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Tiwi Islands Regional Council. [Con-4155]
- On 10 July 2024 Santos emailed Tiwi Islands Regional Council to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Tiwi Islands Regional Council that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Tiwi Islands Regional Council.
- Additional to formal consultation on the Production Operations EP and OEMP, Santos has continued to make a range of efforts to engage on an ongoing basis with NT First Nations People, both directly and through their representative organisations. See Section 8.4.11 Post-acceptance Consultation Implementation Strategy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Tiwi Islands Regional Council.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Consultation with Tiwi people was undertaken by Santos directly with Tiwi people and clan groups and organised via Clan Trustees who are also members of the TLC and Tiwi Regional Council. Santos considers Section 25 consultation requirements to have been met.	No response required.	Santos' consultation with Tiwi people and clan groups is described in Section 4.6.6.1 and summarised in other entries in this Table for Tiwi Land Council and Tiwi people and clan groups.

Victoria Daly Regional Council

Summary of consultation effort:

- On 9 February 2024 Santos emailed Victoria Daly Regional Council to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Victoria Daly Regional Council further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned Victoria Daly Regional Council and left a voice mail message regarding consultation for Barossa Production Operations EP activities.
- On 2 May 2024, Santos emailed Victoria Daly Regional Council further to previous correspondence to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Victoria Daly Regional Council. [Con-4153]
- On 10 July 2024 Santos emailed Victoria Daly Regional Council to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Victoria Daly Regional Council that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Victoria Daly Regional Council.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Victoria Daly Regional Council.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Wagait Shire Council

Summary of consultation effort:

- On 9 February 2024 Santos emailed Wagait Shire Council to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Wagait Shire Council further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned Wagait Shire Council regarding consultation for Barossa Production Operations EP activities and spoke to a team member who asked for previously sent emails to be resent. Santos re-sent the emails the same day. [Con-4147]
- On 7 May 2024, Santos emailed Wagait Shire Council further to previous correspondence to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Wagait Shire Council. [Con-4221]
- On 7 May 2024 Wagait Shire Council emailed Santos and advised it would forward the email received to Councillors. [Con-4222]
- On 10 July 2024 Santos emailed Wagait Shire Council to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Wagait Shire Council that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Wagait Shire Council.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Wagait Shire Council.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

West Arnhem Regional Council

Summary of consultation effort:

- On 9 February 2024 Santos emailed West Arnhem Regional Council to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed West Arnhem Regional Council further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned West Arnhem Regional Council regarding consultation for Barossa Production Operations EP activities and spoke to a team member who asked for previously sent emails to be resent. Santos re-sent the emails the same day. [Con-4148]
- On 7 May 2024, Santos emailed West Arnhem Regional Council further to previous correspondence to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from West Arnhem Regional Council. [Con-4224]
- On 10 July 2024 Santos emailed West Arnhem Regional Council to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised West Arnhem Regional Council that it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from West Arnhem Regional Council.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from West Arnhem Regional Council.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

West Daly Regional Council

Summary of consultation effort:

- On 9 February 2024 Santos emailed West Daly Regional Council to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed West Daly Regional Council further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned West Daly Regional Council and left a voice mail message regarding consultation for Barossa Production Operations EP activities.
- On 2 May 2024, Santos emailed West Daly Regional Council further to previous correspondence to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from West Daly Regional Council. [Con-4154]
- On 10 July 2024 Santos emailed West Daly Regional Council to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised West Daly Regional Council that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from West Daly Regional Council.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from West Daly Regional Council.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

4.7.12 Tourism Operators

Table 4-22: Consultation Summary Table – Tourism Operators

Section 25(1)(d) of the OPGGS(E)R: Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan			
Alure Fishing Charters			
Summary of consultation effort: • On 9 February 2024 Santos emailed Alure Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787] • The email advised that Santos was seeking information to better understand: - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and* - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.* • The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024. • On 11 March 2024 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793] • On 3 April 2024 Santos phoned Alure Fishing Charters and left a voice mail message. • On 2 May 2024, Santos emailed Alure Fishing Charters further to the previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Alure Fishing Charters. [Con-4282] • On 10 July 2024 Santos emailed Alure Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Alure Fishing Charters that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130] • On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982] • On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036] • Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Alure Fishing Charters.			
Summary of response by Relevant Person	**Assessment of merits**	**Santos' Response Statement**	**EP reference**
No response was received from Alure Fishing Charters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Anglers Advantage Fishing Charters

Summary of consultation effort:

- On 9 February 2024 Santos emailed Anglers Advantage Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Anglers Advantage Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned Angler's Advantage Fishing Charters and left a voice mail message.
- On 2 May 2024, Santos emailed Angler's Advantage Fishing Charters to advise it had phoned to follow up on previous emails sent and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Angler's Advantage Fishing Charters. [Con-4283]
- On 10 July 2024 Santos emailed Angler's Advantage Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Angler's Advantage Fishing Charters that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Anglers Advantage Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Anglers Advantage Fishing Charters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Angler's Choice Fishing Safaris

Summary of consultation effort:

- On 9 February 2024 Santos emailed Angler's Choice Fishing Safaris to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Angler's Choice Fishing Safaris further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned Angler's Choice Fishing Safaris and left a voice mail message.
- On 2 May 2024, Santos emailed Angler's Choice Fishing Safaris to advise it had phoned to follow up on previous emails sent and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Angler's Choice Fishing Safaris. [Con-4284]
- On 10 July 2024 Santos emailed Angler's Choice Fishing Safaris to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Angler's Choice Fishing Safaris that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Anglers Choice Fishing Safaris.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Anglers Choice Fishing Safaris.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Arafura Bluewater Charters

Summary of consultation effort:

- On 9 February 2024 Santos emailed Arafura Bluewater Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Arafura Bluewater Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Arafura Bluewater Charters, spoke to a company representative and reminded them of the deadline for comments on the EP.
- On 6 May 2024, Santos emailed Arafura Bluewater Charters, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Arafura Charters. [Con-4311]
- On 10 July 2024 Santos emailed Arafura Bluewater Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Arafura Bluewater Charters that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Arafura Bluewater Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Arafura Bluewater Charters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Arnhem Land Safaris

Summary of consultation effort:

- On 10 June 2024 Santos emailed Arnhem Land Safaris to advise it was proposing to undertake Barossa Production Operations activities in Commonwealth waters and, in preparing the EP for these activities, was required to consult with Relevant Persons. Santos asked Arnhem Land Safaris to advise Santos by 17 June 2024 if it considered it may be a Relevant Person and what functions, interests or activities it has that may be affected by the production operations activities. [Con-4975]
- The email included links to the Barossa Production Operations Activity Booklet and NOPSEMA's EP consultation information for the community. Santos advised if it did not hear from Arnhem Land Safaris by 17 June 2024, it would assume that it did not have functions, interests or activities that may be affected by the activities, or didn't wish to be consulted for this EP.
- On 10 July 2024 Santos emailed Arnhem Land Safaris to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Arnhem Land Safaris.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Arnhem Land Safaris.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos notes that in June 2024, in response to consultation via email and phone on the Darwin Pipeline Duplication EP (Cwth) and DPD Offshore CEMP, Arnhem Land Safaris advised that it did not consider that the activities were relevant to its operations, as it operated on land and inland waters 300km east of Darwin. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Barra Fishing Charters

Summary of consultation effort:

- On 9 February 2024 Santos emailed Barra Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Barra Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]

- On 3 April 2024 Santos phoned Barra Fishing Charters and left a voice mail message.
- On 2 May 2024, Santos emailed Barra Fishing Charters to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Barra Fishing Charters. [Con-4285]
- On 10 July 2024 Santos emailed Barra Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Barra Fishing Charters that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Barra Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP reference
No response was received from Barra Fishing Charters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Bayview Marina

Summary of consultation effort:

- On 9 February 2024 Santos emailed NT tourism operators to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned Bayview Marina regarding Barossa Production Operations EP activities which advised it had no feedback and did not believe they would be impacted.
- On 6 May 2024 Santos emailed Bayview Marina, and to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Bayview Marina. [Con-4317]
- On 10 July 2024 Santos emailed Bayview Marina to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Bayview Marina.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Bayview Marina.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Buffalo Boat Hire

Summary of consultation effort:

- On 10 June 2024 Santos emailed Buffalo Boat Hire to advise it was proposing to undertake Barossa Production Operations activities in Commonwealth waters and, in preparing the EP for these activities, was required to consult with Relevant Persons. Santos asked Buffalo Boat Hire to advise Santos by 17 June 2024 if it considered it may be a Relevant Person and what functions, interests or activities it has that may be affected by the production operations activities. [Con-4976]
- The email included links to the Barossa Production Operations Activity Booklet and NOPSEMA's EP consultation information for the community. Santos advised if it did not hear from Buffalo Boat Hire by 17 June 2024, it would assume that it did not have functions, interests or activities that may be affected by the activities, or didn't wish to be consulted for this EP.
- On 10 July 2024 Santos emailed Buffalo Boat Hire to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Buffalo Boat Hire that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Barra Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference

No response was received from Buffalo Boat Hire.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos notes that in June 2024, in response to consultation by email and phone on the Darwin Pipeline Duplication EP (Cwth) and DPD Offshore CEMP, Buffalo Boat Hire advised that it did not conduct tours that far from Darwin and had provided no comments. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Clearwater Island Lodge

Summary of consultation effort:

- On 9 February 2024 Santos emailed NT tourism operators to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 3 April 2024 Santos phoned and left a voice mail message.
- On 2 May 2024, Santos emailed Clearwater Island Lodge to follow up on previous emails and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Clearwater Island Lodge. [Con-4286]
- On 10 July 2024 Santos emailed Clearwater Island Lodge to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Clearwater Island Lodge that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Clearwater Island Lodge.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	• EP Reference
No response was received from Clearwater Island Lodge.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Cobourg Fishing Safaris/Venture North

Summary of consultation effort:

- On 10 June 2024 Santos emailed Cobourg Fishing Safaris to advise it was proposing to undertake Barossa Production Operations activities in Commonwealth waters and, in preparing the EP for these activities, was required to consult with Relevant Persons. Santos asked Cobourg Fishing Safaris to advise Santos by 17 June 2024 if it considered it may be a Relevant Person and what functions, interests or activities it has that may be affected by the production operations activities. [Con-4977]
- The email included links to the Barossa Production Operations Activity Booklet and NOPSEMA's EP consultation information for the community. Santos advised if it did not hear from Cobourg Fishing Safaris by 17 June 2024, it would assume that it did not have functions, interests or activities that may be affected by the activities, or didn't wish to be consulted for this EP.
- On 2 July 2024 Santos phoned Cobourg Fishing Safaris and left a message with office staff who advised the owner would call back if they had any comments.
- On 10 July 2024 Santos emailed Cobourg Fishing Safaris to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Cobourg Fishing Safaris.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Cobourg Fishing Safaris.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos notes that in June 2024, in response to consultation via email and phone on the Darwin Pipeline Duplication EP (Cwth) and DPD Offshore CEMP, Cobourg Fishing Safaris/Venture North had provided no comments. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Crab Claw Island Resort

Summary of consultation effort:

- On 9 February 2024 Santos emailed NT tourism operators to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Crab Claw Island Resort and spoke to a company representative who asked Santos to call back the following day.
- On 5 April 2024 Santos phoned Crab Claw Island Resort and left a voice mail message.
- On 2 May 2024, Santos emailed Crab Claw Island Resort further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Crab Claw Island Resort. [Con-4301]
- On 10 July 2024 Santos emailed Crab Claw Resort to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Crab Claw Resort that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Crab Claw Island Resort.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Crab Claw Island Resort.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Cullen Bay Fishing Charters

Summary of consultation effort:

- On 9 February 2024 Santos emailed Cullen Bay Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Cullen Bay Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Cullen Bay Fishing Charters and was unable to leave a message.
- On 2 May 2024, Santos emailed Cullen Bay Fishing Charters further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Cullen Bay Fishing Charters. [Con-4278]
- On 10 July 2024 Santos emailed Cullen Bay Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Cullen Bay Fishing Charters that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Cullen Bay Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Cullen Bay Fishing Charters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Cullen Bay Marina

Summary of consultation effort:

- On 9 February 2024 Santos emailed Cullen Bay Marina to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Cullen Bay Marina further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Cullen Bay Marina and left a voice mail message.
- On 2 May 2024, Santos emailed Cullen Bay Marina further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Cullen Bay Marina. [Con-4287]
- On 10 July 2024 Santos emailed Cullen Bay Marina to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Cullen Bay Marina that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the consultation information provided and the steps described above, no comments or input were received on this EP from Cullen Bay Marina.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Cullen Bay Marina.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Darwin Bara Fishing Tours

Summary of consultation effort:

- On 9 February 2024 Santos emailed Darwin Barra Fishing Tours to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Darwin Barra Fishing Tours further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Darwin Barra Fishing Tours and spoke to a company representative who confirmed that emails sent on 9 February and 11 March had been received and that Darwin Bara Fishing Tours did not have any feedback.
- On 6 May 2024, Santos emailed Darwin Barra Fishing Tours further to previous correspondence, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Darwin Barra Fishing Tours. [Con-4309].
- On 10 July 2024 Santos emailed Darwin Bara Fishing Tours to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Darwin Barra Fishing Tours.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
Darwin Bara Fishing Tours responded that it had no feedback on the Production Operations EP.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Darwin Dive Academy

Summary of consultation effort:

- On 9 February 2024 Santos emailed Darwin Dive Academy to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Darwin Dive Academy further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Darwin Dive Academy but was unable to leave a message.
- On 2 May 2024, Santos emailed Darwin Dive Academy to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Darwin Dive Academy. [Con-4279]
- On 10 July 2024 Santos emailed Darwin Dive Academy to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Darwin Dive Academy that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Darwin Dive Academy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Darwin Dive Academy.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Darwin Fish Seeker Charters

Summary of consultation effort:

- On 9 February 2024 Santos emailed Darwin Fish Seeker Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*

- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Darwin Fish Seeker Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 20243. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 and 5 April 2024 Santos phoned Darwin Fish Seeker Charters and spoke to a company representative who advised that Darwin Fish Seeker Charters did not have any feedback.
- On 8 May 2024, Santos emailed Darwin Fish Seeker Charters to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Darwin Fish Seeker Charters. [Con-4323]
- On 10 July 2024 Santos emailed Darwin Fish Seeker Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Darwin Fish Seeker Charters that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Darwin Fish Seeker Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Darwin Fish Seeker Charters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Darwin Harbour Cruises

Summary of consultation effort:

- On 9 February 2024 Santos emailed Darwin Harbour Cruises to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:

- *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
- *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Darwin Harbour Cruises further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Darwin Harbour Cruises and left a message with a team member.
- On 6 May 2024, Santos emailed Darwin Harbour Cruises to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Darwin Harbour Cruises. [Con-4308]
- On 10 July 2024 Santos emailed Darwin Harbour Cruises to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Darwin Harbour Cruises that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Darwin Harbour Cruises.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Darwin Harbour Cruises.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Darwin Harbour Fishing Charters

Summary of consultation effort:

- On 9 February 2024 Santos emailed Darwin Harbour Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Darwin Harbour Fishing Charters regarding consultation for Barossa Production Operations EP activities and spoke to a team member who requested emails sent 9 February and 11 March 2024 be resent. These were re-sent by Santos the same day. [Con-4274]
- On 7 May 2024, Santos emailed Darwin Harbour Fishing Charters to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Darwin Harbour Fishing Charters. [Con-4320]
- On 10 July 2024 Santos emailed Darwin Harbour Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Darwin Harbour Fishing Charters for its input and advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Darwin Harbour Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Darwin Harbour Fishing Charters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Darwin Red Devil Fishing Charters

Summary of consultation effort:

- On 9 February 2024 Santos emailed Darwin Red Devil Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Darwin Red Devil Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Darwin Red Devil Fishing Charters and left a voice mail message regarding consultation for Production Operations EP activities.
- On 2 May 2024, Santos emailed Darwin Red Devil Fishing Charters to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Darwin Red Devil Fishing Charters. [Con-4288]
- On 10 July 2024 Santos emailed Darwin Red Devil Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Darwin Red Devil Fishing Charters that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Darwin Red Devil Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Darwin Red Devils Fishing Charters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Darwin Sailing Club

Summary of consultation effort:

- On 9 February 2024 Santos emailed Darwin Sailing Club to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Darwin Sailing Club further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Darwin Sailing Club and was unable to leave a message.
- On 2 May 2024, Santos emailed Darwin Sailing Club to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Darwin Sailing Club. [Con-4280]
- On 10 July 2024 Santos emailed Darwin Sailing Club to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Darwin Sailing Club that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Darwin Sailing Club.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Darwin Sailing Club.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Darwin Trailer Boat Club

Summary of consultation effort:

- On 9 February 2024 Santos emailed Darwin Trailer Boat Club to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Darwin Trailer Boat Club further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Darwin Trailer Boat Club and spoke to a team member who confirmed emails sent on 9 February and 11 March had been received.
- On 6 May 2024, Santos emailed Darwin Trailer Boat Club to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Darwin Trailer Boat Club. [Con-4306]
- On 10 July 2024 Santos emailed Darwin Trailer Boat Club to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Darwin Trailer Boat Club that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Darwin Trailer Boat Club.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Darwin Trailer Boat Club.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Dinah Beach Cruising Yacht Club

Summary of consultation effort:

- On 9 February 2024 Santos emailed Dinah Beach Cruising Yacht Club to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Dinah Beach Cruising Yacht Club further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Dinah Beach Cruising Yacht Club and left a voice mail message regarding consultation for Barossa Production Operations EP activities.
- On 2 May 2024, Santos emailed Dinah Beach Cruising Yacht Club to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Dinah Beach Cruising Yacht Club. [Con-4289]
- On 2 May 2024, Dinah Beach Cruising Yacht Association emailed Santos and advised it had circulated information received from Santos to its committee and asked interested parties to respond. [Con-4302]
- On 10 July 2024 Santos emailed Dinah Beach Cruising Yacht Association to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Dinah Beach Cruising Yacht Association.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Dinah Beach Cruising Yacht Association.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Dreamers Dive Academy Timor

Summary of consultation effort:

- On 9 February 2024 Santos emailed Dreamers Dive Academy Timor to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Dreamers Dive Academy Timor further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Dreamers Dive Academy Timor and was unable to leave a message.
- On 2 May 2024, Santos emailed Dreamers Dive Academy further to previous correspondence, to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Dreamers Dive Academy. [Con-4281]
- On 10 July 2024 Santos emailed Dreamers Dive Academy Timor to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Dreamers Dive Academy.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Dreamers Dive Academy Timor.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Dundee Beach Fishing Charters

Summary of consultation effort:

- On 9 February 2024 Santos emailed Dundee Beach Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Dundee Beach Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Dundee Beach Fishing Charters and spoke to a team member who confirmed emails sent on 9 February and 11 March had been received.
- On 6 May 2024, Santos emailed Dundee Beach Fishing Charters further to previous correspondence, to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Dundee Beach Fishing Charters. [Con-4305]
- On 10 July 2024 Santos emailed Dundee Beach Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Dundee Beach Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Dundee Beach Fishing Charters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Equinox Fishing Charters

Summary of consultation effort:

- On 9 February 2024 Santos emailed Equinox Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Equinox Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Equinox Fishing Charters and spoke with a company representative regarding consultation for Barossa Production Operations EP activities who provided feedback during the call. The feedback is summarised below.
- On 3 May 2024, Santos emailed Equinox Fishing Charters to summarise feedback received and to advise it had extended the consultation period for the EP until 17 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Equinox Fishing Charters. [Con-4303]
- On 10 July 2024 Santos emailed Equinox Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Equinox Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
Equinox Fishing Charters were concerned about activity and development across different industries, having a potential impact on fishing.	Santos has considered the matters raised in the EP. Santos acknowledges that the response raises a general concern on the potential for cumulative impacts of industry in the region to fishing. Santos has no control over other non-Santos developments and industry in the region but does consider the potential for cumulative impacts with other marine users within its impact and risk assessment (Section 6 and 7) and considers impacts to fish and tourism operators	No response required	An assessment of tourism operators within the operational areas and EMBA is provided in Section 3.6.7. Santos' impact and risk assessment, inclusive of impacts and risks to fish and tourism operators, and an assessment of potential cumulative impacts from concurrent Barossa activities, is provided in Sections 6 and 7.

Estuary Escapes Fishing Charters

Summary of consultation effort:

- On 9 February 2024 Santos emailed Estuary Escapes Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Estuary Escapes Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Estuary Escapes Fishing Charters regarding consultation for Barossa Production Operations EP activities and spoke to a company representative who indicated they wanted to provide feedback and asked for an extension of time to do so.
- On 8 May 2024, Santos emailed Estuary Escapes Fishing Charters further to previous correspondence, to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Estuary Escapes Fishing Charters. [Con-4324]
- On 10 July 2024 Santos emailed Estuary Escapes Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Estuary Escapes Fishing Charters that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Estuary Escapes Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Estuary Escape Fishing Charters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Fish the Top End Fishing Charters (incorporating Obsession Fishing Safaris and Vision Sport Fishing Adventures)

Summary of consultation effort:

- On 9 February 2024 Santos emailed Fish the Top End Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Fish the Top End Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Fish the Top End Fishing Charters and spoke to a company representative regarding consultation for Barossa Production Operations EP activities who advised that they received the emails and did not have feedback as there would be no impacts from Barossa Production Operations EP activities. They also indicated they also manage Obsession Fishing Safaris and Vision Sport Fishing Adventures.
- On 6 May 2024, Santos emailed Vision Sportfishing Adventures, Obsession Fishing Safaris and Fish the Top End Fishing Charters, to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Vision Sportfishing Adventures, Obsession Fishing Safaris and Fish the Top End Fishing Charters. [Con-4307]
- On 10 July 2024 Santos emailed Vision Sportfishing Adventures, Obsession Fishing Safaris and Fish the Top End Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Fish the Top End Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
Top End Fishing Charters responded that it did not have feedback as there would be no impacts from Production Operations EP activities on its functions, interests or activities.	Santos notes the response provided by Top End Fishing.. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

FNA Sports Fishing

Summary of consultation effort:

- On 9 February 2024 Santos emailed FNA Sports Fishing to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed FNA Sports Fishing further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned FNA Sports Fishing and left a voice mail message.
- On 2 May 2024, Santos emailed FNA Sports Fishing to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from FNA Sports Fishing [Con-4290]
- On 10 July 2024 Santos emailed FNA Sports Fishing to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised FNA Sports Fishing that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from FNA Sports Fishing.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from FNA Sports Fishing.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Humbug Fishing

Summary of consultation effort:

- On 9 February 2024 Santos emailed Humbug Fishing to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Humbug Fishing further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Humbug Fishing and left a voice mail message.
- On 2 May 2024, Santos emailed Humbug Fishing to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Humbug Fishing. [Con-4291]
- On 10 July 2024 Santos emailed Humbug Fishing to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Humbug Fishing that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Humbug Fishing.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Mousies Barra Fishing Charters

Summary of consultation effort:

- On 10 June 2024 Santos emailed Mousies Barra Fishing Charters to advise it was proposing to undertake Barossa Production Operations activities in Commonwealth waters and, in preparing the EP for these activities, was required to consult with Relevant Persons. Santos asked Mousies Barra Fishing Charters to advise Santos by 17 June 2024 if it considered it may be a Relevant Person and what functions, interests or activities it has that may be affected by the production operations activities. [Con-4978]
- The email included links to the Barossa Production Operations Activity Booklet and NOPSEMA's EP consultation information for the community. Santos advised if it did not hear from Mousies Barra Fishing Charters by 17 June 2024, it would assume that it did not have functions, interests or activities that may be affected by the activities, or didn't wish to be consulted for this EP.

- On 10 July 2024 Santos emailed Mousies Barra Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Mousies Barra Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Mousies Barra Fishing Charters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos notes that in June 2024, in response to consultation via email and phone on the Darwin Pipeline Duplication EP (Cwth) and DPD Offshore CEMP, Mousies Barra Fishing Charters had provided no comments. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

NT Indigenous Tours

Summary of consultation effort:

- On 9 February 2024 Santos emailed NT Indigenous Tours to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed NT Indigenous Tours further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned NT Indigenous Tours regarding consultation for Barossa Production Operations EP activities and spoke to a team member who requested emails sent 9 February and 11 March 2024 be resent. These were resent by Santos the same day. [Con-4275]
- On 7 May 2024, Santos emailed NT Indigenous Tours to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from NT Indigenous Tours. [Con-4321]
- On 10 July 2024 Santos emailed NT Indigenous Tours to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised NT Indigenous Tours that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from NT Indigenous Tours.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Offshore Boats Fishing Charters

Summary of consultation effort:

- On 9 February 2024 Santos emailed Offshore Boats Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Offshore Boats Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Offshore Boats Fishing Charters and spoke to a company representative who advised they are unlikely to have any interaction with offshore vessels. (CON - 5281)
- On 8 May 2024, Santos emailed Offshore Boats Fishing Charters, to advise it had extended the consultation period for the EP until 22 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Offshore Boats Fishing Charters. [Con-4325]
- On 10 July 2024 Santos emailed Offshore Boats Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]

- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Offshore Boats Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
Offshore Boats Fishing Charter responded that they are unlikely to have any interaction with offshore vessels.	Santos has considered the matters raised in the EP. . Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Outback Fishing Charters

Summary of consultation effort:

- On 10 June 2024 Santos emailed Outback Fishing Charters to advise it was proposing to undertake Barossa Production Operations activities in Commonwealth waters and, in preparing the EP for these activities, was required to consult with Relevant Persons. Santos asked Outback Fishing Charters to advise Santos by 17 June 2024 if it considered it may be a Relevant Person and what functions, interests or activities it has that may be affected by the production operations activities. [Con-4979]
- The email included links to the Barossa Production Operations Activity Booklet and NOPSEMA's EP consultation information for the community. Santos advised if it did not hear from Outback Fishing Charters by 17 June 2024, it would assume that it did not have functions, interests or activities that may be affected by the activities, or didn't wish to be consulted for this EP.
- On 10 July 2024 Santos emailed Outback Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Outback Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Outback Fishing Charters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos notes that in June 2024, in response to consultation via email and phone on the Darwin Pipeline Duplication EP (Cwth) and DPD Offshore CEMP, Outback Fishing Charters had provided no comments. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Palmerston Game Fishing Club

Summary of consultation effort:

- On 9 February 2024 Santos emailed Palmerston Game Fishing Club to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Palmerston Game Fishing Club further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793
- On 4 April 2024 Santos phoned and left a voicemail.
- On 2 May 2024, Santos emailed Palmerston Game Fishing Club to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Palmerston Game Fishing Club. [Con-4292]
- On 10 July 2024 Santos emailed Palmerston Game Fishing Club to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Palmerston Game Fishing Club that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Palmerston Game Fishing Club.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Palmerston Game Fishing Club.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Reel Screamin Barra Fishing

Summary of consultation effort:

- On 9 February 2024 Santos emailed Reel Screamin Barra Fishing to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Reel Screamin Barra Fishing further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Reel Screamin Barra Fishing and spoke to a company representative (also an office-holder with the NT Guided Fishing Industry Association).
- On 6 May 2024, Santos emailed Reel Screamin Barra Fishing to advise it had extended the consultation period for the EP until 20 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Reel Screamin Barra Fishing. [Con-4313]
- On 10 July 2024 Santos emailed Reel Screamin Barra Fishing to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Reel Screamin Barra Fishing that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Reel Screamin Barra Fishing.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Reel Screamin Barra Fishing.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

River and Reef

Summary of consultation effort:

- On 10 June 2024 Santos emailed River and Reef to advise it was proposing to undertake Barossa Production Operations activities in Commonwealth waters and, in preparing the EP for these activities, was required to consult with Relevant Persons. Santos asked River and Reef to advise Santos by 17 June 2024 if it considered it may be a Relevant Person and what functions, interests or activities it has that may be affected by the production operations activities. [Con-4980]
- The email included links to the Barossa Production Operations Activity Booklet and NOPSEMA's EP consultation information for the community. Santos advised if it did not hear from River and Reef by 17 June 2024, it would assume that it did not have functions, interests or activities that may be affected by the activities, or didn't wish to be consulted for this EP.
- On 10 July 2024 Santos emailed River and Reef to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from River and Reef.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from River and Reef.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos notes that in June 2024, in response to consultation via email and phone on the Darwin Pipeline Duplication EP (Cwth) and DPD Offshore CEMP, River and Reef had provided no comments. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Sail Darwin

Summary of consultation effort:

- On 15 February 2024 Santos emailed Sail Darwin to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-4990]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 emailed Sail Darwin further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Sail Darwin and left a voice mail message.
- On 2 May 2024, Santos emailed Sail Darwin to advise it was calling to follow up on previous emails to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Sail Darwin. [Con-4293]
- On 10 July 2024 Santos emailed Sail Darwin to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Sail Darwin that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Sail Darwin.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Sail Darwin.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Saltwater Cultural Tours

Summary of consultation effort:

- On 9 February 2024 Santos emailed Saltwater Cultural Tours to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Saltwater Cultural Tours further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Saltwater Cultural Tours and left a voice mail message.
- On 2 May 2024, Santos emailed Saltwater Cultural Tours to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Saltwater Cultural Tours. [Con-4294]
- On 10 July 2024 Santos emailed Saltwater Cultural Tours to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Saltwater Cultural Tours that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Saltwater Cultural Tours.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Saltwater Cultural Tours.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Sea Darwin

Summary of consultation effort:

- On 15 February 2024 Santos emailed Sea Darwin to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-4981]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Sea Darwin further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Sea Darwin and spoke to a company representative regarding email sent on 15 February and 11 March. They requested the emails be resent and this was done the same day. [Con-4276]
- On 5 April 2024, Sea Darwin emailed Santos and acknowledged receipt of emails below and indicated if there was no response by 9 April assume that Sea Darwin had no input. [Con-4277]
- On 7 May 2024, Santos emailed Sea Darwin to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Sea Darwin. [Con-4318]
- On 10 July 2024 Santos emailed Sea Darwin to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Sea Darwin that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Sea Darwin.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Sea Darwin.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Shoal Bay Sportfishing Tours

Summary of consultation effort:

- On 9 February 2024 Santos emailed Shoal Bay Sportfishing Tours to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Shoal Bay Sportfishing Tours further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned and spoke with a company representative who indicated there was no impact on its activity from Barossa Production Operations EP activities and did not want to respond, requesting to be removed from Santos' contact list.
- On 10 July 2024 Santos emailed Shoal Bay Sportfishing Tours to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Shoal Bay Sportfishing Tours.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Shoal Bay Sportfishing Tours.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Skippers at Dundee

- On 10 June 2024 Santos emailed Skippers at Dundee to advise it was proposing to undertake Barossa Production Operations activities in Commonwealth waters and, in preparing the EP for these activities, was required to consult with Relevant Persons. Santos asked Skippers at Dundee to advise Santos by 17 June 2024 if it considered it may be a Relevant Person and what functions, interests or activities it has that may be affected by the production operations activities. [Con-4982]
- The email included links to the Barossa Production Operations Activity Booklet and NOPSEMA's EP consultation information for the community. Santos advised if it did not hear from Skippers by 17 June 2024, it would assume that it did not have functions, interests or activities that may be affected by the activities, or didn't wish to be consulted for this EP.

- On 4 July 2024 Santos phoned Skippers at Dundee and left a message with a staff member.
- On 10 July 2024 Santos emailed Skippers at Dundee to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Skippers at Dundee.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Skippers at Dundee.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Spring Tide Safaris

Summary of consultation effort:

- On 9 February 2024 Santos emailed Spring Tide Safaris to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Spring Tide Safaris further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Spring Tide Safaris and left a voice mail message.
- On 2 May 2024, Santos emailed Spring Tide Safaris to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Spring Tide Safaris. [Con-4295]
- On 10 July 2024 Santos emailed Spring Tide Safaris to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Spring Tide Safaris for its input and advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Spring Tide Safaris.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Spring Tide Safaris.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Streeter Cruises

Summary of consultation effort:

- On 9 February 2024 Santos emailed Streeter Cruises to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Streeter Cruises further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Streeter Cruises and left a voice mail message.
- On 2 May 2024, Santos emailed Streeter Cruises to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Streeter Cruises. [Con-4296]
- On 10 July 2024 Santos emailed Streeters Cruises to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Streeter Cruises that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]

- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Streeter Cruises.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Streeter Cruises.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Territory Guided Fishing

Summary of consultation effort:

- On 9 February 2024 Santos emailed Territory Guided Fishing to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Territory Guided Fishing further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Territory Guided Fishing and left a voice mail message.
- On 2 May 2024, Santos emailed Territory Guided Fishing to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Territory Guided Fishing. [Con-4297]
- On 10 July 2024 Santos emailed Territory Guided Fishing to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Territory Guided Fishing that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Territory Guided Fishing.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Territory Guided Fishing.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Tiwi Island Adventures

Summary of consultation effort:

- On 9 February 2024 Santos emailed Tiwi Island Adventures to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Tiwi Island Adventures further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Tiwi Island Adventures and left a message with a company representative.
- On 3 May 2024, Santos emailed Tiwi Islands Adventures to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 17 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Tiwi Island Adventures. [Con-4304]
- On 10 July 2024 Santos emailed Tiwi Island Adventures to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Tiwi Island Adventures that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Tiwi Island Adventures.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Tiwi Island Adventures.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Tiwi Island Retreat

Summary of consultation effort:

- On 9 February 2024 Santos emailed Tiwi Island Retreat to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Tiwi Island Retreat further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Tiwi Island Retreat and spoke a team member regarding consultation for Barossa Production Operations EP activities who confirmed that emails sent on 9 February and 11 March had been received.
- On 5 April 2024, Tiwi Island Retreat emailed Santos and advised it does not have any comment or input for the Barossa Production Operations EP consultation process. [Con-4983]
- On 7 May 2024, Santos emailed Tiwi Island Retreat to advise it had extended the consultation period for the EP until 21 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Tiwi Island Retreat. [Con-4322]
- On 10 July 2024 Santos emailed Tiwi Island Retreat to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised it considered that consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Tiwi Island Retreat.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
Tiwi Island Retreat responded that it had no comment or input for the Production Operations EP.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Top End Barra Fishing Tours

Summary of consultation effort:

- On 9 February 2024 Santos emailed Top End Barra Fishing Tours to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]

- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed Top End Barra Fishing Tours further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Top End Barra Fishing Tours and left a voice mail message.
- On 2 May 2024, Santos emailed Top End Barra Fishing Tours to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Top End Barra Fishing Tours. [Con-4984]
- On 10 July 2024 Santos emailed Top End Barra Fishing Tours to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Top End Barra Fishing Tours that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Top End Barra Fishing Tours.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Top End Barra Fishing Tours.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Top End Seafaris

Summary of consultation effort:

- On 9 February 2024 Santos emailed Top End Seafaris to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 11 March 2024 and close on 9 April 2024.
- On 11 March 2024, Santos emailed Top End Seafaris further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3793]
- On 4 April 2024 Santos phoned Top End Seafaris and left a voice mail message.
- On 2 May 2024, Santos emailed Top End Seafaris to advise it was calling to follow up on previous emails and a to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Top End Seafaris. [Con-4299]
- On 10 July 2024 Santos emailed Top End Seafaris to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Top End Seafaris that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Top End Seafaris.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Top End Seafaris.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

Yknot Fishing Charters

Summary of consultation effort:

- On 9 February 2024 Santos emailed Yknot Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under the Barossa Production Operations EP. [Con-3787]
- The email advised that Santos was seeking information to better understand:
  - *if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your department or agency; and*
  - *what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.*
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence 11 March 2024 and close on 9 April 2024.
- On 11 March 2024 Santos emailed Yknot Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 9 April 2024. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. In the email Santos stated that, if input is not received by this date Santos will infer this means you do not want Santos to consult with you further on the Productions Operations EP [Con-3793]
- On 4 April 2024 Santos phoned Yknot Fishing Charters and left a voice mail message.
- On 2 May 2024, Santos emailed Yknot Fishing Charters to advise it was calling to follow up on previous emails and a to advise it was calling to follow up on previous emails and to advise it had extended the consultation period for the EP until 16 May 2024. In providing this extension of time, Santos advised that the information in the booklet and factsheet had been updated to account for an additional risk associated with the proposed activity. Santos confirmed that consultation will close on the revised date unless Santos hears otherwise from Yknot Fishing Charters. [Con-4300]
- On 10 July 2024 Santos emailed Yknot Fishing Charters to advise the consultation period for the Barossa Production Operations EP had been completed. Santos advised Yknot Fishing Charters that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con-5130]
- On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982]
- On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036]
- No further correspondence or feedback was received from Yknot Fishing Charters.

Summary of response by Relevant Person	Assessment of merits	Santos' Response Statement	EP Reference
No response was received from Yknot Fishing Charters.	Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	No response required.	Not applicable.

4.7.13 Other Relevant Persons

Table 4-23: Consultation Summary Table – Other Relevant Persons

Section 25(1)(d) of the OPGGS(E)R: Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan			
Autoridade Nacional do Petróleo e Minerais (ANP Timor-Leste)			
Summary of consultation effort: • On 26 June 2024 Santos emailed ANP in its capacity as having responsibility for petroleum environmental matters in Timor-Leste. Santos advised that it was currently consulting on the Barossa Production Operations EP in accordance with section 25 of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (Cth) and was specifically seeking to clarify the Authority's oil spill notification requirements for inclusion in the appropriate emergency response procedures for the Barossa Project. [Con-4962] • Santos provided the information booklet on the proposed activities, with specific reference to the section on oil spill risk and management and requested the ANP respond on its oil spill notification requirements at its earliest convenience. Santos advised ANP that the information will be used for the development of the EP for production operations activity in Commonwealth waters, which will be assessed by NOPSEMA. • On 26 June 2024 ANP emailed Santos to acknowledge the email and advised it would be considered. [Con-4963] • On 1 July 2024 ANP emailed Santos requesting the information that had been provided via email was re-sent as an official letter and, upon receipt, the ANP would respond accordingly. [Con-4964] Santos provided the letter, via email, to the ANP the same day. [Con-4965] • On 1 July 2024 ANP emailed Santos' confirming that it would review the letter provided by Santos earlier the same day. [Con-5084] • On 17 July 2024 Santos emailed the ANP to request it provide any comments in relation to the environmental management of the Barossa Project by 26 July, if they wished to have them included in this EP. [Con-5114] • On 18 July 2024 ANP emailed Santos to advise it was in the process of finalising its response letter and would send in due course. [Con-5141] • On 2 August 2024 ANP wrote to Santos to advise contact details within Timor-Leste for spill notifications and to request additional information on spill modelling, mitigation measures and the notification process. [Con- 5258] • On 7 August Santos wrote to ANP and provided the details requested by the ANP in their letter of 2 August 2024 and advised that it considered consultation had now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment. [Con--5278] • On 7 August 2024 ANP emailed and thanked Santos for the information and advised they would contact Santos if further information or clarification was required. [Con 5279 • On 15 October 2024 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that the EP had been submitted to NOPSEMA for assessment, provided a link to the full EP on the NOPSEMA website and Santos' contact details for any queries. The Update also stated that the OEMP would be submitted to the NT-DITT for assessment. [Con- 5982] • On 23 January 2025 Santos emailed the Barossa Project Quarterly Update to all stakeholders on its distribution list, including all those consulted during preparation of the Production Operations EP and OEMP. The Update advised that, following a request from NOPSEMA to provide further information, Santos had re-submitted the EP with some amendments in December 2024 for further assessment. The Update also re-stated that the OEMP would be submitted to the NT-DITT for assessment. [Con-6036] • • No further correspondence or feedback was received from the ANP.			
Summary of response by Relevant Person	**Assessment of merits**	**Santos' Response Statement**	**EP Reference**
ANP provided contact details within Timor-Leste for spill notifications and requested additional information on spill modelling, spill mitigation measures and the spill notification process	Santos has considered the matters raised in the EP and provided a response. Santos acknowledged the advice from ANP and has included the contact details provided Table 8-26 and provided the information requested. Santos considers it has provided sufficient information and a reasonable period of time for consultation. Santos considers Section 25 consultation requirements to have been met.	Santos thanked ANP for the providing contact details and confirmed they will be included in the OPEP and provided the information requested.	Notifications to the ANP are included in Table 8-26

5. Impact and risk assessment methodology

Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)R 2023) requirements
Section 21 Environmental assessment
Evaluation of environmental impacts and risks 21(5) The environment plan must include: • details of the environmental impacts and risks of the activity; and • an evaluation of all the environmental impacts and risks, appropriate to the nature and scale of each impact or risk; and • details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable and an acceptable level. 21(6) To avoid doubt, the evaluation mentioned in paragraph (5)(b) must evaluate all of the environmental impacts and risks arising directly or indirectly from: • all operations of the activity; and • any potential emergency conditions, whether resulting from an accident or any other cause.

Environmental impact and risk assessment is the process by which planned and unplanned events that will or may occur during an activity are assessed for their impacts on the environment (as defined in Section 5 of the OPGGS(E)R)) at a defined location and specified time period. In addition, unplanned events are assessed on the basis of their likelihood of occurrence, which defines their risk level.

Santos has undertaken environmental impact and risk assessments for the planned events – including any routine, non-routine and contingency activities – and unplanned events in accordance with the OPGGS(E)R.

This section of the EP provides information relating to the environmental impact and risk assessment approach, specifically:

- terminology used
- summary of the approach used.

The process used to identify, analyse and evaluate environmental impacts and risks is fully described in *Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline*.

5.1 Impact and risk assessment methodology

Common terms applied during the environmental impact and risk assessment process, and used in this EP, are defined in Table 5-1**.**

Table 5-1: Impact and risk assessment terms

Term	Definition
Acceptability	Determined for both impacts and risks. Acceptability of events is in part determined by the consequence of the impact after management controls. Acceptability of unplanned events is in part determined from its risk ranking after management controls. For both impacts and risks, acceptability is also determined from a demonstration of the ALARP principle, consistency with Santos Policies and all applicable legislation and consideration of information received through relevant persons consultation when determining management controls.
Activity	Specific tasks and actions undertaken throughout the lifecycle of exploration, development, production and decommissioning.
ALARP	As low as reasonably practicable – The term refers to reducing impact and risk to a level that is as low as reasonably practicable. In practice, this means showing through reasoned and supported arguments, that there are no other practicable measures that could reasonably be taken to reduce impacts or risks further (NOPSEMA Guidance Note: ALARP, dated 1/08/2022 (N-04300-GN01660166 A138249); NOPSEMA Guideline: Environment plan decision making guideline, dated 16/12/2022 (N-04750-GL1721 A524696).
Authorised person	Person with authority to make the decision or take an action. Examples are Vessel Master, Superintendent, Supervisor, Person-in-Charge, Company Authorised Representative, and Project Manager.

Term	Definition
Control measure	Is defined by the OPGGS(E)R to mean a system, an item of equipment, a person or a procedure that is used as a basis for managing environmental impacts and risks of an activity.
ENVID workshop	Environmental hazard identification workshop.
Environment	Is defined by the OPGGS(E)R as: a. ecosystems and their constituent parts, including people and communities b. natural and physical resources c. the qualities and characteristics of locations, places and areas d. the heritage value of places and includes e. the social, economic and cultural features of the matters mentioned in paragraphs a, b, c and d.
Environmental consequence	A consequence is the outcome of an event affecting objectives. Note 1: An event can be one or more occurrences and can have several cases. Note 2: An event can consist of something not happening. (Reference ISO 73:2009 Risk Vocabulary)
Environmental impact	Defined by the OPGGS(E)R as any change to the environment, whether adverse or beneficial, that wholly or partly results from the activity.
Environmental objective	An environmental result the company intends to achieve.
Environmental risk	Applies to unplanned events. Risk is a function of the likelihood of the unplanned event occurring and the consequence of the environmental impact that arises from that event.
Grossly disproportionate	Where the sacrifice (cost and effort) of implementing a control measure to reduce impact or risk, grossly exceeds the environmental benefit to be gained.
Hazard	A situation with the potential to cause harm.
Impact assessment	The process of determining the consequence of an impact (in terms of the consequence to the environment) arising from a planned or unplanned event over a specified period of time.
Likelihood	The chance of an unplanned event occurring.
Non-routine planned event	An attribute of the planned activity that may occur or will occur infrequently during the planned activity. A non-routine planned event is intended to occur at the time.
Planned activity	The activity to be undertaken under this EP, including the services, equipment, products, assets, personnel, timing, duration, location and aspect of the activity.
Planned event	An event arising from the activity that is done with intent (as in, not an unplanned event) and has some level of environmental impact. A planned event could be routine (expected to occur consistently throughout the activity) or non-routine (may occur infrequently if at all). Air emissions, bilge water discharge and light emissions would be examples of planned events.
Receptor	A feature of the environment that may have values.
Risk	The effect of uncertainty on environmental objectives.
Risk assessment	The process of determining the likelihood of an unplanned event and the consequence of the impact (in terms of economic, human safety and health, or ecological effects) arising from the event over a specified period of time.
Routine planned event	An attribute of the planned activity that results in some level of environmental impact and will occur continuously or frequently through the duration of the planned activity.
Unplanned event	An event that results in some level of environmental impact and may occur despite preventative safeguards and control measures being in place. An unplanned event is not intended to occur during the activity.

5.2 Summary of the environmental impact and risk assessment approach

5.2.1 Overview

Santos operates under an overarching Risk Management Policy. The company Risk Management, Investigation and Assurance Operating Standard, underpins the Risk Management Policy and is consistent with the requirements of AS/NZS ISO 31000:2018, Risk Management – Guidelines (ISO, 2018).

The key steps to environmental risk management are illustrated in Figure 5-1, as defined in the Santos *Offshore Division Environmental Hazard Identification and Assessment Guideline*.

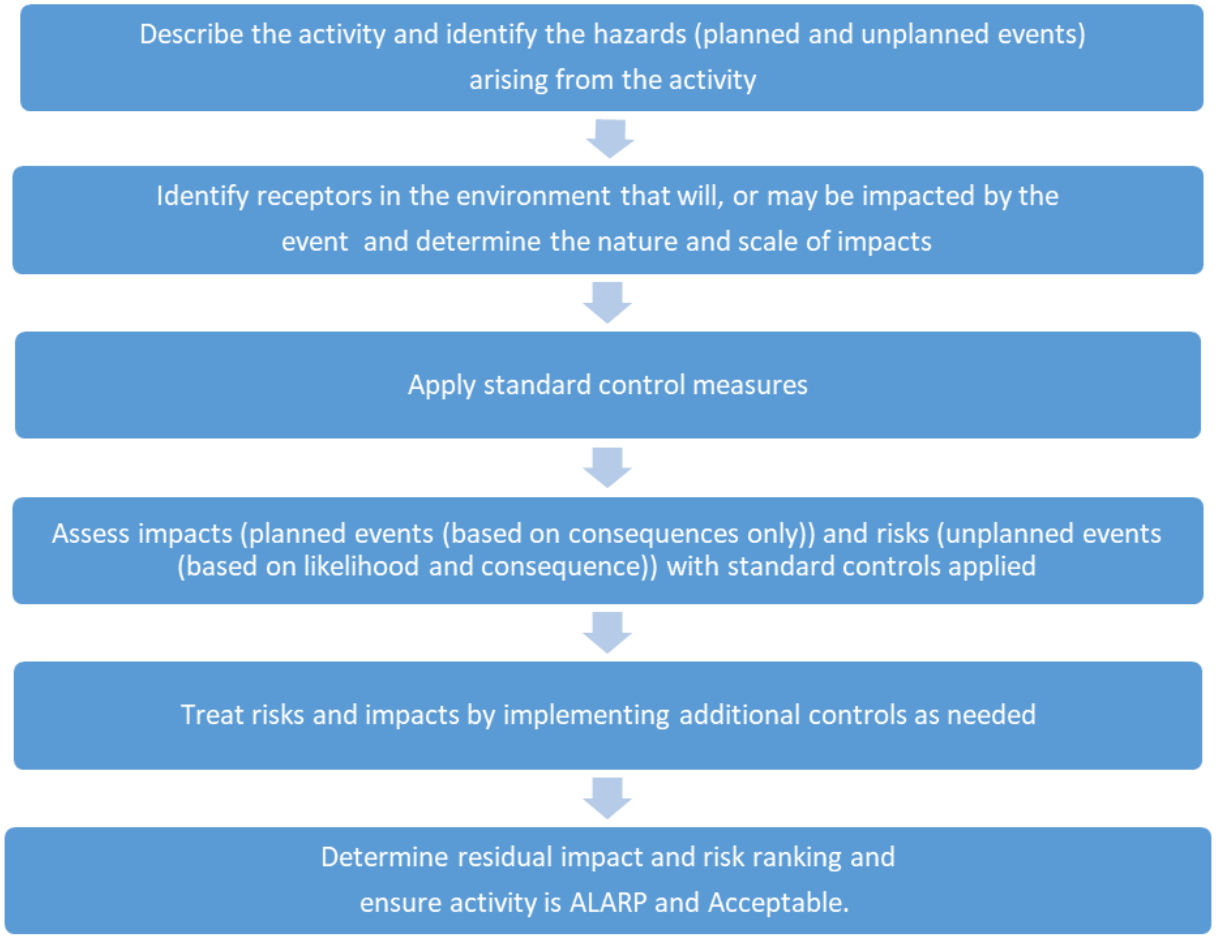

Figure 5-1: Hazard identification and assessment guideline

These steps are considered in activity-specific assessment workshop/s (ENVID workshop/s) and in the development of this EP. The workshop involves participants from Santos' Health, Safety and Environment (HSE), spill response, engineering departments, relevant departments and specialist environmental consultants.

5.2.2 Describe the activity and hazards (planned and unplanned events)

The location, timing and scope of the Activity must be understood to define the hazards and determine the impacts from planned events, and the impacts and risks from unplanned events since these have a bearing upon the environment that may be affected (EMBA).

The outcome of this assessment is detailed in the relevant subsections of Sections 6 and 7.

5.2.3 Identify receptors and determine nature and scale of impacts

A description of the environment within which hazards from the Activity will, or may occur, is required. This constitutes a crucial stage of the risk assessment, as an understanding of the environmental, socio-economic and cultural features and the values and sensitivities that will or may be affected is required to determine the type and consequence of impacts from the Activity being assessed.

The environment must be understood with respect to the spatial and temporal limits of the Activity and key resources at risk that will or could be impacted by planned and unplanned events. Santos has developed its

Barossa Values and Sensitivities of the Marine and Coastal Environment reference document, which was used in Section 3 to describe the existing environment that may be affected by the Activity and informed through consultation (Section 4). A protected matters search was conducted over the EMBA to identify occurring or potentially occurring receptors. These receptors are detailed in Section 3.

An ENVID workshop (as described in Section 5.1) was held in April 2022. A second ENVID workshop was held in February 2024 to review and update the impact assessment based on new information relating to receptors (including values and sensitivities obtained during consultation on other Barossa EPs) and updates to the Activity description. New requirements (such as changes to legislation, other requirements and guidelines) were also considered. Santos has more recently held another workshop in December 2024 to address matters that have arisen during NOPSEMA assessment.

The extent of impacts from planned events or risks from unplanned events were assessed using, where required, modelling (for example, hydrocarbon spills, produced water discharge, cooling water discharge, noise modelling) and scientific reports. The expected duration of each event was also defined based on the advice of subject matter experts.

Santos assessed the cumulative impacts of the Activity with other marine users. However, due to the remote location of the OAs, it is unlikely that there will be a cumulative impact above impact thresholds with other marine users. Concurrent activities (as described in Section 2.3.1) may occur between the Drilling and Completions Activity, SURF Activity and the Activity. Hence the potential cumulative impacts of concurrent activities were considered within each relevant aspect.

5.3 Describe the environmental performance outcomes and control measures

As required by the OPGGS(E)R, environmental performance outcomes/s (EPO), control measures (CM), environmental performance standards (EPSs) and measurement criteria (MC) were identified for the determined environmental impacts and risks.

All reasonably practicable control measures were considered and either accepted for use or not adopted based on whether impacts and risks had been reduced to levels considered acceptable and ALARP.

Accepted control measures were allocated in order of preference according to Figure 5-2.

Control	Effectiveness	Example
Eliminate		*Removal of the risk.* Refueling of vessels at port eliminates the risks of an offshore refueling.
Substitute		*Change the risk for a lower one.* The use of low-toxicity chemicals that perform the same task as a more toxic additive.
Engineering		*Engineer out the risk.* The use of oil-in-water separator to minimise the volume of oil discharged.
Isolation		*Isolate people or the environment from the risk.* The use of bunding for containment of bulk liquid materials.
Administrative		*Provide instructions or training to people to lower the risk.* The use of Job Hazard Analysis to assess and minimise the environmental risks of an activity.
Protective		*Use of protective equipment.* Containment and recovery of spilt hydrocarbons.

Figure 5-2: Hierarchy of controls

5.4 Determine the impact consequence level and risk rankings

The consequence level of a potential impact was determined for each planned and unplanned event using the Santos environment consequence descriptors (detailed in Table 5-2 and Appendix G) on the basis that all control measures have been implemented.

These detailed environmental consequence descriptions are based on the consequence of the impact to relevant receptors within the categories of:

- threatened, migratory or local fauna
- physical environment and habitat
- threatened ecological communities
- protected areas
- socio-economic receptors
- cultural features
- cumulative impacts.

Consequence descriptors are based on set criteria for each receptor category and take into consideration the duration and extent of the impact, receptor recovery time, and the effect of the impact at a population, ecosystem or industry level.

When assessing impacts to cultural features that are part of the environment that may be affected by the Activity, Santos considered cultural features of the environment as defined under the OPGGS(E)R):

(a) ecosystems and their constituent parts, including people and communities

(b) natural and physical resources

(c) the qualities and characteristics of locations, places and areas

(d) the heritage value of places

When assessing the consequence level of impact to cultural features, Santos considers the different types of cultural features and types of impacts. For impacts to cultural features, in the form of impacts to marine species that are either a cultural food source or are considered culturally significant to First Nations people, Santos assesses impacts with reference to the consequence assessment for the threatened/migratory/local fauna.

Similarly, where cultural features are linked to a specific place, impacts to cultural features are assessed with reference to the consequence assessment for physical environment/threatened ecological communities/protected areas as applicable.

Where there are concerns raised by individuals about cultural and spiritual beliefs that do not link to a specific location or place, Santos will evaluate impact and risk acceptability through the consideration of:

- Impacts from other activities in the vicinity of the EP activities (e.g., historical drilling, trawl fishing activity, shipping, commercial developments).
- Information provided from people and /or organisations who assert the cultural and spiritual connections.
- Any expert assessment(s) from suitably qualified expert(s) with relevant experience and credentials.
- Culturally appropriate control measures raised by Relevant Persons, organisations or experts; or proposed by Santos and workshopped with Relevant Persons, organisations or experts.

Taking into account the above considerations, this EP sets out a qualitative assessment demonstrating that impacts and risks of the Activity will be reduced to as low as reasonably practicable and be of an acceptable level.

As planned events are expected to occur during the Activity, the likelihood of their occurrence was not considered during the environmental assessment. Only a consequence level was assigned.

Table 5-2: Summary environmental consequence descriptors

Consequence level	Consequence level description
I	**Negligible** – No impact or negligible impact
II	**Minor** – Detectable but insignificant change to local population, industry or ecosystem factors
III	**Moderate** – Significant impact to local population, industry or ecosystem factors
IV	**Major** – Major long-term effect on local population, industry or ecosystem factors

V	**Severe** – Complete loss of local population, industry or ecosystem factors and/or extensive regional impacts with slow recovery
VI	**Critical** – Irreversible impact to regional population, industry or ecosystem factors

For unplanned events, the consequence level of the impact was combined with the likelihood of the impact occurring (Table 5-3), to determine a residual risk ranking using the Santos corporate risk matrix (Table 5-4).

Table 5-3: Likelihood description

No.	Matrix	Description
F	Almost Certain	Occurs in almost all circumstances OR could occur within days to weeks
E	Likely	Occurs in most circumstances OR could occur within weeks to months
D	Occasional	Has occurred before in Santos OR could occur within months to years
C	Possible	Has occurred before in the industry OR could occur within the next few years
B	Unlikely	Has occurred elsewhere OR could occur within decades
A	Remote	Requires exceptional circumstances and is unlikely even in the long term

Table 5-4: Santos risk matrix

		Consequence					
		I	II	III	IV	V	VI
Likelihood	F	Low	Medium	High	Very High	Very High	Very High
	E	Low	Medium	High	High	Very High	Very High
	D	Low	Low	Medium	High	High	Very High
	C	Very Low	Low	Low	Medium	High	Very High
	B	Very Low	Very Low	Low	Low	Medium	High
	A	Very Low	Very Low	Very Low	Low	Medium	Medium

5.5 Evaluate if impacts and risks are as low as reasonably practicable

For planned and unplanned events, an ALARP assessment was undertaken to demonstrate the standard control measures adopted to reduce the impact (consequence level) or risk to ALARP. This process relies on demonstrating that further potential control measures would require a disproportionate level of cost and effort to reduce the level of impact or risk. If this cannot be demonstrated, then further control measures are adopted. The level of detail included within the ALARP assessment is based upon the nature and scale of the potential impact or risk. For example, more detail is required for a risk ranked as `Medium' compared with a risk ranked as `Low'.

5.6 Evaluate impact and risk acceptability

Santos considers an impact or risk associated with the activities to be acceptable if each of the following criteria, where relevant, is satisfied:

- the consequence of a planned event is ranked as I or II; or a risk of impact from an unplanned event is ranked Very Low to Medium
- an assessment has been completed to determine that sufficient information or studies have been considered to validate the consequence assessment
- the activity will be carried out in a manner that is consistent with the principles of ecologically sustainable development
- that it can be demonstrated that the acceptable levels of impact and risks have been informed by relevant species recovery plans, threat abatement plans and conservation advice
- performance outcomes, control measures and associated performance standards:

- are consistent with legal and regulatory requirements
- are consistent with the Santos Environment, Health and Safety Policy
- are consistent with industry standards and best practice guidance
- where practicable take into consideration Relevant Person feedback
- have been demonstrated to reduce the impact or risk to ALARP

6. Planned Activities Impact Assessment

Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)R 2023) requirements
Section 21 Environmental assessment
Evaluation of environmental impacts and risk 21(5) The environment plan must include: a. details of the environmental impacts and risks for the activity; and b. an evaluation of all the environmental impacts and risks, appropriate to the nature and scale of each impact or risk; and c. details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable and an acceptable level. 21(6) To avoid doubt, the evaluation mentioned in paragraph (5)(b) must evaluate all the environmental impacts and risks arising directly or indirectly from: ○ all operations of the activity; and ○ any potential emergency conditions, whether resulting from an accident or any other cause. *Environmental performance outcomes and standards* 21(7) The environment plan must: ○ set environmental performance standards for the control measures identified under paragraph (5)(c); and ○ set out the environmental performance outcomes for the activity against which the performance of the titleholder in protecting the environment is to be measured; and ○ include measurement criteria that the titleholder will use to determine whether each environmental performance outcome and environmental performance standard is being met.

An environmental hazard identification workshop (ENVID) workshop (as described in Section 4) for planned activities was held in April 2022. A second ENVID workshop was held in February 2024 to review and update the impact assessment based on new information relating to receptors (including values and sensitivities obtained during consultation on other Barossa Environment Plans (EPs), as described in Section 5.2.3) and updates to the Activity description. New requirements (such as changes to legislation, other requirements and guidelines) were also considered.

Santos' environmental assessment identified eight causes of direct and indirect environmental impact associated with the planned activities to be undertaken in the operational areas (OAs). The results of the impact assessments are summarised in Table 6-1 and described in the next subsections.

Table 6-1: Environmental impact assessment summary

EP section	Hazard	Residual consequence level
6.1	Noise emissions	II – Minor
6.2	Light emissions	II – Minor
6.3	Greenhouse gas (GHG) emissions	II – Minor
6.4	Atmospheric emissions	I – Negligible
6.5	Seabed and benthic habitat disturbance	II – Minor
6.6	Interaction with other marine users	II – Minor
0	Operational discharges	II – Minor
0	Produced Water discharges	II – Minor

6.1 Noise Emissions

6.1.1 Description of event

Event	Potential impacts from noise emissions may occur in the OAs from: • floating production, storage and offloading facility (FPSO) (permanently moored without propulsion system): power generation, topsides equipment, flaring, marine systems (such as ballast pumps, seawater lift pumps (Section 2.7.3) • subsea infrastructure: minor source; constant (Section 2.4) • vessel activities: such as vessel engines, thrusters, and other machinery (Section 2.8) including additional vessels in field during hook up and commissioning (e.g. tow vessels), support vessels for day to day operations, contingency Light Well Intervention Vessel (LWIV) activities, IMMR and specific campaign activities • inspection, maintenance, monitoring and repair (IMMR) activities: including remotely operated vehicles (ROV), autonomous underwater vehicle (AUV) and geophysical surveys (Section 2.9) • helicopter activities Concurrent Barossa activities (Section 2.3.1) will generate noise emissions, such as the operation of a mobile offshore drilling unit (MODU) (D&C EP activities), the operation of a construction vessel and transportation vessel (SURF EP activities) and associated geophysical equipment and helicopters used for these activities. **Operational area 1:** All activities described above, including concurrent activities, could be expected within OA1. **Operational area 2:** The Barossa Gas Export Pipeline (Barossa GEP) and associated infrastructure, and activities along the pipeline including IMMR vessel activities.
Extent	**Operational area 1:** Noise emissions will be concentrated around the FPSO, infield subsea infrastructure and vessels, with studies supporting the assessment of only localised effects. The worst-case distance for potential impact (furthest distance at which behavioural impacts to cetaceans may occur) has been conservatively modelled at 11.4 km, associated with vessels under dynamic positioning (DP). Concurrent MODU and support vessel activities (with associated noise emissions) will be concentrated at drill centres >6km from the FPSO turret. The conservative modelled extent of 11.4 km used for FPSO support vessels (based on cetacean behavioural impacts) is also considered appropriate for MODU support vessel using DP. Concurrent SURF construction vessel and associated transportation vessel activities (with associated noise emissions) will also be concentrated at drill centres >6km from the FPSO turret, with a lower likelihood of these vessels working close to the FPSO turret during the FPSO pre initial start-up activities. As considered appropriate for MODU and FPSO support vessel, SURF vessels on DP are expected to generate underwater noise at a similar level and the worst-case extent of behavioural effects of 11.4 km also applies. **Operational area 2:** No permanent noise sources will be active along the pipeline. Periodic activities, such as inspection, maintenance, monitoring and repair (IMMR) will generate noise emissions anywhere within this area.
Duration	**Continuous:** FPSO onboard facilities (no propulsion system) and subsea infrastructure noise will be nearly constant for the field life, unless the FPSO is detached and out of OA1, noting the FPSO would be towed out of OA1 if removed from the field as it has no propulsion system. Support vessel and intermittent helicopter noise will be regularly occurring within OA1. **Infrequent and one-off:** Campaign vessel noise including LWIV and USV will be infrequent, as per operational requirements for specific campaigns within OA1 and OA2. LWIV presence in OA1 if required would be for approximately 34 days up to every 2 years. During HUC additional vessels will be in field for approximately 3 months for the one-off HUC activity. Following completion of hook-up and commissioning, initial start-up will occur for approximately 4 months involving support vessel(s) for this one-off activity. Planned inspection campaigns are scheduled every three years along the pipeline and would take approximately three weeks as the vessel moves slowly along the pipeline. IMMR vessel presence occurs typically for approximately 14 to 30 days in duration every three to five years, or as needed. Activities within OA2 are significantly less frequent than in OA1. **Concurrent:** The duration of overlap for each concurrent Barossa activity within OA1 is presented in full in Section 2.3.1.

	For FPSO pre initial start-up activities there may be concurrent noise from a MODU and support vessels (D&C EP activities) for a period of ~3 months; for ~1 month of this period there may also be noise from a construction vessel and transportation vessel undertaking SURF installation and pre-commissioning (SURF EP). There may be MODU drilling/completion (under the D&C EP) extending for a period of up to ~3 months post FPSO start-up and contingency MODU well workovers activities (nominally of 3-months duration) within the validity period of this EP. Contingency well workover activities using a MODU will be authorised under a separate EP. For the first 6 months post FPSO start-up, there may also be up to ~2 months cumulative duration of SURF installation and pre-commissioning.

6.1.1.1 Introduction

During the Activity, noise will be generated by the FPSO onboard facilities, subsea equipment, flaring, vessels undertaking hook-up and commissioning and initial start-up support, vessels and USV undertaking day to day support and IMMR activities, vessels undertaking LWI survey equipment including multibeam echo-sounder (MBES) or side scan sonar (SSS), and helicopters providing support. The types of noise are described as continuous or impulsive:

- Continuous noise is a continual non-pulsed sound that can be transient (short duration) but without the rapid rise time (pulse) (Southall *et al.*, 2007), examples are vessel operations.
- Impulsive noise is a series of pulsed sound events that are brief, broadband, atonal and transient. Examples are acoustic emissions from survey equipment undertaking MBES and SSS.

6.1.1.2 Noise modelling studies and terminology

Santos commissioned a technical study into Underwater Noise Impacts on Marine Fauna (JASCO, 2020). Santos has used the findings of this study to support the underwater noise emissions impact assessment in this EP. Non-impulsive sounds have a longer duration than impulsive ones, and they usually do not have the high peak sound pressure and rapid rise and decay time impulsive sounds have. However, especially in respect to their auditory effects on marine fauna, the term non-impulsive does not imply long duration signals (JASCO, 2020).

The relevant terminology for underwater acoustic levels relevant to non-impulsive sources are sound pressure levels (SPL) and accumulated sound exposure levels (SEL).

Previous assessments for the Barossa Development (ConocoPhillips, 2018) examined the noise from an FPSO and associated support vessels. The modelling scenarios include the modelling of an operational FPSO and an FPSO with offloading tanker and a support vessel in attendance located at the proposed FPSO site in the Barossa field. The basis for the previous modelling was that the FPSO position was maintained by dynamic positioning thrusters, however this is not the case for the Activity as the FPSO will be permanently moored and therefore DP will not be required. Other associated vessels, such as offtake tankers and other support vessels including campaign vessels, IMMR vessels, LWIV and USV, will be on DP intermittently. This modelling study is therefore conservative for the assessment on the basis that the noise source associated with the FPSO on DP has been removed.

The assessment undertaken for the Barossa Development (ConocoPhillips, 2018) applied Southall *et al.* (2007) to assess potential hearing impairment in marine mammals. Southall *et al*. (2019) has subsequently further refined the assessment approach for low-frequency (LF) cetaceans by determining the effect ranges and applying the unweighted SEL results and LF hearing group specific thresholds. Therefore, the modelling is considered conservative because it does not account for the weighting of frequencies for fauna that do not hear as well. Note also that Southall *et al*. (2021) reports further research recommendations that are aiming to improve the assessment of the severity of marine mammal behavioural responses to human noise.

The Artisan-1 Exploration Well Drilling EP (Beach, 2020) contains an assessment of an anchored mobile offshore drilling unit (MODU) and resupply operations. This assessment did not predict a range to temporary threshold shift (TTS) in high-frequency (HF) cetaceans (using the Southall *et al.*, 2019 definition) at ranges beyond 30 m for the highest potential impact activity: resupply operations. The MODU and associated vessel operations are louder than those predicted for the FPSO, and although the geology is different, at very close ranges it will have less influence than simply the water depth.

The other criteria within ConocoPhillips (2018) relevant to the current assessment are as follows:

- marine mammal behavioural response criteria are unchanged, with 120 dB re 1 µPa (SPL) still the threshold; however, the reference has been updated from National Marine Fisheries Service (NMFS, 2014) to National Oceanic and Atmospheric Administration (NOAA, 2019)
- sound exposure guidelines for fish, fish eggs, sea turtles and larvae from Popper *et al.* (2014) remain unchanged. This will be applied for hearing impairment in sea turtles in the absence of the ability to assess the frequency-weighted thresholds presented in Finneran *et al.* (2017a).

The Southall *et al.* (2021) paper on behavioural response criteria does not provide new numerical thresholds for onset of behavioural responses for marine mammals and thus has not been applied in this assessment. This paper does provide significant context and guidance for future work to better determine such thresholds.

The terminology used to refer to the distances to thresholds are:

- R_{max}, the maximum range to the given sound level over all azimuths
- $R_{95\%}$, the range to the given sound level after the 5% farthest points were excluded.

6.1.1.3 Noise generated by the floating production, storage and offloading facility

There will be low level noise associated with operating the FPSO within OA1, which may include periodic use of an offtake tanker and tug assist that will be engaged during offtake activities (approximately once every three months).

Typical noise levels on the FPSO are expected to be 85 to 95 dB during normal operations, and 102 to 116 dB in emergency scenarios (Barossa Noise and Vibration Report).

The noise generated by the FPSO is predominantly from machinery and equipment on the top deck. The double-hull design of the FPSO helps insulate the marine environment from machinery noise on the top deck and inside the hull.

6.1.1.4 Noise generated by subsea infrastructure

The level of noise emitted by subsea infrastructure such as wellheads, flowlines, valves and the pipeline are expected to be low levels, similar to ambient noise levels in the region. Based on the measurements of wellhead noise discussed in McCauley (2003), which included flow noise in pipelines, noise produced along a pipeline may be expected to be similar to that described for wellheads, with the radiated noise field falling to ambient levels within 100 m of the pipeline.

Woodside has undertaken acoustic measurements on the noise generated by the operation of choke valves associated with the Angel facility (JASCO, 2015). These measurements indicated choke valve noise is continuous, and the frequency and intensity of noise emitted is dependent on the rate of production from the well. Noise intensity at low production rates (16% and 30% choke positions) were approximately 154 to 155 dB re 1 µPa, with higher production rates (85% and 74% choke positions) resulting in lower noise levels (141 to 144 dB re 1 µPa). Noise from choke valve operation was broadband in nature, with most noise energy concentrated above 1 kHz. Noise from choke valve operation was considered minor compared to noise generated by vessels using thrusters in the area.

Due to the relatively high frequency (over 1 kHz), noise emitted by subsea infrastructure such as wellheads, choke valves and flowlines attenuates over shorter distances than vessel noise. Therefore, some behavioural disturbance to whales and dolphins is considered possible, but no significant impacts to marine fauna are considered credible and therefore not considered further in the impact assessment.

6.1.1.5 Noise generated by vessels

Vessel operational noise consists of machinery noise (such as engine noise) and hydrodynamic noise (such as water flowing past the hull, thruster use and propeller singing). Machinery on a ship radiates sound through the hull into the water.

Typical vessel operations that will occur involving DP include:

- support vessels undertaking hook-up and commissioning activities and initial start-up
- resupply activities for the FPSO
- FPSO offtake
- IMMR and specific campaign activities
- Contingency Light Well Intervention Vessel (LWIV) activities
- USV

To represent vessels under DP in the presence of the FPSO, the modelling scenario in ConocoPhillips (2018) of the FPSO offtake has been applied to conservatively estimate ranges to effect. This included both the FPSO and offtake tanker, represented using a conservative power level approximation for the thrusters of 50% load, and a support vessel also using DP to maintain station. Considering the FPSO is permanently moored with no propulsion system, the worst-case scenario as modelled in the OPP is applied in the assessment to represent vessel activities in OA1 operating on DP intermittently, such as offtake tanker, campaign vessel, LWIV, USV and other support vessels.

The activity scenario that does not involve DP is standby of the support vessel near the FPSO and the FPSO on location (as it does not have thrusters). A reasonable representation of vessel noise during this activity is a vessel under slow transit.

The typical sound levels generated by vessels are broadband and usually increase with increasing vessel size, with smaller vessels (less than 50 m) having source levels 160 to 175 dB (re 1 µPa), medium size vessel (50 to 100 m) 165 to 180 dB (re 1 µPa) and large (greater than 100 m) 180 to 190 dB (re 1 µPa) (OSPAR, 2009; Richardson *et al*., 1995 in Genesis Oil and Gas Consultants, 2011). Gotz *et al*. (2009) lists tugboats, crew boats, supply ships and many research vessels in the 50 to 100 m size class also having similar levels of 165 to 180 dB re 1 µPa range (221 SEL_{cum} [Richardson *et al*., 1995]).

JASCO (2020) measured source level noise from two vessels under transit and DP, and although the acoustic level will vary with the specific vessels, particularly the thruster type and configuration, they can be taken as typical. Under transit, source levels were 172.6 dB re 1 µPa (at 11.6 knots) and 181.3 dB re 1 µPa (at 8.8 knots), compared to 171 to 182 dB re 1 µPa when under DP.

This DP source level is similar to that modelled for an FPSO not using a thruster (181 dB re 1 µPa m), and the source level for the vessel during transit will be lower as it is more efficient. Therefore, this is a reasonable approximation to determine ranges for SEL criteria.

6.1.1.6 Noise generated by helicopters

Sound traveling from a source in the air (such as a helicopter) to a receiver underwater is affected by both in-air and underwater propagation processes, and processes occurring at the air/seawater surface interface (such as wind and waves). The level of noise received underwater depends on source altitude and lateral distance, receiver depth, water depth and other variables.

Helicopter engine noise is emitted at various frequencies. However, the dominant tones are generally of a low frequency below 500 Hz (Richardson *et al.*, 1995). Sound pressure in the water directly below a helicopter is greatest at the surface and diminishes with increasing receiver depth. Noise also reduces with increasing helicopter altitude, but the duration of audibility often increases with increasing altitude, with sound penetrating water at angles less than 13°. Noise from the flyover of a Bell 214ST helicopter has been recorded underwater (Richardson *et al.*, 1995), with the maximum recorded sound level for the dominant 22 Hz tone being 109 dB re 1 µPa (SPL) when the helicopter was 152 m from the surface and the hydrophone was 3 and 18 m under the surface, and only detectable underwater for 11 to 38 seconds (based on transit speed), depending on water depth.

For context, the Bell 214 uses a single powerful Lycoming LTC4B-8 engine (2930 shaft horsepower; 2185 kW) (Frawley, 2003), while the more modern Bell 412, often used as a rescue helicopter in Australia (Air Services Australia, 2020) uses twin 1250 shaft horsepower (930 kW) turboshaft engines (Bell Helicopter, 2012). Typical offshore crew change and medivac helicopters in Australia are the Leonardo AW139s (Milne, 2019), which have been measured to be 2 dB(A) quieter than the Bell 412 helicopters (Air Services Australia, 2020).

Although helicopters are expected to land and take off from the FPSO several days per week, the duration of helicopter operation within proximity to the marine environment is limited and intermittent. Further, helicopter operations are expected to result in received underwater noise levels lower than those associated with vessel operations and, given underwater noise from helicopters will be less than that associated with vessels, the findings regarding impacts from underwater vessels are considered to represent a conservative worst case in relation to noise from helicopters.

6.1.1.7 Noise from flaring

Flaring will occur through a flare stack that is 145 m high from the deck, which incorporates an open high pressure (HP) flare tip, a closed LP flare tip and an acid gas flare tip. Noise from flaring is caused by high exit velocities of hydrocarbons through the flare. The flare system generates noise from combustion. As the noise is emitted at the top of the flare stack, 145 m above the deck, noise will radiate spherically in all directions. LP and acid gas flares are normally not lit, and HP flare only takes place intermittently.

The noise from in-air flaring is typically reported in A-weighted units to assist with assessing potential effects on humans. The noise during HP flaring lies in the range 78.6 to 82.0 dBA (Santos, 2023a).

Received levels from airborne propagation modelling were used to ascertain the underwater received levels during flaring activities for a drilling and subsea installation activity (Woodside, 2019). Only a very small fraction of the acoustic energy produced from flaring will transmit through the air and water boundary, due to the surface of water acting as a reflective plane and a significant component of acoustic energy reflecting back into the air.

6.1.1.8 Noise from surveys

Survey activities (Section 2.9) will be undertaken in the field and along the pipeline route throughout the life of the development. MBES and SSS transmit at high frequencies (approximately 70 to 400 Hz) and produce a highly

focused beam of sound down towards the seabed, so there is very limited horizontal sound propagation. Source levels for these survey methods include:

- MBES, such as the Reson SeaBat 7125 transmitting at 400 kHz. At 400 kHz it has a 1° beamwidth along the track, and a source level of 220 dB re 1 µPa (Coastal Frontiers, 2017)
- SSS, which is generally considered a high acoustic density source and medium frequency generator. The level of sound pressure ranges from about 200 to 234 dB re 1 µPa SPL. The frequency ranges from about 75 to 900 kHz (Jimenez-Arranz *et al.*, 2020).

6.1.1.9 Summary of noise sources and rationale for assessment

Of the noise sources described in Sections 6.1.1.3 to 6.1.1.8, noise from helicopters and flaring are expected to be intermittent during the Activity and underwater received levels will not exceed that of Activity vessels including the FPSO. The sound frequencies and levels expected from the activities are summarised in Table 6-2.

Table 6-2: Summary of Expected sound levels during the operations Activity

Source	Expected Source Levels (dB re 1 µPa)	Reference
FPSO on mooring	85 to 95 dB (during normal operations)	Barossa Noise and Vibration Report
Subsea infrastructure	154 to 155 (low production rates) 141 to 144 (high production rates)	JASCO, 2015
Vessels	Under transit: 172.6 (at 11.6 knots) and 181.3 (at 8.8 knots), Under DP: 171 to 182	JASCO, 2020
Helicopters	109 when the helicopter was 152 m from surface	Richardson *et al*., 1995
Flaring	78.6 to 82.0 dBA	Santos, 2023a
Surveys	MBES: 220 SSS: 200 to 234	Coastal Frontiers, 2017 Jimenez-Arranz *et al.*, 2020

Therefore, the assessment has focused on the operations of the project support vessels, survey equipment (MBES and SSS) and the moored FPSO.

6.1.2 Nature and scale of environmental impacts

Potential receptors: Threatened, migratory or local fauna, socio-economic and cultural features.

Some of these marine species have cultural significance to First Nations persons either as a traditional food source or for other cultural reasons (see Sections 3.7.10 and 3.7.10.1).

The levels of acoustic exposure that may result in injury or behavioural changes in marine fauna is an area of increasing research. Due to differences in experimental design, methodology and units of measure, comparison of studies to determine likely sound exposure thresholds can be difficult. On assessment of the available science, thresholds have been defined for informing the impact assessment and interpreting the estimated ensonification ranges. These are discussed for each receptor in JASCO (2020).

The assessment is conducted by comparing modelled received underwater sound levels to defined noise effect criteria, as determined by scientific research and academic papers (JASCO, 2020), for the identified environmental and social receptors.

6.1.2.1 Marine mammals

There are no known significant feeding, breeding or aggregation areas for marine mammals within the OAs, though Omura's whales (not Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) listed) have been detected consistently within the OAs. The closest significant feature to the OAs is the pygmy blue whale distribution range, which is located approximately 60 km away from the boundary of OA1. The breeding biologically important area (BIA) for the Indo-Pacific humpback dolphin is in Darwin Harbour, approximately 45 km from the boundary of OA2 at the closest point.

Several species of baleen whales may occur in the OAs, including the Omura's, sei, fin, pygmy blue, humpback and Bryde's whales. Based on their hearing range, these whales have been classified as low-frequency (LF) cetaceans. A number of odontocetes (including dolphins) may also be present in the OAs. Odontocetes have been classified as HF cetaceans using the hearing group classification from Southall *et al.* (2019).

The Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a) lists noise disturbance as a threat, specifically relating to impulsive sound sources and acute industrial noise such as pile driving. Anchor pile driving noise was assessed and included in the OPP, however this activity was eliminated by choosing an

alternative anchor mooring system (i.e. suction anchors) to effectively reduce noise impact. Shipping noise in busy shipping channels is also identified as a potential source of noise emissions, although the risk assessment determines that consequences would be restricted to individuals, and no population-level effects are expected. The plan requires that anthropogenic noise in BIAs will be managed such that any blue whales may continue to use the area without injury. Because the noise assessment boundary does not impact any blue whale BIA, impacts will be managed in adherence with the Management Plan (CoA, 2015a).

Pygmy blue, Omura's and Bryde's whales were detected acoustically (using autonomous multichannel acoustic recorders deployed close to the seabed at 3 stations) in the Barossa area during a baseline acoustic environment characterisation program undertaken from July 2014 to July 2015 at and surrounding the Barossa field (JASCO, 2016). These whales were detected mostly during May–August, with no detections November–December. The pygmy blue whale detections were more than 400 km further east than the currently estimated northbound migration corridor. This detection was stated as being a significant regional scientific contribution. Omura's whales were detected from April–September with a peak in June–July. The whales seemed to enter the region from a south-west to north-east direction, then maintain a higher presence within the Barossa field area (compared to Evans Shoal and the Caldita field area). They appeared to leave the region reversing their entry path, leaving by the start of November. Pygmy blue whales were detected once during their northward migration in August 2014, over a few consecutive days in late May to early June 2015, on 16 June, 30 June, and 1 July 2015. No detections were logged from the southbound migration. The highest detection rate of the 3 sites was at the Barossa field. Bryde's whales were present in the region from January to October. Their location was detected mainly in shallower waters at Evans Shoal and the Caldita field area compared to the Barossa field area. In May 2022, Woodside contractors conducted a seismic survey for Woodside's Galactic Hybrid 2D MSS. This survey extent was approximately 21,000 km^2 and overlapped the proposed OA. Woodside reported that cetacean species were sighted including false killer whales and pygmy blue whales (personal communication, 1 June 2022).

Based on their hearing range, whale species have been classified as low-frequency cetaceans. Several odontocetes (including spotted bottlenose dolphin, killer whale and sperm whales) may also be present in the OA. Odontocetes have been classified as high-frequency cetaceans using the hearing group classification from Southall *et al.* (2019).

While dugongs may occur in OA2, dugongs spend most of their time in shallow tidal and subtidal seagrass meadows. There are no assessments for impacts of vessel noise on dugongs (sirenians) using the Southall *et al.* (2019) criterion. As their frequency weighting is most similar to HF cetaceans, and their thresholds are higher (as they are less sensitive), results for vessel noise impacts on HF cetaceans have been used as a proxy for those on dugong, noting this is likely to be conservative.

To better reflect the auditory similarities between closely related species, but also significant differences between species groups among the marine mammals, Southall *et al.* (2007) assigned the extant marine mammal species to functional hearing groups based on their hearing capabilities and sound production. This division into broad categories was intended to provide a realistic number of categories for which individual noise exposure criteria were developed. These groups were revised by NMFS (2018) and most recently by Southall *et al.* (2019). The categorisation as such has proven to be a scientifically justified and useful approach in developing auditory weighting functions and deriving noise exposure criteria for marine mammals. These auditory weighting functions are referred to as frequency weighting. These thresholds that detail receptor noise impacts and behavioural response for continuous noise (vessels), along with the new nomenclature and classifications for marine mammals are summarised in Table 6-3. The table details receptor noise impact and behavioural thresholds for continuous noise (vessel), being:

- Low frequency (LF) cetaceans: which consists of baleen whales such as humpback whales.
- High frequency (HF) cetaceans: which consists of toothed whales except porpoises and river dolphins.
- Very High frequency (VHF) cetaceans: which consists of whales such as pygmy sperm whale.

For non-impulsive noise such as that expected during hook up and commissioning, initial startup and operations, NMFS currently uses a step function (all-or-none) threshold of 120 dB re 1 µPa SPL (unweighted) to assess and regulate noise-induced behavioural impacts for marine mammals (NOAA, 2019). The behavioural disturbance threshold criteria applied summates the most recent scientific literature on the impacts of sound on marine mammal hearing, so is considered the most relevant to this Activity. Table 6-3 details cetacean behavioural, TTS and permanent threshold shift (PTS) thresholds for continuous noise (vessels and FPSO); Table 6-4 details cetacean behavioural, TTS and PTS thresholds for impulsive noise (survey equipment).

Table 6-3: Continuous noise: summary of cetacean impact thresholds as derived from Southall *et al*. (2019) and National Oceanic and Atmospheric Administration (2019)

Hearing group	NOAA (2019)	Southall *et al.* (2019)	
	Behaviour	PTS onset thresholds (received level)	TTS onset thresholds (received level)
	SPL (dB re 1 µPa)	Weighted SEL_{24h} (dB re 1 $\mu Pa^2 \cdot s$)	Weighted SEL_{24h} (dB re 1 $\mu Pa^2 \cdot s$)
LF cetaceans	120	199	179
HF cetaceans		198	178
VHF cetaceans		173	153

L_e denotes cumulative exposure over a 24 hour period and has a reference value of 1 µPa2-s

Table 6-4: Impulsive noise: unweighted sound pressure level, SEL_{24h} and peak (PK) thresholds for acoustic effects on marine mammals

Hearing group	NOAA (2019)	NMFS (2018), Southall *et al.* (2019)			
	Behaviour	PTS onset thresholds (received level)		TTS onset thresholds (received level)	
	SPL (dB re 1 µPa)	Weighted SEL_{24h} (dB re 1 $\mu Pa^2 \cdot s$)	PK (Lpk; dB re 1 µPa)	Weighted SEL_{24h} (dB re 1 $\mu Pa^2 \cdot s$)	PK (Lpk; dB re 1 µPa)
LF cetaceans	160	183	219	168	213
MF cetaceans	160	185	230	170	224

Potential impacts from FPSO and vessels

Using predicted source levels described above, estimated distances from Activity vessels to behavioural and physiological thresholds (as listed in Table 6-3) for cetaceans are provided herein.

The predicted extent of thresholds associated with operations of the FPSO can be estimated by considering those determined for the FPSO in isolation during normal operations, as follows:

- the range to the 120 dB re 1 µPa criterion for behavioural responses in marine mammals is approximated to be 1.42 km (R_{max}), (NOAA, 2019)
- PTS and TTS in LF cetaceans could occur within approximately 20 or 200 m, respectively, if the animal remains within that range for 24 hours
- PTS is not predicted in HF cetaceans, although they could experience TTS within 50 m if the animal remains within that range for 24 hours.

The predicted extent of thresholds associated with use of the FPSO with a support vessel in attendance are as follows:

- the range to the 120 dB re 1 µPa criterion for behavioural responses in marine mammals is estimated to be 11.4 km (R_{max}), (NOAA, 2019)
- PTS and TTS in LF cetaceans could occur within approximately 70 or 1860 m, respectively, if the animal remains within that range for 24 hours
- PTS is not predicted in HF cetaceans, although they could experience TTS within 50 m if the animal remains within that range for 24 hours.

These predictions are conservative, as they considered 24 hours of operations, while resupply activities either typically take less than this, or during other activities (such as hook up and commissioning and initial startup as well as ongoing operations including when using campaign vessels [e.g. LWI, IMMR, USV] and support vessels), there are periods of idle time for the vessels.

The predicted extent of thresholds for a vessel in transit have been estimated using measurements of the *Pacific Ariki* (McCauley, 1998); the ranges predicted for the FPSO operating in isolation are as follows:

- the range to the 120 dB re 1 µPa criterion for behavioural responses in marine mammals is estimated to be 1 km, (NOAA, 2019)
- PTS and TTS in LF cetaceans could occur within approximately 20 or 200 m, respectively, if the animal remains within that range for 24 hours

- PTS is not predicted in HF cetaceans, although they could experience TTS within 50 m if the animal remains within that range for 24 hours.

Considering modelling assessments of other similar operations (such as the aforementioned Artisan-1 Exploration Well), and applying a conservative approach, a range to TTS of 50 m for HF cetaceans will be used to represent potential effects on odontocetes within this assessment.

Auditory masking impacts may occur when there is a reduction in audibility for one sound (signal) caused by the presence of another sound (noise). For this to occur, the noise must be loud enough and have a similar frequency to the signal, and both signal and noise must occur at the same time. Therefore, the closer the marine mammal is to the vessel, and the more overlap there is with their vocalisation frequencies, the higher the probability of masking. The potential for masking and communication impacts is therefore classified as high near the vessel (within tens of metres), moderate within hundreds of metres to low within thousands of metres (Clark *et al.*, 2009).

A qualitative assessment of masking was included in ConocoPhillips (2018), which considered the noise from the FPSO operations (including offtake) and the sound levels recorded during the baseline monitoring program (JASCO, 2015). This assessment determined pygmy blue, Omura's and Bryde's whales will experience masking when in the vicinity of the FPSO and, given the lower vocalisation source levels for the latter two species, the area over which masking will occur will be larger than for pygmy blue whales. Masking from the FPSO-associated activities is expected to be more relevant for Omura's and Bryde's whales because of their more regular presence within the region encompassing the Barossa field from summer through to early spring, whereas the migratory pygmy blue whales will only be affected for a short period of time during seasonal migration periods.

Generally, the spatial and temporal scale of behavioural response effects on marine mammals would be limited to the localised area surrounding the proposed FPSO (thousands of metres) encompassing vessels in OA1 and the periods of intensified activities. These ranges will be greater during resupply operations and campaign activities of 14 days, and 34 days for a light well intervention. Because the operations will be focused at a static site, and therefore only influence a small region within the Timor Sea not known to be a critical habitat for any cetacean species, significant effects at the population level are not expected.

Potential impacts from helicopters

Helicopter noise has been measured at a maximum received level of 109 dB re 1 µPa (SPL) and only detectable underwater for 11 to 38 seconds (based on transit speed), depending on water depth (Richardson *et al*., 1995). Therefore, the only credible impact would be behavioural impacts, limited to short term behavioural responses such as diving or increased swimming speed when the helicopter lands or takes off. Such impacts are considered unlikely to result in substantial effects to marine mammal populations or distribution.

Potential impacts from survey equipment

Survey geophysical equipment has been modelled at a number of locations, including the coast of Russia, Greenland, California and the Otway Basin (Zykov *et al.*, 2013; Austin *et al.*, 2012; McPherson & Wood, 2017). These studies, along with the example of accumulation provided in McPherson (2020), indicate both peak and frequency-weighted SEL noise emissions from survey equipment, such as MBES operating at 400 kHz, are typically below sound levels that could result in low- and high-frequency marine mammal TTS or PTS from either PK or SEL criteria (Table 6-4) in a horizontal direction. The threshold for behavioural disturbance (Table 6-4) could be exceeded within 120 m (McPherson, 2020). SSS impulses and MBES sound levels are outside the auditory range of LF species and baleen whales (such as humpback and pygmy blue whales), but within the mid-frequency and HF cetacean marine fauna auditory range (such as sperm whales and dolphins). However, PTS and TTS thresholds for these species (Table 6-4) are only expected to be exceeded close to the source. Due to the lack of aggregating areas for these species, individuals are expected to be transitory only, displaying behavioural responses, and moving away from the source before TTS and PTS thresholds are exceeded.

Survey equipment could cause masking of vocalisations of cetaceans due to the overlap in frequency range between signals and vocalisations. Masking will primarily apply to HF cetaceans, with all signals above 2 kHz. Higher frequency sounds have limited propagation, and attenuate rapidly, resulting in a relatively small area of influence. Therefore, the range at which masking impacts could occur would be limited to within hundreds of metres from the sound source.

Impacts to marine reptiles from underwater noise generated by survey equipment are unlikely to result in significant impacts, given impacts are likely to be limited to physiological impacts in individuals located within tens of metres of the sound source, and behavioural impacts in individuals located within hundreds of metres of the sound source. The risk of impact is further reduced as the vessels will be moving when undertaking surveys and it is highly unlikely any individual would remain the distances above for any length of time.

6.1.2.2 Marine reptiles

OA2 overlaps the flatback turtle internesting BIA, and the boundary of OA1 is 50 km from this BIA. Other individual turtle species and sea snakes may occur within the OAs. As discussed in Section 3.4.3, a compilation of tracking

data from marine turtle telemetry studies on and around the Tiwi Islands indicates turtle foraging areas and migration pathways did not overlap with the OA1, however migration pathways overlap OA2 (Pendoley, 2023) (Table 3-11).

While numerical thresholds have been developed for impacts of impulsive noise sources to marine turtles (for example, Finneran *et al.*, 2017b), the approach defined by Popper *et al.* (2014), also applied in the Barossa Development OPP (ConocoPhillips, 2018), has been applied to impulsive and continuous noise (Table 6-5 and Table 6-6).

Table 6-5: Acoustic effects of continuous noise on marine turtles

Potential marine fauna receptor	Popper *et al.*, 2014	
	Masking	Behaviour
Marine turtle	(N) High (I) High (F) Moderate	(N) High (I) Moderate (F) Low

Note: Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres.

Table 6-6: Criteria for impulsive noise exposure for marine turtles, adapted from Popper *et al*. 2014

Potential marine fauna receptor	Masking	Behaviour	TTS	Recoverable injury	Mortality and potential mortal injury
Marine turtle	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low	(N) High (I) Low (F) Low	(N) High (I) Low (F) Low	>210 dB SEL_{24h} or >207 dB PK

Note: Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres.

Potential impacts from floating production, storage and offloading facility and vessels

Based on the criteria detailed within Table 6-5 there is a low risk of any injury to marine turtles from Activity vessel noise. Behavioural changes, such as avoidance and diving, are only predicted for individuals near the Activity vessels: high risk of behavioural impacts within tens of metres of a vessel and moderate risk of behavioural impacts within hundreds of metres of a vessel. There is a high risk of masking within hundreds of metres of the vessel, and a moderate risk of masking within thousands of metres from the vessel. Little is known regarding masking in marine turtles; behavioural reactions have been found to be highly context specific, with behavioural sensitisation and habituation affecting the onset threshold for reactions and impacts (Ellison *et al.*, 2012). However, given the relatively low-level increase in sound, it is unlikely vessel noise will cause significant masking impacts in turtles.

Potential impacts from helicopters

Helicopter noise will be intermittent during the Activity and below the behavioural impact threshold (PTS and TTS). Impacts to marine turtles from helicopter noise are expected to be limited to short term behavioural impacts (i.e. diving or swimming rapidly) when the helicopter is taking off, based on measurements of helicopter noise (Richardson *et al*. 1995). Considering the offshore location of OA1 where helicopters will be taking off and landing and the water depths of greater than 50m, only individual turtles may be present if they are transiting the area. Such impacts are considered unlikely to affect marine turtle populations or distribution substantially.

Potential impacts from survey equipment

The sound levels of the survey equipment are below those associated with the PK criterion for injury (Table 6-6) beyond a few metres (McPherson, 2020) and, due to the low per-pulse SEL (McPherson, 2020), the SEL criterion will also not be exceeded. Recoverable injury and TTS could occur within tens of metres applying the relative risk criteria from Popper *et al.* (2014) (Table 6-6). Behavioural changes, such as avoidance and diving, are only predicted for individuals in proximity to the Activity vessels: high risk of behavioural impacts within tens of metres of the source and moderate risk of behavioural impacts within hundreds of metres of the source.

Turtles are unlikely to experience masking, even at close range to the source. This is in part because the sounds from survey equipment are all outside of the hearing frequency range for turtles (approximately 50 to 2000 Hz, with highest sensitivity to sounds between 200 and 400 Hz) (Ridgway *et al.*, 1969; Bartol *et al.*, 1999; Ketten & Bartol, 2005; Bartol & Ketten, 2006; Yudhana *et al.*, 2010; Piniak *et al.*, 2011; Lavender *et al.*, 2012, 2014).

Impacts to marine turtles from underwater noise generated by survey equipment are unlikely to result in significant impacts, given impacts are likely to be limited to physiological impacts in individuals located within tens of metres of

the sound source, and behavioural impacts in individuals located within hundreds of metres of the sound source. The risk of impact is further reduced as the vessels will be moving when undertaking surveys and it is highly unlikely any individual would remain the distances above for any length of time.

Sea snakes

There is limited information about the effects of noise on sea snakes. Data suggests sea snakes are sensitive to low-frequency sounds but have relatively low sensitivity compared with bony fishes and marine turtles (discussed in this section). Study results appear to confirm that snakes, including sea snakes, can hear but may have a limited sensitivity to sound pressure compared with previously studied marine vertebrates (Chapuis *et al*., 2019). The sea snake lung could also act as a pressure detector underwater, similar to the swim bladder of bony fishes. Therefore, it is considered there is a moderate risk in the near and intermediate distances (which extends hundreds of metres) of behavioural impacts to sea snakes, with the impacts being limited to temporary avoidance of the area. Such impacts are unlikely to result in substantial impacts to sea snake populations or distribution.

6.1.2.3 Sharks, rays and other fish

There are no known fish aggregation areas in the OAs; however, individuals or schools may pass through the areas and demersal fish may aggregate around subsea infrastructure such as the pipeline (McLean *et al.*, 2017). The closest natural feature that is considered likely to support site-attached fish is Goodrich Bank, which is located approximately 984m from OA2. The closest fish or shark BIA is 505 km from OA1 (whale shark foraging).

All fish species can detect noise sources, although hearing ranges and sensitivities vary substantially between species (Dale *et al.*, 2015). Sensitivity to sound pressure in fish seems to be functionally correlated to the presence or absence of gas-filled chambers in the sound transduction system. These chambers enable fish to detect sound pressure and extend their hearing abilities to lower sound levels and higher frequencies (Ladich and Popper, 2004; Braun and Grande, 2008). Based on their morphology, Popper *et al*. (2014) classified fish into 3 animal groups comprising:

- fish with swim bladders whose hearing does not involve the swim bladder or other gas volumes
- fish whose hearing does involve a swim bladder or other gas volume
- fish without a swim bladder that can sink and settle on the substrate when inactive.

Thresholds for PTS and recoverable injury are between 207 dB peak and 213 dB peak (depending on the presence or absence of a swim bladder), and the threshold for TTS is 186 dB SEL_{cum} (Popper *et al.*, 2014). Because there is no exposure criteria for sharks and rays, the same criteria are adopted, although sharks and rays do not possess a swim bladder

Potential impacts from vessels

The criteria defined in Popper *et al.* (2014) for continuous noise sources has been applied to the assessment of impacts to sharks, rays and other fish (Table 6-7).

Table 6-7: Continuous noise: criteria for noise exposure for fish (adapted from Popper *et al*., 2014)

Marine fauna group	Mortality and potentially mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
I Fish: No swim bladder (particle motion detection) includes sharks and rays.	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
II Fish: Swim bladder not involved in hearing (particle motion detection)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
III Fish: Swim bladder involved in hearing (primarily pressure detection)	(N) Low (I) Low (F) Low	170 dB SPL for 48 h	158 dB SPL for 12 h	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low
Fish eggs and fish larvae	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low	(N) Moderate (I) Moderate (F) Low

Note: Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres.

Based on the Popper *et al*. (2014) review, vessel noise has a low risk of resulting in mortality for all fish types. The risk of recoverable injury to Group I and Group II fish is low; however, it is moderate for TTS and behavioural impacts when fish are within tens of metres of an Activity vessel (Popper *et al.*, 2014). For Group III fish, recoverable injury and TTS may occur within 60 m of the source (McPherson *et al.*, 2019), with a high risk of behavioural impacts occurring within tens of metres of an Activity vessel (Popper *et al.*, 2014).

The most likely impacts to fish from noise will be behavioural responses. Popper *et al.* (2014) identified a moderate risk of behavioural impacts to fish in near (tens of metres) and intermediate distances (hundreds of metres) from the noise source. Masking in fish could also occur within thousands of metres under a worst-case scenario.

Impacts to fish from underwater noise generated by vessel operations are unlikely to result in substantial impacts to populations or distribution, given impacts are likely to be limited to physiological impacts in individuals located within tens of metres of the vessel, behavioural impacts in individuals located within hundreds of metres of the vessel, and masking of fish within thousands of metres. Fish are considered unlikely to remain in proximity to vessels and are therefore unlikely to be exposed to sound at the above thresholds. Site-attached fish at Goodrich Bank, which is located approximately 984 m from OA2 are unlikely to be exposed to these thresholds given the distance.

Potential impacts from survey equipment

The criteria defined in Popper *et al.* (2014) for impulsive noise sources has been adopted (Table 6-8). Impulsive noises from survey equipment could result in physiological impacts to fish located within metres of the sound source, considering the results presented in McPherson (2020). The likelihood of fish being close enough to the sound source for physiological impacts to occur is considered remote.

Table 6-8: Criteria for impulsive noise exposure for fish, adapted from Popper *et al*., 2014

Marine fauna group	Mortality and potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
I Fish: **No swim bladder (particle motion detection)**	>219 dB SEL_{24h} or >213 dB PK	>216 dB SEL_{24h} or >213 dB PK	>>186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
II Fish: **Swim bladder not involved in hearing (particle motion detection)**	210 dB SEL_{24h} or >207 dB PK	203 dB SEL_{24h} or >207 dB PK	>>186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
III Fish: **Swim bladder involved in hearing (primarily pressure detection)**	207 dB SEL_{24h} or >207 dB PK	203 dB SEL_{24h} or >207 dB PK	186 dB SEL_{24h}	(N) Low (I) Low (F) Moderate	(N) High (I) High (F) Moderate
Fish eggs and fish larvae	>210 dB SEL_{24h} or >207 dB PK	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Note: Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres.

Behavioural impacts to fish from survey equipment noise may occur in individuals located within hundreds of metres of the source. None of the survey equipment has energy below 1 kHz; therefore, it is unable to be heard by most fish, which further reduces the risk of impact (Ladich & Fay, 2013). The impact of masking is low at all ranges, except for those species of fish that specialise in pressure detection (i.e. those species with a swim bladder involved in hearing), where relative risk is moderate at distances of thousands of metres. This risk ranking is based on seismic air guns, where it is considered that masking risk could increase at a scale of thousands of metres due to the impulsive noise merging into a continuous noise (Popper *et al.,* 2014). As noted for behavioural impacts, survey equipment energy is outside of the hearing range of most fish species, and therefore any potential masking effects would be limited to a subset of species that specialise in pressure detection and have an overlap in hearing frequency with the survey equipment.

Impacts to fish from underwater noise generated by survey equipment are unlikely to result in substantial impacts to fish distribution or at a population level, given impacts are likely to be limited to behavioural impacts within hundreds of metres and masking within thousands of metres (for those species with a swim bladder involved in hearing) and only to fishes with sensitivity to noise above 1 kHz (of which there are very few species). Furthermore, fish are considered unlikely to remain in proximity of the sound source for long periods of time given vessels are constantly moving when undertaking surveys, limiting exposure above thresholds to very short durations. Site-attached fish at Goodrich Bank, located approximately 984 m from OA2, could be within the range of behavioural impacts from survey impact if their hearing sensitivity was within the survey equipment frequency range (>1 kHz), however survey vessels are constantly moving when undertaking surveys, and survey source noise will not impact Goodrich Bank or any other one location for an extended duration.

Sharks are known to be highly sensitive to low frequency sounds between 40-800 Hz sensed solely through the particle-motion component of an acoustic field, Popper *et al.* (2014). Free ranging elasmobranchs (i.e. sharks) are attracted to sounds possessing specific characteristics – irregular pulse, broadband frequency and transmitted with a sudden increase in intensity (i.e. resembling struggling prey).

6.1.2.4 Invertebrates

Benthic invertebrates are unlikely to be negatively impacted from noise generated from vessel operations. There are no thresholds or guidelines regulating the exposure of marine invertebrates to underwater noise.

Stress responses to non-impulsive sound exposure have been documented for marine invertebrates (JASCO Applied Sciences, 2016). The worst-case consequence for individual animals can be expected to be moderate to major, but due to the limited spatial extent of the affected area, population consequences are considered to be minor.

There is no systematic information available as to if and to what extent marine invertebrates use acoustic cues to communicate with conspecifics or their environment. Anecdotal information indicates no functional relevance of sound for these animals – vibration, such as ground-borne or near-field particle motion – however, sound can be assumed to have functional relevance as it provides information about potential food availability or approaching predators. This information could potentially be masked by the noise and particle motion emitted by the vessels, even though this effect would be limited to the direct vicinity of noise generating sources. The consequence of (acoustic and vibrational) masking is considered to be, in the worst case, moderate for individuals. Due to an expected limited number of individuals experiencing this masking, it would have a negligible impact on a population level.

There is limited and inconclusive data available about the potential for behavioural responses and noise-induced physical effects on marine invertebrates. Theoretically, behavioural responses and significant sensory impairment or injury can have moderate consequences for an individual. In the absence of conclusive scientific information about the scope of these effects and the animals' ability to compensate for the effects, it is impossible to assess the consequences of behavioural responses and noise-induced impairment or injury.

Plankton, including fish eggs and larvae, and pelagic invertebrates could drift close to high energy noise sources (for example, vessel thrusters). However, any negative impacts that could occur would be restricted to within metres of the sound source.

6.1.2.5 Protected areas

OA2 overlaps the Oceanic Shoals Marine Park. Therefore, noise emissions could impact on the values of the marine park. The marine park supports a range of species, including species listed as Threatened, Migratory, Marine or Cetacean under the EPBC Act. BIAs within the marine park include foraging and internesting habitat for marine turtles and four key ecological features (KEFs), of which two are overlapped by OA2.

The potential impacts to marine fauna associated with these protected areas are described above.

6.1.2.6 Socio-economic

No effects to benthic invertebrates are expected, including those of commercial value (e.g. scampi which are targeted in waters deeper than 250 m).

6.1.2.7 Cultural features

No First Nations people feedback was provided about potential noise impacts to any geographically specific cultural features (excluding marine fauna species) during consultation (refer to Section 4.7). Any concerns related to the potential for impacts to cultural features from noise emissions are associated with direct or indirect impacts to culturally significant marine fauna species (refer to Section 3.7.11).

During consultation meetings with Tiwi Clans for the Barossa Development Drilling and Completions EP concerns were raised about the impact of drilling on their dreaming totems (including turtle totems).

Some Tiwi people also raised concerns about the potential impacts to marine life by noise and lights from the drilling activity; and the potential impacts of loud noises and vibrations that could harm imunga (spiritual places that are often connected to other sites) and marine species, which could in turn harm Tiwi people. Other concerns were raised by some Tiwi people in relation to potential impacts to the health of land and sea country which could in turn impact access to food through traditional hunting and fishing, and that if totemic species (e.g. turtles) are impacted by the drilling activity this can impact Tiwi people and make them sick. Although operational activities in OA1 are proposed to occur in the same geographical location to that of the Barossa drilling activities, no specific feedback or concerns were raised during Production Operations consultation by Tiwi Clans or other First Nations relevant persons.

As presented in Section 3.7, some First Nations peoples' cultural beliefs place significance on culturally important spiritual beings and the protection they afford First Nations communities from natural disasters and sickness. Santos recognises that some First Nations Relevant Persons fear sickness or other adverse effects from the actions of spiritual beings in response to impacts on the environment of sea country itself. Of direct relevance these sorts of Tiwi cultural and spiritual values were tested in the Federal Court and were found not to be consistently spread amongst relevant Tiwi Islanders and in any event did not represent a particular 'place' of cultural and spiritual significance.

Santos also notes existing subsea infrastructure has previously been placed on the seabed in the region, such as the Bayu-Undan pipeline since approximately 2006, the Ichthys Pipeline since approximately 2016 and the North West Cable System since approximately 2016, which is in close proximity to OA2. The region also has a history of significant historic and ongoing industrial shipping, fish trawling activities and drilling of nearly 900 offshore wells. There is no evidence to support concerns that the Activity under this EP could harm imunga (spiritual places that are often connected to other sites) which could in turn harm Tiwi people. Santos recognises the importance of cultural and spiritual beliefs to First Nations people. Santos recognises that some First Nations people remain concerned about the potential for adverse consequences to First Nations people and natural environment, that may arise as a result of disturbance from the Barossa Gas Project to spiritual dreaming and culturally important spiritual beings. Santos understands the spiritual protection believed to be afforded to First Nations people is broadly maintained by protecting the features of the natural environment and through ceremonial practices alerting the spiritual beings to the presence of people travelling through country and the like (Corrigan, 2023 and 2024). Cultural ceremonies for the Barossa Gas Project were previously held for the installation of subsea infrastructure and the pipeline and a cultural ceremony will be held at commencement of this Activity.

6.1.2.8 Potential cumulative impacts

On the basis that concurrent Barossa activities will occur within OA1 (see Section 2.3.1), the potential for cumulative noise impacts is acknowledged and discussed further.

During the FPSO pre initial start-up phase (hook-up and cold commissioning) there may be concurrent noise from a MODU, MODU support vessels (up to 3 vessels) and helicopter activities in OA1 (D&C EP activities) for a period of up to ~3 months. There may also be MODU noise, MODU support vessel noise and helicopter noise during drilling/completion under the D&C EP for a duration of ~3 months post FPSO start-up and noise associated with contingency MODU well workovers (contingency MODU for well workovers will be authorised under a separate EP and nominally of 3-months duration) within the validity period of this EP (post FPSO start-up). These noise emissions will be concentrated at drill centres >6km from the FPSO turret.

Similarly, there may be concurrent noise within OA1 from a construction vessel and transportation vessel undertaking SURF installation and pre-commissioning activities (SURF EP activities). This may occur concurrently with FPSO and MODU activities in OA1 during the FPSO pre initial start-up phase for a period of up to ~1 month and continue into the post initial start-up phase where activities may occur for a cumulative duration of ~2 months within a 6-month window. These concurrent SURF EP activities are expected to occur predominantly at drill centres, but there is the potential for a gas export spool to be installed and pre-commissioned at the FPSO location prior to FPSO start-up.

For all three potential concurrent Barossa activities the same principal applies; the greatest level of underwater noise generated will be associated with vessels periodically using dynamic positioning (DP), where thrusters are used to maintain vessel position. Underwater noise associated with other aspects of these activities, including FPSO (including flaring) and subsea infrastructure operations, MODU drilling/completion operations (including flaring), helicopter operations, ROV operations and survey equipment operations are expected to be at a lower level, or for survey equipment, present a lower risk to marine fauna due to the high frequency and focused beam of sound. The greatest potential for underwater noise interactions across Barossa activities is therefore considered to be from DP and interactions of other noise sources are expected to play a lesser role.

When vessels are not using DP they will either be in standby mode or slowly transiting within OA1 and the level of underwater noise will be considerably lower.

The greatest potential for concurrent use of DP in OA1 is from two or more of the following:

- support vessels undertaking FPSO hook-up and commissioning activities and initial start-up (this EP)

- support vessels resupplying the FPSO (this EP)
- support vessels assisting with FPSO offtakes (this EP)
- MODU support vessels manoeuvring during pre-lay anchoring operations (D&C EP)
- MODU support vessels resupplying the MODU (D&C EP)
- SURF construction vessel manoeuvring during subsea infrastructure handling operations (SURF EP)
- Supply of equipment of to SURF construction vessel (SURF EP)

Exposure levels and ranges to marine fauna have been determined by adopting noise modelling results considered conservative for concurrent DP activities (refer Section 6.1.1.5).

PTS and TTS in LF cetaceans (e.g. Bryde's whale, fin whale, humpback whale, pygmy blue whale and sei whale) could occur within approximately 70 or 1,860 m of vessels using DP, respectively, if the LF cetacean remained within that range for 24 hours (Section 6.1.2.1). This is considered unlikely given the mobile nature of cetaceans and that DP would also have to be engaged for a constant 24-hour period for the range to apply. It is unlikely for SURF vessels or MODU support vessels on DP to interact with FPSO support vessels on DP within this range, given that SURF and MODU activities will be primarily located at drill centres >6km from the FPSO turret. Therefore cumulative/additive interactions of PTS/TTS exposure levels for LF cetaceans between Barossa activities is not expected. For HF cetaceans (e.g. killer whale, sperm whale, spotted bottlenose dolphin) the TTS range is considerably lower (50m) and the PTS threshold was not predicted to be exceeded (Section 6.1.2.1).

For marine turtles and fish TTS is expected to be within a range of tens of metres and interactions between DP vessels are not expected to alter these ranges.

The greatest potential for cumulative noise effects between concurrent Barossa activities is with respect to cetacean behaviour. Using an effect threshold of 120 dB re 1 µPa, modelling predicts this threshold to extend to over 11km around vessels using DP, which is almost twice the distance between the FPSO turret and drill centres where concurrent Barossa activities are primarily expected to occur. In the event that vessels were using DP at the FPSO location and drill centre locations at the same time, the zone in which behavioural effects to cetaceans could occur would materially increase in size during the time of concurrent DP activity. Given that concurrent Barossa activities are expected to occur over a period of months rather than years, and that concurrent DP activities would only be intermittent during these periods, the duration of an extended behavioural effect zone is not expected to be significant. Furthermore, and more importantly, OA1 is not near any cetacean BIAs or known foraging, calving or migrating areas, with the nearest designated cetacean BIA (pygmy blue whale migration) greater than 170km away. Any increased behavioural effect zone from concurrent activities is unlikely to affect a large number of cetaceans nor effect any key life-cycle processes for cetaceans.

For marine turtles and fish, the potential for concurrent Barossa activities to materially increase the potential for behavioural effects is lower and as with cetaceans there are no BIAs or known aggregation, breeding or feeding areas in the vicinity of OA1 with the nearest marine turtle BIA (flatback turtle internesting) 50km away and the nearest shoal/bank (Lynedoch Bank) 45km away.

There are no planned concurrent activities in OA2, therefore neither additive nor cumulative noise effects are expected.

6.1.3 Environmental performance outcomes and control measures

The EPOs relating to this event are:

- No injury of, or mortality to, EPBC Act 1999 listed marine fauna or marine fauna listed as threatened species under the *Territory Parks and Wildlife Conservation Act 1976* (NT) as a result of the Activity. (EPO-08)
- No displacement of marine turtles from habitat critical during nesting/breeding (including internesting periods for turtles) and ensure biologically important behaviour can continue in biologically important areas. (EPO-15)
- The outer boundary of the planned operational noise footprint (approximately 11.4km from source) will not impact the nearest shoals/ banks of Lynedoch Bank, Tassie Shoal or Evans Shoal (located >27km away). (EPO-22)

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this Activity are shown in Table 6-9 to demonstrate the potential impacts from this aspect are as low as reasonably practicable (ALARP). Control measures that are adopted have associated environmental performance standards (EPSs) and measurement criteria that are presented in Table 6-9. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 6-9: Control measure evaluation for noise emissions

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-6.1.1	Apply Santos' Protected Marine Fauna Interaction and Sighting Procedure to vessel and helicopter activities when in the vicinity of cetaceans and turtles (isolation control)	Santos implements EPBC Regulations– Part 8 Division 8.1 Interacting with cetaceans (and applied for marine turtles) where vessel crew (or Vessel Master of the USV) act as wildlife observers to reduce the risk of a collision with marine fauna (Section 7.3). This control may result in a minor ancillary reduction in the potential for vessel noise impacts. It also effectively reduces helicopter noise levels received by fauna near the sea surface through minimising interaction with marine fauna. Reduces the potential impacts to culturally significant marine species, including totemic species, such as marine turtles and marine mammals.	Operational costs to adhere to marine fauna interaction restrictions, such as vessel speed and direction, and helicopter height above marine fauna are based on legislated requirements and must be accepted.	**Adopted** – benefits in reducing impacts to marine fauna outweigh the costs incurred by Santos. Control drives compliance with EPBC Regulations (Part 8).
BAO-CM-6.1.2	Vessels equipped and crewed in accordance with Australian maritime requirements, including Marine Order 30 (Prevention of Collisions) and Marine Order 21 (Safety and Emergency Arrangements) (administrative control)	Ensures contracted vessels are operated, maintained, and crewed in accordance with industry standards and regulatory requirements. Ensures vessels meet Marine Assurance Standards to reduce the likelihood of vessel collision (such as minimum and working lighting for maritime safety).	Costs are expected as part of standard procedure.	**Adopted** – benefit of assuring vessels outweighs procedure compliance costs.
Additional control measures				
BAO-CM-6.1.3	Cultural ceremony for FPSO arrival and inductions for all site-based workforce will include information on cultural heritage to raise awareness about the cultural and spiritual belief of First Nations people (administrative control)	Addresses concerns raised (during consultation for the Barossa Project construction activities) of some First Nations people about the potential impacts of the Activity on their spiritual beliefs in a culturally appropriate manner.	Cost to engage First Nations representatives to perform cultural ceremony. Administrative cost to deliver cultural heritage training.	**Adopted** - benefits considered to outweigh costs

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Avoid activities near cetaceans and turtles) (isolation control)	Reduces noise impacts to internesting flatback turtles during key life stages. Reduces the potential impacts to culturally significant marine species, including totemic species, such as marine turtles and marine mammals.	Reduces the window of opportunity for undertaking the activity.	**Not adopted** – the potential for impact is considered acceptable as impacts to marine turtles from underwater noise generated by survey equipment are likely to be limited to physiological impacts in individuals located within tens of metres of the sound source, and behavioural impacts in individuals located within hundreds of metres of the sound source. Activities in HC area will be infrequent (every three to five years, and short in duration).
N/A	Verification of noise levels (administrative control)	Allow adaptive management controls to be implemented if impact is greater than expected. May help verify estimated potential noise impact zones.	Costs of deploying noise monitoring equipment and processing data. Field monitoring program not warranted where potential impacts are low risk	**Not adopted** – cost disproportionate to increase in environmental benefit, given the rapid reduction in noise levels from activity and the low-level behavioural responses expected.
N/A	Implement a shutdown zone around MBES and SSS in OA2 (elimination control)	Provide an area around the survey vessel where fauna is observed, and if within a defined zone of potential impact from the survey, the equipment is shut down to avoid physiological impact.	Additional costs for suitably trained personnel to observe for fauna around the shutdown zone and the potential disruption in survey data collection if the activity has to stop partway through.	**Not adopted** – MBES and SSS surveys are infrequently conducted as part of ongoing operations.
N/A	Dedicated marine mammal observer (MMO) on board vessel during MBES and SSS (administrative control).	Improved ability to spot and identify marine fauna.	Additional cost of contracting several specialist MMOs. Even if marine fauna is identified, noise sources cannot be shut down if marine fauna are detected, since these sources are integral to safe operation of vessels.	**Not adopted** – cost disproportionate to increase in environmental benefit given there are no seismic surveys (as per EPBC Policy Statement 2.1 Part B.1), activity noise generated is considered negligible and no known BIAs overlap (or are close to) OA1.
N/A	Application of EPBC Policy Statement 2.1 Interaction between offshore seismic exploration and whales (administrative control)	Minimises potential impacts to whales as a result of seismic activities through visual observations, soft starts, stop work, nighttime and low visibility procedures.	Additional cost of contracting several specialist MMOs. Cost associated with soft starts and	**Not adopted** – cost disproportionate to increase in environmental benefit given there are no seismic surveys (as per EPBC Policy

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		No seismic activities will be undertaken as part of the proposed activities.	stop work procedures.	Statement 2.1) activity noise generated is considered negligible and no known BIAs overlap (or are close to) OA1. The noise from the FPSO is continuous and required for operations therefore it is not feasible to implement EPBC Policy Statement 2.1**.** Campaign vessels noise is infrequent, and no seismic activities will be undertaken.
N/A	Use of passive acoustic monitoring (administrative control)	Improve detection of some sensitive receptors.	Costs of passive acoustic monitoring operators. Operational costs of shutdowns will potentially prolong the activity.	**Not adopted**- Cost incurred disproportionate to increase in environmental benefit given the low-level behavioural response expected. Limited ability of passive acoustic monitoring to detect cetaceans would provide little benefit to species expected to be present.
N/A	Manage timing of activities to avoid coinciding with sensitive periods for marine fauna present in the operations area (pygmy blue whale migration period) (elimination control)	Reduces the risk of impacts from noise emissions during environmentally sensitive periods for listed marine fauna	High cost in moving or delaying activity schedule. The risk to all listed marine fauna cannot be reduced due to variability in timing of environmentally sensitive periods and unpredictable presence of some species. The noise from the FPSO is continuous and required for operations.	**Not adopted** - TTS thresholds from underwater noise will be limited to within a few hundred meters of the source and will not overlap the water depths (500m+) that pygmy blue whales are known to use during their migration. Therefore, potential for impacts to migrating whales is extremely limited, given close proximity to the source for underwater noise to fall below TTS levels (considered an injury under the Management Plan for Pygmy Blue Whales), in water depths shallower than preferred by migrating pygmy blue whales. Therefore, the activities are not inconsistent with the objectives of the

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
				Pygmy Blue Whale Management Plan.
N/A	Further restrict vessel operating speeds in OA1. (administrative control)	Reduce consequence of collisions (causing harm) and likelihood as fauna have longer to detect and avoid the vessel.	Administrative costs to update existing Santos procedure and induction materials and train personnel	**Not adopted**– not considered necessary as there are no BIAs within OA1. Campaign vessel noise will be infrequent and vessels will comply with EPBC Regulations – Part 8 Division 8.1 Interacting with cetaceans (and applied for marine turtles), through implementation of (BAO-CM-6.1.1).
N/A	Vessel activities will only occur during daylight hours. (elimination control)	Reduces the risk of impacts from noise emissions due to vessel being stationary at night	Vessels are required to work 24 hours when undertaking operations and maintenance activities to ensure the safe operation of the facility. Limiting the activity to daylight hours would also result in significant financial costs.	**Not adopted-**limiting the activity to daylight hours would increase the time required to undertake activities to ensure the safe operation of the facility. The high financial cost would be grossly disproportionate to negligible environmental benefits.

6.1.4 Environmental impact assessment

Key receptors	Consequence level
Noise emissions	
Threatened, migratory or local fauna	Noise levels from the FPSO, helicopters, survey equipment and vessels that may cause behavioural responses to threatened, migratory or local fauna are expected to generally be confined to the OAs and concentrated within a radius of a few hundred metres of the noise source to within approximately 11.4 km, depending upon the noise sources and operations. Impacts to marine mammals from underwater noise generated by the Activity are unlikely to result in substantial impacts, given there are no significant feeding, breeding or aggregation areas in the vicinity of OA1. The closest significant marine mammal feature (pygmy blue distribution range) is located approximately 60 km away from OA1, which is outside the area predicted to exceed thresholds for behavioural, masking or physiological impacts. Therefore, any responses will be limited to transiting individuals, which is unlikely to result in substantial impacts to marine mammal populations or distribution. PTS and TTS thresholds for marine mammals are only expected to be exceeded close to the source. Due to the lack of aggregating areas for these species, individuals are expected to be transitory only, displaying behavioural responses, and moving away from the source, before TTS and PTS thresholds are exceeded. The southern end of OA2 traverses nesting buffer HC area for flatback and olive ridley turtles, overlaps a portion of the internesting BIA for flatback turtles, and is 11 km to the internesting BIA for olive ridley turtles. Impacts to marine turtles from underwater noise are unlikely to result in impacts to populations or distribution, given impacts are likely to be limited to behavioural and masking impacts within a relatively small area of important turtle habitat. The risk of impact is further reduced as the vessel-based noise and survey equipment noise that will occur within the BIA for flatback turtles will be for short periods of time only, and intermittently over the life of the field; therefore, vessel noise will not impact any one location for an extended duration. Typically, based on vessel speeds and activities, a survey vessel will travel at about 25 km/day and traverse the turtle internesting HC within about two days. Other routine Activity vessels will only be in OA2 for very limited durations (less than 24

Key receptors	Consequence level
	hours). IMMR activities may include the use of support vessels and USVs and any pipeline repair activities may require campaign vessels and USVs. Other protected species of marine reptiles (such as sea snakes), seabirds and fish (such as sharks and sawfish) are not expected to be affected, given their wide distribution (in the case of sea snakes and sharks), distances to seabird breeding colonies, and preference for shallow coastal habitats (sawfish). For the above reasons, no substantial change to threatened and migratory species is anticipated that may: • lead to a long-term decrease in the size of a population • reduce the area of occupancy of the species • fragment an existing population into two or more populations • adversely affect habitat critical to the survival of a species • displace threatened and migratory marine fauna from habitat critical areas • disrupt biologically important behaviours of Threatened and Migratory marine fauna in BIAs • disrupt the breeding cycle of a population • modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline • interfere with the recovery of the species.
Physical environment and habitat	Not applicable – Noise will not impact the physical environment itself (including the shelf break and slope of the Arafura Shelf KEF and Carbonate bank and terrace system of the Van Diemen Rise KEF that overlap the OAs). Species associated with the continental slope and patch reefs, and the hard substrate sediments of deep channels that characterise these KEFs – such as demersal fish, whale sharks, sharks, sea snakes and turtles – are unlikely to aggregate within the OAs due to the lack of seafloor features. However, potential impacts to these species are described above.
Threatened ecological communities	Not applicable – No threatened ecological communities identified in the area over which noise emissions are expected.
Protected areas	Noise will not impact the physical environment itself, but there will be potential impacts to the values of the protected area as described above (Threatened, Migratory fauna). However, no substantial change that may modify, destroy, fragment, isolate or disturb the following values of the Oceanic Shoals Marine Park will occur: • KEFs of the marine park • Threatened and Migratory marine species • BIAs for foraging and internesting marine turtles.
Socio-economic	The consequence of noise emissions on receptors is assessed as I – Negligible. Impacts to fauna, including fish and other marine species is limited to temporary behavioural impacts within an approximate 11.4 km radius around activities at OA1, and will not result in significant impacts to marine species at the individual or population level. Impacts to species in the vicinity of OA2 are also not expected given the infrequent and short duration of IMMR activities. Given the negligible consequence to species, subsequent impacts to commercial fish stock or species with cultural significance are not anticipated.
Cultural Features	No First Nations people feedback was provided about potential noise impacts to cultural features during consultation for this Activity. For assessment of impacts to marine species that are of cultural significance and/or represent a traditional food source for First Nations groups, refer to the assessment for threatened, migratory or local fauna. Santos notes that existing subsea infrastructure has previously been placed on the seabed in the region, such as the Bayu-Undan pipeline since approximately 2006, the Ichthys Pipeline since approximately 2016, the North West Cable System since approximately 2016 and Barossa GEP since 2023. The region also has a history of significant historic and ongoing industrial shipping, fish trawling activities and drilling of almost 900 offshore wells. There is no evidence to support actual adverse effects from the actions of spiritual beings in response to impacts on the environment from these activities. Notwithstanding, in response to the concerns raised by some First Nations people during consultation for the Drilling and Completions EP, DPD EP and the GEP EP (noting no concerns were raised by First Nations people for this Activity during the development of this EP), a control measure (BAO-CM-6.1.3) relating to cultural heritage training and cultural ceremony was developed with input from Relevant Persons and acknowledges the recommendations by First Nations people as suggested to Dr Corrigan (Corrigan, 2023 and 2024).

Key receptors	Consequence level
	Santos understands the spiritual protection believed to be afforded to the Tiwi people is broadly maintained by protecting the features of the natural environment and through cultural ceremonial practices, by introducing the Activity to the seas and any First Nations spiritual beings. Santos considers the adoption of EPO-19 and BAO-CM-6.1.3 practicable and appropriate.
Cumulative impacts	On the basis that concurrent activities will occur within OA1 (see Section 2.3.1), the potential for cumulative sound emissions is acknowledged. Only concurrent vessel DP activities are likely to have the capacity to change the size of the impact threshold boundaries and this is expected to be short term (intermittent) and applicable to cetacean behavioural effects only. However, given the short duration of concurrent activities and absence of significant feeding, breeding or aggregations areas and marine fauna BIAs within the noise assessment boundary, additive and cumulative noise effects are not expected to be significant and limited to behavioural effects to transiting cetaceans. Cumulative noise effects are not considered significant enough to change the overall consequence level of Minor.
Overall worst-case consequence	II – Minor

6.1.5 Demonstration of as low as reasonably practicable

Use of the FPSO and vessels is unavoidable if the activities are to proceed as required. The FPSO has been designed to be a moored FPSO, rather than on DP 24 hours a day, seven days a week (24/7). DP is therefore eliminated from use due to a permanent mooring. The added benefit of using a moored FPSO, aside from a reduction in noise, is the reduction in fuel usage and therefore air emissions.

Tow, support and campaign vessels including LWIV and USV, are expected to produce similar noise emissions to other marine vessels that frequent or transit through the vicinity of the OAs.

Use of helicopters to transfer personnel to and from the FPSO is necessary to allow operational activities to occur safely and effectively, with some personnel required to be rotated to and from other locations, and to provide for a rapid method of transferring to and from the FPSO in the case of an emergency. A performance standard prohibiting helicopters from landing or taking off in the presence of marine megafauna would introduce an unacceptable risk to human life.

Flaring is required for safety and operational reasons. However, the FPSO has been designed to use vapour recovery on the LP flare system. This reduces the frequency at which flaring occurs throughout operations and therefore reduces the amount of noise emitted during routine operations. The added benefit of using vapour recovery, aside from a reduction in noise, is the reduction in air emissions.

In relation to spiritual and/or cultural heritage beliefs and connections to sea country and related concerns of some Tiwi Islanders, Dr Corrigan reported the suggestions of a number of senior and authoritative Tiwi Islanders who informed him as to culturally appropriate responses. For example, a common practice is the use of ceremonies to introduce activities or the presence of strangers to spiritual beings. On the basis that the most appropriate way to show respect for concerns related to spiritual/cultural beliefs is through culturally appropriate measures as recommended by First Nations people, Dr Corrigan's recommendation as put to him by Tiwi people (refer Section 3.7.12) has been adopted in this EP where any First Nations Relevant Person has raised similar concerns, even if the concern was raised during consultation for the Barossa Development Drilling and Completions EP and not expressly raised in relation to this EP. Santos has also been implementing cultural heritage training and ceremony in the course of undertaking activities authorised pursuant to the Barossa Gas Export Pipeline Installation EP since November 2023 with broad support of First Nations communities as a culturally appropriate practice and response to cultural concerns. Santos considers that the adopted control measure BAO-CM-6.1.3 based on Dr Corrigan's recommendations will reduce environmental impacts and risks to ALARP, as relevant to First Nations individuals who hold these concerns in relation to their beliefs.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the impacts such that the residual consequence is assessed to be II – Minor. The proposed management controls are in accordance with the Santos risk management criteria and are considered appropriate to reduce impacts to ALARP.

6.1.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence from noise emissions is II – Minor.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecological sustainable development?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers the principles of ESD: The impacts associated with noise emissions do not result in 'threats of serious or irreversible harm' as detailed within the EPBC Act and biodiversity and ecological integrity will be maintained. • conservative assumptions have been applied to the underwater noise modelling • there are no identified health, diversity or productivity impacts that may affect the biodiversity or ecological function for future generations. The consequence against this aspect is II (Minor) and therefore does not affect the outcomes of the principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)?	Yes – Control measures implemented will reduce the potential impacts from the Activity noise emissions to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b) • Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c) • Approved Conservation Advice for *Aipysurus fuscus* (dusky sea snake) (DCCEEW, 2024p). **Recovery plans:** • Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015–2025 (CoA, 2015a) **Other management plans/guidelines**: • Marine bioregional plans for the NMR (CoA, 2012a). For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes and the control measures outlined in Section 6.1.3. Santos considers that the level of impact from Activity noise emissions is not inconsistent with these plans. IMMR activities that may be required in the Oceanic Shoals Marine Park are not inconsistent with the International Union for Conservation of Nature (IUCN) principles and North Marine Parks Network Management Plan objectives (DNP, 2018a) or the DNP Commercial Activity Licence conditions, refer Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with EPBC Regulations Part 8. Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.7 and Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.

Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with AMSA-NT, the ACF and Tiwi Islands Clan Groups and Individuals, have been considered when evaluating performance outcomes, control measures and associated performance standards (see section 4.7 for further information). Santos has considered and evaluated specific control measures proposed by AMSA-NT and the ACF within Table 6-9. However, no additional performance outcomes or control measures have been adopted. Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have been adopted in this EP. An additional performance outcome (EPO-19) and an additional control measure (BAO-CM-6.1.3) have also been adopted for noise emissions based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measure BAO-CM-6.1.3 adopted.

The consequence of noise emissions is assessed as II – Minor. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential impacts are considered acceptable.

6.2 Light Emissions

6.2.1 Description of event

Event	Sources of impacts from lighting to sensitive receptors within the OAs may occur as a result of: • safety and navigational lighting on the FPSO • safety and navigational lighting on vessels • spot lighting used when needed, such as equipment deployment and retrieval • light from flaring on the FPSO. Lighting will consist of bright white (as in, metal halide, halogen, fluorescent) lights typical of lighting used in the offshore petroleum and maritime industries, including shipping and fishing, with light-emitting diode (LED) lighting throughout the FPSO. Activity vessels will have external lighting to provide a safe working environment and to comply with relevant maritime navigation requirements, at night. Concurrent Barossa activities (Section 2.3.1) will result in additional light emissions, these will be associated with: • the operation of a MODU (including intermittent and short duration flaring [two to three days for each well]) • support vessels (D&C EP activities) • the operation of a construction vessel and transportation vessel (SURF EP activities). Therefore, the cumulative impacts have been considered in this assessment. **Operational area 1:** Lighting associated with vessels and FPSO presence (including flaring) 24 hours/day, 365 days a year within the OA and IMMR activities including campaigns and LWI activities. Concurrent activity lighting will also occur. **Operational area 2:** Lighting from vessels undertaking IMMR activities along the pipeline intermittently throughout the Activity.
Extent	**Operational area 1:** Contour modelling conducted for the Barossa FPSO predicted light or light glow from flaring (worst case light event) reaching ambient levels within 68.4 km and light or light glow from the FPSO in the non-flaring scenario (i.e. external lighting) reaching ambient levels within 16.5 km. The distance at which behavioural impacts may be possible were modelled to extend up to 16.7 km and 6.4 km from the FPSO for the flaring and non-flaring scenarios respectively (Worley, 2025). Light modelling undertaken (Pendoley, 2022) indicates that light or light glow from vessels (including campaign and support vessels) may be visible on surface waters up to 15 km from the source. With light reducing to levels unlikely to cause biological effects at a distance of 3.3 km. In the event of concurrent activities such as drilling, the MODU and support vessel activities (with associated light emissions) will be located at one of the drill centres, which are >6 km from the FPSO turret. As described in the accepted Barossa Drilling EP, the worst-case extent of light spill is 52.4 km associated with the short-term flaring from the MODU, with typical light spill of 26.6 km from operational and navigation lighting. Concurrent construction vessel and associated transportation vessel (with associated light emissions) undertaking SURF installation and pre-commissioning will be concentrated at drill centres >6 km from the FPSO turret, with the potential for these vessels working close to the FPSO turret during FPSO pre initial start-up activities. A worst-case extent of light spill of 10.9 km is associated with a construction vessel. **Operational area 2:** No permanent light sources will be required along the pipeline, but periodic activities may require lighting (as in, IMMR). Light or light glow from vessels is expected to reduce to levels unlikely to cause biological effects at 3.3 km from the source, either moving slowly along the pipeline or in one area for approximately 14 to 30 days (depending on the type of IMMR).

Duration	**Continuous**: Permanent lighting on the FPSO and from intermittent flaring during the life of the field, and limited flaring (approximately 24 hours per well) during commissioning. Support vessel presence is required for day-to-day operations and routine IMMR. **Infrequent and one-off:** Campaign vessels for specific activities would be less frequent, up to two per year for approximately 14 to 30 days, and approximately 34 days for LWI that may be undertaken every two years. During hook-up and commissioning additional vessels will be in field for approximately 3 months associated with the one-off HUC activity. Following completion of hook-up and commissioning, initial start-up will occur for approximately 4 months involving support vessel(s) for this one-off activity. Planned inspection campaigns are scheduled every three years along the pipeline and would take approximately three weeks as the vessel moves slowly along the pipeline. IMMR vessel presence occurs typically for approximately seven to 30 days in duration every three to five years, or as needed. Activities within OA2 are significantly less frequent than in OA1. **Concurrent:** The duration of overlap for each concurrent Barossa activity within OA1 is presented in full in Section 2.3.1. FPSO pre initial start-up activities may include concurrent light spill from a MODU (D&C EP) and support vessels for a period of ~3 months (including intermittent short-duration light spill from flaring); for ~1 month of this period there may also be light spill from a construction vessel and transportation vessel undertaking SURF installation and pre-commissioning (SURF EP). There may be MODU drilling/completion (under the D&C EP) extending for a period of ~3 months post FPSO start-up and contingency MODU well workovers activities (nominally of 3-months duration) within the validity period of this EP. Contingency MODU well workovers will be authorised under a separate EP. For the first 6 months post FPSO start-up, there may also be up to ~2 months cumulative duration of SURF installation and pre-commissioning.

6.2.1.1 Light modelling methodology

Santos has undertaken two separate light spill modelling studies for the Barossa development including:

- Vessel light spill along the Barossa GEP (Pendoley, 2022) and
- Flaring and non-flaring (i.e. external lighting) at FPSO (Worley, 2025).

6.2.1.1.1 Illumina Model

Both modelling studies used the ILLUMINA model; a 3D model that accounts for both line of sight and atmospheric scattering, allowing the attenuation of light over distance and extent of sky glow to be modelled. The modelling used the exact specifications (location of lighting, light type, height and orientation, shielding, etc) of the pipelay and construction vessels and the FPSO lighting and flaring. As typical for the Timor Sea, and to allow for comparability for potential future models, cloud cover was set as zero for the modelling; therefore, the simulation has no contribution of light from cloud reflectance. Model outputs were provided in radiance (W/m²/sr, where W = watts, m² = metres squared and sr = steradian).

While the behavioural response of marine turtles to light is relatively well understood (see Section 6.2.2.2), there is currently no accepted intensity limits for determining what the impact of a given light might be. In the absence of any other published or generally accepted units of measurement, or scale, for measuring the impact of Artificial Light at Night (ALAN) on marine turtles, the modelling uses an approach based on the visibility of the full moon, the brightest natural light source visible within the region of the horizon used by hatchlings during sea finding, as a benchmark. The output, expressed in Full Moon Equivalents (FME), is modelled for the Orientation Field of View (OFOV) used by hatchlings during sea finding. This approach gives the model outputs some biological relevance when interpreting the results for environmental impact assessment (Pendoley 2022; Worley 2025). This modelling study is in line with methodology detailed in the National Light Pollution Guidelines for Wildlife (DCCEEW 2023h).

Several factors influence the visibility and impact of light on hatchlings, including light intensity, visibility (a function of lamp orientation and shielding), spectral power distribution (wavelength and colour), atmospheric scattering, cloud reflectance, spatial extent of sky glow, duration of exposure, horizon elevation, lunar phase, hatchling swimming speeds, species, tide and current speeds, and flow direction (Worley, 2025).

The range of moon brightness across a whole lunar cycle is a realistic representation of the natural ambient light levels to which turtles' eyes are adapted. On a new moon, there is little to no ambient light, and this is when hatchlings are at greatest risk of misorientation or disorientation due to artificial light sources. The amount of ambient light present on a full moon is substantial and may override any artificial light cues that could potentially influence hatchling orientation.

The sensitivity of a hatchling turtle to directional light can be described by a specific 'cone of acceptance', which indicates how much of the world a hatchling views and measures at any one instant, defined by Lohmann *et al*.

(1997) as 180° horizontally and 30° vertically from the horizon. To understand potential impacts on hatchling behaviour, all pixels in the 180° by 30° window centred over the brightest light source at the observer viewpoint are averaged and described as the OFOV. This average radiance value is then expressed as a proportion of the brightness of a full moon at a 45° inclination that would be visible within the same field of view. This proportion is termed FME.

Impacts to marine turtles are assessed on a scale based on FME, where values equal to or greater than one FME are likely to have an impact, and values less than one FME having varying likelihoods of impact down to 0.01 FME (as in, 1% of the radiance of a full moon), which is considered to have no impact (Table 6-10).

The scale is logarithmic to represent the nature of light decay with distance (a function of the inverse square law). At the lower end of the scale, the radiant output is equivalent to no light in the sky (a new moon) while the upper limit is equivalent to the brightness of ten full moons. The upper limit was selected to try to account for the increase in radiance levels that can be caused when light is reflected from clouds. Extending the scale beyond this limit was deemed unnecessary.

Table 6-10: Artificial light impact potential criteria (marine turtles) (Worley, 2025)

Impact level	OFOV (FME) ranges[47]	Impact potential to marine turtles
5	10 to 100	Light or light glow visible and impact likely
4	1 to 10	Light or light glow visible and impact likely
3	0.1 to 1	Light or light glow visible and behavioural impact possible, depending on ambient moon phase at the time of exposure
2	0.01 to 0.1	Light or light glow visible but behavioural impact unlikely (as in, not biologically relevant)
1	<0.01	Light or light glow is considered ambient and no impact expected

6.2.1.2 Floating Production, Storage and Offloading Facility, including Flaring

Due to the size and height of the FPSO and the permanence of the vessel, light from the FPSO will be more visible than from the largest Activity vessel in OA1 (refer vessel modelling information below). Therefore, FPSO lighting and flaring has been used to determine the distance that light may be visible from OA1 during the Activity. Cumulative impacts from other activities in OA1 are addressed in Section 6.2.2.8.

The light modelling study completed (Worley, 2025) specific to the Barossa FPSO includes both a flaring scenario with all lights on, and a non-flaring scenario accounting for lighting only.

6.2.1.2.1 Light Modelling Assumptions

Under normal steady state operating conditions there are no continuous sources of flaring on the FPSO and only the pilot light of the FPSO HP flare is lit. Planned and unplanned flaring may be required to safely dispose of hydrocarbon gas (as described in Section 2.7.2.4). During emergency shutdown or blowdown events the intensity of flaring activities will be the greatest with both the HP and LP flare potentially being used concurrently, these are typically short term unplanned scenarios occurring for a matter of days.

Santos provided detailed lighting diagrams, schematics, and datasheets to assist with the generation of an accurate lighting inventory for the modelling. Detailed information about all external lights associated with the FPSO, including location, height, lumen output, spectral characteristics and shielding were inputted to the model. Combustion data was also provided for the flaring scenario.

The scenario selected for flaring estimation, represents the longest duration flaring scenario from the production separator at a total rate of 270 MMscfd. This is a short-term flaring event that may occur due to unplanned equipment shutdown/trips, and for the purpose of modelling this was taken as a worst-case scenario for light emissions. Short term upset conditions representing blowdown and emergency conditions are considered unlikely to occur and therefore were not considered representative for the modelling scenarios.

Input data for the flaring light emissions included a gas flow rate of 310,503 kg/hr (equates to 270 MMscfd), which resulted in a modelled flare flame height of 73 m from the top of the flare stack, which is 185 m above sea level (a total height of 258 m above sea level). The flare was simulated as a series of seven point sources evenly spaced vertically above the flare stack with evenly distributed luminosity values in the modelling (Worley, 2025).

To approach the light modelling conservatively, the following assumptions were made:

[47] *Proportion of radiance of a full moon within orientation field of view, where 100 equals the radiance of one hundred full moons and 0.01 equals 100th the radiance of one full moon*

- All external lighting was considered switched on
- Indoor areas were excluded, including the living quarters and engine room as these lights are shielded by the presence of the FPSO and are considered inconsequential to the external lighting. In addition, internal lighting is a horizontal source, whereas external lighting is a mix of orientation which has a greater influence on the contour modelling than a horizontal source
- The base elevation of the FPSO was used as mean sea level (MSL)
- Common fixtures were assumed for navigation/marine obstruction lighting
- No shielding of lights by the actual FPSO itself i.e. assumes all lights are on and not shielded by equipment or the orientation of the FPSO and hence are visible from any direction.

6.2.1.2.2 Light Modelling Results (FPSO)

Contour modelling was undertaken to represent distances from the sources of light in which certain OFOV FME thresholds are reached. The results of the contour modelling can be seen in Table 6-11, Figure 6-1 and Figure 6-2 relevant to Seabird BIAs and Turtle BIAs and critical habitat. The flaring scenario contours have a substantially higher radius, due to the flame height (73 m from the top of the flare stack with a total height of 258 m above sea level) and intensity of the modelled flame. Impact levels associated with potential or higher impacts (OFOV FME > 0.1) extend ~16.7 km and ~6.4 km from the FPSO for the flaring and non-flaring scenarios respectively. The modelled light is considered to be ambient and expected to have no appreciable impact (OFOV FME <0.01) at ~68.4 km and ~16.5 km in the flaring and non-flaring scenarios respectively.

Table 6-11: Contour modelling results for flaring and non-flaring scenarios (Worley, 2025)

Impact level	OFOV (FME) ranges[48]	Distance from source (m)	
		Flaring	Non-Flaring
5	10-100	< 2,819	< 270
4	1-10	7,309	1,949
3	0.1-1	16,680	6,419
2	0.01-0.1	34,879	16,509
1	<0.01	> 68,410	> 16,509

Seagull Island is the closest land based sensitive receptor habitat (marine turtle nesting) to the FPSO, located approximately 140 km south of the vessel. The ambient light contour extends to a distance ~71.6 km from the nearest land based sensitive receptor habitat (Seagull Island). This receptor falls outside of the recommended 20 km buffer for light assessment detailed in the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023h). The panoramic modelling provides a confirmation of negligible levels of light emission received at this location for both the flaring and non-flaring operating scenarios. The flaring scenario is substantially brighter than the non-flaring scenario, however the OFOV FME value remains negligible (2.00×10^{-4}) which is equivalent to 0.0002 full moons.

[48] *Proportion of radiance of a full moon within orientation field of view, where 100 equals the radiance of one hundred full moons and 0.01 equals 100th the radiance of one full moon*

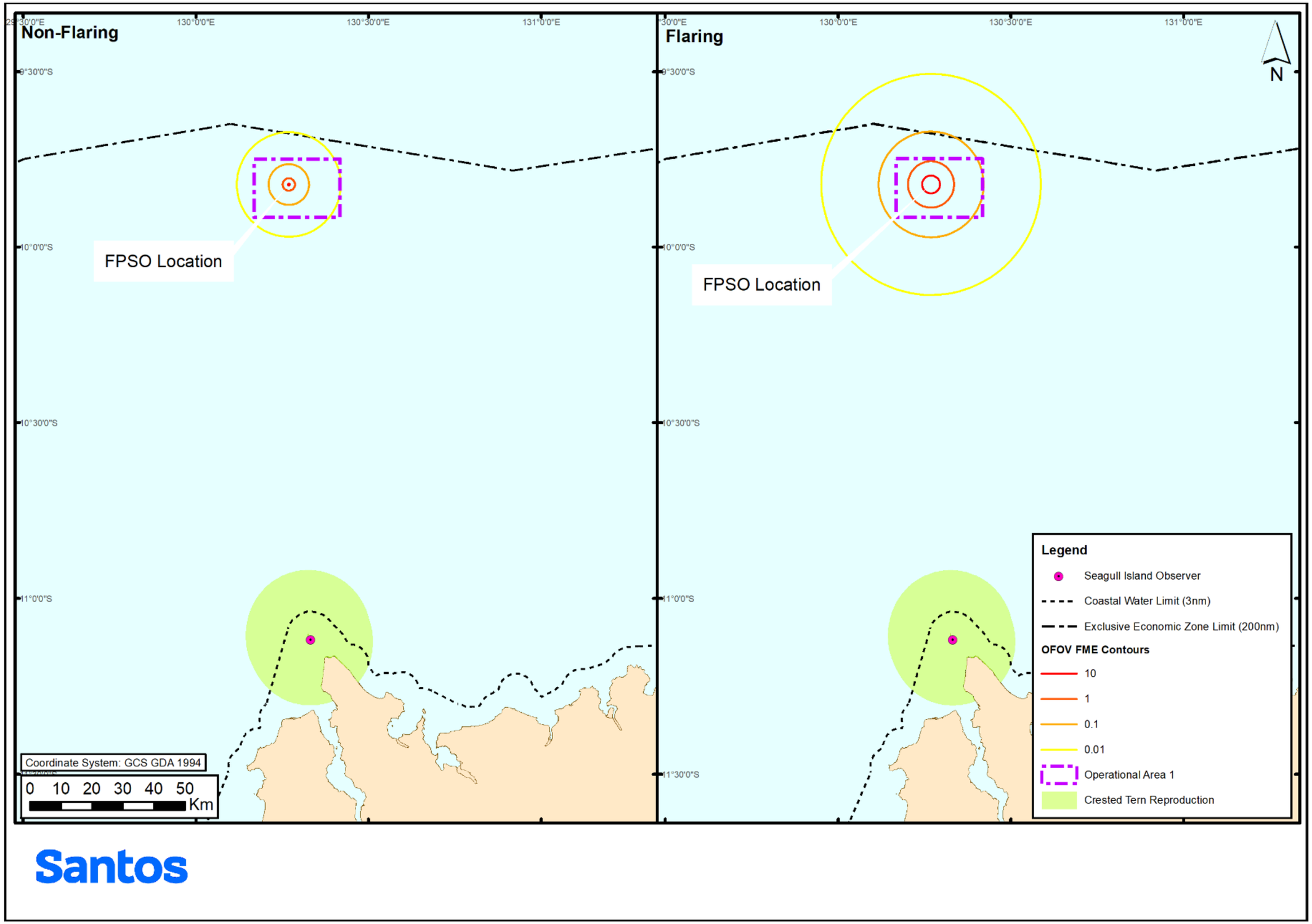

Figure 6-1: Seabird BIAs in relation to radiance of light sources with distance from the FPSO facility for non-flaring and flaring scenarios

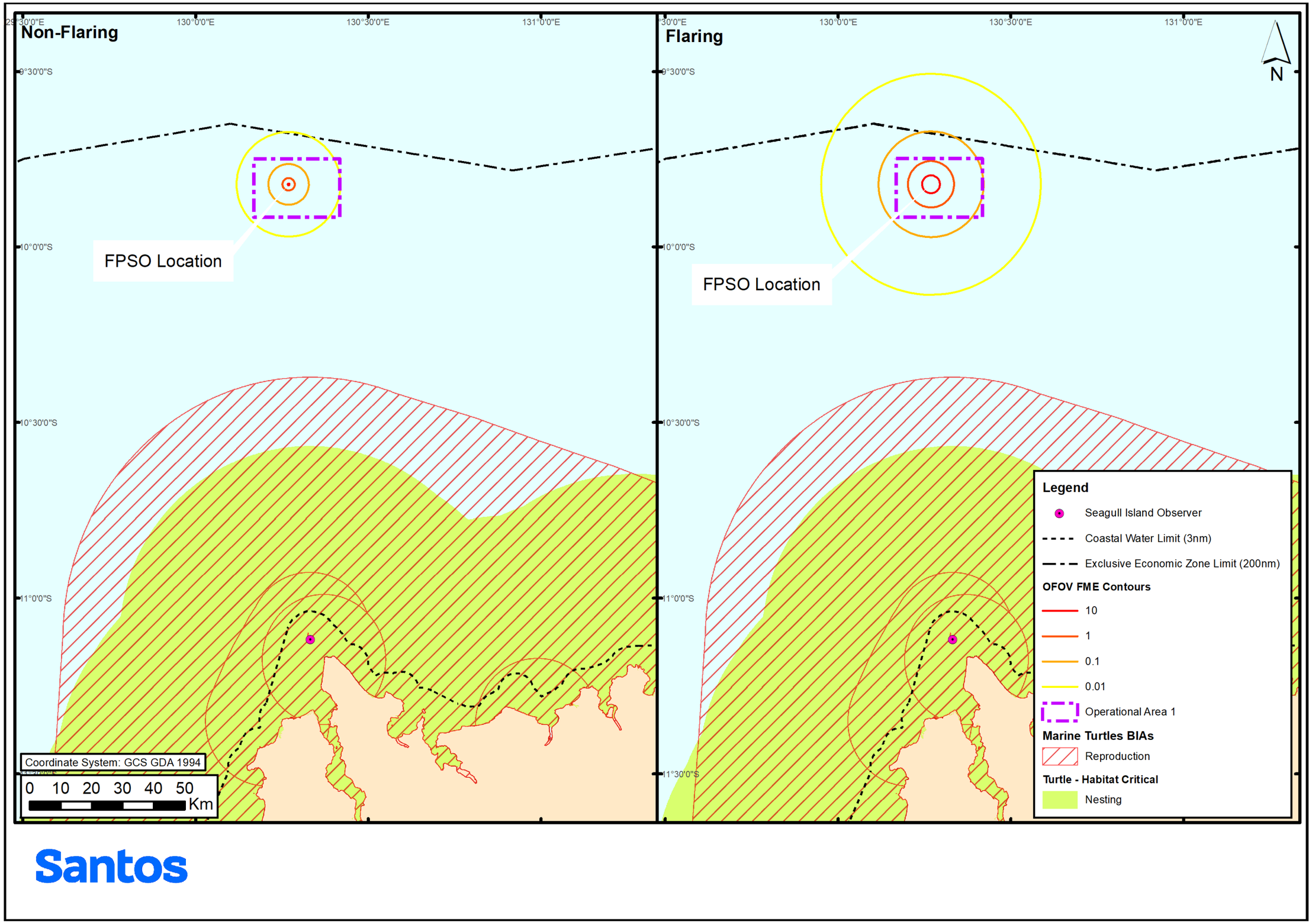

Figure 6-2: Turtle BIAs and critical habitats in relation to radiance of light sources with distance from the FPSO facility for non- flaring and flaring scenarios

6.2.1.3 Vessels

Low-intensity light spill will be generated from project, campaign and support vessels as a consequence of providing safe illumination of work and accommodation areas. Additional lighting will be required periodically for safely loading and unloading support vessels and export tankers.

Unless specifically required to support over the side activities, such as lifting or IMMR activities, or for navigational purposes, lighting is directed over the work area, which aids in limiting light spill to the marine environment. As the light from vessels is at a lower height than the FPSO due to deck height, the worst-case line of sight assessment is assumed to be from the FPSO (refer above). The light modelling completed for vessels is considered relevant for activities occurring outside of OA1.

Santos has undertaken light spill modelling (Pendoley, 2022) for the pipelay vessel (*Audacia*), and construction vessel (*Fortitude*) used to complete the Barossa GEP pipelay activity in OA2 (described in the Barossa Gas Export Pipeline Installation EP). These vessels are larger (and therefore expected to produce a greater level of light spill) than those proposed for typical support and IMMR activities covered by this EP. However, if sections of pipeline need to be replaced, or LWI activities are required, a similar sized vessel (campaign vessel) to these modelled vessels may be used. The light spill modelling conducted is therefore conservative for typical support and IMMR activities (including USV) covered by this EP but representative for larger campaign vessels that are less likely to be required.

6.2.1.3.1 Light Modelling Results (vessels)

The impacts in this section are based on the light modelling undertaken by Pendoley for the *Audacia* pipelay vessel which is considered conservative given that the typical campaign or IMMR vessel is much smaller. The results are summarised in Table 6-12 and presented in Figure 6-3 (Pendoley, 2022). Model results are independent of location-specific variables so are representative of light spill at any location along the Barossa GEP route in OA2 or vessels within OA1. The location shown in Figure 6-3 is the closest point that an IMMR vessel or campaign vessel would be from a turtle nesting beach (Cape Fourcroy) during the Activity. Cumulative assessment is included in Section 6.2.2.8 for any concurrent activities.

Applying the potential impact criteria in Table 6-12, the results show that at approximately 15 km, light levels have reduced to ambient. At approximately 3.3 km from the source, radiance is at 0.1 FME and, therefore, light will be visible but unlikely to result in a behavioural impact (as in a biologically relevant impact) to marine turtle hatchlings. Impacts may occur within approximately 3.3 km of the pipelay vessel, with the highest visible light emissions at 160 m from the vessel.

Figure 6-3 shows that at the nearest turtle nesting beach at Cape Fourcroy (approximately 7 km away), FME is modelled at between 0.1 and 0.01. Applying the impact criteria in Table 6-12, light and light glow is likely to be visible at this nesting habitat, but behavioural impacts on hatchlings are unlikely. Behavioural impacts become more likely at distances less than 3.3 km from an Activity IMMR vessel, support or campaign vessel.

Table 6-12: Distance of full moon equivalent radiances from modelled pipelay vessel (from Pendoley, 2022)

Impact level	OFOV (FME) ranges[49]	Distance from source (m)
5	10-100	<160
4	1-10	160
3	0.1-1	724
2	0.01-0.1	3,274
1	<0.01	>14,804

[49] *Proportion of radiance of a full moon within orientation field of view, where 100 equals the radiance of one hundred full moons and 0.01 equals 100th the radiance of one full moon*

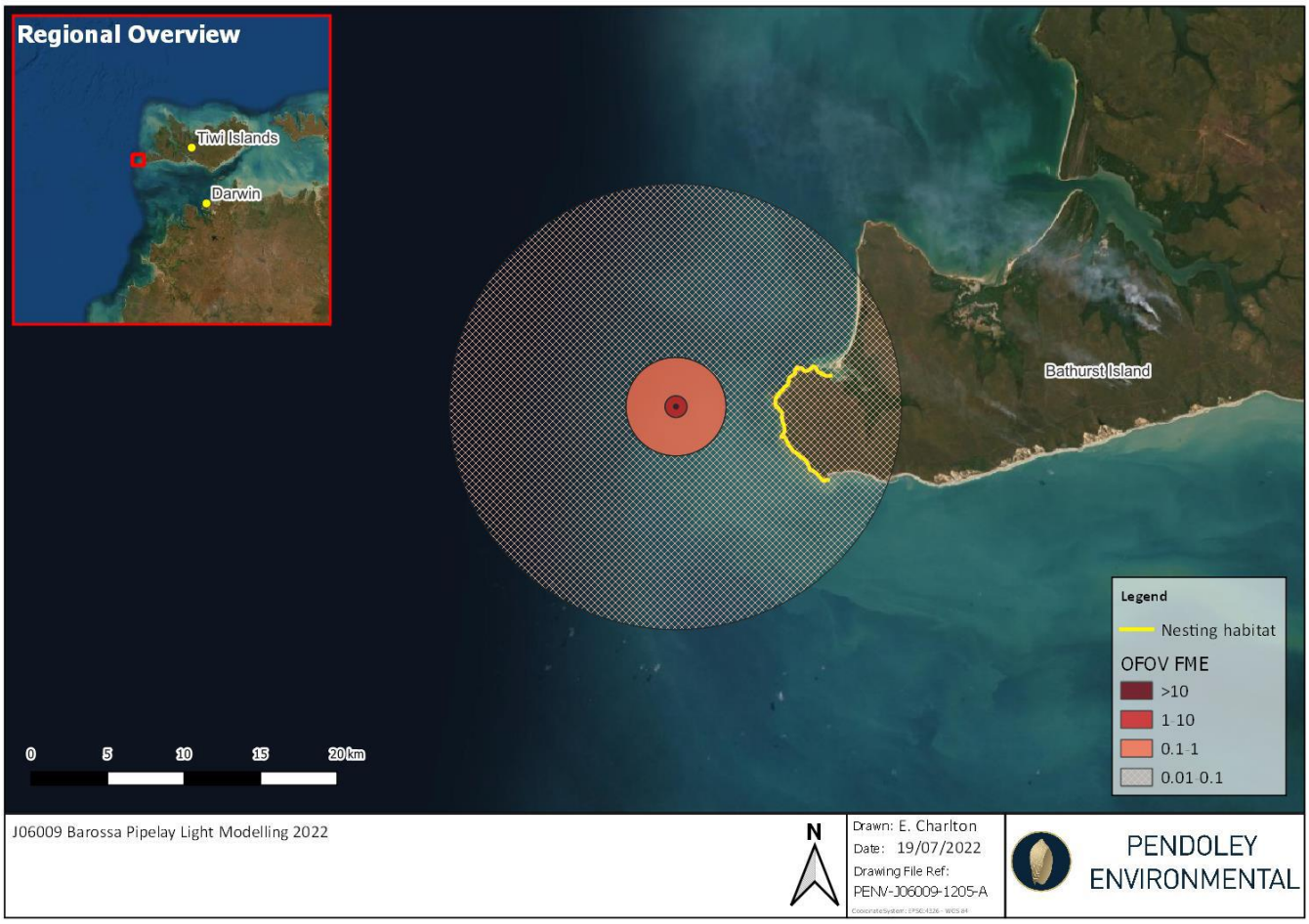

Figure 6-3: Modelled full moon equivalent radiances from a pipelay vessel in relation to the closest turtle nesting beach to the Barossa GEP (Pendoley, 2022)

6.2.2 Nature and scale of environmental impacts

Potential receptors: Threatened, migratory or local fauna, socio-economic and cultural features.

Due to the size and height of the FPSO and the permanence of the vessel, light from the FPSO will be more visible than from the largest Activity vessel in OA1. Therefore, FPSO lighting has been used to determine the worst-case distance that light may be visible from OA1 during the Activity.

Cumulative light scenarios are likely with light emissions from the FPSO, support vessels, campaign vessels, and additional vessels during hook-up and commissioning, potentially concurrent with the MODU conducting drilling activities and vessels conducting SURF activities. During operations concurrent activities may occur resulting in light emissions from the FPSO, support vessels and a vessel undertaking IMMR or campaign activities such as LWI. Operational light emissions from the FPSO will be a constant presence during normal operations, with intermittent flaring occurring as required, whereas light emissions from support vessel activities, IMMR activities, LWI activities or the MODU will be temporary, occurring only for the duration of the specific activities conducted alongside the FPSO or above subsea infrastructure.

During IMMR activities along the pipeline in OA2, campaign vessels will be used that may require 24-hour activities over short durations in the same locations and vessel lighting will be the worst-case source from OA2. Light emissions associated with navigational lights from the offshore facility and vessels have the potential to increase ambient light levels.

The combinations of colour, intensity, closeness, direction and persistence of a light source are key factors in determining the magnitude of environmental impact (EPA WA, 2010). Lighting from the FPSO and vessels may appear from direct, unshielded light sources or through sky glow. Where direct light falls upon the ocean, this area of light is referred to as light spill. Sky glow is the diffuse glow caused by light that is screened from view, but through reflection and refraction creates a glow in the atmosphere. The distance at which direct light and sky glow may be visible from the source is dependent on the lighting on the facility and vessel and environmental conditions. An assumption that lighting from the FPSO during flaring may have a behavioural impact ~16.7 km away is based on the light emissions modelling, however in the non-flaring scenario this distance reduces to ~6.4km. Flaring on

the Barossa FPSO will be intermittent and therefore this greater extent (~16.7km) of lighting visibility will occur on an intermittent basis. The Barossa FPSO vessel and facility lighting will be a constant light source within OA1.

Receptors that have important habitat present within a 20 km buffer of the OAs were considered as having potential for interaction, based on recommendations of the National Light Pollution Guidelines for Wildlife (NLPG) (DCCEEW, 2023h). The 20 km threshold provides a precautionary limit based on observed effects of sky glow on marine turtle hatchlings (15 to 18 km) and fledgling seabirds grounded in response to artificial light 15 km away (DCCEEW, 2023h).

The NLPG advocates best practice lighting design to provide benefits to wildlife. The following design principles should be considered (DCCEEW, 2023h):

- start with natural darkness and only add light for specific purposes
- use adaptive light controls to manage light timing, intensity and colour
- light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill
- use the lowest intensity lighting appropriate for the task
- use non-reflective, dark-coloured surfaces
- use lights with reduced or filtered blue, violet, and ultra-violet wavelengths.

Due to the use of the central battery system (CBS) on the FPSO, the lighting design meets the best practice design principles 2, 3 and 4. Further consideration of principles 1, 5 and 6 is discussed in Section 6.2.5.

Continuous lighting in the same location for an extended period of time may result in alterations to fauna behaviour. The specific impacts on different fauna groups is described below.

6.2.2.1 Marine mammals

While no marine mammal BIAs overlap the OAs, individual species are likely to be present. Marine mammals are not known to be attracted to light sources at sea. Cetaceans predominantly use acoustic senses to monitor their environment, rather than visual cues (Simmonds *et al.*, 2004), and there is no evidence to suggest artificial light sources adversely affect the migratory, feeding or breeding behaviours of marine mammals.

Since mammals use variations in the length of day to anticipate environmental changes and time their reproduction, light pollution that affects day length perception (such as 24 hour lighting on the FPSO for the life of the project) could lead to changes in biological functions. However, marine mammals occurring within the region will be transient in the OAs.

There is potential for opportunistic foraging, should prey abundance be increased, particularly as fish species may pool in areas of light spill; dolphins particularly may be indirectly attracted to lit structures or illuminated marine environments for foraging purposes.

Individuals are unlikely to be exposed to artificial light for durations sufficient to impact biological functions. Impacts are expected to be limited to the light spill on surface waters immediately around the light source on the FPSO and vessels. They will not result in population level impacts.

6.2.2.2 Marine Reptiles

6.2.2.2.1 Sea Snakes

Studies have shown sea snakes display varying responses to light. For example, *Hydrophine* species appear to be attracted to light and have been observed floating on the sea surface and swimming up to light (pers. comm. M. Guinea, Charles Darwin University, 2014). However, *Aispysurus* species of sea snake do not appear to be attracted to light and are not seen on the surface at night (pers. comm. M. Guinea, Charles Darwin University, 2014). Most sea snakes are likely to be associated with the offshore shoals and banks in the Timor Sea, with the closest bank being Goodrich Bank, which is 984 m from OA2.

It is recognised some pelagic sea snake individuals (*Pelamis* genus) may occur in the OAs and may be attracted to the light from the activities. However, while such individuals may come to investigate the light source, it is considered unlikely they will stay within the area (pers. comm. M. Guinea, Charles Darwin University, 2014).

6.2.2.2.2 Turtles

OA1 with a 20 km buffer (as recommended by the NLPG) does not intersect any BIAs for marine reptiles. The nearest BIA is the flatback turtle internesting BIA, 50 km south; light modelling results show that lighting may have a behavioural impact up to 16.7km away in the flaring scenario, and 6.4km in the non-flaring scenario of the FPSO. Light glow may be visible within the flatback turtle internesting BIA but behavioural impact is unlikely as the FME

drops to 0.01 to 0.1 within ~34.9 km and ~16.5 km in the flaring and non-flaring scenario respectively where behavioural impact is unlikely (Worley, 2025).

It is recognised that light emissions from gas flares still pose a potential risk to wildlife due to the high intensity, but the distance of the FPSO from the nearest BIA being >50 km away indicates that light from flaring and the Barossa FPSO are not likely to be visible to significant numbers of turtles and are not expected to affect behaviour of turtles at any life stage. A compilation of tracking data from marine turtle telemetry studies on and around the Tiwi Islands indicates turtle foraging areas and migration pathways did not overlap with the OA1, however migration pathways overlap OA2 (Pendoley, 2023) (Figure 3-6).

Significant numbers of olive ridley turtles (at the genetic stock, national and international level) nest at beaches along the west coast of Bathurst Island and are the priority stock for protection. Flatback turtles also nest here, though numbers are not significant when compared to other nesting sites of this genetic stock. Unlike other turtle populations (for example, on the NWS of WA), the olive ridley and flatback turtles on Bathurst Island do not exhibit discrete nesting and hatching seasons. Rather, there is low-level nesting year-round, with a peak in nesting, internesting and hatching during winter months. OA2 overlaps an internesting BIA for flatback turtles, is 11 km from the olive ridley foraging BIA and 17 km from a green turtle internesting BIA. It also overlaps nesting HC area for olive ridley and flatback turtles. As discussed in Section 3.5.6, a compilation of tracking data from marine turtle telemetry studies on and around the Tiwi Islands indicates migration pathways for marine turtles overlap OA2 (Pendoley, 2023) (Table 3-11).

The proportion of the nesting buffer HC area for flatback and olive ridley turtles that is intersected by the Barossa GEP corridor (OA2) is 3.7% and 3.2%, respectively. However, the actual area likely to be affected by light emissions during IMMR at any one time will be considerably smaller, given the reality that the area of disturbance will be based on a vessel slowly moving along a defined pipeline route. The extent of biologically relevant light intensity has been modelled to extend out to 3.3 km from a pipelay vessel (Pendoley, 2022), which due to the size of the modelled vessel, is considered to be conservative for a typical support or IMMR vessel (including USV) and representative for a larger campaign vessel. The extent of biologically relevant light will not impact any one location for an extended duration, due to the vessel speeds and Activity types that are conducted.

Other individual species of turtles may traverse the OAs and likely forage at the shoals and banks in the region.

The Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) highlights artificial light as a threat to marine turtles. Specifically, the plan indicates artificial light may reduce the overall reproductive output of a stock, and therefore recovery of the species, by:

- inhibiting nesting by females
- disrupting hatchling orientation and sea-finding behaviour
- creating pools of light that attract swimming hatchlings and increase their risk of predation.

The most significant risk posed to marine turtles from artificial lighting is the potential disorientation of hatchlings after their emergence from nests by light spill on beaches, although breeding adult turtles can also be disoriented (Longcore & Rich, 2016, in EPA WA, 2010).

Nesting

Artificial lighting on or near beaches is known to disrupt nesting behaviour (refer Witherington & Martin, 2003 for review) and has the potential to deter nesting activity. After egg laying, nesting females use light cues to return to open ocean, orientating towards the brightest light (Witherington & Martin, 2003). However, observations of nesting females and emerging hatchlings at the same beach showed females were disorientated much less often than hatchlings (Witherington, 1992), indicating nesting females are less vulnerable to impacts of artificial light on sea-finding than hatchlings.

The greatest light intensity from an Activity vessel (IMMR or campaign vessel) at the nearest turtle nesting beach at Cape Fourcroy is predicted to be equivalent to between 1% and 10% the radiance of a full moon, which is not considered biologically relevant to adults or hatchlings (Pendoley, 2022). As such, behavioural impacts to nesting females at nesting beaches are not expected.

Hatchlings

Hatchlings emerging from the sand are known to locate the ocean using a combination of topographic and brightness cues, orienting towards the lower, brighter oceanic horizon and away from elevated silhouettes of dunes and vegetation bordering the beach on the landward side (Limpus, 1971; Limpus & Kamrowski, 2013; Pendoley & Kamrowski, 2016; Salmon *et al.*, 1992). Turtle hatchlings primarily use light cues to orient to water but may also use other secondary cues such as beach slope (DCCEEW, 2023h). Once in the water, they generally maintain seaward headings by using wave propagation direction as an orientation cue (Lohmann & Fittinghoff-Lohmann, 1992). Salmon (2003) identified two distinct behavioural responses of hatchling turtles exposed to artificial light after emerging from the nest, being:

- misorientation – when hatchling turtles orientate towards artificial light sources instead of directly towards the ocean
- disorientation – when turtle hatchlings crawl in circuitous paths, often near artificial light sources.

Hatchlings disoriented or misoriented by artificial lighting may take longer, or fail, to reach the sea. This may result in increased mortality through dehydration, predation or exhaustion (Salmon & Witherington, 1995).

Once hatchlings enter the ocean, they are thought to employ a survival strategy that involves rapid dispersal away from predator-rich nearshore habitats to reach deeper waters where they develop into juveniles. An internal compass set while crawling down the beach, together with wave cues, are used to reliably guide them offshore (Lohmann & Lohmann, 1992; Stapput & Wiltschko, 2005; Wilson *et al.*, 2020). In the absence of wave cues, however, swimming hatchlings have been shown to orient towards light cues (Lorne & Salmon, 2007; Harewood & Horrocks, 2008) and in some cases, wave cues were overridden by light cues (Thums *et al.*, 2013, 2016). The speed and direction of at-sea dispersal is substantially influenced by currents; the offshore trajectory of flatback hatchlings at Thevenard Island was displaced by tidal currents which ran parallel to the beach, an effect that increased as the hatchlings moved further offshore (Wilson *et al.*, 2018, 2019).

However, when light was present, this effect was diminished, showing hatchlings actively swam against currents and towards the light source, which slowed their offshore dispersal from 0.5 m/s when no light was present, to 0.35 to 0.44 m/s, depending on the type of light (Wilson *et al.*, 2018). The mean swimming of flatback hatchlings under natural light conditions (0.5 m/s) were similar to speeds of green turtle hatchlings (0.49 m/s) (Thums *et al.*, 2016). The swimming speed of olive ridley hatchlings has not been measured; however, since they are smaller than both flatback and green turtle hatchlings, swimming speeds are expected to be lower (Pendoley, 2020).

These results suggest hatchlings can move in any direction when their swimming speed is greater than the speed of the nearshore current, although the speed at which currents can no longer be overcome by hatchlings will be species-specific and related to swimming speeds. Wilson *et al.* (2018) reported that when flatback hatchlings were within 150 m of the beach, they were able to swim against currents up to 0.3 m/s, although, 0.3 m/s was the maximum current speed recorded during the study and, therefore, whether flatback hatchlings can swim against stronger currents is currently untested. Even if olive ridley hatchlings respond to light cues in the same way flatback hatchlings do, their smaller size suggests reduced capability to swim against currents compared to flatback turtles.

Attraction of dispersing hatchlings to vessel light emissions and spill could result in two main impacts, being:

- increased energy expenditure as hatchlings swim against currents towards light sources and when entrapped in light spill, with potential effects to individual fitness
- increased risk of predation while silhouetted in areas of light spill.

At the C4 current meter location, approximately 20 km north-west of Cape Fourcroy on Bathurst Island, currents were strongly rectilinear, flooding towards the south and ebbing towards the north. On the spring tide, maximum current speeds were around 1.1 m/s, reducing to around 0.3 m/s on the neaps. Statistical analysis showed current speed was greater than 0.3 m/s for approximately 66% of the deployment time (Fugro, 2015). Dispersal studies at Thevenard Island (Wilson *et al.*, 2018) suggest hatchlings will enter the ocean and disperse in the direction of the predominant current, which could be either north or south.

There is potential for hatchlings at sea to be attracted to light emissions if they are carried by currents to within approximately 3.3 km of an Activity IMMR or campaign vessel (based on modelling conducted for a pipelay vessel). However, the likelihood of attraction would be lower during periods of full moon and IMMR vessel activity is limited to a duration of approximately 30 days every 3-5 years, further reducing the proportion of the Activity duration within habitat critical, where attraction is most likely to occur. If attraction did occur, it is likely individuals would remain entrapped in light for short periods (Wilson *et al.*, 2018; Thums *et al.*, 2016). At worst case, individuals would be trapped until dawn.

The greatest light intensity from an Activity vessel (IMMR or campaign vessel) at the nearest turtle nesting beach at Cape Fourcroy is predicted to be equivalent to between 1% and 10% the radiance of a full moon, which is not considered biologically relevant to adults or hatchlings (Pendoley, 2022). As such, behavioural impacts to emerging hatchlings at nesting beaches are not expected.

Internesting and foraging

Although OA2 overlaps important internesting habitat, the number of individuals likely to be present is expected to be limited. Suitable internesting habitat for flatback turtles is defined as water depths shallower than 16 m (Whittock *et al.*, 2016; Pendoley, 2019). Internesting olive ridley turtles remained relatively close to nesting beaches during the nesting period (in comparison to post-nesting movements); tagged turtles remained within 48 km of the nesting beach in waters typically less than 30 m depth (Hamel *et al.*, 2008). Water depths along the pipeline route are below 35 m, leading Pendoley (2019) to conclude most flatback and olive ridley turtles are not expected to use waters along the pipeline route for internesting, although some individual turtles may be encountered. Internesting

may occur year-round, with a peak expected between April and June, with increased potential for internesting females to occur in OA2 during this time.

If individual turtles are present, light emissions from vessels are unlikely to be of concern. There is no evidence, published or anecdotal, to suggest internesting, mating, foraging or migrating turtles are impacted by light from offshore vessels, and nothing in their biology would indicate this as a plausible threat as marine turtles do not use light as a cue during these behaviours (Pendoley, 2019; Witherington & Martin, 2003). As such, light emissions from the vessels are unlikely to result in displacement of or behavioural changes to individuals in these life stages. Marine turtles do not feed during the breeding season (Limpus *et al.*, 2013) and light is not a cue to internesting behaviours. Therefore, potential impacts of artificial light to internesting turtles are not considered likely.

Adult turtles have been observed feeding on prey presumed to be attracted by lights of oil production platforms in the Gulf of Mexico (Kebodeaux, 1994). However, illuminating fishing nets has been shown to reduce the bycatch of green turtles as they are thought to alert them to the presence of a net (Ortiz *et al.*, 2016). This suggests that, although aggregation of foraging turtles may occur around light sources as a secondary response to effects of light on prey distribution, light does not appear to act as a cue to foraging behaviour.

Summary

In summary, FPSO and vessel light emissions are not expected to impact nesting females or emerging hatchings at nesting beaches, since modelling predicts light or light glow at the closest point to shore (associated with vessels operating in OA2) is not expected to exceed intensities considered biologically relevant (Pendoley, 2019). Additionally, FPSO and vessel light emissions are not expected to impact individual internesting turtles since there is no evidence, published or anecdotal, to suggest internesting turtles are impacted by light from offshore vessels, and OA1 is 50 km from the nearest BIA for turtles. Impact levels associated with potential or higher impacts (OFOV FME > 0.1) extend ~16.7 km and ~6.4 km from the FPSO for the flaring and non-flaring scenarios respectively. The contours do not reach any land based receptor for either scenario due to the offshore location of the FPSO, or the flatback turtle nesting BIA.

For vessels, the impact levels associated with potential or higher impacts (OFOV FME > 0.1) extend ~3.3 km from the source.

Any disruption to hatchling dispersal behaviour is expected to represent an insignificant proportion of the total annual number of hatchlings emerging from the Bathurst Island for the following reasons:

- hatchlings would need to be carried to within approximately 3.3 km of a large vessel for light intensities to be great enough to lead to attraction
- for this to occur, currents would need to be aligned with the orientation of the vessels from the nesting beach. Adjacent to Bathurst Island, they run north-south, which means it would be virtually impossible for hatchlings to actively reach the vessels.

It might be possible for individuals to be passively carried to within biologically relevant light intensity around the vessel; however, this is only likely to occur for a small proportion of the overall peak hatchling emergence season, given vessels will only be within 20 km (a precautionary distance recommended in the NLPG for undertaking an environmental impact assessment) of nesting beaches for short periods when undertaking IMMR.

Further, since nesting occurs year-round, there will be a significant proportion of hatchlings originating from Bathurst Island that are not exposed to potential light sources.

Of the hatchlings that are exposed and attracted to light sources, it is not credible that every hatchling will be attracted to vessel light, given localised water movements and individual variability in swimming speed and direction.

Of the small proportion of hatchlings that may become entrapped in light spill, the worst-case scenario is death from predation, which is unlikely to occur in every instance; for example, none of the entrapped hatchlings anecdotally observed from a pipeline vessel were predated (Pendoley pers ob., 2003 in Pendoley, 2019).

Considering the above, any increased mortality from predation or increased energy expenditure will likely be limited to a negligible proportion of the annual number of hatchlings for the given genetic stocks.

Once daylight emerges, the impacts of artificial light will cease, allowing dispersal behaviour of any entrapped hatchlings to resume. It is not credible that the same hatchlings will be entrapped in light spill on subsequent nights, since they will be carried away from the vessels by currents. Therefore, any attraction to vessel lighting by hatchlings is not expected to displace individuals from important habitat.

6.2.2.3 Sharks, Rays and other fish

Fish at the surface of the water have the potential to be impacted by artificial light. The response of fish to light emissions varies according to species and habitat. Experiments using light traps have found some fish and zooplankton species are attracted to light sources (Meekan *et al.*, 2001), with traps drawing catches from up to

90 m away (Milicich *et al.*, 1992). Lindquist *et al.* (2005) concluded from a study that artificial lighting associated with offshore energy activities resulted in an increased abundance of clupeids (herring and sardines) and engraulids (anchovies). These species are known to be highly photopositive. The artificial light serves to focus their marine plankton prey and consequently leads to enhanced foraging success.

Nguyen & Winger (2019) describe four common movement patterns of fish in response to light; phototaxis (movement towards or away from light), photokinesis (movement or lack of movement in response to light), aggregation and diel vertical migration, and showed behavioural responses are influenced by both wavelength and intensity. Since many predatory fish rely on visual cues to locate and capture prey, increased light can lead to changes in predator-prey interactions.

The area of impact is likely to be restricted to areas where light is directly visible to fish, such as areas of light spill on the ocean surface. Light emissions associated with activities in OA1 may influence behaviour of fish, resulting in aggregation or increased abundance of fish in the vicinity of facilities. Aggregation around moving vessels in OA2 is less likely.

Sharks and rays are not known to be significantly attracted to light sources at sea. However, they may be attracted to the fish that are attracted to the light. Sharks and rays identified as potentially occurring in the OAs typically inhabit nearshore coastal waters (such as sawfish, speartooth shark, northern river shark, reef manta ray and giant manta ray). While individuals of some species (such as great white, mako, scalloped hammerhead and whale sharks) may transit the open ocean environments surrounding the OAs, impacts from light will not result in population-level effects and will not extend to any areas of biological importance for these species. Light has not been identified as a key threat for the whale shark (Section 3.4.3.1.1), and although whale sharks may forage around the facilities if prey abundance is increased, this is unlikely to impede migration.

6.2.2.4 Seabirds and Migratory Shorebirds

Seabirds may either be attracted by the light source itself or indirectly as structures in offshore environments tend to attract marine life at all tropic levels, creating food sources and providing artificial shelter for seabirds (Surman, 2002). Offshore light sources may also provide enhanced capability for seabirds to forage at night. Artificial light can disorient seabirds, disrupt natural foraging and migratory behaviours, and potentially cause injury through interaction with infrastructure. A number of migratory seabirds and shorebirds may transit the OAs along their migratory pathway.

In general, the impacts from light emissions are considered to be heavily influenced by weather conditions. During clear weather conditions, well-lit structures have a lesser impact on avifauna compared to poor visibility conditions. During conditions of persistent light rain, fog or mist, which are unusual events in the Timor Sea, the reflectance of light is increased, compounding the disorientation effects of avifauna and potentially resulting in high mortalities due to collision with structures. The likelihood and frequency of such events leading to significant mortalities in the Timor Sea are considered low, as such events are unusual and generally localised.

It is possible shorebirds migrating along the East Asian-Australasian Flyway may be attracted to the non-routine flaring or the lighting on the FPSO and use the facilities for resting, potentially causing disorientation to flying birds, disruption to foraging activities or affect stopover selection (DCCEEW, 2023h).

Fledgling seabirds can be affected by lights up to 15 km away (DCCEEW, 2023h). Light emissions from IMMR and campaign vessels in OA2 are not anticipated to impact the breeding population of crested terns located on the shoreline of Seagull Island, given its distance from vessel light sources (more than 19 km). Foraging species are unlikely to be disorientated by light emissions, given the scale of lighting required for IMMR vessels and campaign vessels (if required) and the relatively short-term nature of the activities in OA2 when they occur.

Where there is important habitat for seabirds within 20 km of a project, the NLPG (DCCEEW, 2023h) recommends consideration be given as to whether light is likely to have an effect on those birds. There are no BIAs for nocturnal species that overlap OA1 or OA2. The closest BIA is for the crested tern, located 8km away from OA2, and 111 km from OA1. The crested turn is a diurnal species, therefore does not forage or fledge at night, nor use light as a behavioural cue. Nocturnal species may pass through the area, but are not expected in large numbers and aggregations, and are likely to be adults migrating or foraging, which are less vulnerable to light compared to fledglings. Therefore, any impacts to birds are expected to be restricted to a negligible number of individuals.

Species with a nocturnal component to their life history, such as fledging shearwaters, are most vulnerable to negative effects of artificial light. Two shearwater species were identified in Section 3.4.3.4. Of these, only the wedge-tailed shearwater breeds in Australia. While individuals may be present within the OAs, the nearest wedge-tailed shearwater BIA is located more than 630 km away (Table 3-16), and the nearest breeding colony further still. At these distances, fledglings are not expected to occur in the OAs. While adult shearwaters may traverse the OAs, they are less vulnerable to light than fledglings. Though adults may be attracted to (and land on) offshore infrastructure, they are not expected in significant numbers (Black, 2005).

6.2.2.5 Protected Areas and Key Ecological Features

OA2 traverses the Oceanic Shoals Marine Park; however, the values and sensitivities of the marine park are submerged (such as KEFs) or are described above (turtles).

6.2.2.6 Socio-economic

The distance from the OA1 to the Northern Prawn Fishery's medium- and high-intensity fishing areas is approximately 113 km and 121 km, respectively. Lighting from activity vessels will not impact these areas.

6.2.2.7 Cultural Features

No First Nations people feedback was provided about potential light impacts to any geographically specific cultural features (excluding marine fauna species) during consultation (refer to Section 4.7). Any concerns related to the potential for impacts to cultural features from light emissions are associated with direct or indirect impacts to culturally significant marine fauna species (refer to Section 3.7.11).

First Nations people maintain a continuing spiritual connection with sea country, including marine fauna species with cultural significance, such as totems or as a cultural food source and AMPs. The OA1 is approximately 44 km from the nearest protected area (Oceanic Shoals AMP), which is a submerged receptor, and is therefore outside the light assessment boundary. Impacts to fauna, including fish and other marine species, is likely to be limited to localised, temporary behavioural impacts and is unlikely to result in significant impacts to marine species at the individual or population level. In considering the distance to the nearest marine turtle BIA (>50 km), impacts to turtles from the Activity lighting are expected to be restricted to localised attraction and temporary disorientation, but with no long-term or residual impact. Given the negligible consequence to species and sea country, subsequent impacts to socio-economic receptors including cultural features (e.g. culturally significant marine fauna) are not anticipated.

Information provided by some Tiwi people during consultation for the Drilling EP, raised concerns about the potential impacts of lights on marine turtles from drilling, and potential impacts to marine life generally, and that if totemic species (e.g. turtles) are impacted by the drilling activity this can impact Tiwi people and make them sick. As production operations activities are proposed to occur in a similar geographical location to that of the Barossa drilling, Barossa GEP and SURF activities, Santos considers that similar concerns may exist, despite there being no specific feedback or concerns raised during Production Operations consultation.

6.2.2.8 Potential Cumulative Impacts

Concurrent Santos activities under this EP will occur within OA1 (see Section 2.3.1), the potential for cumulative light impacts is acknowledged. The concurrent activities can fall under the:

- accepted Barossa Development Drilling and Completions EP (D&C EP)
- the FPSO Mooring Installation and Pre-commissioning EP (referred to as the Barossa Subsea Umbilicals, Risers and Flowlines (SURF EP)),

The FPSO and its associated light spill will be present throughout the FPSO pre initial start-up activities (hook up and cold commissioning) and post initial start-up activities (initial start-up and production operations) covered under this EP.

The cumulative effect of FPSO and MODU lighting (together with their support vessels) and the cumulative effect of the FPSO and SURF vessel lighting will be relatively short-lived and limited to the duration of drilling/completion, contingency MODU workover and SURF installation campaigns.

MODU and associated support vessel lighting associated with drilling/completions activities (under the D&C EP) may occur for a duration of ~3 months pre FPSO start-up and for a period of ~3 months following FPSO start up. MODU and support vessels will be centred around drill centres >6km from the FPSO turret location. MODU lighting associated with contingency well workovers could also occur concurrently with FPSO operations. Contingency well workover activities using a MODU will be authorised under a separate EP.

Lighting associated with a construction vessel and associated transportation vessel undertaking SURF installation and pre-commissioning activities (under the SURF EP) could occur concurrently with FPSO lighting and MODU lighting for a period of ~1 month prior to FPSO start-up and up to ~2 months within a 6-month period following FPSO start-up.

FPSO light spill modelling (Table 6-11) shows that levels where behavioural impact is possible are reached >16.7 km away in the flaring scenario and >6.4 km in the non-flaring scenario.

As presented in the D&C EP, and based on relevant modelling, typical MODU direct lighting may be visible up to 26.6 km away (derrick lights) and up to 52.4 km away for short duration flaring (two to three days per well), which is well within the contour modelling results for flaring from the FPSO and similar distance (~16.5 km) for lighting.

Noting that these distances indicate light will be at ambient and no impact expected. For concurrent SURF EP activities in OA1, where construction vessels may be used, relevant modelling demonstrates that light spill from these vessels is expected to return to ambient levels at approximately 11 km from the source.

In accordance with the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023h) sensitive receptors within 20 km of the light source should be considered. There are no known BIAs within the light assessment boundary, with the closest turtle BIA being approximately 50 km from OA1 and the closest land at Seagull Island, from which seabirds may fledge or turtles may hatch, being approximately 140 km away. While there is expected to be temporary cumulative light spill from the FPSO (and associated vessels), MODU (and associated support vessels) and SURF vessels at certain times before and after FPSO start-up, these are not considered to result in substantial adverse impacts to sensitive marine fauna, including birds and turtles, due to the short and intermittent nature of the concurrent activities, the spatial extent of visible lighting from these activities and the relatively large distances to biologically important areas for marine fauna (e.g. turtle BIAs, Seagull Island). On that basis, no change to the overall consequence level due to cumulative light impacts from Santos activities in OA1 is predicted.

6.2.3 Environmental performance outcomes and control measures

The EPOs relating to this event are:

- No injury of, or mortality to, EPBC Act 1999 listed marine fauna or marine fauna listed as threatened species and under the *Territory Parks and Wildlife Conservation Act 1976* (NT) as a result of the Activity. (EPO-08)
- No light emissions from the Activity except as required for safe operations and working requirements (EPO-12)
- No significant impact to cultural features from the Activity (EPO-19)

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this Activity are shown Table 6-13 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria that are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 6-13: Control measure evaluation for light emissions

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-6.1.2	Vessels equipped and crewed in accordance with Australian maritime requirements, including Marine Order 30 (Prevention of Collisions) and Marine Order 21 (Safety and Emergency Arrangements) (administrative control)	Light spill from unnecessary lighting reduced, further lowering potential additional light pollution to the environment, thus reducing the potential impacts to fauna.	Lighting is required to ensure safe working conditions, and to alert other users of the sea to the FPSO and vessel presence.	**Adopted** – requirement to comply with maritime and safety regulations.
BAO-CM-6.2.1	Lighting limited to that required for safe work conditions and navigational purposes (isolation control)	Light spill from unnecessary lighting reduced, even further lowering the likelihood of impacts to fauna from project vessel lighting. Lighting is assessed to only provide necessary lighting for safety and navigation during the activity. Reducing the potential for additional light pollution to the environment, thus reducing the potential impacts to marine fauna.	Limited additional cost associated with compliance assurance only.	**Adopted** – requirement to comply with maritime and safety regulations

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-6.2.2	Additional lighting management (as recommended in the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023h) implemented in OA2 when undertaking activities within 3.3 km of turtle BIA or HC, where it does not impact the ability of light to safely illuminate the work area (administrative control)	Reduces light spill when operating vessels within 3.3 km of turtle HC.	Costs associated with lighting assessment and installation of additional shielding (if required).	**Adopted** – minimises the potential impact to turtles during critical life stages.
Additional control measures				
BAO-CM-6.2.3	Vessel searchlights will only be operated when retrieving AUVs at night or in the event of an emergency (administrative control)	Searchlights are the most significant source of light from Activity vessels. Not operating these lights during planned activities will reduce light spill.	Negligible costs	**Adopted**
N/A	Do not flare (elimination control)	Reduce potential for impacts on certain sensitive receptors from light emissions. Note, normally unlit LP and acid gas flare tips, and no routine LP flaring (refer Section 2.7.2.4)	Potential safety and operational risks.	**Not adopted** – not flaring would impact the safety and viability of Barossa production operations. Note: flaring is limited due to the inherent design and use of the vapour recovery system and dedicated thermal oxidiser, resulting in no continuous LP flare streams.
N/A	Implement a seabird management plan to prevent seabird landings on offshore facilities (CoA, 2020) (administrative control)	A management plan to help manage birds appropriately is recommended in seabird foraging areas during breeding season (CoA, 2020) to prevent significant diversion from migratory and breeding activities.	Significant costs associated with implementing controls, monitoring effectiveness, and ensuring appropriate training for personnel involved in implementing measures on the large FPSO.	**Not adopted** – the OAs do not overlap any BIAs for seabirds, and the closest point to a BIA is 8 km from OA2 at Seagull Island (for crested terns) and vessels within OA2 will be present for short durations only. Lighting management measures are already in place on the FPSO with the use of a CBS to manage lighting, and vessel activities in OA2 are short duration and intermittent, therefore limiting potential impacts to seabirds.
N/A	Limit or exclude nighttime operations (elimination control)	Would reduce light emissions to the marine environment.	The FPSO is a permanently moored facility operated continuously – night-time operations are unavoidable. Would double the duration of activity; increase impacts or potential impacts in other areas, including increase in waste, air emissions, risk of vessel collision etc. A minimal level of artificial	**Not adopted –** given the minimal risk of impacts to turtles and seabirds occurring at OA1 and infrequent and limited duration of planned activities at OA2, the financial and environmental costs of requiring all works to be undertaken during daylight hours only are not considered appropriate.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
			lighting will still be required on the IMMR vessel on a 24- hour basis for safety reasons.	
N/A	Change the wavelength of outdoor lights to avoid wavelengths within the peak sensitivity of turtles and seabirds (substitution control)	Negligible due to the absence of turtle and seabirds in vulnerable life stages within the OA.	Navigational lighting colours are stipulated by law. Working and egress areas must be lit for health and safety reasons.	**Not adopted –** the high financial cost would be grossly disproportionate to negligible environmental benefits. Health and safety reasons, and maritime regulations, dictate lighting.
N/A	Use dark, matte surfaces on FPSO and vessels (substitution control)	Would reduce reflection and scattering of light resulting in skyglow.	Additional cost to repaint surfaces. Some areas may require lighter surfaces to manage heat conduction for health and safety. Unlikely to result in a material light reduction.	**Not adopted** – the high financial cost would be grossly disproportionate to negligible environmental benefits. May compromise health and safety in some circumstances.
N/A	Avoid any IMMR activities in OA2 within peak turtle nesting and hatchling emergence seasons for both flatback and olive ridley turtles (elimination control)	Reduce potential for impacts on turtles during critical life stages from light emissions.	Scheduling constraints to avoid peak turtle seasons for planned IMMR activities may impact vessel contracting strategy and implementation.	**Not adopted** – unlike other turtle populations (for example, on the NWS of WA), the olive ridley and flatback turtles on Bathurst Island do not exhibit discrete nesting and hatching seasons. Rather, there is low level nesting year-round, with a peak in nesting, internesting and hatching during winter months. Impacts to nesting females, emerging hatchlings and dispersing hatchlings at sea are not expected to result in changes at the individual, population or genetic stock level. A seasonal exclusion would not avoid all turtle nesting, internesting and hatchling activity but may avoid the known peaks. The impact assessment determined the risk to hatchlings from light emissions is low and not inconsistent with the requirements of the Recovery Plan for Marine Turtles in Australia 2017–2027.
N/A	Additional lighting management (as recommended in the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023h) implemented in OA1 (administrative control)	Reduces light spill from vessels and FPSO operating in OA1	Costs associated with lighting assessment and installation of additional shielding, monitoring of blind closures at night, lighting management measures etc	**Not adopted** – OA1 does not overlap any BIAs for seabirds or turtles. Light modelling indicates that lighting falls to ambient levels within ~16.5 km, which is 125 km from the nearest turtle nesting beach. Lighting management measures are already in place on the FPSO with the use of a CBS to manage lighting, therefore limiting potential

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
				impacts to turtles and seabirds.
N/A	Undertake lighting verification study for permanent lighting source (FPSO)	Confirm light modelling inputs are correct to ensure the light modelling results are accurate for the location and therefore impact assessment is validated.	Time and cost for undertaking light verification of each individual light source, and repeating the modelling.	**Not adopted** - Santos provided detailed lighting diagrams, schematics, and datasheets to assist with the generation of an accurate lighting inventory for the modelling. In addition, assumptions were made to ensure conservatism in the results. Given the distance of sensitive receptors, including seabird and turtle BIAs from the facility, this is considered disproportionate to the cost.

6.2.4 Environmental impact assessment

Key receptors	Consequence level
Light emissions	
Threatened, migratory or local fauna	Negligible in OA1, Minor in OA2 – Sensitive receptors that may be impacted by light emissions in the same location for an extended period of time include marine turtles, fish at surface and seabirds. **Turtles** The offshore light emissions associated with vessels, flaring and the FPSO in OA1 is not expected to have a discernible effect on adult turtles or hatchlings and the potential for light from flaring to attract marine turtles once they are at sea is not expected, with negligible impacts expected. The southern end of OA2 traverses nesting HC area for flatback and olive ridley turtles, overlaps a portion of the internesting BIA for flatback turtles, and is 11 km to the internesting BIA for olive ridley turtles. There is no evidence, published or anecdotal, to suggest internesting turtles are impacted by light from offshore vessels (Pendoley, 2019). Modelling shows direct light or light glow from the vessels, flaring and FPSO lighting in OA1, and IMMR vessels (or campaign vessels if required) in OA2 does not exceed intensities considered biologically relevant at the closest nesting beaches (Pendoley, 2022, Worley 2025), so impact to nesting females or emerging hatchings is not expected to occur. In the unlikely event hatchlings do become entrapped in light spill from vessels, the proportion impacted is considered negligible when compared to the total number of hatchlings emerging from Bathurst Island beaches across the year. It will also be a temporary phenomenon, occurring during hours of darkness only. After sunrise, hatchling dispersal behaviour will resume. Displacement of individuals from habitat critical areas is therefore not a credible outcome. **Fish and seabirds** Fish and birds have been shown to be attracted to artificial light sources; however, large-scale changes in species abundance or distribution are unlikely. The behavioural responses are unlikely to significantly alter critical behaviours such as migration or spawning, reducing the credibility of population-level effects. Impacts to transient fish and seabirds will be limited to behavioural effects, with no decrease in local population size, area of occupancy of species or loss or disruption of habitat critical nor disruption to the breeding cycle. **Marine mammals** Cetaceans and marine mammals are not known to be significantly attracted to light sources at sea; therefore, disturbance to behaviour is unlikely. Indirect impacts on food sources and habitats are also unlikely. There is potential for opportunistic foraging, should prey abundance be increased; however, individuals are unlikely to be exposed to artificial light for durations sufficient to impact biological functions.
Physical environment and habitat	Not applicable – No impacts to physical environments and habitats from light emissions are expected.
Threatened ecological communities	Not applicable – No threatened ecological communities identified in the area over which light emissions are expected.
Protected areas	Not applicable – The values of the protected area are described above (turtles, fish, cetaceans).

Key receptors	Consequence level
Socio-economic	The consequence of light emissions on receptors is assessed as I – Negligible. Impacts to fauna, including fish and other marine species is likely to be limited to localised, temporary behavioural impacts and will not result in significant impacts to marine species at the individual or population level. Given the negligible consequence to species, subsequent impacts to socio-economic receptors including commercial fishing and cultural features are not anticipated. Lighting is not expected to cause an impact to other socio-economic receptors other than to act as a visual cue for avoidance of the area by other marine users for safety purposes. The consequence level for socio-economic receptors is considered to be I – Negligible
Cultural features	Given negligible consequence to species, subsequent impacts to cultural features not expected.
Cumulative impacts	On the basis that concurrent activities (see Section 2.3.1) will occur within OA1, the potential for cumulative light emissions is acknowledged. Notwithstanding the potential for overlap of the extent of light effects from concurrent activities, due to the absence of significant feeding, breeding or aggregations areas within the area that behavioural impact is possible (conservatively 16.7 km (flaring scenario and 6.4 km in non-flaring scenario) from the Activity OA1 based on FPSO modelling (Worley, 2025) and the short and intermittent duration of the concurrent activities, additive and cumulative light effects can reasonably be expected to be negligible. The lighting control measures identified reduce the potential for impacts to sensitive marine fauna.
Overall worst-case consequence	II – Minor

6.2.5 Demonstration of as low as reasonably practicable

The presence of the FPSO and vessels in the field is required to undertake operations including LWI. All vessels in Australian waters adhere to the navigation safety requirements (Marine Order 30 – prevention of collisions). Elimination or reduction of lighting onboard the FPSO or vessels would increase the potential for collision risk (and associated oil spills), introduce safety risks to marine crews, and would be non-compliant with marine codes and regulations.

The lighting specification on the FPSO has been guided by that required for safe operation while minimising light intensity and light spill overboard where possible. Lights required to illuminate large areas have been directed in-board, reducing light spill onto the ocean. Lights that spill overboard (except for emergency requirements) are only used during vessel activities, bunkering and condensate offtake operations, activities which normally are of a limited duration.

The FPSO has a CBS lighting system that is designed so brightness of light can be reduced (as in, dimmed) or turned off when lighting is not in use. This ensures lighting is not on unnecessarily throughout operations and ensures energy efficiency.

Lighting impacts are not only related to the amount of artificial light, but also the types of light and the wavelengths the different light types emitted. Measurements of light emitted from an FPSO recorded peak wavelengths between 530 to 620 nm, which is within the range that is visible to marine turtles and seabirds (300 to more than 700 nm) (Woodside, 2019). This lighting was likely metal halide, halogen or fluorescent lighting rather than LED. The CBS lighting system involves a centralised lighting system using LED lighting powered by battery, in the form of an uninterruptible power supply capable of supplying escape lighting for 90 minutes, with a digital addressable lighting interface system for controlling and monitoring the lights.

The use of the CBS lighting system allows for emergency and escape lighting to be powered from the central battery system along with the normal lights. This eliminates the need for separate emergency/escape lighting with built-in batteries, enables light types to be tailored to the region that needs illumination, resulting in fewer lights across the facility and reducing light spill.

The CBS lighting system also allows for dimming and controlling lighting across the FPSO, improving lighting where required, and avoiding unnecessary lighting and light spill. Lights can be dimmed during daylight hours – as per DNV class rules, escape lighting cannot be switched off, but can be dimmed, whereas for other facilities without dimming capability these lights would remain on at full energy – as well as in unmanned areas at night. The lighting for each area or module can be individually controlled.

The benefits of the novel CBS lighting system include:

- reduced overall number of lights
- reduced energy consumption overall, due to optimised spacing and alignment of LED lights, enhanced by controllable areas and dimmable lighting

- reduced light spill to the environment
- increased safety by enhanced emergency and escape lighting, with better uniformity
- reduced operations requirements for maintaining and replacing integrated batteries
- reduced waste for disposal of spent light bulbs and integrated batteries.

For the Barossa FPSO, a vapour recovery system has been incorporated into the design, which recycles potential waste gas for reuse within the process, avoiding flaring under normal operating conditions. Intermittent flaring during inlet production separator flaring may have a behavioural impact to species up to ~16.7 km away (FME 0.1- 1) but be at ambient levels within ~68 km (no impacts expected at ambient level). Additionally, the removed reservoir CO_2 stream, which requires disposal, is sent to a dedicated thermal oxidiser, which has an enclosed combustion chamber as opposed to a visible flame at the top of the stack (as for flares), meaning no light emissions are discharged from the oxidiser stack (refer Section 2.7.2.4).

A low pressure (LP) flare pilot is not required during normal operations, and has been replaced by a fast-starting, normally unlit pilot, while the LP flare is normally purged by nitrogen, an inert gas, in lieu of the more traditional fuel gas purge (which requires combustion and hence a pilot light).

This enhanced design for the Barossa FPSO means the LP flare is normally unlit and hence does not generate light emissions under normal operations. This is best practice for the region, above and beyond the business-as-usual approach, and will contribute to the Barossa FPSO generating reduced light emissions than comparable facilities.

Flaring is required for safety and operational reasons. However, the FPSO has been designed to use vapour recovery on the LP flare system. This reduces the frequency at which flaring occurs throughout operations and therefore reduces the light emissions emitted during constant operations. The added benefit of using vapour recovery, aside from a reduction in light, is the reduction in air and noise emissions. Additionally, use of a thermal oxidiser that has an enclosed combustion chamber results in no light emissions from the oxidiser stack. These enhanced design features result in the LP flare and acid gas flare normally being unlit.

The design of the facility has been optimised to require minimum intervention or repair over the design life of 25 years, which results in a reduced frequency of IMMR activities with a risk-based inspection and monitoring programme implemented. The inspection regime reduces unnecessary offshore activities and associated environmental risks and allows a more flexible approach to the inspection. This in turn will result in fewer long-term IMMR activities being required in the OAs.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the impacts, such that the residual consequence is assessed to be II – Minor (in OA2). The proposed control measures are in accordance with the Santos risk management criteria and are considered appropriate to manage impacts to ALARP.

6.2.6 Acceptability evaluation

The consequence of light emissions is assessed as II – Minor. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential impacts are considered acceptable.

Is the consequence ranked as I or II?	Yes – maximum consequence from light emissions is II – Minor.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecological sustainable development?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers the principles of ESD: The impacts associated with light emissions do not result in 'threats of serious or irreversible harm' as detailed within the EPBC Act and biodiversity and ecological integrity will be maintained. • conservative assumptions have been applied to the light emissions modelling • there are no identified health, diversity or productivity impacts that may affect the biodiversity or ecological function for future generations. The consequence against this aspect is II – Minor and therefore does not affect the outcomes of the principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat	Yes – Control measures implemented will reduce the potential impacts from the Activity light emissions to species identified in the following relevant species recovery plans and management plans/guidelines, as also set out in Table 3-13.

abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives?	**Recovery plans:** • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) **Other management plans/guidelines:** • National Light Pollution Guidelines for Wildlife (DCCEEW, 2023h) • The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) The Activity will not compromise the objectives set out in the Recovery Plan for Marine Turtles in Australia or the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023h), as biologically important behaviours of nesting adults and emerging and dispersing hatchlings can continue, given the distance from the nearest nesting beaches. There is no evidence to suggest the proposed Activity will result in marine turtles being displaced from habitat critical to their survival nor for important biological behaviour to be interrupted. For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes and the control measures outlined in Section 6.2.3. Santos considers that the level of impact from Activity light emissions is not inconsistent with these plans. IMMR activities that may be required in the Oceanic Shoals Marine Park are not inconsistent with the IUCN principles and North Marine Parks Network Management Plan objectives (DNP, 2018a) or the DNP Commercial Activity Licence conditions, refer Appendix C. The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the Shelf break and slope of the Arafura Shelf KEF. Significant impacts to this KEF are not predicted for this Activity
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with SOLAS 1974, the *Navigation Act 2012* (and relevant Marine Orders) and COLREGS. Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.7.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with the ACF, have been considered when evaluating performance outcomes, control measures and associated performance standards (see Section 4.7 for further information). Santos has considered and evaluated specific control measures proposed by the ACF within Table 6-13. However, no additional performance outcomes or control measures have been adopted. Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have been adopted in this EP.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

6.3 Greenhouse Gas Emissions

6.3.1 Description of event[1]

Event	Gaseous greenhouse gas (GHG) emissions are gases that trap heat within the atmosphere through the absorption of longwave radiation reflected from the earth's surface. The emissions of CO_2, nitrous oxide (N_2O), CH_4, sulphur hexafluoride, hydrofluorocarbons and perfluorocarbons are recognised as GHG emissions. GHG emissions generated at the FPSO are predominantly CO_2, CH_4 and N_2O emitted to the atmosphere when hydrocarbons are burned, flared, vented or released as fugitive emissions either through processing or transmission. The GHG Protocol (World Resources Institute) defines direct or 'Scope 1' emissions as GHG emissions from sources that are owned or controlled by the company. Scope 1 GHG emissions are emissions released into the atmosphere as a direct result of the activities at a facility. Scope 1 GHG emissions from the Barossa production operations (inclusive of production from wells, the FPSO, Barossa GEP through to the upstream weld of the DLNG beach valve) are considered direct emissions and are derived from: • fuel combustion – hydrocarbon-based fuels (primarily gas, with diesel used intermittently) are combusted to generate heat and power • flaring – a vital safety feature in which hydrocarbons are combusted intermittently (in emergency or planned shutdown or maintenance circumstances) to prevent overpressure and/ or the creation of an explosive atmosphere. Flaring is also expected during commissioning and start up (well clean up and multi-rate testing) • venting – reservoir CO_2 extracted from the gas is vented via a thermal oxidiser (primary) or acid gas flare (back-up) • fugitive emissions – may occur from pressurised equipment, emitted by infrequent operational activities, or unplanned equipment leaks. The GHG Protocol (World Resources Institute) defines indirect GHG emissions as emissions that are a consequence of the activities of the Activity but occur at sources owned or controlled by another entity. Scope 2 emissions for a facility represent the 'indirect' emissions that are released outside the facility boundary to produce the electricity that is imported into the facility and used. The FPSO generates its own power, heating and cooling requirements (captured in Scope 1 emissions) therefore there are no Scope 2 emissions associated with the activity (Section 6.3.2.1.2). Scope 3 emissions are broader indirect emissions other than Scope 2 emissions that occur outside a facility boundary as a result of the activities. Onshore processing and support vessel/ helicopter operations are separate to the Activity and represent indirect emissions sources. Scope 3 emissions sources associated with the FPSO include: • support vessels (for example supply, campaign [including LWI and USV] and IMMR vessels) and helicopters (business travel) • transport (via tankers and carriers) processing and end-user consumption of the condensate from the FPSO • onshore processing of gas at Darwin Liquefied Natural Gas (DLNG) facility • transport and end-user consumption of the sales products (LNG from DLNG facility and condensate from the FPSO) in international markets (predominantly Asia). Environmental impacts associated with atmospheric emissions other than GHGs are assessed in Section 6.4.
Extent	Direct and indirect GHG emissions will be generated in both OAs. Indirect GHG emissions will also be generated outside of the OAs (as described above).
Duration	Generation of direct and indirect GHG emissions will occur during the HUC and initial start-up phases and over the life of production operations (approximately 25 years). **Concurrent:** The duration of overlap for each concurrent Barossa activity within OA1 is presented in full in Section 2.3.1. For FPSO pre start-up activities there may be concurrent GHG emissions from a MODU and support vessels for a period of approximately 3 months (including GHG emissions from intermittent flaring); for approximately 1 month of this period there may also be GHG emissions from a construction vessel and transportation vessel undertaking SURF installation and pre-commissioning (SURF EP). There may be MODU drilling/completion (under the D&C EP) extending for a period of up to approximately 3 months post FPSO start-up and contingency MODU well workovers activities (nominally of 3-months duration) within the validity period of this EP. Contingency well workovers using a MODU will be authorised under a separate EP. For the first 6 months post FPSO start-up, there may also be up to approximately 2 months cumulative duration of SURF installation and pre-commissioning.

[1] In this Section, references to "Santos" are – unless expressed otherwise – to Santos in its capacity as Operator of the Barossa joint venture (**JV**), not to Santos as an independent entity.

6.3.2 Nature and scale of environmental impacts

6.3.2.1 Greenhouse gas emissions estimates

To quantify potential greenhouse gas (GHG) emissions, the metric CO_2-e is used to standardise various GHGs, such as CO_2, CH_4, and N_2O. This involves converting the quantities of emitted gases into an equivalent amount of CO_2 that would have the same global warming potential.

The calculation methodology models GHG emissions based on Activity input data and industry standard data. The methods used in this modelling align with the relevant Australian and international legislation, regulations, standards and guidelines, being:

- National Greenhouse and Energy Reporting (NGER) Act 2007 and associated (Measurement) Determination 2008, and Safeguard Mechanism Rule 2015, and has substantially adopted Method 1
- International Organisation for Standardisation (ISO) 14064 Greenhouse gases – Part 1: Specification with guidance at the organisation level for quantification and reporting of greenhouse gas emissions and removals
- ISO 14040: 2006 Environmental management – Life Cycle Assessment – Principles and Framework.

Under the NGER regime, emissions are described as either Scope 1, 2 or 3, which relate to where the emissions occur (Clean Energy Regulator (CER), 2024):

- Scope 1 (direct) GHG emissions are the emissions released to the atmosphere as a direct result of an activity, or series of activities, at a facility level.
- Scope 2 GHG emissions are the emissions released to the atmosphere from the indirect consumption of an energy commodity. For example, 'indirect emissions' come from the use of electricity produced in another facility.
- Scope 3 GHG emissions are indirect emissions (other than Scope 2 emissions) that are generated in the wider economy. They occur as a consequence of the activities of a facility, but from sources not owned or controlled by the operator of the facility.

During the operations phase authorised under this EP, Santos, on behalf of the Barossa Joint Venture, controls the:

- extraction of well fluids and gasses from the reservoir using multiple subsea wells
- processing of the well fluids and gasses onboard the FPSO
- export of the gas to the DLNG facility via pipeline
- delivery of condensate to offtake vessels loading from the FPSO.

Onshore processing is separate to the Activity and is not controlled by the Barossa JV. The DLNG joint venture is responsible for processing and liquefying the gas at the DLNG facility. This activity is not regulated under the OPGGS Act and associated Regulations, and is not part of the Activity authorised by this EP. The Barossa joint venture partners are responsible for the shipping and final use of the gas and condensate, lifting their allocated volumes of LNG and condensate based on their equity share in the project These activities are not regulated under the OPGGS Act and associated Regulations, and are not part of the Activity authorised by this EP.

A GHG emissions forecast was prepared by Santos to determine the GHG emissions over the life of the Activity. The Activity emissions sources in Table 6-14 have been included in the GHG emissions forecast.

Table 6-14: Greenhouse gas emissions source inclusions

Activity	Aspect emissions source	GHG emission scope
Direct – Operations Scope 1		
Production operations at Barossa FPSO (including offshore power generation, processing and compression of gas for transport via the gas export pipeline to DLNG)	Combustion & Processing	Scope 1
Indirect - Upstream Scope 3		
Business travel	Flights	Scope 3
Support vessels (for example tugs, supply, campaign and IMMR vessels)	Vessels	Scope 3

Activity	Aspect emissions source	GHG emission scope
Indirect - Downstream Scope 3		
Operations at DLNG	Processing	Scope 3
Transport, further processing and customer use of condensate & LNG	Transport & Combustion/Feedstock consumption	Scope 3

These emissions sources are explained in more detail below. Table 6-15 provides a summary of the key assumptions that support the GHG emissions estimates presented in this EP. Facility performance is expected to be less stable during initial start-up and the early years (1-3) of steady state operations as the Operator gains experience with the process and equipment and optimises its performance. Emissions calculations assumptions are more conservative for this period to take this into account, for example a higher number of facility shutdowns (and associated unplanned flaring) are assumed. As facility performance reliability is expected to improve over time (years 4-25), assumptions are less conservative. Emissions estimates will inform fuel and flare targets for HUC and Initial Start-Up which will be actively monitored on a daily basis via the fuel and flare target setting process (Section 8.2.4.1). Emissions estimates for steady state operations will be tracked monthly and estimates assumptions reviewed annually (Section 8.2.4.2). Where exceedances of emissions estimates occur or are predicted to occur, these will be assessed in accordance with the Environment Plan MoC process (Section 8.5.2).

Table 6-15: GHG Emissions sources and assumptions

Stage	Emission Source	Description
Direct Scope 1 Emissions		
Hookup & cold-commissioning	During hook-up and cold-commissioning power will be supplied by essential diesel generators before commissioning of the fuel gas system post-RFSU. Diesel usage during the first year of operations (inclusive of commissioning and startup activities) will be higher than steady state operations. There will be no flaring prior to RFSU.	
	Diesel	Pre-RFSU, power on the FPSO will be provided by the essential diesel generators at 28m^3/day, estimated at 93 days. Contingency of 18 days diesel usage (28 m^3/day) in the event of delays to commencement of start-up
Initial Start-up to Steady State	During initial start-up to steady state, diesel emissions will progressively be replaced with fuel gas as the fuel gas system is commissioned, and emissions from flaring and venting (reservoir CO_2) will commence. Flaring will be elevated during the initial start-up phase (relative to the pilot flare levels during normal operations) as wells are cleaned up, and processing equipment and systems are progressively commissioned for normal operations.	
	Diesel	Post-RFSU power on the FPSO will be provided by the GTGs. 1 GTG will run on diesel for the first 7 days until the fuel gas system can produce sufficient gas for GTG fuel switch testing. The diesel usage rate for the GTG is 146 m^3/day. During restart following emergency shut down testing, diesel use assumed as follows: • 3 days on essential diesel generators (28m^3/day) • 1 day – 1 GTG on diesel • 0.5 days – 1 GTG on diesel
	Fuel Gas	Ramp-up of GTGs on fuel gas during initial commissioning of the fuel gas system assumed as follows: • 1 GTG for 7 days on fuel gas (4.9 MMscfd) • 2 GTGs for 41 days on fuel gas (5.8 MMscfd per GTG) • 3 GTGs for 18 days on fuel gas (7.7 MMscfd per GTG) During restart following emergency shut down testing, fuel gas use assumed as follows: • 0.5 days – 1 GTG on fuel gas (4.9 MMscfd) • 2 days – 2 GTGs on fuel gas (5.8 MMscfd per GTG) • 1 day – 3 GTGs on fuel gas (7.7 MMscfd per GTG) • 3 days – 4 GTGs on fuel gas (6.2 MMscfd per GTG)

Stage	Emission Source	Description

	Flaring	• Well clean-up flaring up to 24hrs per well (6) at maximum flaring rate of 250 MMscfd
		• Ramp-up flaring assumptions:
		  • From RFSU to pipeline pressurisation: assumed flaring rate of 127 MMscfd for an expected period of 16 days subject to equipment start-up
		  • From pipeline pressurisation to ESD testing: assumed flaring rate of 118 MMscfd for an expected period of 41 days subject to equipment start-up
		  • Post ESD test ramp up to handover to operations: assumed flaring rate of 115 MMscfd for an expected period of 18 days subject to equipment start-up
		• Unplanned DLNG outages during post RFSU:
		  • 3 flaring events for 3 days each at 130 MMscfd (DLNG outage < 3 days);
		  • 3 flaring events for 3 days each at 130 MMscfd (DLNG outage 3 days or greater). For DLNG outages 3 days or greater, the field would be shut-in after 3 days and flaring would cease until DLNG has restarted.
		• Flare pilots supplied with propane gas for 7 days (~1974kg) until fuel gas system is online.
		• Reservoir CO_2 vented via acid gas flare until thermal oxidiser commissioned – no change in CO_2 emissions whether vented via acid gas flare or thermal oxidiser

Steady State Operations and Maintenance	During the operations and maintenance phase, fuel gas combustion will be the primary source of emissions. Flaring will be limited to 4-yearly planned shutdowns or safety flaring during unplanned upset or emergency conditions. Diesel use will be limited to planned and unplanned shutdown events and periodic testing of safety critical equipment e.g. essential generator. Fugitive emissions from equipment associated with offshore processing, offtake operations and gas pipeline transmission and represent ~1% the total Scope 1 emissions over the life of the project. Production profile assumptions: • Year 2025-2037: HP mode • Year 2037-2041: LP mode • Year 2041-2047: <67% LP mode • Year 2047-2050: <33% LP mode • Planned shutdown for 35 days every 4 years, first shutdown in 2029	
	Fuel gas	• Fuel gas will be used to run three gas turbine generators to supply power for FPSO processing systems. • Supplementary fuel gas supply to the thermal oxidiser supplied by flammable CO_2 removal membrane Stage 1 permeate stream
	Flare	• Low pressure (LP) flare is normally operated as a closed flare with pilots extinguished and nitrogen purge to flare stack. LP flare is operational when vapour recovery unit (VRU) is offline. VRU is 2 by 100% so LP flaring limited to 0.3 MMscf per year. • High pressure (HP) flare normally lit and purged using fuel gas, requiring ~14mmscf of fuel gas per year • Planned shutdown for 35 days every 4 years, requiring restart flaring at 130 MMscf for 1 day *Flaring from unplanned events* • Type 1[1] unplanned shutdowns – 10 events annually for yrs 1-3 during expected lower performance reliability; 7 events annually for years 4-25 with expected improved performance reliability; 4hrs from trip to commencing restart assumed. • Type 2[2] unplanned shutdowns – 4 events annually for yrs 1-3 during expected lower performance reliability; 3 events annually for years 4-25 with expected improved performance reliability; 24 hrs from trip to commencing restart assumed. • HP flaring from unplanned field shutdown events (Type 1 and 2 events) up to ~1200 MMscf per year

Stage	Emission Source	Description
		• HP flaring from unplanned equipment trips up to ~220 MMscf per year e.g. compression equipment trips • LP flaring from unplanned field shutdown events ~14 MMscf per year • Acid Gas Flare only operational when thermal oxidiser is offline when reservoir CO_2 is vented via the acid gas flare. Unplanned outages of the thermal oxidiser (when the acid gas flare would be operational) are estimated to be up to 30 days per year (10 days total for Type 1[1] shutdowns and 20 days total for Type 2[2] shutdowns)
	Vent	• Mid case 18% reservoir CO_2 • Reservoir processed via thermal oxidiser during normal operations; otherwise processed via the acid gas flare during unplanned outages of the thermal oxidiser.
	Diesel	• GTGs to run on diesel for 35 days every 4 years during planned shutdowns. Essential diesel generators also to be operational for the duration of planned shutdowns. • Essential diesel generator testing 10 mins per week. • Emergency diesel generator testing 40 mins per week. • Fire water pump testing (diesel fuel) for 30 mins per week • Inert gas generator (diesel fuel) operation for 100 hours per year • GTGs to run on diesel during fuel gas system unplanned outages or GTG trips for up to 108 hours per year
	Fugitives	• Fugitives from natural gas processing: number of offshore facilities (1) and the H&MB gas compositions for each operating mode. • Fugitives from condensate offloading: assumed 158,111 tonnes of condensate offloaded in the first year; 360,370 t/y condensate offloaded during HP mode; and 367556 t/y for the remaining. • Fugitives from produced water: forecast PW flowrate of 22 m^3/h produced water on average during HP and 36.7 m^3/h PW during LP/LLP. • Fugitives from pipeline transmission (including GEP): the total subsea flowline length of ~34 km while the GEP length is 285 km (Commonwealth waters section). • Fugitives from refrigerant use: Refrigerant leakage emissions from HVAC chillers and refrigeration, operated full year; HVAC chiller assumed to use 2.2 t of R134a, and refrigeration to use 0.8 kg of R134a, 0.4 kg of R404a and 3 kg of R452A.
Indirect Scope 3 Emissions		
All Activity stages	Business travel	Transportation of employees for business related activities. Limited to travel associated with travel of operations workforce to and from site during hookup & commissioning, steady state operations and maintenance. Includes for allocation of flights to Darwin (return) and transport from Darwin to the FPSO (by helicopter and support vessels). GHG emissions have been estimated using vessel fuel consumption rates estimated by contractors, internal helicopter fuel consumption data and emission factors from the National Greenhouse and Energy Reporting Scheme.
	Support vessels	A number of vessels will undertake activities during hook up and commissioning through initial start up to steady state operations. GHG emissions estimates includes mobilisation, transit and working activities (demobilisation excluded) and is based on the number of planned vessels (refer Section 2.3) consuming marine diesel fuel. Key activity assumptions: • Supply vessel mobilisation once every 5 days during CSU, every 14 days during steady state. • Assumed mobilisation/transit speed is 9 knots. • Infield subsea inspection campaigns twice yearly up to 21 days[50]

[50] *Includes mobilisation and transit time to OA*

Stage	Emission Source	Description
		• Subsea intervention campaign once every two years up to 28 days[50] • GEP inspections once every 3 years for up to 51 days[50] • Well intervention activities are assumed to be conducted every 2 years using light well intervention vessel, up to 34 days per campaign • 21 helicopter flights per week during CSU; 5 helicopter flights per week during steady state
	Operations at DLNG	Processed gas is imported to DLNG via the Barossa GEP from the Barossa FPSO. The primary activity at the DLNG Plant is the liquefaction of natural gas, to produce LNG. Key DLNG GHG emissions assumptions applied to forecast LNG production and reservoir CO_2 (~6%) feed gas disposal, as supplied by DLNG to the Barossa JV: • LNG production: 0.00537549 tCO_2-e per GJ LNG produced • Electricity generation: 0.854 tCO_2-e per MWh electricity produced • Reservoir CO_2: 1 tCO_2-e per tonne CO_2
	Transport of condensate[3] & LNG[4]	• Potential furthest sales destination for condensate is Korea, with approximately 6 offtakes via offtake tankers per year from the FPSO, travel duration of 10 days, at 35m^3 day marine diesel fuel consumption. • Potential furthest sales destination for LNG is North China, with approximately 52 offtakes via LNG carriers per year from DLNG, duration of 10 days, at 75m^3/day LNG fuel consumption.

	Customer Use of Condensate[5] & LNG[6]	• Condensate end use assumptions:
		  • ~60% used for petrochemical;
		  • ~35% for refining;
		  • ~5% for power generation (full combustion).
		• LNG end use assumptions[7]:
		  • 100% power generation (full combustion).

[1] Type 1 unplanned shutdowns - shorter duration shutdown events, which trips Powergen and autostarts Essential Generator. No FPSO topsides blowdown to flare, 10 events assumed to occur annually years 1-3 with lower facility reliability; 7 events assumed to occur annually years 4-25 with improved facility reliability.

[2] Type 2 unplanned shutdowns - longer duration shutdown events resulting topsides blowdown to flare, including restart flaring and diesel requirements. 4 events assumed to occur annually years 1-3 with lower facility reliability; 3 events assumed to occur annually years 4-25 with higher facility reliability.

[3] Condensate transport emissions factor: NGER MD Section 2.41 Method 1

[4] LNG transport emissions factor: NGER MD Section 2.41 Method 1

[5] Condensate product use emissions factors:

Petrochemical - DCCEEW Safeguard Mechanism default emissions Intensity for polyethylene, 0.125 t CO_2-e/t pelletised PE. A factor of 1.5 applied to convert PE to pelletised PE. Plastic-oil factor taken from Lulea University of Technology, Gervet (2007)

Refining - DCCEEW Safeguard Mechanism default emissions Intensity for Petroleum refining, 0.138 tCO_2e/kL

Power generation combustion - NGER MD Section 2.48A Method 1

[6] LNG product use emissions factor: NGER MD Section 2.20 Method 1

[7] Emissions from regasification and gas transport to power generation facility excluded from LNG end use emissions calculation

6.3.2.1.1 Direct – Scope 1 Emissions

Table 6-16 provides a summary of the Scope 1 (direct emissions) for the 25 year lifecycle of Barossa production operations for commissioning and steady state operations.

Table 6-16: Estimated Direct (Scope 1) emissions for the 25 year lifecycle of Barossa production operations

Production Operations	Total Scope 1 emissions ($MtCO_2$-e)	
	Before reservoir emissions offset	Net-zero reservoir emissions[1]
FPSO arrival, hookup & cold-commissioning and Initial Start-up to Steady State (total)	**1.10**	**1.10[2]**
Fuel (diesel)	*0.01*	*0.01*

Fuel (gas)	*0.06*	*0.06*
Flaring (initial start-up to steady state only)	*1.03*	*1.03*
Steady State Operations and maintenance (total)	**53.14**	**18.35**
Fuel (gas)	*11.02*	*11.02*
Flare	*6.68*	*6.68*
Vent (reservoir CO_2)	*34.79*	*0*
Fuel (diesel)	*0.08*	*0.08*
Fugitives	*0.57*	*0.57*

[1] In compliance with NGER and the Safeguard Mechanism, Barossa reservoir emissions will be net-zero.

[2] Reservoir emissions during initial start-up will be offset per NGER and Safeguard Mechanism requirements

Figure 6-4 provides annual estimates of direct (Scope 1) emissions over the 25-year lifecycle of Barossa production operations. Total estimated direct (Scope 1) emissions for the 5-year period for this EP are 12.2 $MtCO_2$-e) (before reservoir emissions offset). Note that actual reservoir emissions will be net-zero in accordance with Safeguard Mechanism obligations.

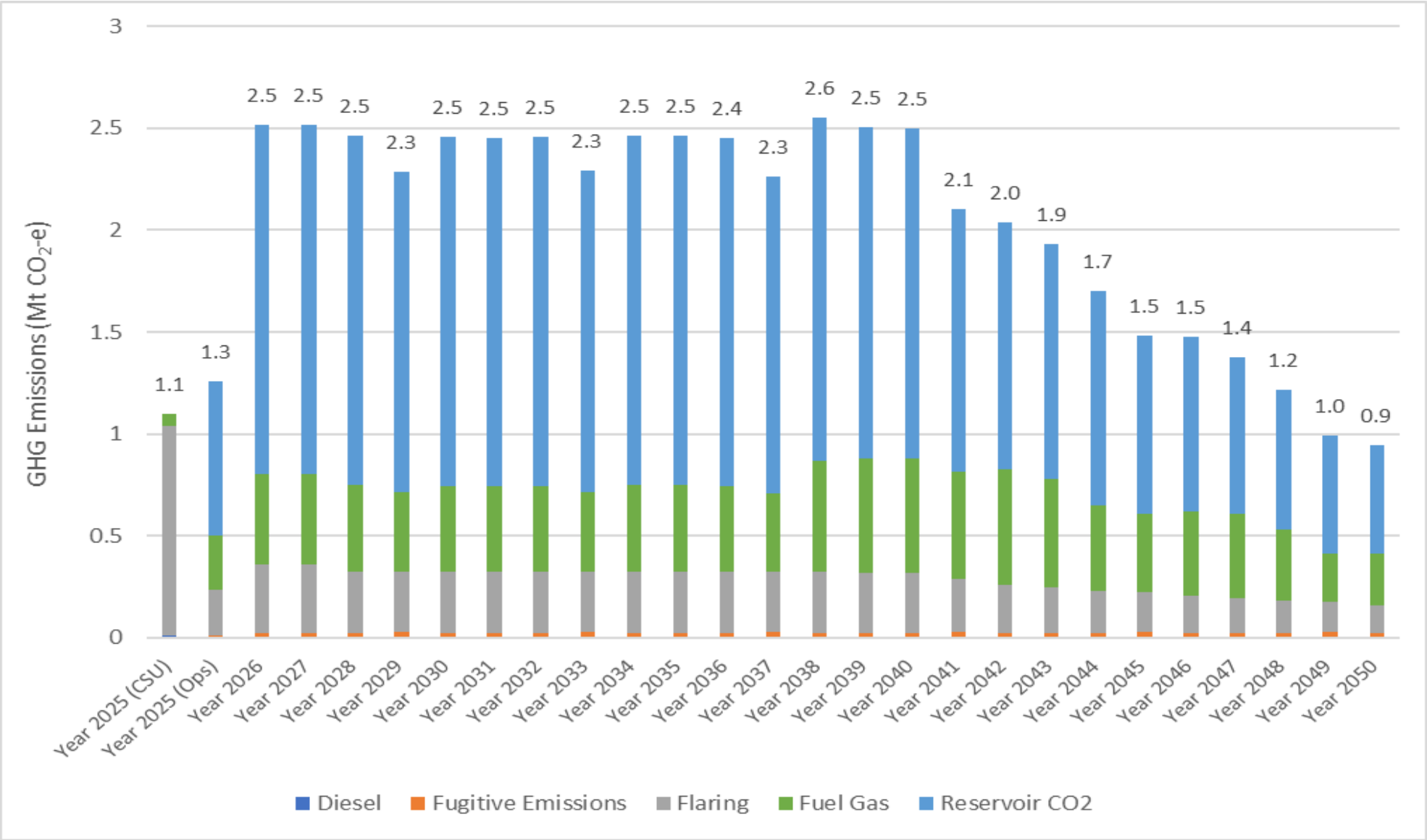

Figure 6-4: Estimated annual direct (Scope 1) emissions for the 25 year lifecycle of Barossa production operations (before reservoir emissions offset. Note that actual reservoir emissions will be net-zero in accordance with Safeguard Mechanism obligations).

6.3.2.1.2 Indirect - Scope 2 emissions

The Barossa FPSO generates its own power, heating and cooling requirements (captured in direct emissions) therefore there will be no Scope 2 emissions associated with the Activity.

6.3.2.1.3 Indirect - Scope 3 emissions

Australian and International carbon accounting rules mean each country and each emitter is responsible for reporting their own Scope 1 and Scope 2 emissions. The NGER Act does not require reporting of Indirect (Scope 3) Emissions. To support the evaluation of potential risks and impacts of the Activity, an estimate of the indirect (Scope 3) emissions is provided in Table 6-17 including emissions generated during HUC and initial start-up.

Table 6-17: Indirect (Scope 3) emissions estimates for the 25 year lifecycle of Barossa production operations

Subcategory	Scope 3 Emissions ($MtCO_2$-e)
Business Travel	0.07
Support vessels	0.1
Operations at DLNG	32.29
Transport and customer use of LNG	186.53
Further processing, transport and customer use of condensate	1.99
Total	**220.98**

Annual indirect (Scope 3) emissions over the 25-year lifecycle of Barossa production operations are provided in Figure 6-5. Total estimated indirect (Scope 3) emissions for the 5-year period for this EP are 49.8 $MtCO_2$-e).

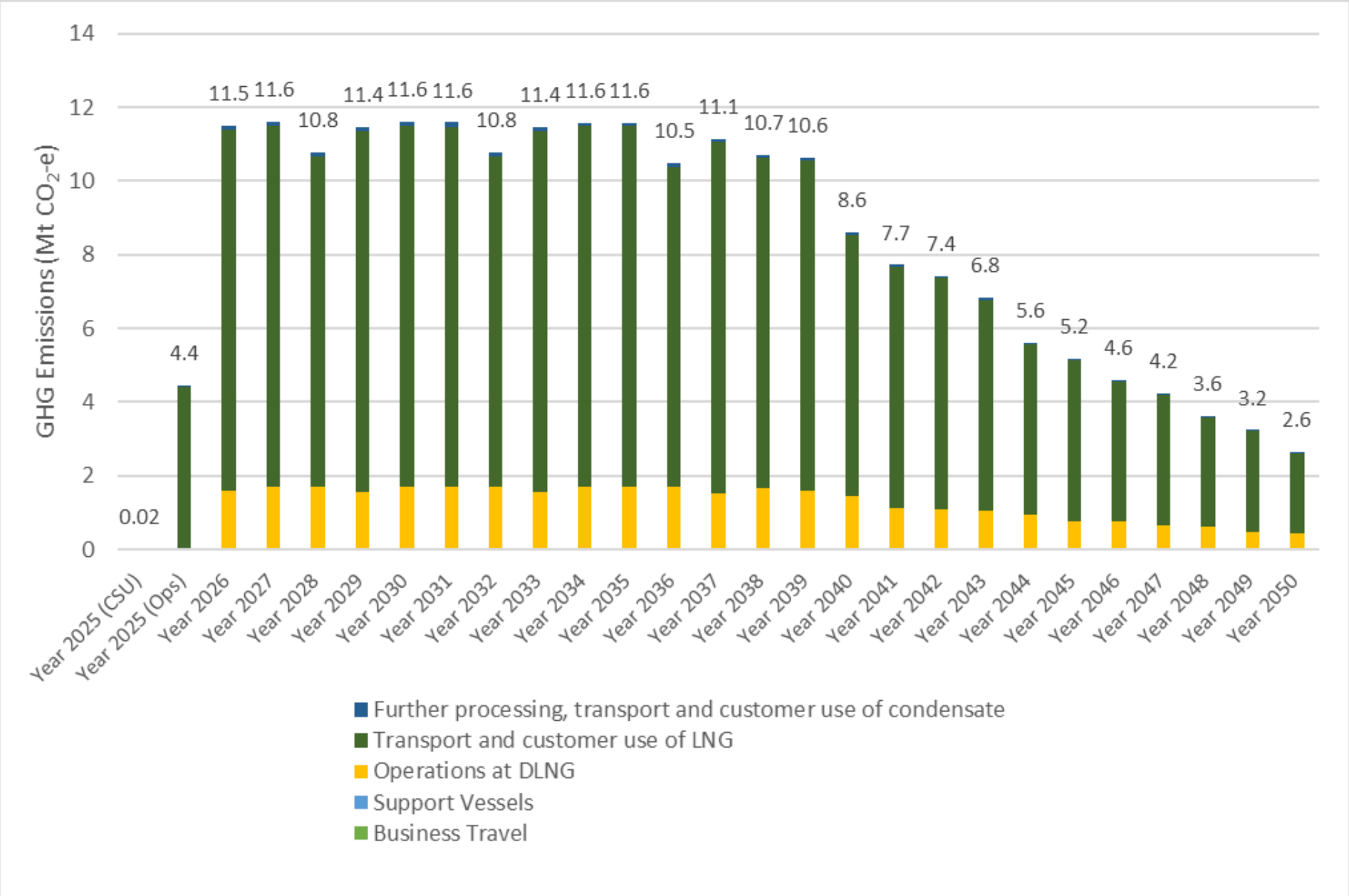

Figure 6-5: Estimated annual indirect (Scope 3) emissions for the 25-year lifecycle of Barossa production operations

The Scope 1 and 2 GHG emissions from the DLNG facility (owned by a separate joint venture to the Barossa Development) are indirect (Scope 3) emissions for the Activity. DLNG facility GHG emissions from processing of Barossa feed gas will be approved and regulated under the Safeguard Mechanism and other applicable Commonwealth regulatory frameworks (Section 6.3.2.7). GHG emissions from the DLNG facility are not administered by NOPSEMA. The Barossa Joint Venture has a contractual obligation to reimburse DLNG for costs incurred for acquiring carbon credits required to offset DLNG's emissions liability as a result of processing Barossa gas at the Darwin LNG plant.

6.3.2.1.4 Total emissions (all scopes)

An overview of direct and indirect emissions from the Activity is provided in Table 6-18. All estimates are sensitive to production rate, which is dependent on reservoir and process performance, and will change over the life of the facility, as shown in Figure 6-6.

Estimates have been provided for the 'gross' (before reservoir emissions offset) and 'net' (net-zero reservoir emissions) GHG emissions of the Activity. Consistent with the NGER Act and the Safeguard Mechanism, it is a compliance obligation for all reservoir emissions to be net-zero. Therefore, the most meaningful and appropriate representation of the contribution of this Activity to total GHG emissions is the 'net-zero reservoir emissions' figures.

Table 6-18: Total emissions estimate for the 25-year lifecycle of Production Operations

Barossa Production Operations	Lifecycle Emissions ($MtCO_2$-e)	
	Before reservoir emissions offset	Net-zero reservoir emissions
Direct - Scope 1	**53.14**	**18.35**[1]
Indirect - Scope 3	**220.98**	**220.98**
Total	**274.12**	**239.33**

[1] *Reservoir emissions during initial start-up will be offset per Safeguard Mechanism requirements*

Annual total estimated emissions (Scope 1 and Scope 3) for the 25-year lifecycle of Barossa production operations are provided in Figure 6-6. Total estimated emissions (Scope 1 and Scope 3) for the 5-year period for this EP are 61.9 $MtCO_2$-e).

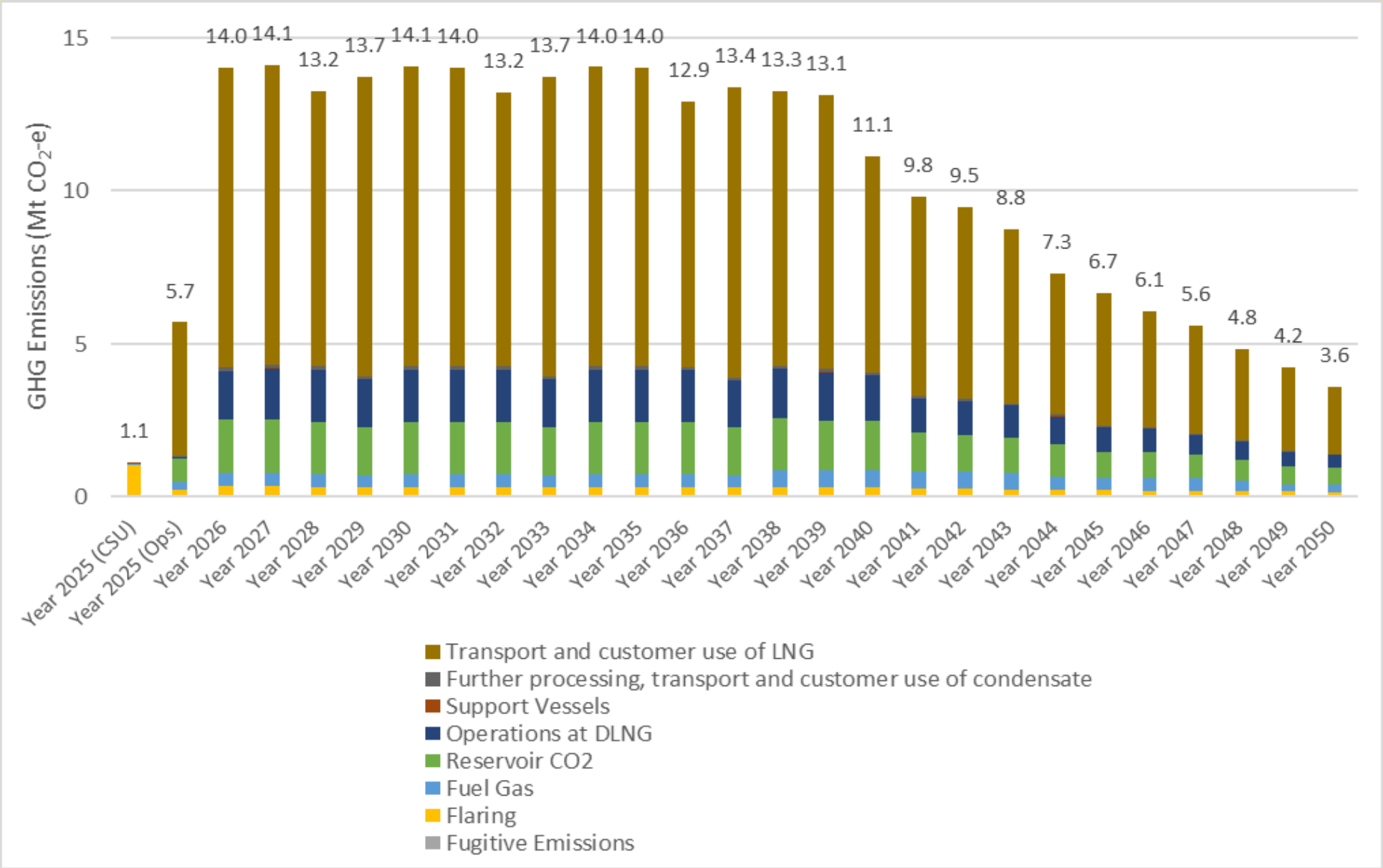

Figure 6-6: Estimated annual total emissions (Scope 1 and Scope 3) for the 25-year lifecycle of Barossa production operations

6.3.2.2 The role of natural gas in the energy transition

Natural gas plays a critical role in meeting ever growing global energy demand as a versatile and abundant energy source. The world needs gas for electricity generation, manufacturing, agriculture, and many other everyday products. Importantly, gas has many more uses than simply generating electricity. This includes heating and feedstock for making things like fertilisers, pharmaceuticals, polymers and chemicals, steel, bricks and cement.

Gas plays a critical role in the transition to a lower carbon future, able to flexibly fill market supply gaps as alternative energy sources emerge. As the world looks to decarbonise and builds additional renewable energy sources, natural gas will play a critical role in responding to fluctuations in supply, by providing on-demand firming power generation, ensuring continuous and safe operations (AEMO 2024, IEA 2023c).

Natural gas supply is a necessary component in the energy security of Australia and Asia and will be required to provide affordable and reliable energy while the world transitions to lower carbon alternatives. This is recognised in the Australian Government's Future Gas Strategy which emphasised that "under all credible net zero scenarios, natural gas is needed through to 2050 and beyond" (Department of Industry, Science and Resources, 2024). The IEA has acknowledged that "No new long-lead time upstream oil and gas projects are needed in the NZE Scenario, neither are new coal mines, mine extensions or new unabated coal plants. Nonetheless, continued investment is required in existing oil and gas assets and already approved projects. Sequencing the decline of fossil fuel supply investment and the increase in clean energy investment is vital if damaging price spikes or supply gluts are to be avoided" (IEA 2023b). Santos has signed binding long-term LNG Supply and Purchase Agreements with our customers, including for Barossa. These contracts demonstrate the ongoing demand for LNG from the Barossa project.

Under a range of different potential future modelled scenarios where global temperature increase is limited to 1.5 degrees Celsius, natural gas remains an integral part of the energy mix out to 2050. The International Energy Agency's (IEA) Net Zero by 2050 scenario assumes world demand of about 31,000 petajoules of gas per year in 2050, of which almost 60 per cent would be served with abated gas through carbon capture and storage (IEA, 2023b). Modelling conducted by the Network for Greening the Financial System (NGFS) also predicts gas demand will be ongoing through 2050, with a global demand of about 33,500 PJ forecast in their Net Zero 2050 scenario (NGFS, 2024).

An analysis of 97 United Nations Intergovernmental Panel on Climate Change (IPCC) scenarios which limit global temperature increase to 1.5 degrees with low or no overshoot indicates ongoing demand for gas to 2050, particularly in the Asia-Pacific region where median gas demand in 2050 is comparable with demand in 2020 (IPCC, 2022). These almost 100 scenarios, all aligned to the temperature goals of the Paris Agreement, show a range of gas demand profiles, however all include a continued role for gas in the global energy mix out to 2050.

With respect to global gas demand, the median of the IPCC scenarios shown in Figure 6-7 indicates flat to decreasing demand from 2020 through to 2040. This demand then remains relatively flat to 2050, with the world continuing to demand more than 76EJ of gas in 2050.

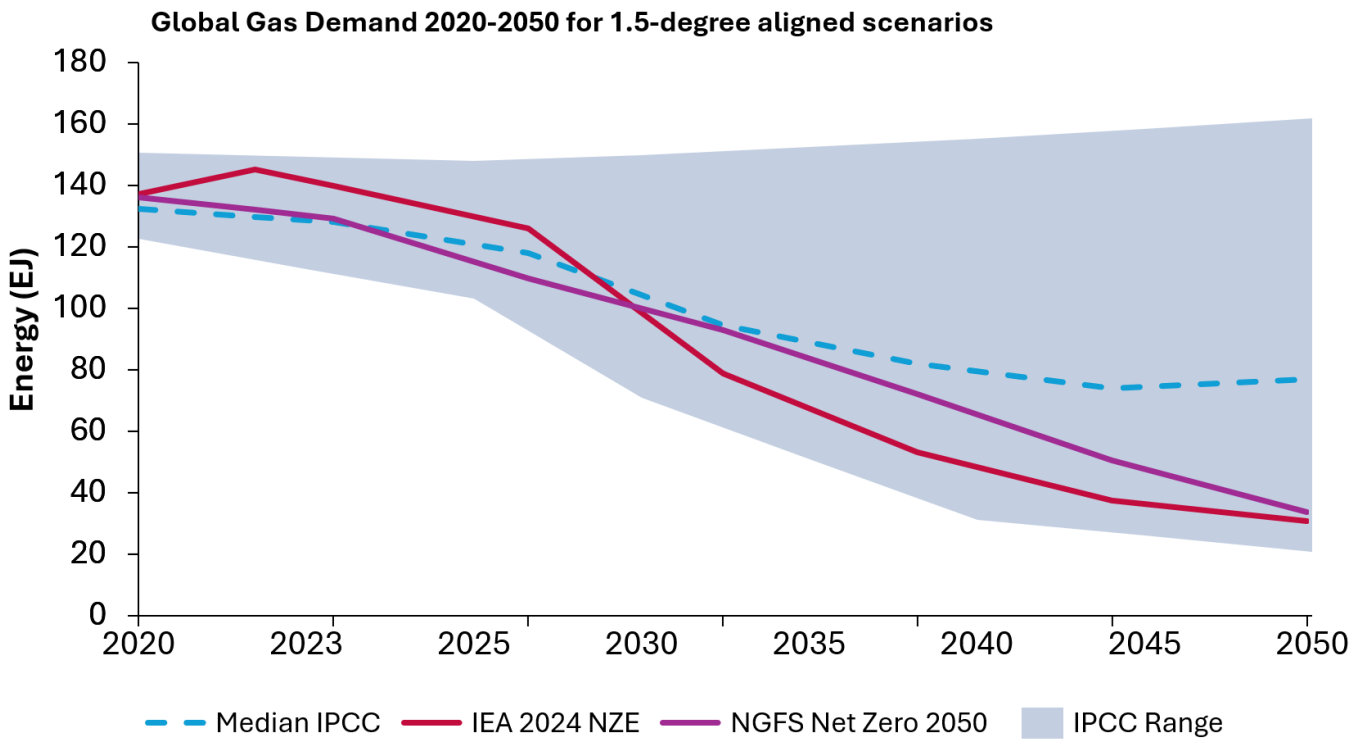

Figure 6-7: Global Gas Demand 2020-2050 for 1.5 degrees Celsius aligned scenarios

In relation to gas demand for the Asia-Pacific region per Figure 6-8, the median of the IPCC scenarios shows gas demand increasing between 2020 and 2030. From 2030 to 2050 there is a subsequent slight decline in gas demand, however 2050 demand remains at 28EJ, an approximately 7% decline from 2020 demand. Gas demand for the Asia-Pacific region is also modelled in the NGFS Net Zero 2050 scenario, showing a demand in 2050 of about a third of that in 2020 (NGFS, 2024). The Australian Government's Future Gas Strategy reiterates the importance of natural gas to our region, noting that "Continued supply of LNG can reduce the carbon intensity of our region's energy mix" (Department of Industry, Science and Resources, 2024).

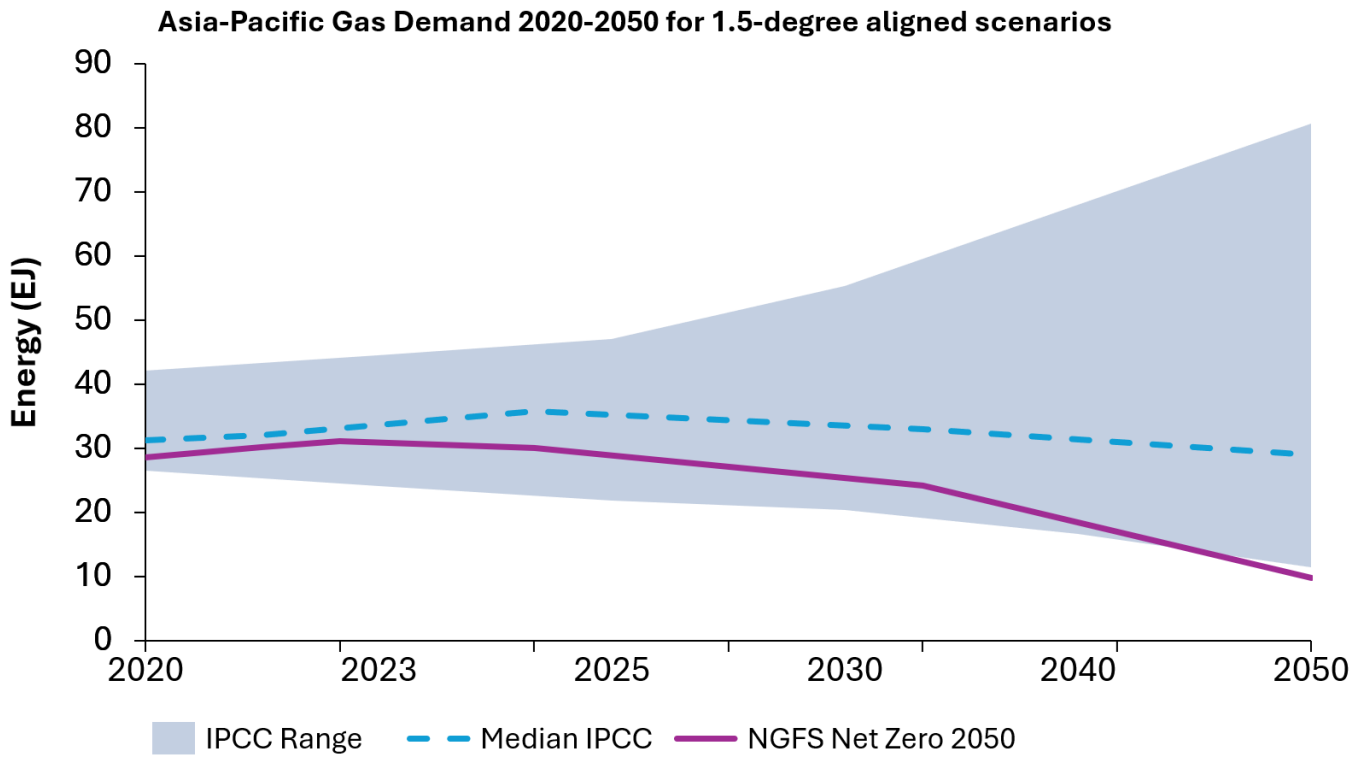

Figure 6-8: Asia-Pacific Gas Demand 2020-2050 for 1.5-degree aligned scenarios

In its Emissions from Oil and Gas Operations in Net Zero Transitions report (IEA 2023c), the IEA notes that oil and gas operations account for approximately 15% of total energy related emissions globally, identifies and advocates for oil and gas producers to abate those emissions and analyses broader implications for the sector through the energy transition which includes the need for increased investment in lower carbon energy. This EP demonstrates that the application of management and abatement measures reduce GHG emissions associated with the Activity to acceptable and ALARP levels.

Given that natural gas has a continued role under a range of Paris-aligned scenarios, GHG emissions associated with the Activity are able to be accommodated and managed under Australia's carbon budget and, internationally, under the carbon budget of Paris Agreement signatories and countries with mid-century net-zero commitments, for which further information is set out below.

It is acknowledged that information produced by the IPCC, the IEA and other organisations related to climate scenarios and the energy transition are subject to change. Santos will stay abreast of such changes and apply Environment Plan MoC processes (Section 8.5.2).

6.3.2.3 Barossa production operations in context

The Activity forms part of the Barossa Development which was approved by NOPSEMA in 2018 via acceptance of the Barossa Development OPP, which enabled the granting of a production licence by NOPTA, conferring property rights to the gas and condensate resource. The production licence was granted in 2020.

The Barossa Gas project will play an important role in providing natural gas to a global market with customers having already contracted to purchase the gas for ten years with extension options. Barossa's proximity to Asia provides a significant advantage over LNG supply from alternative sources, with shipping emissions associated with supply to Asian customers at least 50 per cent lower on a per-million tonnes LNG basis compared to Middle East, North American East, and Russian West producers (Wood Mackenzie LNG Emissions Tool, 2024).

Regardless of whether or not LNG is produced from Barossa gas, Barossa customers would still consume the same amount of LNG to meet their energy needs. If the gas were sourced from another LNG project elsewhere in the world such as the Middle East, the United States, or Australia's west or east coasts, then the shipping distances would be significantly greater. For example, shipping time from Darwin to Japan is approximately eight days as compared with approximately 16 days from the Middle East and approximately 23 days from the East Coast of America. Over the life of the Barossa Project, transport emissions are estimated at around 1.5MtCO_2-e, compared with an estimated 3MtCO_2-e from the Middle East and an estimated 4.3MtCO_2-e for the United States of America. By leveraging its strategic location and reduced shipping distances, Barossa and DLNG offer a meaningful advantage in minimising upstream carbon emissions for its customers.

Production operations are necessary to exercise the Barossa joint venture's property rights to the condensate and gas resource and were clearly anticipated and contemplated when the OPP was accepted by NOPSEMA and when the production licence was subsequently granted by NOPTA. On the basis of these approvals and property rights, Santos – in its capacity as a Barossa titleholder – entered a long-term Sales and Purchase Agreement (SPA), which is a contractual commitment for the supply and purchase of 1.5 million tonnes per annum of equity LNG from Barossa for a period of ten years with extension options, at a price based on the Platts Japan Korea Marker (JKM). Santos also has options to pursue further LNG transactions through commercial flexibilities negotiated with Diamond Gas International (subsidiary of Mitsubishi). SK and JERA will take their equity LNG shares into their global energy portfolios. Energy security is a critical factor for countries such as Japan and Korea, with customers seeking both title to LNG reserves and long-term contracts to ensure they can meet their supply needs well into the future. Therefore, it is reasonable to assume that, since 2020, Japan and Korea would have factored Barossa gas into their energy outlooks through to at least 2035 and potentially, beyond. Without Barossa LNG supply, it is reasonable to assume both Japan and Korea would need to obtain title to gas reserves and secure LNG supply from other sources to meet their future demand profiles. This is in part because a considerable proportion of LNG demand in these countries is for direct heating of buildings and high temperature heating for manufacturing and chemicals feedstock, not just thermal power generation.

6.3.2.4 Emissions comparisons

Climate change is a global issue being managed by the international community of states under the United Nations Framework Convention on Climate Change (UNFCCC). Australia is a signatory to the UNFCCC and the Paris Agreement. Under the Paris Agreement, Australia must submit emissions reduction commitments known as Nationally Determined Contributions (NDCs). These-commitments constitute Australia's contribution to global climate efforts and to meeting the temperature objectives of the Paris Agreement (to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit temperature increase to 1.5°C). Australia has legislated various measures to ensure these commitments are met. This legislation includes the Safeguard Mechanism which will require the Barossa Gas Project to be net-zero reservoir emissions from day one and to have an emissions baseline and reduction trajectory set by Australia's CER.

The international framework has been developed to facilitate an orderly approach to what is a global problem. The nature, quantity and timeframe of each country's contribution and the pathways to achieve UNFCCC obligations vary widely, including having regard to the particular circumstances of each country. This framework recognises, and is premised on, the fact that climate change is a global issue – there is no correlation between where GHG emissions are released and where climate change impacts are felt. For this reason, Australia sets and reports against its emissions reduction targets in 'net' terms, not by individual sectors or projects. The Australian Government is aware of planned production in the Barossa gas field. It has granted property rights for the production of gas from the Barossa field through the award of a production licence and has acknowledged the production of gas from the Barossa field in its latest emissions projections.

In this context, and at NOPSEMA's request, Santos has sought to contextualise the contribution of emissions from the Activity in this EP relative to Australian and global net carbon budgets.

The contribution of estimated annual average CO_2-e emissions from the Activity to net carbon budgets nationally and globally is presented in Table 6-19.

Australian Carbon Budget

As reflected in Australia's NDC under the Paris Agreement and the Climate Change Act 2022, Australia is committed to a single year target to reduce greenhouse gas emissions to 43% below 2005 levels by 2030 and net-zero by 2050 – see Section 6.3.2.6.2 for a description of Australia's greenhouse gas emissions framework.

Based on a 43% reduction by 2030, the net carbon budget for this period is 4,377 Mt CO_2-e (DCCEEW, 2024q). Assuming a further linear decline between 2030 and 2050 (the full activity lifecycle for this EP), this creates a net carbon budget of 7262 Mt CO_2-e. The net carbon budget comprises gross economy wide emissions (additions) less total carbon sequestration volumes (subtractions).

Global Carbon Budget

The United Nations IPCC in its Sixth Assessment Report forecast the remaining net carbon budgets (from 1 January 2020) for a 50% likelihood to limit global warming to a specified range of temperature increase based on pre-industrialised levels (i.e. since 1850-1900) (IPCC, 2022). Section 6.3.2.6.1 describes the international framework for management of greenhouse gas emissions.

Global Surface Temperature Change	Estimated carbon budgets (50th percentile) $MtCO_2$
1.5°C	500,000
2.0˚C	1,350,000

Table 6-19: Barossa production operations net greenhouse gas emissions in context

Stage	Lifecycle gross emissions ($MtCO_2e$)	Lifecycle net emissions ($MtCO_2e$)	Barossa Production Operations Net GHG Emissions Contribution (%)		
			Australian carbon budget (Mt CO_2e)[1]	Global carbon budget - 1.5° C ($MtCO_2e$)[1]	Global carbon budget - 2.0° C ($MtCO_2e$)[1]
	Scope 1				
Operations and maintenance[2]	53.14	18.35	0.3%	0.004%	0.001%
	Scope 3				
Operations at DLNG and support operations	32.46	32.46	0.4%	0.006%	0.002%
Product transport and end use	188.52	188.52	NA[3]	0.04%	0.014%
Totals	**274.12**	**239.33**	**0.7%[4]**	**0.05%**	**0.02%**

[1] Out to 2050
[2] Net-zero reservoir emissions
[3] End-user combustion will occur outside Australia
[4] Excludes end-user combustion emissions that will occur outside Australia

As set out in Section 6.3.2.1.4, although estimates have been provided for 'gross' and 'net' GHG emissions of the Activity for completeness, regard should be had to the 'net-zero reservoir emissions' when assessing the true contribution of the Activity to Australia's and the globe's net carbon budgets, given that it is a compliance obligation

for reservoir emissions to be net-zero in accordance with the NGER Act and the Safeguard Mechanism, administered by the Clean Energy Regulator.

Net GHG emissions (within Australia) from Barossa production operations represent 0.7% of Australia's net carbon budget to 2050.

Net GHG emissions from Barossa Production Operations represent 0.05% and 0.02% respectively of net global carbon budgets under 1.5˚C and 2˚C temperature increase scenarios.

At 0.7% of Australia's net carbon budget to 2050, and 0.05% and 0.02% of net global carbon budgets for 1.5˚C and 2˚C temperature increases respectively, the net GHG emissions from Barossa production operations comprise a nominal amount in the overall scheme of the national and international carbon budgets and will not materially or substantially contribute to Australia's GHG emissions or global emissions levels. In any event, carbon budgets are made up of both additions and subtractions to cumulative GHG emissions. Accordingly, these are theoretical calculations for indicative purposes only.

6.3.2.5 Risks of climate change to the Australian environment

The IPCC (2021) have reaffirmed the near-linear relationship between cumulative anthropogenic CO_2 emissions and global warming, highlighting the basis for setting net-zero emissions targets. It is known that the physical impacts of climate change on environmental receptors are the result of global GHG emissions from a multitude of sources (minus the GHG sinks) that have accumulated in the atmosphere (IPCC, 2018).

The impacts on the climate cannot be attributed to one specific sector or activity. In the context of evaluating potential impacts and risks that may be associated with GHG emissions from all sources globally, including from this Activity, this EP has considered broader climate change issues. This section outlines the potential environmental impacts that could occur due to global climate change. Santos, in its capacity as an independent company, recognises the scientific consensus on climate change assessed by the IPCC.

The IPCC is the United Nations body for assessing the science related to climate change and finalised the Sixth Assessment Report (AR6) in 2023. This consists of three Working Group contributions and a Synthesis Report. A summary of outcomes of the working group's contributions comprises a range of matters, which amongst others include:

- The AR6 Working Group I (AR6-WG1) report stated that it is unequivocal that there is human-induced warming. It also stated that increased atmospheric carbon dioxide (CO_2) levels, generated by human activity, are the largest driver of warming over the longer term, and that there are a range of factors, including emissions of methane, which increase warming in the short-term.
- The AR6-Working Group II report stated that human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability. It stated that global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans. The report noted that societal choices and actions implemented in the next decade will determine the extent to which medium- and long-term pathways will deliver climate resilient development.
- The AR6 Working Group III (AR6-WG3) report provided an updated global assessment of climate change mitigation progress and pledges and examined the sources of global emissions. It explained developments in emissions reduction and mitigation efforts and assessed the impact of national climate pledges in relation to long-term emissions goals. More than 2,000 quantitative emissions pathways were submitted to the IPCC, of which 1,202 scenarios included sufficient information for assessing the associated warming. The report found that there are many pathways in the literature that likely limit global warming to 2°C with no overshoot, or to 1.5°C with limited overshoot. These variations occur because, while climate science is able to calculate a 'carbon budget' of net emissions before any particular temperature outcome is reached, the allocation of this budget between different human activities requires additional judgements about, for example, technology, economics, consumer preferences and policy choices.

The State of the Climate 2024 (Commonwealth of Australia, 2024) states that Australia is projected to experience the following in the coming decades:

- continued warming, with more extremely hot days and fewer extremely cool days.
- a further decrease in cool season rainfall across many regions of the south and east.
- continued drying in the south-west of Western Australia, especially during winter and spring.
- likely increases in the average duration of drought and aridity in regions within the south and east.
- a longer fire season for the south and east, and an increase in the number of dangerous fire weather days

- more intense short-duration heavy rainfall events, even in regions where the average rainfall decreases or stays the same.
- fewer tropical cyclones, but a greater proportion projected to be of high intensity, with ongoing large variations from year to year. The intensity of rainfall associated with tropical cyclones is also expected to increase and, combined with higher sea levels, is likely to amplify the impacts from those tropical cyclones that do occur.
- fewer east coast lows on average, particularly during the cooler months of the year
- ongoing sea level rise through this century and beyond, at a rate that varies by region. Recent research on potential ice loss from the Antarctic ice sheet suggests that a scenario of larger and more rapid sea level rise can't be ruled out.
- more frequent extreme sea levels linked to coastal inundation and coastal erosion. For most of the Australian coast, extreme sea levels that had a probability of occurring once in a hundred years are projected to become an annual event by the end of this century with lower emissions, and by the mid-21st century for higher emissions.
- continued warming and acidification of surrounding oceans with consequent impacts on biodiversity and ecosystems.
- increased and longer-lasting marine heatwaves, which will further stress marine environments, such as kelp forests, and increase the likelihood of more frequent and severe bleaching events in coral reefs around Australia, including the Great Barrier Reef and Ningaloo Reef.
- an increase in the risk of natural disasters from extreme weather, including 'compound extremes', where multiple extreme events occur together or in sequence, thus compounding their impacts.

The report also provides the following updated projections of Australia's average temperature over the next two decades:

- the average temperature of each future year is now expected to be warmer than any year prior to the commencement of human-caused climate change.
- ongoing climate variability means each year will not necessarily be hotter than the last, but the underlying probabilities are changing. This leads to less chance of cool years and a greater chance of repeatedly breaking Australia's record annual average temperature (e.g. record set in 2005 was subsequently broken in 2013 and then again in 2019).
- while the previous decade was warmer than any other decade in the 20th century, it is likely to be the coolest decade for the 21st century.
- the average temperature of the next 20 years is virtually certain to be warmer than the average of the past 20 years
- the amount of climate change expected in the next decade is similar under all plausible global emissions scenarios. However, by the mid-21st century, higher ongoing emissions of greenhouse gases will lead to greater warming and associated impacts, while lower emissions will lead to less warming and fewer impacts
- warming is generally expected to be greater in the interior of Australia than near the coast.

Ecosystems are particularly susceptible to adverse effects of climate change. The 'loss of climatic habitat caused by anthropogenic emissions of greenhouse gases' has been listed as a key threatening process under the EPBC Act (DCCEEW, 2021), consisting of reductions in the bioclimatic range within which a given species or ecological community exists due to human induced emissions (DCCEEW, 2021). The process is considered to have a continental distribution, including both terrestrial and marine areas. Ecosystems in which the process occurs include: alpine habitats, coral reefs, wetlands and coastal ecosystems, polar communities, tropical forests, temperate forests, and arid and semi-arid environments (DCCEEW, 2021).

Redistribution and reorganisation of natural systems, driven by climate change, is a major threat to biodiversity (Chapman *et al*., 2020). A report by Australia's Biodiversity and Climate Change Advisory Group summarises the potential impacts of climate change to marine and terrestrial species, habitats and ecosystems across Australia (Steffen *et al*., 2009).

Extensive modelling and monitoring studies over the last 20 years provide considerable evidence that global climate change is already affecting and will continue to affect species (Hoegh-Guldberg *et al*., 2018). However, these impacts are likely to be highly species-dependent and spatially variable. Climate change may not only change species distribution patterns but also life-history traits, such as migration patterns, reproductive seasonality and sex ratios.

Increases in fire regimes will impact Australian ecosystems, altering composition structure, habitat heterogeneity and ecosystem processes. Changes in climate variability and averages could also be important drivers of altered species interactions, both native and invasive species (Dunlop *et al*., 2012). Climate change could result in significant ecosystem shifts, as well as alterations to species ranges and abundances within those ecosystems (Hoegh-Guldberg *et al*., 2018).

Climate variability and change has been identified as a threat to some EPBC Act protected species in relevant conservation management plans and recovery plans, including marine turtles, mammals, sharks and seabirds and migratory shorebirds as per Table 3-13.

The North-west Marine Parks Network Management Plan 2018 (DNP, 2018a) identifies climate change as a pressure that may impact marine park values. The management plan states that “the impacts of climate change on the marine environment are complex and may include changes in sea temperature, sea level, ocean acidification, sea currents, increased storm frequency and intensity, species range extensions or local extinctions, all of which have the potential to impact on marine park values” (DNP, 2018a).

Within the Marine Bioregional Plan for the North-West Marine Region (NWMR) (DSEWPaC, 2012a), pressures related to climate change are assessed as ‘of potential concern’ for species of marine turtle, inshore dolphins, sawfish, sea snakes, whale shark, dugong, and seabird and shorebird, as well as the KEFs and shipwrecks known to occur in the NWMR.

Changes to climate can also result in impact to social receptors that have values which include the ecological receptors described above, including KEFs and AMPs. Climate change may also impact on the functions, interests or activities of other users which rely on these ecological values, including commercial and recreational fisheries and tourism. A temperature change of between 0.9°C to 2.0°C is forecast to reduce fisheries yield as the maximum catch potential around Australia by between 3% and 10% (IPCC 2023).

Impacts to cultural heritage sites and places of spiritual importance in coastal locations may also be experienced due to rising sea levels. Global mean sea level increased by 0.20 [0.15 to 0.25] m over the period 1901 to 2018, with a rate of rise that has accelerated since the 1960s to 3.7 [3.2 to 4.2] mm yr^{-1} for the period 2006 –2018. Human activities were very likely the main driver of observed global mean sea level rise since 1971 (IPCC, 2021).

6.3.2.6 Climate Change Management Frameworks

6.3.2.6.1 International greenhouse gas emissions framework

Paris Agreement (United Nations Framework Convention on Climate Change (UNFCCC, 2021))

The UNFCCC came into force in 1994 and comprises of 198 parties. The convention established a goal of preventing dangerous anthropogenic interference with the climate system. Subordinate treaties and agreements have been ratified by parties to the convention, including the Paris Agreement, which was agreed under the convention at COP21 in 2015 and has been endorsed by 195 parties. The Paris Agreement is currently the world's most comprehensive climate action agreement underpinned by broad international support.

One of the key aspects of the Paris Agreement (the agreement) is Article 2 which, in seeking to strengthen the global response to climate change, reaffirms the goal of limiting global temperature increase to well below 2°C, while pursuing efforts to limit the increase to 1.5°C. This was reaffirmed in December 2023 in the COP28 decision (UNFCCC 2023).

The Paris Agreement also calls on Parties to contribute to global efforts, in a nationally determined manner, taking into account the objectives of the Paris Agreement and their different national circumstances, pathways and approaches, to transition away from fossil fuels in energy systems is to be done in a just, orderly and equitable manner, accelerating action in this critical decade, so as to achieve net-zero by 2050 in keeping with the science (UNFCCC 2023).

The text also recognises that transitional fuels can play a role in facilitating the energy transition while ensuring energy security (UNFCCC 2023).

Australia is a signatory to the agreement. In support of meeting the aims of the agreement, the Australian Government has legislated a target of reducing emissions to 43% below 2005 levels by 2030 and committing to net-zero emissions by 2050 (refer to ‘Australia’s Nationally Determined Contributions’ below).

The Paris Agreement requires all parties to put forward their best efforts through "Nationally Determined Contributions (NDCs)" to reduce GHG emissions and to strengthen these efforts in the years ahead. The NDCs represent national action for each country individually. As such, countries will choose to implement their NDCs in a variety of ways, consistent with their domestic policies and strategies. Countries are required to transparently and regularly report their climate actions and support, including whether they have met or are on schedule to meet the goals per their NDCs. As at January 2025, there are 195 parties to the Paris Agreement that have put forward NDCs.

The participating Paris Agreement parties aim to reach global peaking of GHG emissions as soon as possible to achieve a climate-neutral world by 2050, recognising developing country parties' peaking emissions may occur later than developed countries. After the peak in GHG emissions, it is expected there will be rapid reductions in accordance with best available science, to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHG in the second half of this century, on the basis of equity and in the context of sustainable development and efforts to eradicate poverty (UNFCCC, 2021).

The convention recognises that to achieve the Paris Agreement's long-term goals, climate action will need to get more ambitious over time. To sustain this rising ambition, the agreement establishes a continuous improvement cycle through which countries plan and communicate their NDCs, then implement their plans, and finally review individual and collective progress to inform future planning and updates to their next NDCs. This process provides the foundation for countries to fully bring the objectives of the Paris Agreement to fruition (World Resources Institute, 2021).

Effective interaction between climate science and policy underpins the Paris Agreement. Scientific observations, research and assessment continue to inform the international climate regime, as well as national and regional climate policies. The United Nations climate change process, under the Paris Agreement, relies on scientific information about climate change.

This continuous improvement cycle supports the agreement's commitment to comprehensively take stock of collective progress every five years (global stocktake – Article 14 of the Paris Agreement), a key element of the process that is sometimes referred to as the agreement's ‘ambition mechanism’. The global stocktake process assesses the collective progress towards achieving the purpose of the agreement and its long-term goals, evaluating both the performance of countries in meeting their NDCs and contemporary climate and environmental scientific literature. The Intergovernmental Panel on Climate Change assesses the scientific, technical and socioeconomic information relevant for understanding the risk of human-induced climate change and prepares comprehensive assessment reports and special reports to support the global stocktake process.

The Paris Agreement is underpinned by the international environmental legal principle of common but differentiated responsibilities. The principle holds that all states are responsible for addressing global environmental degradation yet are not equally responsible. On the one hand, the principle balances the need for all countries to take responsibility for global environmental problems and, on the other hand, the need to recognise the wide differences in levels of economic development between countries. Australia, for example, has a more ambitious target than developing countries because of this principle.

The enhanced transparency framework established within the Paris Agreement (Article 13) requires that, starting in 2024, countries report transparently on actions taken and progress in climate change mitigation, adaptation measures and support provided or received. It also provides international procedures for reviewing submitted performance reports and contemporary climate and environmental scientific literature. The information gathered through the enhanced transparency framework is intended to then feed into five-yearly global stocktakes and review and updates to NDCs.

To facilitate implementation of the Paris Agreement, the Katowice climate change package (UNFCCC, 2018) sets out the essential procedures and mechanisms that bring the Paris Agreement into operation and contains operational guidance on:

- the information about domestic mitigation and other climate goals and activities that governments will provide in their NDCs
- how to communicate about efforts to adapt to climate impacts
- the rules for functioning of the transparency framework for action and support (referred to in Article 13 of the agreement), which will show what countries are doing about climate change
- the need to establish a committee to facilitate implementation of the Paris Agreement and promote compliance with the obligations undertaken under the agreement
- how to conduct the global stocktake (the first stocktake was in 2023) of overall progress towards the aims of the Paris Agreement
- how to assess progress on the development and transfer of technology
- how to provide advance information about financial support to developing countries and the process for establishing new targets on finance from 2025 onwards.

The Katowice package provides countries with detailed guidance for performing the continuous improvement cycle of the agreement, guidance on how to prepare their NDCs (clear and transparent information about how GHG emissions are calculated and timeframes for contributions commitments), and what types of information participating countries should share concerning adaptation priorities, plans and actions.

To inform further planning for meeting the global Paris Agreement targets, countries must review their efforts, individually and collectively. The review of individual countries' progress will aim to verify data quality and assess progress against each country's targets, while the global stocktake review will assess the collective progress toward the agreement's long-term goals and identify the remaining gaps, challenges and opportunities for further action. The agreement has also set up an expert committee focused on facilitating implementation and promoting compliance to help countries address barriers to implementation and further climate action.

The countries to which Barossa LNG and condensate will be exported are anticipated to report their associated GHG emissions from processing, refining and use of the Barossa LNG and condensate as their Scope 1 and 2 GHG emissions, either within the context of their own NDCs and associated emissions reduction policies and regulations, as parties to the Paris Agreement, or having regard to their mid-century net-zero commitments. These are described and accounted for in this EP within the indirect emissions estimates.

Australia's nationally determined contributions (United Nations Framework Convention on Climate Change, 2022)

Australia has ratified the Paris Agreement and has adopted NDCs that can be monitored and reported on as part of the five-year stocktake. At the Paris conference in 2016, Australia announced its first NDC to reduce GHG emissions to 26 to 28% below 2005 levels by 2030. Further commitments were made by the then elected government in 2021 to reach Net Zero Emissions (NZE) by 2050.

In May 2022, the Government announced a goal of reducing Australia's GHG emissions by 43% below 2005 levels by 2030 and reaffirmed Australia's commitment to NZE by 2050. This was lodged with the UNFCCC as an updated NDC as part of Australia's obligations under the Paris Agreement. The procedures around NDCs under the Paris Agreement (obligations to prepare, communicate and maintain NDCs) are legally binding though the NDCs themselves are not. Australia mainly focuses on Article 10, with a low-emissions technology-led approach. Australia's NDCs are implemented through schemes such as the Safeguard Mechanism and the Emissions Reduction Fund, in addition to continuous monitoring and focusing on alternatives to lower overall emissions. The *Climate Change Act 2022* (Cth) (Section 6.3.2.6.2) was subsequently enacted to enshrine into law Australia's 2030 emissions reduction target of 43% below 2005 levels.

Under the Paris Agreement, a country must update its NDC every 5 years. Australia's updated NDC is anticipated to be submitted ahead of COP30 in September 2025, and it is expected to include an emissions reduction target to 2035. Each new target is to be more ambitious than the last, to support the global goals under the Paris Agreement.

6.3.2.6.2 National greenhouse gas emissions framework

Australia has a well-established legislative framework under which certain GHG emissions from Barossa production operations will be regulated or managed to further Australia's Paris Agreement commitments. This includes:

- GHG emissions reporting under the *National Greenhouse and Energy Reporting Act 2007* (NGER Act) (Cth) and the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*
    - the Emissions Reduction Fund (Australian Carbon Credit Units Scheme)
    - the Safeguard Mechanism to keep net emissions below an established baseline and require net-zero reservoir emissions for new gas fields that feed LNG projects. The Safeguard Mechanism currently applies to facilities that emit more than 0.1 $MtCO_2$-e per annum.

Key elements of the mechanism include:

- Safeguard facilities must meet the reporting and record-keeping requirements of the NGER Act, including the Clean Energy Regulator's requirements for audits prior to baseline setting and annual audits for facilities that emit over 0.1 $MtCO_2$-e per annum. In its capacity as the Operator of the Barossa facility, Santos will report audited Scope 1 and 2 GHG emissions from Barossa in accordance with the NGER Act.
- If a safeguard facility is likely to exceed its baseline, the responsible emitter must act, including by purchasing and surrendering Australian Carbon Credit Units, to offset excess emissions.
- Penalties apply for non-compliance.

National Greenhouse and Energy Reporting Act

The NGER Act is a single national framework for reporting and disseminating company information about GHG emissions, energy production, energy consumption and other information otherwise specified under the legislation (DISER, 2022). The objectives of the NGER Act are to:

- inform government policy

- inform the Australian public
- help meet Australia's international reporting obligations
- assist Commonwealth, State and Territory government programmes and activities
- avoid duplication of similar reporting requirements in the states and territories.

The Scope 1 GHG emissions of the Activity will be reported under the NGER Act. There are no Scope 2 GHG emissions related to the Activity. Scope 3 GHG emissions associated with the Activity are not required to be reported, given that these emissions constitute the Scope 1 and 2 GHG emissions of other emitters. This includes the GHG emissions associated with processing at DLNG facility, which are regulated in accordance with the Safeguard Mechanism and an approved Operational Environmental Management Plan (EMP) (Section 6.3.2.7). It also includes GHG emissions from customer use of condensate and LNG that will occur in Asia, predominately Japan and Korea, with the emissions being regulated as Scope 1 and 2 GHG emissions under the frameworks of those countries. All consuming countries will be signatories to the Paris Agreement or have mid-century net-zero emissions targets.

The Safeguard Mechanism is also administered under the NGER Act. The CER administers the NGER Act, its legislative instruments, and related policies and processes. The CER administers the scheme by:

- registering and deregistering corporations for reporting
- receiving reports
- monitoring and enforcing compliance
- applying the audit framework
- publishing reported data

Emissions Reduction Fund (Australian Carbon Credit Units Scheme)

The purpose of the *Carbon Farming Initiative Amendment Act 2014* (Cth) was to amend the *Carbon Credits (Carbon Farming Initiative) Act 2011* (Cth) to include and establish the Emissions Reduction Fund (now referred to as the Australian Carbon Credit Units Scheme). The Emissions Reduction Fund (Australian Carbon Credit Units Scheme) is a voluntary scheme that aims to provide incentives for a range of organisations and individuals to adopt new practices and technologies to reduce their emissions. Through the Emissions Reduction Fund, participants in the Australian Carbon Credit Units Scheme can earn Australian Carbon Credit Units (ACCUs) for every tonne of carbon dioxide equivalent they store or avoid emitting. ACCUs can be sold and can generate an income for participants. A number of activities are eligible under the ACCU scheme.

Safeguard Mechanism

One of the key statutory instruments for regulating Australia's emissions in line with its NDCs under the Paris Agreement is the *NGER (Safeguard Mechanism) Rule 2015* (Cth) (the Safeguard Mechanism), made under the NGER Act and administered by the Clean Energy Regulator. The Safeguard Mechanism was developed to ensure Australia's largest industrial GHG emitters keep their net emissions below an emissions limit (a baseline). The Safeguard Mechanism currently applies to facilities that emit more than 0.1 Mt CO_2-e per annum and requires annual emissions to be reported against a designated emissions 'baseline'.

The Safeguard Mechanism is one element of a whole of economy approach, implemented to achieve Australia's NDCs, and is complementary to a range of programs that measure, manage, reduce or offset Australia's GHG emissions.

Emissions from the Activity will be regulated under the Safeguard Mechanism through establishing a cap (baseline) on Barossa facility emissions, including a specific requirement for net-zero reservoir emissions from start-up. Under the Safeguard Mechanism, annual emissions are reported under the NGER Scheme and compared against the facility baseline. Santos is required to generate or procure and surrender Australian Carbon Credit Units or Safeguard Mechanism Credits for any emissions above the baseline for the compliance period, to ensure net emissions for the facility remain under the prescribed baseline. In 2022, the Australian government proposed Safeguard Mechanism reforms to require a greater contribution to Australia's climate targets from large industrial facilities. Under these reforms, and as a new-build facility as determined by the CER, the Barossa facility Safeguard Mechanism baseline will be set in accordance with global best practice benchmarks by the CER. The emissions baselines for both the Barossa facility and the DLNG facility will gradually decline to limit Scope 1 emissions and achieve net-zero by 2050 (noting that, as set out at Section 6.3.2.1.3, Scope 1 emissions of DLNG facility are indirect (Scope 3) emissions of the Activity and are subject to separate regulatory reporting requirements). The decline rates have been set at 4.9% each year to 2030. After 2030, decline rates will be set in predictable five-year blocks, consistent with updates to Australia's NDC under the Paris Agreement. Decline rates for 2030-31 to 2034-35 will be set by 1 July 2027. The process for setting the future decline rates will involve consultation, and advice from the Climate Change Authority (CCA) and the latest Annual Climate Change

Statements to Parliament. To assist industry planning for achieving net-zero by 2050, an indicative annual decline rate has been set in the Safeguard Rules at 3.3% per annum from 2030-31 to 2049-50. The actual rate will be confirmed through the five-year baseline setting process.

Compliance with the Safeguard Mechanism is of primary importance in ensuring that GHG emissions associated with the Activity are kept to acceptable levels. GHG emissions at or below the baseline and the Safeguard Mechanism's future decline rates will assist in keeping Australia's emissions under its NDCs in accordance with the Paris Agreement.

The coming online of the Activity has been acknowledged by the Australian Government in its latest emissions projections. For example, the Commonwealth DCCEEW in *Australia's emissions projections 2024* (November 2024) discusses emissions from LNG production and the role of the Safeguard Mechanism in reducing and controlling fugitive and on-site emissions, including the role of safeguard facilities such as the implementation of leak detection and repair measures and reduced flaring (see pages 68 and 69 of the report). The report expressly addresses the proposed resumption of gas production at the Darwin LNG facility with gas from the 'Barossa field'.

The above report is informed by DCCEEW's *Methodology for Australia's emissions projections* (November 2024). The report identifies major new oil and gas development for which production is anticipated to start in 2025 and beyond, and the Barossa Development is expressly referenced in Table 7 (see pages 25-26) of the report.

Compliance with obligations under the Safeguard Mechanism may be achieved through (among other things) the purchase or surrender of ACCUs or Safeguard Mechanism Credits (SMCs). In 2023, Santos in its capacity as an independent company, entered into forward contracts for the purchase of 2.5 million ACCUs at fixed prices to be delivered and paid between December 2023 and January 2027. Santos is also generating some of its own emissions reduction units (including ACCUs and SMCs) at the portfolio level.

The Safeguard Mechanism baseline will be set in accordance with global best practice benchmarks by the CER, and calculated taking into account a number of production variables which may result in changing baseline requirements from one reporting period to the next.

In 2022, the ACCU scheme was independently reviewed, including the integrity of ACCUs, and recommendations for improvements were made, which are in the process of being implemented, but the scheme was otherwise found to be sound and fundamentally well-designed (*Independent Review of Carbon Credit Units: Final Report*, December 2022).

The responsible Commonwealth minister has communicated to the Barossa joint venture partners on a number of occasions that he anticipates there being ACCUs available for this project. Natural gas remains an integral part of the energy mix out to 2050 (AEMO 2024, IEA 2023c) and, with ACCUs being part of the national carbon management framework, it is reasonable to assume the availability of ACCUs for gas projects would have been contemplated in setting Australia's NDCs. In this regard, the projected ACCU demand and issuance for the period 2025-2040 is set out in Figure 17 of *Australia's emissions projections 2024 chart data*, which was released with the DCCEEW reports released in November 2024, as referenced above. This data has been derived by reference to the emissions projection information in these reports and it is therefore reasonable to assume that the number of ACCUs anticipated by the Barossa Development have been considered with relation to Australia's anticipated ACCU issuance. Santos' reliance on ACCUs will form part of its reporting to the CER and will continue to be monitored by the CER.

The availability of ACCUs over the next decade is supported by analysis of the balance between supply, holdings, and cancellation rates (RepuTex Energy, 2024). Throughout the decade, ACCU supply is projected to steadily increase, surpassing 30 million annually by 2030, alongside rising cancellation rates to meet Safeguard Mechanism requirements. By 2027, supply is forecasted to fall into deficit due to growing annual cancellations, which will force ACCUs to be withdrawn from inventory until new supply comes into the market. Modelling shows ACCU holding inventory will continue to rise from approximately 36 million in 2024 to around 50 million by 2027, providing sufficient coverage for the deficit. Additionally, growing demand will send price signals to incentivise new ACCU supply. As noted above, Santos is already generating some of its own emissions reduction units (including ACCUs and SMCs) at the portfolio level. The Moomba CCS project completed commissioning in 2024 and is now operating and storing CO_2 in depleted reservoirs of the Cooper Basin. This project has been registered with the CER as an ACCU generating project and is anticipated to commence generating ACCUs within 12 months as at February 2025.

Ultimately, it is a matter for Santos to manage its compliance with its emissions baseline. The surrender of ACCUs is just one available option. The Safeguard Mechanism is administered by the CER and any failure to comply would result in the CED imposing penalties. The CER is constituted under different legislation than NOPSEMA. The CER was established by the *Clean Energy Regulator Act 2011*. It is a non-corporate Commonwealth entity under the *Public Governance, Performance and Accountability Act 2013*. It is therefore reasonable for NOPSEMA to rely on the CER's administration of the law, including the Safeguard Mechanism scheme and the ACCU scheme in relation to this EP.

Management of the emissions of the Barossa Development in accordance with the Safeguard Mechanism will ensure that this Activity does not have an unacceptable impact on climate change, as the Scope 1 GHG emissions of the Activity are being considered as part of Australia's NDC and, therefore, also into the global trajectory to limit global warming in line with the Paris Agreement targets. Sectoral pathways to achieve "net-zero" will necessarily differ and this is why this goal is expressed as a net-zero emissions target and not a "zero" emissions target. This reality has been recognised most recently in the Climate Change Authority's Electricity and Energy Sector Pathway Review released on 5 September 2024.

Climate Change Act 2022

The Climate Change Act 2022 (Cth) enshrines into law Australia's emissions reduction target of 43% from 2005 levels by 2030 and net-zero emissions by 2050. In addition, this Act ensures accountability through an annual update to Parliament by the Climate Change Minister on the progress made towards the target and empowers the Climate Change Authority to provide advice to government on future targets.

6.3.2.6.3 Corporate greenhouse gas emissions management

The Barossa project is structured as a Joint Venture (JV) and emissions management therefore needs to be considered in the context of Santos being not only a standalone corporate entity, but also a Barossa JV partner. As a titleholder and the nominated operator of Barossa, Santos is in a position to apply to the Barossa Development those aspects of its corporate policies, strategies and initiatives relating to emissions management as are appropriate having regard to its joint venture arrangements and Barossa operations.

Scope 1 GHG emissions will be regulated under the NGER regime and the Safeguard Mechanism, which accords with Australia's NDC under the Paris Agreement.

Unlike Scope 1 GHG emissions, there is no compliance framework for Scope 3 GHG emissions management in Australia. This is because Scope 3 GHG emissions are the Scope 1 and Scope 2 GHG emissions of upstream suppliers and downstream users. The international system for GHG regulation, underpinned by the UNFCCC and Paris Agreement, recognises that responsibility lies with the countries in which those emissions are generated. NDCs, including that of Australia, are consistent with this approach. Accordingly, Scope 3 GHG emissions commitments made by companies are generally voluntary.

Santos, in its capacity as an independent company, has set commercial carbon storage and Scope 3 equivalent targets at a corporate level. Santos' commercial carbon storage and Scope 3 equivalent targets at 31 December 2024, as outlined in Santos' Annual Report 2024 including the Climate Report, are:

- **2030**: Reduce customers' emissions, Santos' Scope 3, by at least 1.5 $MtCO_2$-e from the supply of low carbon fuels and carbon management services
- **2040**: Build and operate a commercial carbon storage business, safely and permanently storing approximately 14 Mtpa of third-party CO_2-e per annum
- **Long-term**: Aspiration to store more carbon than we emit across Scope 1, 2, and 3 equivalent emissions

These targets are supported by a range of strategies and actions, as outlined in Santos' Annual Report 2024 including the Climate Report, and Climate Transition Action Plan. Actions implemented may change year-on-year as pathways to these targets evolve, but in 2024 included, at the corporate level:

- Directly approached approximately 180 Santos suppliers (including Barossa suppliers) and requested Scope 1 and 2 emissions data to verify our Scope 3 emissions estimates and better understand how our suppliers' emissions and emissions reduction targets support our emissions reduction efforts.
- Collaborated with an LNG vessel owner in a trial of additional cooling technology on vessels, which delivered a 16 per cent emissions reduction for the LNG vessel in the initial trial.
- Explored opportunities though engagement with our customers, such as CCS studies with multiple steel and fertiliser manufacturers, low carbon fuel joint studies with international energy consumers, and negotiations for third-party CCS solutions for LNG customers.
- Expanded customer engagement to better understand how our products are used and processed, how our products contribute to reaching customer emissions targets and how customer emissions reduction pathways support Santos' downstream Scope 3 equivalent medium and long-term targets
- Participation in the Climate Leaders Coalition 'Artificial Intelligence for Scope 3' workstream

As discussed in Section 8.5.7, each Santos Regional Business Unit (including the WA NA and TL region where Barossa is located) is required to submit a decarbonisation plan for the business unit as part of the annual corporate Long Term Planning Process. These plans outline decarbonisation opportunities to achieve regulatory compliance, including with Australia's Safeguard Mechanism, and set out pathways that each asset (including

Barossa) may follow to contribute to the company-level Scope 1 and 2 emissions reduction targets. The long-term plans, including the decarbonisation opportunities, are consolidated by the corporate planning group and then reviewed and discussed with executive leadership to determine the best way to achieve compliance and targeted emissions reduction. Section 8.5.7 discusses implementation of these plans in greater detail.

The collection of information via the Barossa decarbonisation plan (which outlines emissions sources of the Activity) and through engagement with customers and suppliers will be undertaken for the purposes of corporate climate-related disclosure, under Australia's climate-related financial disclosure regime. The AASB Australian Sustainability Reporting Standard necessitates the disclosure of Scope 3 emissions data that considers the entire value chain, reflects changed circumstances, is based on a robust measurement approach and reasonable assumptions, and is verified (see Australian Sustainability Reporting Standard AASB S2, at B38-B57).

As the operator of the Barossa Development, Santos will apply its corporate targets and adopt its associated strategies and initiatives to Barossa, as appropriate having regard to its joint venture arrangements and Barossa operations. This will support the achievement of the EPOs for GHG emissions outlined in Section 6.3.3. Santos' Scope 3 equivalent targets and associated strategies and initiatives are directed to achieving reductions in Scope 3 emissions via a proactive and collaborative approach which involves engagement with both suppliers and contractors. Specific control measures have been adopted for the Activity in line with this approach (refer to BAO-CM-6.3.21, 6.3.22, 6.3.23 and 6.3.24). Santos has also committed to only selling Barossa products generated from the Activity to customers from countries who are signatories to the Paris Agreement or have mid-century net-zero commitments (BAO-CM-6.3.19). Implementation of these control measures will allow Santos to continually pursue a range of management and abatement measures relevant to GHG emissions associated with third party consumption of gas from the Barossa Development. These are appropriate and practicable given that Santos does not have operational control over third party GHG emissions. Given the dynamic conditions in which the industry operates, Santos' strategies and targets will change and adapt over time.

6.3.2.7 Regulation of Darwin Liquefied Natural Gas Facility Scope 1 GHG emissions

As outlined at Table 6-15, the gas extracted through operations under this EP will be processed at the DLNG facility, and therefore the Scope 1 GHG emissions of DLNG facility are Scope 3 (indirect) GHG emissions of the Activity. The DLNG facility is owned by a different joint venture to the Barossa Development and its operation is outside the scope of the Activity of this EP (and outside the control of the Barossa Joint Venture). Notwithstanding this, the frameworks by which emissions from the DLNG facility are regulated are relevant to NOPSEMA's and Santos' evaluation of potential indirect impacts from the Scope 1 emissions of DLNG facility as indirect emissions of the Activity.

Northern Territory GHG emissions regulatory framework

The operation of the DLNG facility is currently authorised by Environment Protection licence EPL217-03, granted under the Northern Territory *Waste Management and Pollution Control Act 1968* (NT). It is a condition of that licence for the licensee to implement an Operational Environmental Management Plan (*OEMP*). It is a requirement of EPL217-03 that the OEMP include environmental management strategies for managing GHG emissions.

The DLNG facility is authorised by the DLNG Operations Environmental Management Plan (*DLNG OEMP*). This plan describes the environmental risks and risk management controls associated with the operation of the DLNG facility, including in relation to GHG emissions. These controls are set out at Table 7-1 of the DLNG OEMP and include the primary use of fuel gas by compressor and OSPG gas turbines (A1.1, A2.1), annual maintenance on equipment to ensure efficient combustion (A2.3, A4.2, A5.2) and plant design and operational monitoring to achieve flaring efficiency (A6.2). Further controls are provided for potential direct and indirect GHG emissions from sources including stack emissions, flaring, venting, fugitive emissions, and accidental hydrocarbon gas emissions and leaks of refrigerants.

In May 2020, the NT EPA accepted a proposal by ConocoPhillips Pipeline Australia Pty Ltd, as then operator of DLNG facility, to (among other things) extend the operational life of DLNG facility from 2024 to 2050 and allow a further LNG production capacity of 3.7 million tonnes per annum. In accepting this proposal, the NT EPA concluded that the potential environmental impacts and risks of the proposed changes to the existing operation of the DLNG facility, including air quality and Scope 1 greenhouse gas emissions associated with the operation of DLNG facility, would be mitigated to such an extent that they are not considered to be significant. The Northern Territory (NT) EPA considered the residual risks to be adequately regulated through existing NT EPA approval mechanisms including the DLNG Operations Environmental Management Plan and other relevant legislation and policies (NT EPA, 2020). An addendum to the OEMP has also been approved to ensure the operator's compliance with relevant regulatory requirements associated with the DLNG facility during the life extension project (*DLNG Addendum*). The DLNG Addendum also identifies and describes all credible environmental risks and risk management controls associated with the DLE project, including in relation to GHG emissions. These controls are set out at Table 7-1 of the DLNG Addendum and include the selection of appropriate materials during plant design (DLE-A13.4, DLE-A17.4) as well as further annual maintenance for efficient combustion (DLE-A2.3, DLE-A5.2, DLE-A7.1) and plant design and operational monitoring for flaring efficiency (DLE-A6.2).

Tables 8-1 of the DLNG OEMP and DLNG Addendum include 'Environmental Management Strategies' for the implementation of risk management controls according to performance criteria.

Commonwealth GHG emissions regulatory framework

DLNG's Scope 1 GHG emissions from processing of Barossa feed gas will be regulated under the *National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015* which sets the contribution to emissions reduction from large industrial facilities in line with Australia's 2030 and 2050 emissions reduction targets (Section 6.3.2.6.2). As a facility with Scope 1 GHG emissions of more than 100,000 tonnes of CO_2-e per year, DLNG facility will be subject to a Safeguard Mechanism baseline. The CER has approved the Emissions Intensity Determination (EID) for DLNG facility in July 2024, which is used to calculate the Safeguard baseline each year.

6.3.2.8 Potential Cumulative Impacts

On the basis that concurrent activities (see Section 2.3.1) will occur within the OA, there will be GHG emissions generated across the spread of concurrent activities.

Estimated total GHG emissions for an eight well drilling campaign are 183,608 tCO_2-e (22,951 tCO_2e per well). Estimated total GHG emissions for the SURF campaign are 21,210 tCO_2e. Adopting a conservative assumption that concurrent drilling of two wells and six months of the SURF campaign activities overlaps with production operations activities, this would represent an approximately 2% increase in GHG emissions compared with no concurrent activities. This increase is considered incremental to emissions from production operations, with negligible cumulative impacts. This is a timing issue, rather than an issue that affects the total emissions from all activities of the Barossa Development, as these emissions have been described and accounted in the relevant accepted EPs for each activity.

6.3.3 Environmental performance outcomes and control measures

Assuming that emissions from the Activity will cause an equivalent net increase in cumulative Australian and global GHG emissions, this increase constitutes a nominal amount in the overall scheme of the national and international carbon budgets. Santos has adopted environmental performance outcomes and control measures directed to minimising the GHG emissions from the Activity and therefore the potential contribution of these emissions to net cumulative GHG emissions globally. A range of controls have been considered for both direct (Scope 1) and indirect (Scope 3) GHG emissions in the design and for the Operations phase, as well as a system of continual review and improvement during operations (Section 8.5.3.3).

In setting the environmental performance outcomes and control measures regarding GHG emissions, it is important to recognise the global consensus of the Paris Agreement under which countries have agreed to manage and reduce their own emissions with the aim to limit the global temperature increase in this century to 2°C, while pursuing efforts to limit the increase even further to 1.5°C. Santos has developed its EPOs and control measures having regard to the UNFCCC framework which sets out the responsibility of each country to manage and reduce its emissions and the autonomy of each country in determining its pathway to achieve its emissions reduction targets.

Accordingly, the acceptable levels of GHG emissions are defined as follows:

- Acceptable levels of direct (Scope 1) emissions from the Activity are set by the Safeguard Mechanism Baseline on Barossa facility emissions, in line with the Australian Government's NDCs under the Paris Agreement.
- Acceptable levels of indirect (Scope 3) emissions from the Activity within Australia are also set by the Safeguard Mechanism Baseline on Barossa facility emissions, in line with the Australian Government's NDCs under the Paris Agreement.
- Acceptable levels of indirect (Scope 3) emissions from the Activity outside of Australia will be set by customer countries within the context of their own NDCs under the Paris Agreement or mid-century net-zero commitments, and associated emissions reduction policies and regulations, noting that the emissions would arise regardless of the source of the gas being consumed (i.e. if gas was not supplied from Barossa, it would be supplied from elsewhere to meet customer and customer country demand).

The EPOs for GHG emissions are:

- Manage indirect GHG emissions associated with the Activity consistent with the temperature objectives of the Paris Agreement, including by implementing company-wide targets and strategies for Scope 3 emissions reduction at Barossa as appropriate (having regard to joint venture arrangements and Barossa operations) and supporting customers and suppliers to reduce their GHG emissions. (EPO-10)
- Undertake the Activity in a manner that is compliant with the requirements of the Safeguard Mechanism. (EPO-11)

An assessment of the environmental benefits, and the potential costs or issues associated with control measures for this Activity, is shown in Table 6-20 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPOs and measurement criteria that are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 6-20: Control measures ALARP evaluation for greenhouse gas emissions

CM reference	Control measure	Environmental benefit	Potential cost/ issues	Evaluation
Standard control measures – Scope 1				
Hook-up and Cold Commissioning				
BAO-CM-6.4.10	Barossa Facilities and vessels planned maintenance system to confirm equipment integrity is maintained in accordance with manufacturers guidelines. (administrative control)	Reduces emissions by ensuring contracted vessels are operated, maintained and manned in accordance with industry standards and regulatory requirements.	Personnel costs of implementing.	**Adopted –** benefits of ensuring vessels are maintained outweigh the costs.
BAO-CM-6.3.1	Monitoring of vessel fuel consumption and vessel speed management to reduce fuel use (administrative control)	Active monitoring of fuel consumption informs opportunities to optimize support vessel fuel use efficiencies to reduce fuel use emissions e.g. vessel speed management depending on operational requirements. The vessels are advised prior to sailing to sail at "economic" speeds – specific to each vessel whereby fuel usage is optimised, unless there is an operational requirement for faster speeds.	Administration costs for monitoring and opportunity evaluation activities.	**Adopted -** Optimised support vessel fuel consumption has emissions reduction and cost reduction benefits.
Initial Start-up to Steady State				
BAO-CM-6.3.2	Initial start-up will be sequenced to ensure the maximum amount of alignment between the respective facilities whilst minimising fuel use and flaring (engineering control)	Best practice to minimise unnecessary fuel use and flaring during initial start-up (following introduction of hydrocarbons).	Delayed commencement of production operations.	**Adopted** – emissions benefit outweighs impact to initial start-up timeliness
BAO-CM-6.3.3	Hook-up and commissioning and initial-start-up fuel and flare performance target setting (administrative control)	Structured process to track emissions performance during initial start-up and manage deviations from performance targets to reduce emissions to ALARP.	Administrative cost to implement, potential impact to execution schedule	**Adopted** – emissions benefit outweighs impact to initial start-up timeliness
Steady State Operations				
BAO-CM-6.3.4	Energy efficient design of the FPSO power and heat supply system: Combined cycle gas turbine (CCGT) system, which incorporates high-efficiency gas	The WHRUs provide the required process heat for the facility (up to 21.2 MW) while the STG is sized to deliver up to 29 MW of electricity, which would otherwise need to be	Viable solution for Barossa FPSO because process heat requirements for the Barossa FPSO are relatively low compared to similar	**Adopted** – benefit outweighs cost.

CM reference	Control measure	Environmental benefit	Potential cost/ issues	Evaluation
	turbine generators (GTGs) with waste heat recovery units (WHRUs), once-through steam generators (OTSGs) and a steam turbine generator (STG). Relevant Engineering Design Specifications and emissions reduction opportunities implemented as part of final facility construction. (engineering control)	generated by additional energy consumption.	facilities. Novel system for offshore Application.	
BAO-CM-6.3.5	Energy efficient design for FPSO process compression: Electric drive motors – fixed speed Relevant Engineering Design Specifications and emissions reduction opportunities implemented as part of final facility construction. (engineering control)	Electric drive motors are more energy efficient and reliable than mechanical driven gas turbines.	Compression reliability dependent on power supply via CCGT.	**Adopted** – benefit outweighs cost.
BAO-CM-6.3.6	Energy efficient design of the FPSO reservoir CO_2 removal system: 2-stage membrane system for reservoir CO_2 removal Relevant Engineering Design Specifications and emissions reduction opportunities implemented as part of final facility construction. (engineering control)	Removal of the reservoir CO_2 offshore allows for the export of gas with a higher hydrocarbon content, which reduces the duty of the export gas compressors for the same downstream production rate, by approximately 15%. A 2-stage system increases the CO_2 concentration in the waste permeate stream up to approximately 95% (compared to a 1-stage system) which reduces loss of residual hydrocarbons in the disposal waste stream. A 2-stage membrane system requires less process heat than an acid gas removal unit, eliminating the need for an additional stand-alone boiler and associated additional GHG emissions	Additional FPSO size and weight requirements for a 2-stage membrane system	**Adopted** – benefit outweighs cost.
BAO-CM-6.3.7	Energy efficient design of the FPSO reservoir CO_2 disposal system: Thermal oxidiser destruction efficiency up	Higher destruction efficiency of the CO_2 permeate stream compared to a flare system, and less fuel gas required compared	Additional FPSO size and weight requirements for a thermal oxidizer.	**Adopted** – benefit outweighs cost.

CM reference	Control measure	Environmental benefit	Potential cost/ issues	Evaluation
	to 99.9% methane destruction efficiency Relevant Engineering Design Specifications and emissions reduction opportunities implemented as part of final facility construction (engineering control)	to a flare system to achieve the equivalent level of combustion performance.		
BAO-CM-6.3.8	Energy efficient design of the FPSO low pressure flare and acid gas flare – normally unlit (pilotless) Relevant Engineering Design Specifications and emissions reduction opportunities implemented as part of final facility construction (engineering control)	Reduced fuel gas consumption during operations, which increases the overall energy efficiency of facility operations.	Nil – best practice	**Adopted** – benefit outweighs cost.
BAO-CM-6.3.9	Reporting of GHG emissions as per the NGER Scheme (administrative control)	This is a regulatory requirement under the NGER Act with which Santos and its contractors must comply.	Cost associated with implementing.	**Adopted –** NGER reporting is a Commonwealth regulatory requirement.
BAO-CM-6.3.10	Net-zero reservoir emissions through the purchase and/or surrender of Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs) (administrative control)	Achieving a net-zero outcome for reservoir emissions effectively neutralises the potential impact of reservoir emissions. Reservoir emissions represent >60% of Barossa's total Scope 1 emissions.	Costs of ACCUs/SMCs. Availability of ACCUs: In 2023, Santos, as an independent company, entered into forward contracts for the purchase of 2.5 million ACCUs at fixed prices to be delivered and paid between December 2023 and January 2027. Santos is also generating some of its own emissions reduction units (including ACCUs and SMCs) at the portfolio level. As discussed in Section 6.3.2.6.2, the responsible Commonwealth minister has communicated to the Barossa JV on a number of occasions that he anticipates there being ACCUs available for this project. The availability of ACCUs over the next decade is supported by analysis of the	**Adopted –** in line with regulatory requirements, noting that Santos is committed to reducing emissions to ALARP regardless of regulatory requirements.

CM reference	Control measure	Environmental benefit	Potential cost/ issues	Evaluation
			balance between supply, holdings, and cancellation rates undertaken by RepuTex Energy, 2024.	
BAO-CM-6.3.11	The purchase and/or surrender of Australian carbon credit units (ACCUs) or Safeguard Mechanism Credits (SMCs) required under the NGER (Safeguard Mechanism) Rule 2015 for any non-reservoir emissions from the Barossa facility above the annual baseline, as determined by the Clean Energy Regulator (administrative control)	Emissions from the Barossa facility are managed in accordance with baselines set by the Commonwealth government under the Safeguard Mechanism, which supports achievement of the Commonwealth Government's emissions reduction targets under the *Climate Change Act 2022* and Australia's Paris Agreement NDCs.	Cost of ACCUs/SMCs. Availability of ACCUs In 2023, Santos, as an independent company, entered into forward contracts for the purchase of 2.5 million ACCUs at fixed prices to be delivered and paid between December 2023 and January 2027. Santos is also generating some of its own emissions reduction units (including ACCUs and SMCs) at the portfolio level. As discussed in Section 6.3.2.6.2, the responsible Commonwealth minister has communicated to the Barossa JV on a number of occasions that he anticipates there being ACCUs available for this project. The availability of ACCUs over the next decade is supported by analysis of the balance between supply, holdings, and cancellation rates undertaken by RepuTex Energy, 2024.	**Adopted** – in line with regulatory requirements, noting that Santos is committed to reducing emissions to ALARP regardless of regulatory requirements.
BAO-CM-6.3.12	Implement an Operations GHG Emissions Management Plan (GHGEMP) as described in Section 8.3.2.13) to manage facility direct GHG emissions to ALARP over the life of the Activity, inclusive of: • Emissions Performance target setting (Section 8.2.4.2) • Critical Equipment Maintenance (Section 8.3.2.3.1)	Managing uncertainty and reduction of GHG emissions to ALARP over the life of the Activity.	Best practice. Opportunity cost between emissions reduction and production impact.	**Adopted** – benefit outweighs cost.

CM reference	Control measure	Environmental benefit	Potential cost/ issues	Evaluation
	• Methane Emissions Management (Section 8.3.2.12) • Decarbonisation Opportunity Management (Section 8.5.7) (administrative control)			
BAO-CM-6.3.13	Fuel gas will be used preferentially for power generation instead of liquid fuel (substitution control)	Fuel gas generates lower GHG emissions than marine diesel oil or marine gas oil per unit of electricity generated.	More cost-effective to run FPSO power generation on fuel gas than marine diesel oil or marine gas oil alternatives.	**Adopted –** results in lower GHG emissions without an adverse cost impact
BAO-CM-6.3.14	Measure/estimate emissions from all fuels combusted and gas disposal streams to meet NGER/NPI requirements (administrative control)	Emissions measurement system for GHG emissions in line with NGERS/NPI requirements.	Costs for installation and ongoing maintenance and calibration of measurement equipment.	**Adopted** – in line with Australian regulatory requirements for GHG/NPI reporting.
BAO-CM-6.3.15	Flare ignition system design to automatically reignite flare pilot on detection of loss of flame (engineering control)	High energy system will attempt to auto reignite for up to two minutes to prevent cold venting. Back-up flame front generator available.	Costs for installation and ongoing maintenance of flare ignition system.	**Adopted** - benefit outweighs cost.
BAO-CM-6.3.16	MARPOL-compliant (Marine Order 97) fuel oil will be used by vessels and MGO will be used on the FPSO to reduce atmospheric emissions (substitution control)	Reduces emissions through use of low sulphur fuel in accordance with MARPOL Annex VI (and Marine Order 97).	None identified.	**Adopted** – it is a legislated requirement.
BAO-CM-6.3.17	Pursuant to Marine Order 97, relevant vessels will have a current International Air Pollution Prevention (IAPP) Certificate or equivalent and Ship Energy Efficiency Management Plan (SEEMP) (administrative control)	Reduces emissions by ensuring compliance with MARPOL Annex VI (and Marine Order 97).	Cost of maintaining certification.	**Adopted –** benefit of ensuring vessel is compliant outweighs the minimal costs and it is a legislated requirement.
Other control measures - Scope 1				
BAO-CM-6.3.18	Santos' vessel vetting process to include evaluation of vessel emissions and the potential for use of alternative fuels (substitution control)	Reduces total emissions associated with engines.	Consideration to be made but potentially limited by required specifications and vessel availability.	**Adopted** –. The vessels selected will comply with Santos' vessel vetting process.
N/A	Using lower emissions vessels (substitution control)	Reduces total emissions associated with engines.	Not practically feasible at present. The contracted vessels required are specialised and have limited availability. The vessels selected will comply with Santos' vessel	**Not adopted –** Not practically feasible at present. The contracted vessels are specialised and have limited availability.

CM reference	Control measure	Environmental benefit	Potential cost/ issues	Evaluation
			vetting process.	
N/A	Design for future renewables integration (importation of electrical power from onshore solar with subsea cable or offshore wind) (engineering control)	Renewables integration could reduce Barossa Scope 1 non-reservoir operational emissions from FPSO power generation.	Outside the scope of the accepted Barossa Development Offshore Project Proposal. No approvals for construction of onshore solar or offshore wind. Requires significant modifications and cost to the FPSO design, including a battery system (see below), to accommodate renewable power importation. Purchase cost of imported renewable electricity. Emissions reduction benefit significantly impaired without a battery energy storage system (to avoid firming with diesel generation). Size of the battery system needed to supplement intermittent renewable energy and to ensure a continuous uninterrupted power supply for safe operations would be approximately 5,000 tonnes. Technical feasibility not yet proved, swivel technology for size and scale of HV cable not proven with manufacturer of FPSO swivel. Safe battery room location, significant ventilation needs, deck space and weight requirements render the opportunity impractical to accommodate on the existing FPSO without major hull modification.	**Not adopted –** economic, design and approvals challenges to enable the FPSO to import electrical power outweigh possible net environmental benefit (assuming incorporation of a battery energy storage system could be physically possible which is not the case on the existing facility). The reliability of supply of low or zero carbon electricity is unproven in Australia and without firming (to mitigate intermittency) could not be relied upon to meet the uptime requirements of the offshore facility to maintain production supply to onshore LNG, introducing significant risk of thermal cycles and production outages. Renewable supply back-up firing sources (to mitigate intermittency) likely to be equivalent fuel (gas) or higher carbon fuels (diesel) eroding emissions benefit.
N/A	Routing of reservoir CO_2 emissions to a CCS project (engineering control)	Reservoir CO_2 emissions are captured and abated, significantly reducing Scope 1 emissions.	There is no immediately available CCS option for the Barossa Gas Project. Potential CCS	**Not adopted** as a control measure – there is no immediately available CCS option available today for the Barossa Gas Project.

CM reference	Control measure	Environmental benefit	Potential cost/ issues	Evaluation
			developments such as the proposed Bayu-Undan CCS project require regulatory frameworks, policies and foreign government approvals in order to proceed. The proponents of the project require all necessary approvals and commercial arrangements to be in place in order to make a final investment decision. This is outside of the control of the Barossa joint venture. Notwithstanding, the Barossa joint venture has invested around US$600 million in the Darwin Pipeline Duplication to enable CO_2 to be sequestered and stored in the depleted Bayu-Undan reservoirs as part of a CCS project. This is a very significant investment to keep this CCS as an option to further reduce reservoir CO_2 emissions. Front End Engineering and Design for the proposed Bayu Undan CCS project is continuing and the proponents of Bayu Undan CCS are engaged with a range of stakeholders to progress the development.	The Barossa joint venture will continue to evaluate CCS options as they become available.
NA	Battery Energy Storage System to supplement combined cycle power generation (engineering control)	Avoid the need for additional gas turbine generator and eliminate spinning reserve, reducing fuel consumption and improving Scope 1 emissions.	Size of the battery system needed to provide equivalent 'spinning reserve' and to ensure a continuous uninterrupted power supply for safe operations. Battery system space and weight requirements render the opportunity infeasible. Design of CCPGP	**Not adopted** – steam turbine generator provides spinning reserve and eliminates need for gas turbine generator reducing fuel consumption and improving Scope 1 emissions.

CM reference	Control measure	Environmental benefit	Potential cost/ issues	Evaluation
			with steam turbine generator provides equivalent benefit.	
NA	Reservoir CO_2 disposal via reinjection (engineering control)	Reduces Scope 1 emissions by not disposing reservoir CO_2 to atmosphere.	Reinjection of acid gas is not common practice for offshore production facilities. Reservoir suitability to reinject acid gas is not proven. Cost for injection compressor, subsea wells and subsea system. Fuel gas emissions for reinjection compression impairs the net emissions benefit of reinjecting the reservoir CO_2.	**Not adopted** – unproven reservoir suitability could negate potential net emissions benefit.
NA	Venting (to atmosphere) of the removed waste gas (includes CO_2) stream including residual hydrocarbons. (engineering control)	Technical solution that potentially reduces the emissions profile if combined with a process to direct capture the CO_2.	Vents do not have moving parts or require a fuel source and are considered to have 100% reliability (so do not require a backup), with 0% hydrocarbon destruction efficiency. Venting of the removed CO_2 stream generates the highest GHG emissions under HP and LP operations due to the residual hydrocarbons from the 2-stage membranes system. Venting was considered for comparison due to its prominence at benchmarked facilities. The Barossa Functional Specification prescribed that venting was not progressed in design given large quantum of waste gas emitted to atmosphere and no direct air capture options available given offshore location and FPSO size.	**Not adopted** – generates the highest direct GHG emissions.
NA	Continuous flaring of waste gas (includes CO_2) stream including	Technical solution that potentially reduces the emissions profile if	Continuous flaring requires the use of supplementary fuel	**Not adopted** –increased disposal costs associated with use of supplemental

CM reference	Control measure	Environmental benefit	Potential cost/ issues	Evaluation
	residual hydrocarbons (engineering control)	combined with a process to direct capture the CO_2.	gas, increasing GHG and atmospheric emissions. Existing flare stack can be utilised, with dedicated flare tip. Use of supplementary fuel gas increases disposal costs.	fuel gas (product that could be sold) and higher GHG emissions.
NA	Monitoring of direct and indirect methane emissions (administrative control)	Increased accuracy of emissions measurement system for GHG emissions reporting.	Given the volume of methane emissions expected from processing, the cost associated with the installation and maintenance of additional instrumentation is disproportionate. Implementation of bi-annual source-level fugitive detection and measurement survey supported by site-level drone methane measurement (BAO-CM-6.3.12)	**Not adopted** – fugitive emissions will be estimated based on default NGER factors, and bi-annual source level fugitive detection and measurement surveys will be undertaken.
Standard Control Measures - Scope 3				
BAO-CM-6.3.19	Barossa products generated from the Activity will only be sold to customers from countries that are signatories to the Paris Agreement or have a mid-century net-zero emissions commitment, as at the date of the relevant contract of sale. (administrative control)	Supports the objective of the Paris Agreement to limit global temperature rise to less than 2°C and pursue efforts to limit the temperature rise to 1.5°C to the extent possible by Santos, having regard to the autonomy of each country in determining its pathway to achieving its emissions reduction target and to the responsibility of each country to meet its net-zero commitments.	Limitations on who the Barossa products can be sold to. Minor costs associated with periodic monitoring.	**Adopted** – the benefit of implementing sales controls to drive focus on global climate targets in the international community outweighs the costs and risks.
BAO-CM-6.3.20	Onshore Processing Services Agreements will only be made with Australian facilities that are subject to the Safeguard Mechanism (administrative control).	Supports the objective of the Paris Agreement to limit global temperature rise to less than 2°C and pursue efforts to limit the temperature rise to 1.5°C to the extent possible, by Santos having regard to the responsibility of each country to meet its net zero commitments and to the autonomy of each country in determining the role that gas will play in meeting these commitments.	The Barossa JV will process all gas through the DLNG facility, which is subject to the Safeguard Mechanism.	**Adopted**– the benefit of implementing sales controls to drive focus on global climate targets in the Australian community outweighs the costs and risks.

CM reference	Control measure	Environmental benefit	Potential cost/ issues	Evaluation
BAO-CM-6.3.21	GHG emissions reduction initiatives of suppliers will be evaluated in the tender evaluation process via development and implementation of a framework for identifying, assessing and implementing emissions reduction opportunities for all Barossa supplier contracts of $30m+ value. Through the data collection and tender evaluation process, opportunities to collaborate on emissions reduction initiatives and low carbon alternatives will be sought, including the potential to support suppliers in respect of: • investments in innovations in technology. • research programs. • education and training relating to the adoption of emissions reduction policies and processes and/or • monitoring programs The tender evaluation framework will be reviewed and refined to ensure it is adaptive to advancements in technology, data collected and other opportunities to encourage reductions in GHG emissions. (administrative control)	Engaging with suppliers and collaborating-on initiatives will support suppliers to reduce their own GHG emissions. Review and refinement of the approach will continue to encourage entrepreneurialism and the take up of GHG reduction initiatives. The materiality threshold of $30m+ for supplier contract value has been selected on the basis that it represents approximately 65% of current and budgeted supplier contracts, representing around 85% of the forecast emissions for the first 5 years of Barossa operations. It also aligns with existing executive level delegation procedures that will ensure an additional level of rigour is applied at the procurement phase.	There are potential costs associated with implementing initiatives.	**Adopted** – Collaborating with suppliers on initiatives will be adopted subject to a feasibility analysis, the willingness of suppliers to collaborate and value to the environment. Ongoing review of the threshold spend will be conducted to ensure the most emissions intensive activities are captured.
BAO-CM-6.3.22	Annual engagement with suppliers with Barossa supplier contracts of $30m+ value to request GHG emissions data for Barossa activities. Data sought would include: • quantitative and qualitative climate-related targets (including for Scopes 1, 2 and 3 emissions)	Ensures estimates for these emissions are aligned with best practice approach and are within the bounds of this EP. The materiality threshold of $30m+ for supplier contract value has been selected on the basis that it represents approximately 65% of current and budgeted supplier contracts, representing around	There are potential challenges associated with procuring actual emissions data from third parties.	**Adopted** – Collaborating with suppliers will be subject to the willingness of suppliers to engage. Ongoing review of the threshold spend will be conducted to ensure the most emissions intensive activities are captured.

CM reference	Control measure	Environmental benefit	Potential cost/ issues	Evaluation
	• information about the supplier's approach to setting, reviewing and monitoring progress against each target • information about the supplier's performance against each climate-related target, including GHG emissions data and measurement approach, inputs and assumptions, over the past year • the supplier's use over the past year, and planned use, of carbon credits to offset GHG emissions • information regarding the supplier's climate-related risks and opportunities, including information regarding the supplier's emissions reduction initiatives (if any) Data will be used to verify GHG emissions estimates associated with our suppliers and track performance against Santos' Scope 3 equivalent climate targets and Climate Transition Action Plan. (administrative control)	85% of the forecast emissions for the first 5 years of Barossa operations It also aligns with existing executive-level delegation procedures that will ensure an additional level of rigour is applied at the procurement phase.		
BAO-CM-6.3.23	Annual engagement with Barossa customers and the DLNG onshore processing facility via a survey regarding the use of Barossa product. Information sought would include: • GHG emissions data (Scope 1 and 2 emissions) attributable to Barossa product • information regarding use over the past year, and planned use, of	Ensures estimates for these emissions are aligned with best practice approach and are within the bounds of this EP.	There are potential challenges with procuring actual emissions data from third parties.	**Adopted** – Collaborating with customers and the DLNG onshore processing facility will be subject to the willingness of these third party entities to engage.

CM reference	Control measure	Environmental benefit	Potential cost/ issues	Evaluation
	carbon credits to offset GHG emissions attributable to Barossa product • information regarding climate-related risks and opportunities, including information regarding the entity's emissions reduction initiatives (if any) Data will be used to verify GHG emissions estimates associated with our onshore processing facilities and customers and track performance against Santos' Scope 3 equivalent climate targets and Climate Transition Action Plan. (administrative control)			
BAO-CM-6.3.24	Supporting customers, the DLNG onshore processing facility and suppliers to reduce GHG emissions by: • promoting global measurement and reporting standards by participating in relevant industry associations and collaboration initiatives; and • advocating for policy frameworks that enable a consistent approach to carbon emissions management. (administrative control)	There are collective benefits to standardised, transparent and effective measurement and reporting standards, along with stable policy frameworks, which will promote GHG emissions reduction globally.	Nil. Santos will engage in these efforts and initiatives as part of its routine business endeavours.	**Adopted**
Other Control Measures - Scope 3				
N/A	Monitoring of DLNG facility operator compliance with Northern Territory and Federal requirements relating to GHG emissions from processing of gas at DLNG. (administrative control)	Intention to provide additional assurance that processing emissions are managed in compliance with requirements.	The Barossa JV has no control over the operations of the DLNG facility. DLNG facility operator will be subject to compliance enforcement (if required) by relevant Northern Territory and Commonwealth regulators.	**Not adopted** – The Barossa JV has no control over operations of the DLNG facility, which is owned by a different joint venture.
N/A	Monitoring of how	Intention to provide	The Barossa JV has	**Not adopted** – The

CM reference	Control measure	Environmental benefit	Potential cost/ issues	Evaluation
	customer countries are performing against their NDCs and adjust or revoke sales contracts accordingly. (administrative control)	additional assurance that customer emissions are managed in compliance with Paris Agreement NDCs.	no control over the performance of countries against their NDCs or international agreement processes under the UNFCCC, including the Paris Agreement.	Barossa JV has no control over the performance of countries against their NDCs or international agreement processes under the UNFCCC, including the Paris Agreement.
N/A	Monitoring to ensure its customers are using its product in the most responsible way by taking all possible steps to reduce emissions from its product, such as by ensuring customers are meeting best practice standards for LDAR and MRV (administrative control)	Intended to provide additional assurance as a safeguard to ensure that customer emissions are managed in accordance with customer country NDCs.	The Barossa JV has no control over the performance of countries against their NDCs or international agreement processes under the UNFCCC, including the Paris Agreement. Nor does it have any control over the standards imposed under the laws and regulations of customer countries, which will differ in accordance with the individual country pathway selected to achieve its emissions reduction targets.	**Not adopted -** The Barossa JV has no control over how customers on sell their product or what standards they implement with binding LNG sales and purchase agreements having been entered into prior to the taking of a final investment decision and after the acceptance of the OPP and granting of the production licence.
N/A	Product sales limited to customers for new (post 2020) gas-fired power stations unless it can prove that energy is displacing coal and not renewables (administrative control)	Intended to provide additional assurance as a safeguard to ensure that customer emissions are managed in accordance with customer country NDCs.	LNG buyers range from trading companies to utility companies supplying not only power generation, but city gas and industrial heating and feedstock gas. This requirement would be anti-competitive and impose on the Barossa JV an obligation that other sellers of LNG in the Asian market do not face (including other Australian LNG sellers). There would be no environmental benefit since this measure would not reduce gas supply to other gas-fired power stations. The gas would simply come from other sources in the international market.	**Not adopted –** This requirement would be anti-competitive and impose on the Barossa JV an obligation that other sellers of LNG in the Asian market do not face (including other Australian LNG sellers). Binding LNG sales and purchase agreements were entered into prior to the taking of a final investment decision and after the acceptance of the OPP and granting of the production licence.

6.3.4 Environmental impact assessment

Key receptors	Consequence level
GHG emissions	
Threatened, Migratory or local fauna	The following recovery and conservation plans listed in Table 3-13 identify climate change as a threat. Conservation Advice: • Approved Conservation Advice for *Rhincodon typus* (whale shark) (2015) • Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a) • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (2015) • Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (2015) • Commonwealth Conservation Advice on *Dermochelys coriacea* (Leatherback turtle) (2008) • Approved Conservation Advice for *Calidris canutus* (Red knot) (2016) • Conservation Advice for *Papasula abbotti* (Abbott's booby) (2020) • Approved Conservation Advice for *Aipysurus fuscus* (dusky sea snake) (DCCEEW, 2024p) Recovery and management plans: • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) • Recovery Plan for the White Shark (*Carcharodon carcharias*) (CoA, 2013) • Wildlife Conservation Plan for Seabirds (CoA, 2020) • Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c) • Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a). Considering that: • In any event, even assuming that emissions from the Activity will cause an equivalent net increase in cumulative Australian and global emissions, this increase comprises a nominal amount in the overall scheme of the national and international carbon budgets; and • In any event, there is no correlation between where GHG emissions are released and where climate change impacts are felt, It is not possible to draw a link between GHG emissions from the Activity and any specific climate related impact on threatened, migratory or local fauna which may result from any net increase to cumulative GHG emissions globally. By keeping the Project emissions under the Safeguard Mechanism baseline, the Project's incremental contribution to global warming is within acceptable limits as determined by reference to Australia's NDC under the UNFCCC. Conservatively, the associated potential environmental impacts to Threatened, Migratory or local fauna (e.g. seabirds) is assessed as I – Negligible.
Physical environment and habitat	The physical environment and associated habitats are susceptible to the effects of climate change. Marine and coastal environments (including those within the EMBA such as shoals and banks, coral reefs, seagrass and algal habitat and mangrove communities) are susceptible to climate change effects such as ocean warming, ocean acidification, rising sea level and changes to ocean current and storm regimes and associated changes to coastal processes. Terrestrial communities are susceptible to changes to temperature, changes to rainfall patterns and changes to the frequency and severity of fire and severe weather events. Considering that: • In any event, even assuming that GHG emissions from the Activity will cause an equivalent net increase in cumulative Australian and global emissions, this increase comprises a nominal amount in the overall scheme of the national and international carbon budgets; and • In any event, there is no correlation between where GHG emissions are released and where climate change impacts are felt, it is not possible to draw a link between GHG emissions from the Activity and any specific climate related impact on physical environment and habitat which may result from any net increase to cumulative GHG emissions globally. By keeping the Project emissions under the Safeguard Mechanism baseline, the Project's incremental contribution to global warming is within acceptable limits as determined by reference to Australia's NDC under the UNFCCC. Conservatively the associated potential environmental impacts to the physical environment and habitat is assessed as I – Negligible.
Threatened ecological communities	Threatened ecological communities are susceptible to the effects of climate change. Coastal / terrestrial communities are susceptible to climate change effects such as rising sea level, changes to ocean current and storm regimes, changes to temperature and rainfall patterns and changes to the frequency and severity of fire events. Considering that:

Key receptors	Consequence level
	• In any event, even assuming that emissions from the Activity will cause an equivalent net increase in cumulative Australian and global emissions, this increase comprises a nominal amount in the overall scheme of the national and international carbon budgets; and • In any event, there is no correlation between where GHG emissions are released and where climate change impacts are felt, it is not possible to draw a link between GHG emissions from the Activity and any specific climate related impact on threatened ecological communities which may result from any net increase to cumulative GHG emissions globally. By keeping the Project emissions under the Safeguard Mechanism baseline, the Project's incremental contribution to global warming is within acceptable limits as determined by reference to Australia's NDC under the UNFCCC. Conservatively, the associated potential environmental impacts to threatened ecological communities is assessed as I – Negligible.
Protected areas	The values of protected areas associated with threatened and migratory fauna are described above (Threatened, Migratory or local fauna). Protected areas, include Australian Marine Parks, World Heritage Properties, Commonwealth Heritage Places, Ramsar and nationally important wetlands and key ecological features (KEFs). The Australian Marine Park network supports natural, cultural, heritage and socio-economic values, including habitats (e.g. coral reefs), listed EPBC Act and culturally important species and high species diversity. These values are susceptible to the effects of climate change such as ocean warming, ocean acidification, rising sea level and changes to ocean current and storm regimes. The Australian Marine Parks within the EMBA are the Oceanic Shoals Marine Park, the Arafura Marine Park, the Ashmore Reef Marine Park, Cartier Island Marine Park, the Argo-Rowley terrace Marine Park, the Arnhem Marine Park and the Joseph Bonaparte Gulf and contain natural, cultural, heritage and socio-economic values (refer Section 3.5.4) that are susceptible to effects of climate change. Scott Reef and Surrounds (a Commonwealth Heritage Place, refer Section 3.5.3.2) and the Garig Gunak Barlu National Park (refer Section 3.5.4.4) are within the EMBA and are susceptible to the same climate change effects as Australian Marine Parks. KEFs are Commonwealth marine areas important for biodiversity and ecosystem function and integrity. Similar to Australian Marine Parks, KEFs have values that are susceptible to effects of climate change. The KEFs that occur in the EMBA are typically geomorphic features (e.g. tributaries, carbonate bank and terrace system, pinnacles) (refer Section 3.5.5). They can support marine fauna that use the surface waters above the features, including plankton, pelagic invertebrates and fish, marine mammals, marine reptiles and seabirds. Ramsar and nationally important wetlands are critical for biodiversity and ecological balance and provide habitat for EPBC Act listed species (e.g. species of seabirds and shorebirds). Wetlands are susceptible to the effects of climate change such as sea level rise, increased temperatures and increased intensity and frequency of storms and fires. Within the EMBA, Ramsar and nationally important wetlands are Ashmore Reef, Coburg Peninsula, Daly-Reynolds Floodplain Estuary System and Finiss Floodplain and Fog Bay Systems (refer Section 3.5.2). These wetlands provide key habitats that support a high diversity and abundance of migratory birds and various wetland habitats. Considering that: • In any event, even assuming that emissions from the Activity will cause an equivalent net increase in cumulative Australian and global emissions, this increase comprises a nominal amount in the overall scheme of the national and international carbon budgets; and • In any event, there is no correlation between where GHG emissions are released and where climate change impacts are felt, it is not possible to draw a link between GHG emissions from the Activity and any specific climate related impact on protected area which may result from any net increase to cumulative GHG emissions globally. By keeping the Project emissions under the Safeguard Mechanism baseline, the Project's incremental contribution to global warming is within acceptable limits as determined by reference to Australia's NDC under the UNFCCC. Conservatively the associated potential environmental impacts to protected areas is assessed as I – Negligible.
Socioeconomic receptors	Changes to climate can result in impacts to social receptors that have values which include the ecological receptors described above, including KEFs and Australian Marine Parks (AMPs). Climate change may also impact on the functions, interests or activities of other users which rely on these ecological values, including commercial and recreational fisheries and tourism. Considering that: • In any event, even assuming that emissions from the Activity will cause an equivalent net increase in cumulative Australian and global emissions, this increase comprises a nominal amount in the overall scheme of the national and international carbon budgets; and • In any event, there is no correlation between where GHG emissions are released and where climate change impacts are felt, it is not possible to draw a link between GHG emissions from the Activity and any specific climate related impact on socioeconomic receptors which may result from any net increase to cumulative

Key receptors	Consequence level
	GHG emissions globally. By keeping the Project emissions under the Safeguard Mechanism baseline, the Project's incremental contribution to global warming is within acceptable limits as determined by reference to Australia's NDC under the UNFCCC. Conservatively the associated potential environmental impacts to socioeconomic receptors is assessed as I – Negligible.
Cultural features	For assessment of impacts to marine species of cultural significance, refer to the assessment for threatened, migratory or local fauna. For assessment of impacts to the physical environment to which First Nations people are connected and have raised concerns, refer to the assessment for the physical environment/ threatened ecological communities / protected areas.
Cumulative impacts	Increase in GHG emissions from concurrent activities is incremental to emissions during periods without concurrent activities and unlikely to results in cumulative impacts. Therefore, no change to the overall consequence level due to cumulative impacts is expected.
Overall worst-case consequence	I-Negligible

6.3.5 Demonstration of as low as reasonably practicable

Based on the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision, Santos considers the adopted control measures to have reduced the impacts and risks of GHG emissions from Barossa Production Operations to ALARP through the following measures:

- Facilities design emissions reductions which have reduced scope 1 non-reservoir emissions by over 50% (compared to the Barossa Development OPP baseline) (Section 6.3.5.1).
- Net-zero reservoir emissions, in line with regulatory requirements, through purchase or generation of ACCUs or SMCs to offset reservoir emissions
- Implementation of an Operations GHGEMP to reduce scope 1 emissions from facility operations to ALARP over the life of the Activity (Section 6.3.5.2). The GHGEMP has been adopted as a specific control measure (BAO-CM-6.3.12) with corresponding environmental performance standards (Section 8.1). The following protocols, procedures, systems and measures, as detailed further within the implementation strategy at the sections cross-referenced below, will be incorporated in, and form part of, the GHGEMP:
  - Emissions Performance target setting (Section 8.2.4.2)
  - Critical Equipment Maintenance (Section 8.3.2.3.1)
  - Methane Emissions Management (Section 8.3.2.12)
  - Decarbonisation Opportunity Management (Section 8.5.7)
- Measures which (while recognising that indirect emissions are outside of Santos' control and that each country is responsible for determining the manner in which it decarbonises to meet net-zero commitments) restrict the onshore processing and sale of products generated by the Activity to facilities and customers where there is an appropriate regulatory regime and/ or international commitment to the climate transition (see BAO-CM-6.3.19 and 6.3.20).
- Engagement with suppliers at the tender stage and with suppliers, the DLNG onshore processing facility and customers on an annual basis via control measures and performance standards (see BAO-CM-6.3.21, 6.3.22, 6.3.23 and 6.3.24). This engagement will:
  - enable Santos to verify its own scope 3 emissions estimates associated with the Activity via data collection
  - assist Santos in tracking performance against its scope 3 equivalent climate targets and Climate Transition Action Plan
  - facilitate support being provided to customers, the DLNG onshore processing facility and suppliers to reduce their own GHG emissions, thereby reducing the indirect GHG emissions associated with the Barossa Development
- Promoting global measurement and reporting standards and advocating for policy frameworks that enable a consistent approach to carbon emissions management.
- Supply of Barossa gas to Asian customers reduces associated shipping emissions. Shipping emissions are at least 50 per cent lower on a per-million tonnes LNG basis when compared to Middle East, North American East, and Russian West producers (Wood Mackenzie LNG Emissions Tool, 2024).
- Various adaptive management mechanisms to address areas of uncertainty, including:
  - emissions performance target setting (Section 8.2.4.2)

- methane emissions management (Section 8.3.2.12)
- implementation of Environment Plan management of change processes (Section 8.5.2) where seminal reports are published or there are material advances in technology relating to GHG emissions management
- implementation of performance review and continual improvement processes (Section 8.5.3.3)
- decarbonisation opportunity management (Section 8.5.7)
- at the corporate level, GHG emissions target setting and implementation of Santos' Climate Transition Action Plan

With consideration of risk and grossly disproportionate principles, no reasonable additional/ alternative controls were identified that would further reduce the impacts.

Santos considers all practicable management measures to have been implemented. Therefore, any impacts and risks associated with direct and indirect GHG emissions from Barossa Production Operations in Commonwealth waters are considered to have been reduced to ALARP.

6.3.5.1 Facilities design GHG emissions reductions

Table 6-21 presents the design and equipment selection measures that have been adopted for the Barossa FPSO. Adoption of these measures has resulted in over a 50% reduction in emissions (fuel, flare, vent) compared to the Barossa Development OPP emissions baseline. The Scope 1 emissions estimate in Section 6.3.2.1.1 reflects the adoption of the design measures listed in Table 6-21. Whilst Santos is confident in its estimates with respect to the use of these design measures, they will nonetheless be subject to in-field monitoring and validation. Validation of these design measures will be addressed as part of implementation of the Operations GHG Emissions Management Plan, through measures such as review of reported emissions against baseline estimates and monitoring equipment performance against design (see Section 6.3.5.2 and Section 8.2.4).

Table 6-21: Facilities design Scope 1 emissions reductions

Design measures	Emissions reduction benefit
Normally-unlit LP and acid gas flares	The use of normally-unlit LP and acid gas flares is considered best practice and the ALARP option by eliminating emissions associated with continuous flaring.
Continuously-lit HP flare pilot (fuel gas purge)	A continuously lit HP flare pilot will increase emissions under normal operating scenarios. However, this emissions increase is less than the GHG emissions resulting from a flameout or failure to light event, which is more likely under other design options considered, and is considered the ALARP option.
High pressure (HP) flare *planned* flaring limited to planned commissioning/start-up and shutdown flaring. *Unplanned* use of HP flare limited to process/equipment upsets/trips.	No 'routine' flaring during normal operations is best practice to eliminate a continuous source of operational emissions.
Full electrification of FPSO processing equipment, with CCGT power generation	Electrification of FPSO processing equipment using CCGT reduces the FPSO's emissions intensity. Waste heat from gas turbines is used to generate steam and run a steam turbine generator, removing the need to run an extra gas turbine. The Barossa FPSO is one of the first adopters of this technology both regionally and internationally for comparative offshore facilities.
Two-stage CO_2 removal membranes	The two-stage CO_2 removal membranes minimise hydrocarbon losses to the CO_2 membrane permeate stream, resulting in lower GHG emissions.
CO_2 membrane permeate stream sent to the thermal oxidiser with flare backup	The thermal oxidiser/ back-up flare reduces the amount of methane emissions by oxidising the methane before release.
Supply of process heating via waste heat recovery	Improves energy efficiency and reduces emissions of the FPSO by providing process heating from waste heat recovery. Less energy intensive than traditional alternatives such as use of stand-alone boilers to generate process heat.
Vapour recovery system with a two by 100% sparing philosophy	The use of a spared vapour recovery system reduces emissions by capturing low pressure vented gas that would otherwise be vented or flared, and is considered best practice and the ALARP option.

6.3.5.2 Operations GHG emissions management plan

Ongoing reduction of direct (scope 1) facility GHG emissions to ALARP over the life of the Activity will be governed under the Operations GHG Emissions Management Plan (GHGEMP). The GHGEMP is further described in the Implementation Strategy section of the EP (Section 8.3.2.13).

6.3.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence from GHG emissions is I - Negligible. As discussed above, the Activity will generate both Scope 1 (direct) and Scope 3 (indirect) GHG emissions. As outlined in Section 6.3.3, the acceptable levels of GHG emissions are defined as follows: • Acceptable levels of direct (Scope 1) emissions from the Activity are set by the Safeguard Mechanism Baseline on Barossa facility emissions, in line with the Australian Government's NDCs under the Paris Agreement. • Acceptable levels of indirect (Scope 3) emissions from the Activity within Australia are also set by the Safeguard Mechanism Baseline on Barossa facility emissions, in line with the Australian Government's NDCs under the Paris Agreement. • Acceptable levels of indirect (Scope 3) emissions from the Activity outside of Australia will be set -by customer countries within the context of their own NDCs under the Paris Agreement or mid-century net zero commitments and associated emissions reduction policies and regulations, noting that the emissions would arise regardless of the source of the gas being consumed (ie if gas was not supplied from Barossa, it would be supplied from elsewhere to meet customer and customer country demand) In evaluating the acceptability of Scope 3 emissions from the Activity, it is important to recognise the global consensus of the Paris Agreement under which countries have agreed to manage and reduce their own emissions with the aim to limit the global temperature increase in this century to 2°C, while pursuing efforts to limit the increase even further to 1.5°C. Santos has developed its EPOs and control measures having regard to the UNFCCC framework which sets out the responsibility of each country to manage and reduce its emissions and the autonomy of each country in determining its pathway to achieve its emissions reduction targets. Santos will otherwise only supply gas to customers that have a mid-century net zero commitment. Compliance with the Safeguard Mechanism is of primary importance in ensuring that Scope 1 GHG emissions associated with the Activity are kept to acceptable levels. GHG emissions at or below the baseline and the Safeguard Mechanism's future decline rates are already anticipated and thus accounted for under Australia's NDCs under the Paris Agreement. As outlined in Table 6-19 and Section 6.3.2.4: • Net GHG emissions (within Australia) from Barossa production operations represent 0.7% of Australia's 2050 net carbon budget. • Net GHG emissions from Barossa Production Operations represent 0.05% and 0.02% respectively of net global carbon budgets under 1.5°C and 2°C temperature increase scenarios. At 0.7% of Australia's carbon budget to 2050, and 0.05% and 0.02% of global carbon budgets for 1.5^{0}C and 2^{0}C temperature increases, the emissions from Barossa production operations comprise a nominal amount in the overall scheme of the national and international carbon budgets and will not materially or substantially contribute to Australia's net GHG emissions or net global emissions levels. Santos has adopted environmental performance outcomes and control measures directed to minimising GHG emissions from the Activity and therefore the potential contribution of these emissions to net cumulative GHG emissions globally. A range of controls have been considered and adopted for both direct (Scope 1) and indirect (Scope 3) emissions.
Is further information required to validate the consequence assessment?	No – The predicted GHG emissions associated with the Activity comprise a nominal amount in the overall scheme of the national and international carbon budgets and will not materially or substantially contribute to existing and future predicted Australian and global GHG emissions, having regard to the acceptability criteria as outlined in the preceding row.

Are the risks and impacts consistent with the principles of ecological sustainable development?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considered principles of ESD. Ensuring that GHG emissions are consistent with the principles of ESD requires balancing economic, social and environmental considerations. The Activity will be regulated under the Safeguard Mechanism under the NGER Act, which plays a critical role in achieving adherence to the principles of ESD. It does this by setting emissions baselines and requiring facilities to implement measures that minimise emissions over time, consistent with Australia's NDCs under the Paris Agreement. Implementation of the proposed control measures will reduce GHG emissions from the Activity to within baseline emissions levels. Further, the sale of Barossa LNG to customers within countries that have signed the Paris Agreement, where each country is responsible for accounting for, reporting and reducing emissions within their jurisdiction, will ensure that indirect emissions from the Activity are also consistent with the principles of ESD. By way of further explanation as to how the impacts from GHG emissions of the Activity are consistent with each of the principles of ESD: *(a) Decision making processes should effectively integrate both long term and short term economic, environmental, social and equitable considerations* As noted above, the Activity will be regulated under the Safeguard Mechanism. Under the Safeguard Mechanism, the Project will be required to have net -zero reservoir emissions and meet an emissions baseline set by the Clean Energy Regulator. This allows the Activity to proceed, in recognition of the importance of the role of gas in the energy transition, but with an acceptable level of GHG emissions, effectively integrating economic, environmental, social and equitable considerations. *(b) If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation* Several control measures require emissions monitoring. Coupled with the requirement to reduce emissions below a legislated baseline under the Safeguard Mechanism, these measures are consistent with the 'precautionary principle'. This is because they involve taking an adaptive management approach which is critical in addressing the uncertainty surrounding climate change and ensuring that any potential negative environmental impacts that would be associated with GHG emissions extending beyond baseline levels are proactively and appropriately avoided or offset. *(c) Inter-generational equity* Regulation under the Safeguard Mechanism ensures that the Activity aligns with the principle of intergenerational equity, as it is designed to lower emissions over time in alignment with Australia's NDCs under the Paris Agreement, thereby emphasising the responsibility of current generations to mitigate the harmful effects of climate change for future generations. *(d) The conservation of biological diversity and ecological integrity should be fundamental consideration in decision-making* The conservation of biological diversity and ecological integrity are core drivers of international efforts to reduce emissions via the Paris Agreement. In its context as an independent company, Santos' commitment to sell Barossa LNG gas to Paris signatories or countries with mid-century net-zero emissions commitments only is consistent with this principle. Regulation under the Safeguard Mechanism also ensures that GHG emissions are in line with Australia's NDCs and the Paris Agreement.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)?	Yes – Acceptable levels of impact and risks, and control measures implemented, have been informed by relevant species recovery plans, conservation advice, wildlife conservation plans and management actions set out in Table 3-13. At 0.7% of Australia's net carbon budget to 2050, and 0.05% and 0.02% of global carbon budgets for 1.5^{0}C and 2^{0}C temperature increases, the emissions from Barossa production operations comprise a nominal amount in the overall scheme of the national and international carbon budgets and will not materially or substantially contribute to Australia's net GHG emissions or net global emissions levels. In any event, carbon budgets are made up of both additions and subtractions to cumulative GHG emissions. Whether or not a net increase in cumulative Australian GHG emissions will occur is subject to multiple variables outside of the Barossa JV's control, other than its responsibility to manage the Activity's emissions to keep them under the Safeguard Mechanism baseline. For all the recovery plans identified in Table 3-13, the objectives are achieved through the adoption of EPO-10, EPO-11 and the control measures outlined in Table 6-19.
Are performance outcomes, control measures and associated performance standards consistent	Yes – performance outcomes, control measures and associated performance standards are consistent with GHG reporting legislation and emissions regulation. Performance outcomes, control measures and associated performance standards to manage the impacts and risks from GHG emissions associated with Barossa production operations are

with legal and regulatory requirements?	consistent with relevant global agreements and frameworks and Australian legislation and regulations, including: • the NGER (Safeguard Mechanism) Rule 2015, the regulatory mechanism of primary relevance to Barossa production operations in Commonwealth waters GHG emissions, which requires net-zero reservoir emissions, and Scope 1 emissions above a facility specific baseline to be offset. The Safeguard Mechanism is the appropriate performance standard for Scope 1 emissions from the Activity. This legislation reflects Australia's pathway to meet its obligations under the Paris Agreement. • the *National* Greenhouse *and Energy Reporting Act 2007* • GHG emissions are globally managed through the implementation of the Paris Agreement agreed under the United Nations Framework Convention on Climate Change at COP21 in 2015, which has established a global framework under which countries individually manage and reduce their emissions in accordance with their Nationally Determined Contributions (NDCs). This sets an ambitious climate-related goal (Article 2) and establishes a global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change (Article 7). The Paris Agreement commits individual signatory countries to define their nationally determined contributions, reach peak GHG emissions as soon as possible (Article 4), adopt rules and procedures to mitigate GHG emissions and adopt a compliance and reporting mechanism, as well as adaptive management and continuous improvement: • In relation to indirect emissions, Onshore Processing Services Agreements will only be made with Australian facilities that are subject to the Safeguard Mechanism (BAO-CM-6.3.20). Barossa products will only be sold to customers from countries that are signatories to the Paris Agreement or have mid-century net-zero emissions commitments (BAO-CM-6.3.19). The GHG emissions associated with the end use of Barossa products are expected to be managed under the emissions framework each customer country has agreed through their Paris Agreement NDCs or equivalent net-zero commitment. • Under a range of different potential future scenarios where global temperature increase is limited to 1.5 degrees Celsius, natural gas remains an integral part of the energy mix out to 2050 and plays a critical role in the transition to a lower carbon future, able to flexibly fill market supply gaps as alternative energy sources emerge. Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.7.

Are performance outcomes, control measures and associated performance standards consistent with relevant Santos policies?	Yes – Performance outcomes, control measures and associated performance standards align with relevant Santos policies, including Santos': • Environment, Health and Safety Policy • Climate Report 2024 (part of the Santos Annual Report 2024) and the emissions reductions targets outlined therein • Climate Transition Action Plan Santos' Climate Report 2024 outlines a climate strategy focused on backfilling and sustaining existing infrastructure, decarbonising Santos and third-party operations and investing in the technologies needed to develop the low carbon fuels of the future as markets evolve. Santos' approach to the temperature objectives of the Paris Agreement as outlined in the Climate Report 2024 involves: • setting short, medium and long-term emissions reduction targets which support the objective of limiting global warming to 1.5 degrees Celsius • achieving net zero emissions through decarbonisation via the Climate Transition Action Plan, which includes a commitment to supply chain collaboration and working with customers and suppliers to cultivate demand for low carbon fuels and carbon solutions • enhancing national commitments via continuing compliance with regulatory frameworks, such as Australia's Safeguard Mechanism, to enable Australia to meet its NDC therefore contributing to the global trajectory to limit global warming in line with Paris Agreement targets – this is reflected in EPO-11 • foster global collaboration by supporting global partners in their decarbonisation goals through the development of a CCS strategy and offering commercial carbon management services and low carbon fuels, as demand evolves, to customers and emitters in hard-to-abate industries. As Santos' Climate Report 2024 sets strategies directed at achieving consistency with Paris Agreement objectives, adopting these strategies at Barossa (as appropriate, having regard to joint venture arrangements and Barossa operations) therefore supports the achievement of EPO-10 (managing indirect GHG emissions associated with the Activity consistent with the temperature objectives of the Paris Agreement). Santos' Climate Report 2024 also identifies that Santos: • recognises the important role of renewables and the key role gas plays in complementing and supporting the deployment of renewable technologies • sees its role as a supplier of lower carbon energy and ultimately, carbon reduction solutions • prioritises avoidance and reduction of GHG emissions as a key lever towards decarbonising the business • recognises that carbon credits are likely to be required to offset hard-to-abate emissions from both its operations and the wider economy • intends to prioritise generating its own emissions reduction credits Santos' Sustainability Committee oversees the company's sustainability policies and practices and continually evaluates the company's performance against its emissions reduction targets via annual reporting. Engagement with suppliers, the DLNG onshore processing facility and customers via control measures and performance standards (see BAO-CM-6.3.21, 6.3.22, 6.3.23 and 6.3.24) will: • enable Santos to verify its own scope 3 emissions estimates associated with the Activity via data collection • assist Santos in tracking performance against its Scope 3 equivalent climate targets and Climate Transition Action Plan • facilitate support being provided to customers, the DLNG onshore processing facility and suppliers to reduce their own GHG emissions, thereby reducing the indirect GHG emissions associated with the Barossa Development In sum, the environmental performance outcomes and the controls that will be implemented are consistent with Santos' internal requirements. Direct emissions from Barossa Production Operations will be incorporated into the total emissions reporting by Santos once the project becomes operational. Climate change management is embedded within Santos' business strategy, including lowering operating emissions, in its capacity as an independent company.

Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – Consideration and adoption of controls described in relevant best practice industry standards including: • Environmental management in the upstream oil and gas industry – IOGP- IPIECA, 2020. • OGCI: Aiming for Zero Methane Emissions Initiative • IPIECA Flaring Management Guidance • IPIECA Sustainability Guide
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – Issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with the ACF, the ECNT and the Clean Energy Regulator, have been considered when evaluating performance outcomes, control measures and associated performance standards (see section 4.7 for further information). It is acknowledged that GHG emissions associated with the Activity, and the impacts of climate change, were noted as a material issue for Relevant Persons consulted in the course of preparing this EP. EPOs and control measures have been adopted to ensure that GHG emissions associated with the Activity are ALARP and acceptable. In developing and determining these EPOs and control measures, specific control measures proposed by Relevant Persons (including the ACF and ECNT) were evaluated. Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs were also evaluated in developing the EPOs and control measures for this EP. The final form of the EPOs and control measures adopted have been determined and adopted for the reasons set out in this EP..
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

6.4 Atmospheric Emissions

6.4.1 Description of event

Event	Air polluting emissions, such as sulphur oxides (SO_X), nitrogen oxides (NO_X) and volatile organic compounds (VOCs) are discharged to the atmosphere during continued operations of the Barossa facilities, contributing to a localised reduction in air quality. Atmospheric emissions from Barossa production operations are derived from: • fuel – combustion of fuels (natural gas during normal operations; diesel during cold-commissioning, initial start-up, planned maintenance or emergency conditions) to generate power or heat • flaring – combustion of hydrocarbons to prevent the creation of an explosive atmosphere during the initial start-up phase (including well-clean up) and intermittently during planned maintenance or upset conditions • venting – via a thermal oxidiser; venting of fuel gas used for storage tank blanketing; venting of nitrogen/helium during leak testing; • fugitive emissions from the process and unintentional emissions released from equipment leaks or other components that are not regarded as venting • combustion emissions from vessels and helicopters. Support and campaign vessels may also use: • an incinerator to manage wastes • ozone-depleting substances (ODS) in closed-system rechargeable refrigeration systems (no ODS used on the FPSO). Concurrent Barossa activities (Section 2.3.1) in OA1 will result in additional atmospheric emissions associated with the operation of a MODU (including intermittent and short duration flaring (two to three days for each well]) and support vessels (D&C EP activities) and the operation of a construction vessel and transportation vessel (SURF EP activities). Therefore, the cumulative impacts have been considered in this assessment.
	Operational area 1: All activities described above, including concurrent activities, are planned within OA1. **Operational area 2:** Only IMMR vessel activities are planned within OA2.
Extent	The quantities of atmospheric emissions under normal operating conditions will quickly dissipate into the surrounding atmosphere of an open ocean environment. The same is true for concurrent Barossa activities that will occur in OA1. It is recognised the emissions will also contribute to global GHG emission which have impacts outside of the OAs. This is further assessed in Section 6.3.

Duration	**Continuous:** Fuel, flare, vent emissions from the FPSO and support vessel and helicopter operations throughout the duration of the Activity. **Infrequent and one-off:** Atmospheric emissions specific to cold-commissioning and initial start-up phases: - diesel emissions for power generation and utilities during cold-commissioning and initial start-up - flaring during initial start-up (including well clean-up) - acid gas flare prior to commissioning of thermal oxidiser Duration of emissions during initial start-up will be dependent on duration of system/equipment testing and DLNG commissioning durations. Campaign vessels for specific activities would be less frequent, up to two per year for approximately 14 to 30 days and approximately 34 days for LWI that may be undertaken every two years. **Concurrent:** The duration of overlap for each concurrent Barossa activity within OA1 is presented in full in Section 2.3.1. For FPSO pre initial start-up activities there may be concurrent atmospheric emissions from a MODU and support vessels for a period of ~3 months (including intermittent short-duration emissions from flaring); for ~one month of this period there may also be atmospheric emissions from a construction vessel and transportation vessel undertaking SURF installation and pre-commissioning (SURF EP). There may be MODU drilling/completion (under the D&C EP) extending for a period of up to ~3 months post FPSO start-up and contingency MODU well workovers activities (nominally of 3-months duration) within a ~5-year period. Contingency well workovers will be authorised under a separate EP. For the first 6 months post FPSO start-up, there may also be up to ~2 months cumulative duration of SURF installation and pre-commissioning.

6.4.2 Nature and scale of environmental impacts

6.4.2.1 Atmospheric emissions estimates

The atmospheric emissions estimates cover all Activity stages including:

- Hookup and Cold Commissioning
- Initial Start-up
- Steady State Operations

The substances emitted to air included for the estimates are typical combustion by-products.

- Carbon monoxide (CO)
- Nitrogen oxides (NOx as NO_2)
- Sulphur oxides (SOx as SO_2)
- Volatile organic compounds (VOC)
- Particulate matter (PM2.5 and PM10)

There will also be mercury (Hg) emissions to atmosphere due to its presence in the reservoir gas/fluids.

The design basis used for the atmospheric emissions inventory is based on the mid case of the well testing result of the reservoir, this includes hydrocarbon assay and the CO_2. Well fluids from the Barossa field are processed to separate condensate and field gas, and the field gas is further processed through a series of separation steps to obtain permeate gas (CO_2 rich) and fuel gas / export gas to DLNG. Permeate gas is treated via a thermal oxidiser prior to disposal to atmosphere. A backup acid gas flare system is used when the thermal oxidiser is not available.

Key design inputs in addition to the process and exhaust stream flows, and composition of key processing streams relevant to the atmospheric emissions estimates are as follows.

Reservoir:

- H_2S: 40 ppm.
- Hg: 500 ppbw in vapour phase.
- Assumed wet fuel gas composition is the same as reservoir fluid composition.

Separation – permeate stream:

- H_2S: balance of H_2S (assumed all to disposal via thermal oxidiser or acid gas flare).
- Hg: 0 ppb (negligible Hg in permeate stream downstream of CO^2 removal membranes).

Separation – export / fuel gas stream:

- H_2S: 17 ppm H_2S.
- Hg: 20 ppbw (given specification of low temperature separation and decanting predicted efficiency of 99.5%).

Treatment and disposal:

- Thermal oxidiser: fuelled with permeate stream, no additional fuel gas requirement.
- Acid gas flare: fuel gas assist required.

A variety of methods were used to determine the air emissions. Method selection was considered in order of descending preference:

I. Manufacturer equipment modelling results: Equipment such as the gas turbine generators were modelled using predicted fuel gas compositions. Fuel / heat rates were matched with modelled outcomes and used as is.

II. Manufacturer equipment datasheets: Performance curves for equipment such as the fire water pumps were provided. Fuel / heat rates were matched with modelled outcomes and used as is.

III. NPI or API emission factors: Where equipment specific emissions data was not available, NPI or API emissions factors were used for flaring and fugitive emissions sources,.

A mix of methods are used depending on what information was available for each piece of equipment and/or emission type. For example, emissions modelling for the gas turbine generators did not account for particulate matter emissions, which necessitated the use of NPI estimates to estimate particulate matter emissions from the gas turbines.

An overview of the key activity and equipment assumptions used in the atmospheric emissions for each stage of the Activity is provided in Table 6-22.

Table 6-22: Summary of key assumptions that support the atmospheric emissions calculations presented in this EP.

Stage	Emission Source	Emissions Points and Key Assumptions
Hookup & cold-commissioning	During hook-up and cold-commissioning power will be supplied by essential diesel generators before commissioning of the fuel gas system post-RFSU. Diesel usage during the first year of operations (inclusive of commissioning and startup activities) will be higher than steady state operations. There will be no flaring prior to initial start-up.	
	Diesel	Emission Points: • Essential Generators • Inert Gas Generator • Gas Turbine Generators • Vessels - various Diesel fuel will comply with MARPOL Annex VI and Marine Order 97 which gives effect to IMO low sulphur fuel oil requirements (0.5% m/m sulphur content) Pre-RFSU, power on the FPSO will solely be provided by the essential diesel generators at 28m^3/day, estimated at 93 days. Contingency of 18 days diesel usage (28 m^3/day) in the event of delays to commencement of start-up
	Aviation Gas	Emissions Points

Stage	Emission Source	Emissions Points and Key Assumptions
		• Helicopters (landing and take-off only)
Initial Start-up to Steady State	During initial start-up to steady state diesel emissions will progressively be replaced with fuel gas as the fuel gas system is commissioned, and emissions from flaring and venting (reservoir CO_2) will commence. Flaring will be elevated during the initial start-up phase (relative to flare levels during normal operations) as wells are cleaned up, and processing equipment and systems are progressively commissioned for normal operations.	
	Diesel	Emissions Points • Essential Generators • Inert Gas Generator • Gas Turbine Generators • Vessels - various Diesel fuel will comply with MARPOL Annex VI and Marine Order 97 which gives effect to IMO low sulphur fuel oil requirements (0.5% m/m sulphur content) Post-RFSU power on the FPSO will be provided by the GTGs. One GTG will run on diesel for the first 7 days until the fuel gas system can produce sufficient gas for GTG fuel switch testing. The diesel usage rate for the GTG is 146 m^3/day. During restart following emergency shut down testing, diesel use as follows: • Three days on essential diesel generators (28m3/day) • 1 day – 1 GTG on diesel • 0.5 days – 1 GTG on diesel
	Aviation Gas	Emissions Points • Helicopters (landing and take-off only)
	Fuel Gas	Emissions Points: • Gas Turbine Generators GTGs fuelled by 'wet gas' for up to 7 days until membrane separators commissioned, and then fuelled by 'dry gas' following commissioning of membrane separators. Ramp-up of GTGs on fuel gas during initial commissioning of the fuel gas system as follows: • 1 GTG for 7 days on fuel gas (4.9 MMscfd) • 2 GTGs for 41 days on fuel gas (5.8 MMscfd per GTG) • 3 GTGs for 18 days on fuel gas (7.7 MMscfd per GTG) During restart following emergency shut down testing, diesel use as follows: • 0.5 days – 1 GTG on fuel gas (4.9 MMscfd) • 2 days – 2 GTGs on fuel gas (5.8 MMscfd per GTG) • 1 day – 3 GTGs on fuel gas (7.7 MMscfd per GTG) • 3 days – 4 GTGs on fuel gas (6.2 MMscfd per GTG)

	Flaring	Emissions Points
		• LP Flare (planned)
		• HP Flare (planned)
		• Acid Gas Flare (planned)
		Assumptions
		• Well clean-up flaring up to 24hrs per well (6) at maximum flaring rate of 250 MMscfd
		• Ramp-up flaring assumptions:
		  ○ From RFSU to pipeline pressurisation: maximum flaring rate of 127 MMscfd for up to 16 days
		  ○ From pipeline pressurisation to ESD testing: maximum flaring rate of 118 MMscfd for up to 41 days
		  ○ Post ESD test ramp up to handover to operations: maximum flaring rate of 115 MMscfd for up to 18 days
		• Unplanned DLNG outages during post RFSU:
		  ○ 3 flaring events for 3 days each at 130 MMscfd (DLNG outage < 3 days);

Stage	Emission Source	Emissions Points and Key Assumptions
		○ 3 flaring events for 3 days each at 130 MMscfd (DLNG outage 3 days or greater). For DLNG outages 3 days or greater, the field would be shut-in after 3 days and flaring would cease until DLNG has restarted. • Flare pilot supplied with propane gas for 7 days (~1974kg) until fuel gas system is online. • Reservoir CO_2 vented via acid gas flare until thermal oxidiser commissioned for up to 54 days – ~20% increase in CO_2e when venting via acid gas flare compared to thermal oxidiser.
Steady State Operations and Maintenance	During the operations and maintenance phase, fuel gas combustion will be the primary source of emissions. Flaring will be limited to 4-yearly planned shutdowns or safety flaring during unplanned upset or emergency conditions. Diesel use will be limited to planned and unplanned shutdown events and period testing of safety critical equipment e.g. essential generator. Fugitive emissions are a by-product of offshore processing, offtake operations and gas pipeline transmission and represent ~1% of total direct lifecycle emissions. Production profile assumptions: • Year 2025-2037: HP mode • Year 2037-2041: LP mode • Year 2041-2047: <67% LP mode • Year 2047-2050: <33% LP mode • Planned shutdown for 35 days every 4 years, first shutdown in 2029	
	Fuel gas	Emissions Points ○ Gas Turbine Generators ○ HP Flare pilot • Fuel gas will be used to run three gas turbine generators to supply power for FPSO processing systems. • Supplementary fuel gas supply to the thermal oxidiser supplied by flammable CO_2 removal membrane Stage 1 permeate stream
	Flare	Emissions Points • LP flare (unplanned) • HP flare (unplanned) • Acid Gas Flare (unplanned) • Low pressure (LP) flare is normally operated as a closed flare with pilots extinguished and nitrogen purge to flare stack. LP flare is operational when vapour recovery unit (VRU) is offline. VRU is 2 by 100% so LP flaring limited to 0.3 MMscf per year. • High pressure (HP) flare normally lit and purged using fuel gas, requiring ~14mmscf of fuel gas per year • Planned shutdown for 35 days every 4 years, requiring restart flaring at 130 MMscfd for 1 day *Flaring from unplanned events* • Type 1[1] unplanned shutdowns – 10 events annually for yrs 1-3; 7 events annually for years 4-25; 4hrs from trip to commencing restart assumed. • Type 2[2] unplanned shutdowns – 4 events annually for yrs 1-3; 3 events annually for years 4-25; 24 hrs from trip to commencing restart assumed. • HP flaring from unplanned field shutdown events (Type 1 and 2 events) up to ~1200 MMscf per year • HP flaring from unplanned equipment trips up to ~220 MMscf per year e.g. compression equipment trips • LP flaring from unplanned field shutdown events ~14 MMscf per year • Acid Gas Flare only operational when thermal oxidiser is offline when reservoir CO_2 is vented via the acid gas flare. Unplanned outages of the thermal oxidiser (when the acid gas flare would be operational) are estimated to be up to 30 days per year (10 days total for Type 1[1] shutdowns and 20 days total for Type 2[2] shutdowns)
	Vent	Emissions Points

Stage	Emission Source	Emissions Points and Key Assumptions
		• Thermal Oxidiser Assumptions • Mid case 18% reservoir CO_2 • Reservoir processed via thermal oxidiser during normal operations; otherwise processed via the acid gas flare during unplanned outages of the thermal oxidiser.
	Diesel	Emissions Points • Emergency Generator • Essential Generators • Inter Gas Generator • Vessels - various • Firewater Pump (unplanned apart from planned testing) • Gas Turbine Generator (unplanned) Assumptions • Diesel fuel will comply with MARPOL Annex VI and Marine Order 97 which gives effect to IMO low sulphur fuel oil requirements (0.5% m/m sulphur content) • GTGs to run on diesel for 35 days every 4 years during planned shutdowns. Essential diesel generators also to be operational for the duration of planned shutdowns. • Essential diesel generator testing 10 mins per week. • Emergency diesel generator testing 40 mins per week. • Fire water pump testing (diesel fuel) for 30 mins per week • Inert gas generator (diesel fuel) operation for 100 hours per year • GTGs to run on diesel during fuel gas system unplanned outages or GTG trips for up to 108 hours per year
	Aviation Gas	Emissions Points • Helicopters (landing and take-off only)
	Fugitives	• Fugitives from natural gas processing: number of offshore facilities (1) and the H&MB gas compositions for each operating mode. • Fugitives from condensate offloading: assumed 158,111 tonnes of condensate offloaded in the first year; 360,370 t/y condensate offloaded during HP mode; and 367556 t/y for the remaining. • Fugitives from produced water: forecast PW flowrate of 22 m^3/h produced water on average during HP and 36.7 m^3/h PW during LP/LLP.

[1] Type 1 unplanned shutdowns - shorter duration shutdown events, which trips Powergen and autostarts Essential Generator. No FPSO topsides blowdown to flare, 10 events assumed to occur annually years 1-3; 7 events assumed to occur annually years 4-25.

[2] Type 2 unplanned shutdowns - longer duration shutdown events resulting topsides blowdown to flare, including restart flaring and diesel requirements. 4 events assumed to occur annually years 1-3; 7 events assumed to occur annually years 4-25.

Table 6-23 provides an estimate of the atmospheric emissions for the 25-year lifecycle of Barossa production operations for commissioning and steady state operations.

Table 6-23: Estimated atmospheric emissions (tonnes) for the 25 year lifecycle of the Activity

Production Operations	CO (t)	NOx (t)	SO_2 (t)	VOC (t)	PM (t)	Hg (t)
FPSO arrival, hookup & cold-commissioning and Initial Start-up to Steady State						
Fuel (diesel)	99	634	92	45	104	-
Aviation gas	4	0.01	0.001	0.08	0.7	-
Fuel (gas)	23	29	0.5	5	0.9	0.0004

Production Operations	CO (t)	NOx (t)	SO_2 (t)	VOC (t)	PM (t)	Hg (t)
Flare (incl. reservoir CO_2 - initial start-up only)	2,891	498	31	4,984	19	0.2
Steady State Operations and Maintenance						
Fuel (diesel)	1,075	6,568	528	292	1,067	-
Aviation gas	50	0.1	0.009	1	8	-
Fuel (gas)	4,462	6,103	168	675	741	0.1
Flare	13,137	2,265	1,149	22,651	354	0.4
Vent (reservoir CO_2)	7,126	4,276	3,919	-	-	-
Fugitives	-	-	-	2,864	-	-
Grand Total	**28,867**	**20,373**	**5,888**	**31,517**	**2,295**	**0.7**

Table 6-24 provides an estimate of the atmospheric emissions for the 5-year period for this EP.

Table 6-24: Estimated atmospheric emissions (tonnes) for the 5-year period for this EP.

Production Operations	CO (t)	NOx (t)	SO_2 (t)	VOC (t)	PM (t)	Hg (t)
FPSO arrival, hookup & cold-commissioning and Initial Start-up to Steady State (total)						
Fuel (diesel)	99	634	92	45	104	-
Aviation gas	4	0.01	0.001	0.08	0.7	-
Fuel (gas)	23	29	0.5	5	0.9	0.0004
Flare (incl. reservoir CO_2) (initial start-up only)	2,891	498	31	4,984	19	0.2
Steady State Operations and Maintenance (total)						
Fuel (diesel)	228	1,405	118	64	226	-
Aviation gas	12	0.03	0.002	0.2	2	-
Fuel (gas)	885	1,319	36	146	157	0.02
Flare	3,779	652	351	6,516	107	0.1
Vent (reservoir CO_2)	1,880	1,128	1,034	-	-	-
Fugitives	-	-	-	623	-	-
Grand Total	**9,801**	**5,665**	**1,663**	**12,383**	**617**	**0.3**

Annual averages inclusive of all sources across the 25-year lifecycle of the Activity (steady-state only) are shown in Table 6-25.

Table 6-25: Annual average atmospheric emissions (tonnes) across the 25-year lifecycle of the Activity (steady-state only) assuming a flat emissions rate for 25 years.

Production Operations	CO (t)	NOx (t)	SO_2 (t)	VOC (t)	PM (t)	Hg (t)
FPSO arrival, hookup & cold-commissioning and Initial Start-up (total)						
Fuel (diesel)	4	25	4	2	4	-
Aviation gas	0.1	0	0	0.003	0.03	-
Fuel (gas)	1	1	0.02	0.2	0.04	0
Flare (incl. reservoir CO_2) (initial start-up only)	116	20	1	199	0.7	0.008
Steady State Operations and Maintenance (total)						
Fuel (diesel)	43	263	21	12	43	-
Aviation gas	2	0.005	0	0.04	0.3	-
Fuel (gas)	178	244	7	27	30	0.004
Flare	525	91	46	906	14	0.02
Vent (reservoir CO_2)	285	171	157	-	-	-
Fugitives	-	-	-	115	-	-

Potential receptors: Physical environment and habitat, threatened, migratory or local fauna, socio-economic.

The potential impact from the release of air emissions identified above is:

- deterioration of local air quality.

Hydrocarbon combustion may result in a temporary, localised reduction of air quality in the environment immediately surrounding the discharge point during the Activity. Non-GHG emissions, such as NO_X, SO_2, CO, PM, VOCs and Hg can lead to a reduction in local air quality.

VOCs can be harmful to human health and also to the environment, as they can be toxic; however, this is generally relevant to high concentrations of VOCs in closed environments. VOCs are not expected to be in large enough volumes to be harmful and will rapidly disperse, reducing potential for impact.

Hg is present in the Barossa reservoir gas and will be present in emissions from facility equipment which can be harmful to the environment. During normal operations, there will be low levels of mercury in the fuel gas combustion, flaring and thermal oxidiser exhaust streams that will rapidly disperse, reducing potential for impact.

Flaring is a necessary safety control and combustion emissions are required during the Activity to run equipment and vessels.

The quantities of vessel emissions will quickly dissipate into the surrounding atmosphere. Air emissions will be similar to other vessels operating in the region for both petroleum and non-petroleum activities.

ODS have not been used as refrigerants on the FPSO (heating, ventilation and air conditioning systems use R134a, R290 and R452A).

Interactions with sensitive environmental receptors linked to air pollutants is not expected considering OA1 is located offshore and far from populated regions. Although individual migrating birds may roost on the FPSO or campaign vessels, air emissions are not expected to have negative effects on birds because of the highly dispersed nature of the air emissions. Possible effects are localised variations in air quality that are restricted to the FPSO or campaign vessel/s location. It is anticipated that the effects of air emissions will disperse well in advance of the closest populated area and will have negligible direct or cumulative effects on environmental receptors or exceed National Environmental Protection (Ambient Air Quality) measures (NEPM) standards (OA1 is approximately 130km from the Tiwi Islands and 285 km north-north-west of Darwin). This is further supported by the results of the exhaust gas dispersion study for the Barossa FPSO, that assessed potential impacts of atmospheric pollutants to offshore personnel. These dispersion studies did not detect concentrations greater than the long-term workplace limits for almost all target locations for all pollutants of concern, including NO_2, CO, CO_2, SO_2 and Hg (BWO, 2023a). In the few cases where modelled concentrations did exceed long-term workplace limits,

these are only expected to occur very infrequently and for very short durations such as use of firewater pumps for testing or in an emergency, running GTGs with wet gas during a black start scenario.

As the Activity will occur in open-ocean offshore waters, the combustion of fuels and incineration in such remote locations will not impact on air quality in coastal towns, the nearest being the Tiwi Islands (approximately 130 km south from OA1) and Darwin (approximately 285km south-east of OA1).

Potential impacts are expected to be short term and relate to localised reduction in air quality, limited to the immediate vicinity of the emissions release. Atmospheric emissions impacts are expected to have negligible direct or cumulative impacts on sensitive environmental receptors or be above National Environmental Protection (Ambient Air Quality) measures.

6.4.2.2 Potential cumulative impacts

On the basis that concurrent activities (see Section 2.3.1) will occur within the OA1, the potential for cumulative impacts of atmospheric emissions is acknowledged.

The D&C EP and the SURF EP assessed potential atmospheric emission impacts to be negligible given the remote location and the relatively short duration of each activity. Given the relatively short periods for which there are expected to be concurrent drilling/completion, SURF and FPSO activities in OA1, and the spatial separation of these activities (drill centres are >6km from the FPSO turret) negligible additive and cumulative atmospheric emissions effects from concurrent activities are predicted.

6.4.2.3 Indirect consequences from Darwin Liquefied Natural Gas Facility Operations

Emissions from processing of Barossa feed gas at DLNG facility would be generated from operation of the acid gas thermal oxidiser, refrigeration turbines, power generation turbines and steam boiler, and are expected to be comparable to DLNG facility operations when processing Bayu-Undan feed gas. The Barossa feed gas is expected to have a higher H_2S concentration (10–17 ppm), compared to the previous feed gas (4-6 ppm). However, the upgrade of the acid gas removal system would result in an overall minor decrease in H_2S emissions due to the new thermal oxidiser technology which optimises acid gas disposal, has increased reliability (>95%) and is designed to convert H_2S to SO_2 and H_2O, benzene to CO_2 and H_2O, and reduce emissions to as low as reasonably practical (ALARP).

The changes to DLNG facility operations associated with processing Barossa feed gas were addressed in a Notice of Intent (NOI), submitted to the NT EPA for assessment. The purpose of the NT EPA assessment was to determine if the scope of the change would require assessment under the *Environmental Assessment Act 1982* NT. In its assessment of the NOI[51], the NT EPA concluded that the potential environmental impacts and risks of the proposed changes to the existing operation of the DLNG facility would be mitigated to such an extent that they are not considered to be significant. The NT EPA considered that the residual risks will be sufficiently regulated through updates to the DLNG Facility Operations Environmental Management Plan, a revision to the DLNG Facility Environment Protection Licence (EPL-217) under the *Waste Management and Pollution Control Act 1998* NT and other relevant legislation and policies (NT EPA, 2020).

6.4.3 Environmental performance outcomes and control measures

The EPO relating to this event is:

- Atmospheric emissions associated with the Activity will me*et al*l regulatory source emission standards. (EPO-09)

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this Activity are shown in Table 6-25 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria that are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

[51] *DLNG Natural Gas Transition Work Program Statement of Reasons*

Table 6-26: Control measures evaluation for atmospheric emissions

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-6.3.16	MARPOL-compliant (Marine Order 97) fuel oil will be used by vessels and MGO will be used on the FPSO to reduce atmospheric emissions (substitution control)	Reduces emissions through use of low-sulphur fuel in accordance with MARPOL Annex VI (and Marine Order 97).	None identified.	**Adopted** – it is a legislated requirement.
		FPSO power generation systems reduce emissions to the atmosphere by primarily using produced fuel gas as opposed to liquid fuel. A CCGT and Steam Turbine Generator used to reduce fuel gas usage. Fuel reduction by using a steam turbine generator. Turbines used are Low NO_x burners.	Costs during design and construction phases.	**Adopted** – benefits in reducing emissions to atmosphere outweigh costs.
BAO-CM-6.3.17	Pursuant to Marine Order 97, relevant vessels will have a current International Air Pollution Prevention (IAPP) Certificate or equivalent and Ship Energy Efficiency Management Plan (SEEMP) (administrative control)	Reduces emissions by ensuring compliance with MARPOL Annex VI (and Marine Order 97).	Cost of maintaining certification.	**Adopted –** benefit of ensuring vessel is compliant outweighs the minimal costs and it is a legislated requirement.
BAO-CM-6.4.1	Ozone depleting substance (ODS) and lower global warming potential (GWP) refrigerants use and handling procedures (administrative control)	Reduces probability of potential impacts to air quality due to ODS emissions.	Personnel cost of maintaining ODS record book/ recording system.	**Adopted –** benefits of ensuring no ODS release outweighs the minimal costs
BAO-CM-6.1.2	Vessels equipped and crewed in accordance with Australian maritime requirements, including Marine Order 30 (Prevention of Collisions) and Marine Order 21 (Safety and Emergency Arrangements) (administrative control)	Ensures contracted vessels are operated, maintained, and crewed in accordance with industry standards and regulatory requirements. Ensures vessels meet Marine Assurance Standards to reduce the likelihood of vessel collision (such as minimum and working lighting for maritime safety).	No additional costs, as this is an industry standard requirement.	**Adopted –** benefit of assuring vessels outweighs procedure compliance costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-6.4.2	Connection of process hydrocarbon vents to flare and vapour recovery system (engineering control)	Reduced flaring and atmospheric pollution.	Cost during design and construction phases.	**Adopted –** benefits in reducing emissions to atmosphere outweigh costs.
BAO-CM-6.4.3	Vessel waste incineration management (note: no waste incinerator on board the FPSO) (engineering control)	Reduces the potential for emissions/ particulates by ensuring only permissible waste is incinerated as per Marine Order 97.	Cost associated with onshore waste disposal.	**Adopted –** impact on air quality outweighs the costs and impacts associated with transporting waste to shore for landfill. *Note: no waste incinerator on board the FPSO*.
BAO-CM-6.4.4	National Pollutant Inventory (NPI) Reporting (administrative control)	Collects information about emissions across Australia.	Administrative costs of recording and collating information and reports	**Adopted –** legislated requirement.
BAO-CM-6.4.5	HSE inductions will include applicable environmental requirements (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements. Ensures personnel are suitably aware of cultural features and values.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted -** benefits considered to outweigh costs
BAO-CM-6.4.6	Low-temperature Separator (LTS) operates within Integrity Operating Window (engineering control)	When both the LTS stages are operating within their Integrity Operating Windows as defined in the Static Equipment Integrity Management Plan, 99.5% of elemental mercury is predicted to be removed from the gas stream and therefore does not have the potential to be released through mercury emissions.	Operating the LTS stages within their Integrity Operating Window requires effort through monitoring and action but is a requirement to safely meet gas export specifications and to protect equipment from damage.	**Adopted –** implementation of the control (in conjunction with decanting) removes mercury from the production process and lowers mercury emissions as well as ensuring safety and reliability of producing gas at export specifications. Benefits outweigh costs.
BAO-CM-6.4.7	Mercury collection pot gauge (engineering control)	Ensures that through the provision of gauges and daily recording of mercury levels, elemental mercury removed in LTS stages and collected in mercury collection pots can be checked and removed, preventing build-up in the production system.	Cost of MCP gauges and effort of daily monitoring	**Adopted** – the cost and effort in the provision of gauges and associated monitoring is outweighed by the benefit in ensuring mercury is removed from the production system

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-6.4.8	Mercury Decanting Procedure (administrative control)	Ensures that there is an effective process in place for the removal of elemental mercury out of the production system through decanting of mercury from mercury collection pots.	Cost and effort in developing procedure and effort in recording actions against procedural steps	**Adopted** – the cost and effort in developing procedure and effort in recording actions against procedural steps is outweighed by the benefit of ensuring mercury is effectively and safely removed from the production system
Additional control measures				
BAO-CM-6.3.13	Fuel gas will be used preferentially for power generation fuel instead of liquid fuel. (substitution control)	Fuel gas generates lower GHG emissions than marine diesel oil or marine gas oil per unit of electricity generated	More cost-effective to run FPSO power generation on fuel gas than marine diesel oil or marine gas oil alternatives	**Adopted –** results in lower GHG emissions without an adverse cost impact
BAO-CM-6.3.2	Initial start-up will be sequenced to ensure the maximum amount of alignment between the respective facilities whilst minimising flaring. (administrative control)	Best practice to minimise unnecessary flaring during initial start-up (following introduction of hydrocarbons).	Delayed commencement of production operations.	**Adopted** – emissions benefit outweighs impact to initial start-up timeliness
BAO-CM-6.3.3	Hook-up and commissioning and initial-start-up fuel and flare target setting (administrative control)	Structured process to track emissions performance during initial start-up and manage deviations from performance targets to reduce emissions to ALARP.	Administrative cost to implement, potential impact to execution schedule	**Adopted** – emissions benefit outweighs impact to initial start-up timeliness
BAO-CM-6.3.15	Flare ignition system design to automatically reignite flare pilot on detection of loss of flame (engineering control)	High energy system will attempt to auto reignite for up to two minutes to prevent cold venting. Back-up flame front generator available.	Costs for installation and ongoing maintenance of flare ignition system.	**Adopted** - benefit outweighs cost.
BAO-CM-6.3.14	Measure/estimate emissions from all fuels combusted and gas disposal streams to meet NGER/NPI requirements (administrative control)	Emissions measurement system for GHG emissions in line with NGERS/NPI requirements.	Costs for installation and ongoing maintenance and calibration of measurement equipment.	**Adopted** – in line with Australian regulatory requirements for GHG/NPI reporting.
BAO-CM-6.4.9	Emissions Performance target setting (Section 8.2.4.2) (administrative control)	Managing uncertainty and reducing emissions to ALARP over the life of the Activity	Administrative cost to implement	**Adopted** – emissions benefit outweighs impact to initial start-up timeliness
BAO-CM-6.4.10	Barossa Facilities and vessels planned maintenance system to confirm equipment integrity is maintained in accordance with manufacturers guidelines. (administrative control)	Reduces emissions by ensuring FPSO and vessels are operated, maintained and crewed in accordance with industry standards and regulatory requirements.	Personnel costs of implementing.	**Adopted** – benefits of operating equipment within Operational parameters will help control emissions created by equipment.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Removal of all ODS containing equipment from contracted vessels (elimination control)	Eliminates potential of ODS emissions occurring.	ODS is rarely found on vessels and there is a low potential for ODS releases. If there is ODS-containing equipment (such as refrigerators), it will be managed as per Marine Order 97: Marine Pollution Prevention – Air Pollution.	**Not adopted** – based on cost to replace all equipment and the low potential for ODS releases.
N/A	Using lower emissions vessels (substitution control)	Reduces total emissions associated with engines.	Not practically feasible. The contracted vessels required are specialised and have limited availability. The vessels selected will comply with Santos' vessel vetting process.	**Not adopted** – not practically feasible. The contracted vessels are specialised and have limited availability. The vessels selected will comply with Santos' vessel vetting process.
N/A	Eliminate flaring by venting uncombusted hydrocarbons instead (elimination control)	Not further assessed as high carbon dioxide permeate (waste) gas stream sent to a thermal oxisider for combustion (with flare back up) occurs for the majority of operational time and is a key safety critical element for the safe operation of the FPSO.	Long term sustained operational hydrocarbon venting is not good industry practice, as unburnt hydrocarbons pose potential for greater environment impact compared to combusted emissions. In addition, the ability to flare hydrocarbons is a key critical safety element for the safety operation of the FPSO. Removing the ability to flare hydrocarbons may result in unacceptable safety risks on the FPSO.	**Not adopted** – Venting of uncombusted hydrocarbons has a much larger and unacceptable environmental impact (GHG emissions) The flare and thermal oxidiser are key safety critical elements for the safe operation of the FPSO.
N/A	No waste incineration during activities by vessels (elimination control)	Eliminates waste incineration emissions.	Increase in health risk from storage of some wastes. Requirement to transfer waste for onshore disposal. Cost of waste disposal.	**Not adopted** – waste incineration is a permissible maritime activity if done in accordance with regulations. *Note: no waste incinerator on board the FPSO*

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Installation of alternative mercury removal technology ie. Mercury Removal Unit (MRU) (engineering control)	A MRU provides slightly higher mercury removal (99.7%) from production when compared to the removal of mercury through LTS drop-out and decanting (99.5%). With MRU, mercury is absorbed in the removal media with less potential of leaks and spills (refer Section 6.4.5.1).	Installation of MRU would result in increased capital expenditure and ongoing maintenance and waste management costs. Other issues associated with MRU are increased levels of mercury contaminated waste to onshore landfill (spent media) and an increase in fire risk (major accident events) (refer Section 6.4.5.1).	**Not adopted** – A comparison of MRU vs mercury decanting is provided in Section 6.4.5.1
N/A	Mercury Collection Pot (MCP) high-level alarm (engineering control)	Reduces risk of MCP overfilling by alerting operations personnel	Given the MCP capacity and relatively slow expected fill rate of the MCPs (5-7 months during steady operations) and the frequent (daily) manual reading of MCP magnetic level gauges (BAO-CM-6.4.7), a MCP high-level alarm is not considered to be required to reduce the risk of MCP overfilling to ALARP and is also not considered technically feasible.	**Not adopted** – cost outweighs the benefit.

6.4.4 Environmental impact assessment

Key receptors	Consequence level
Atmospheric emissions	
Threatened, migratory or local fauna	Long-term behavioural impacts e.g. avoidance, to seabirds may occur where seabird flight paths overlap the location of the facility. No decrease in local population size or area of occupancy of species, loss or disruption of critical habitat or disruption to the breeding cycle. The consequence level for threatened, migratory or local fauna (seabirds) is considered to be I - Negligible
Physical environment and habitat	As Barossa operational activities occur in the open ocean and offshore waters, the combustion of fuels in such remote locations will not impact on air quality in coastal towns. The quantities of gaseous emissions are relatively small and will, under normal circumstances, quickly dissipate into the surrounding atmosphere. The highly dispersive nature of local winds is expected to reduce potentially harmful or 'noticeable' gaseous concentrations within a short distance from the vessels or FPSO. The consequence level is therefore assessed as I - Negligible
Threatened Ecological Communities	Not applicable – No threatened ecological communities present.
Protected areas	Not applicable – Gaseous emissions are relatively small, will quickly dissipate into the surrounding atmosphere, and are not considered to be a potential source of impact for protected areas.

Key receptors	Consequence level
Socio-economic	Not applicable – Gaseous emissions are relatively small, will quickly dissipate into the surrounding atmosphere, and are not considered to be a potential source of impact for socio-economic receptors.
Cultural features	For assessment of impacts to marine species of cultural significance, refer to the assessment for threatened, migratory or local fauna. For assessment of impacts to the physical environment to which First Nations people are connected and have raised concerns, refer to the assessment for the physical environment/threatened ecological communities /protected areas.
Cumulative impacts	On the basis that concurrent activities (see Section 2.3.1) will occur within OA1, the potential for cumulative atmospheric emissions is acknowledged. However, given the short duration of concurrent activities, the intermittent nature of MODU and FPSO flaring, and significant distance to sensitive receptors (Tiwi Islands are 130km south of OA1), additive and cumulative light effects can reasonably be expected to be negligible Therefore, no change to the overall consequence level due to cumulative impacts is reasonably expected.
Overall worst-case consequence	I-Negligible

6.4.5 Demonstration of as low as reasonably practicable

Combustion of fossil fuels is essential to undertaking the Activity to power the FPSO, vessels, helicopters and equipment. Practical and reliable alternative fuel types and power sources for the FPSO, vessels and helicopters have not been identified. However the use of fuel gas is maximised on the FPSO, with diesel for backup only, which significantly reduces pollutant emissions from the facility.

Flaring is an essential element for safe operations that results in atmospheric emissions. Normally unlit low pressure flare and acid gas flare tips combined with vapour recovery result in reduced flaring and associated pollution.

Lack of refrigeration systems (as in, air conditioning) on-board the FPSO and vessels would lead to unacceptable workplace conditions and poor food hygiene standards, limiting the FPSO and vessels' ability to undertake the activities. Therefore, there is no practical alternative to the use of refrigeration.

Santos had regard to the need to reduce environmental impacts to ALARP in order to inform the key areas of the FPSO design relevant to potential environmental impacts associated with the mercury removal, and associated technology selection which is discussed below in Section 6.4.5.1.

6.4.5.1 Mercury removal technology

The selection of the mercury removal technology follows an ALARP review of technically feasible technologies to demonstrate the design has minimised environmental impact and risk to ALARP.

The available technology options investigated for the removal of mercury included assessment of mercury removal units and mercury decanting:

1. Mercury removal units (MRU) – the gas stream is routed through a mercury removal bed to absorb mercury out of the process gas, the spent media is subsequently disposed onshore (when media is replaced every four years)
2. Mercury decanting – collecting and decanting mercury from the low temperature separators for onshore treatment / disposal / recycling as elemental mercury

An evaluation of the mercury removal technologies is presented in Table 6-27.

Table 6-27: Summary of mercury removal options as low as reasonably practicable review

Option assessment	Option 1: Mercury Removal Unit (MRU)	Option 2: Mercury Decanting
Atmospheric emissions	• MRUs are slightly more effective at removing mercury (99.7%) than decanting	• Decanting removes mercury at a slightly lower level (99.5%) than MRU
GHG emissions	• Increased leak paths due to additional topside process facilities to accommodate MRUs	• Fewer leak paths by utilising topside process facilities (LTS)

Option assessment	Option 1: Mercury Removal Unit (MRU)	Option 2: Mercury Decanting
Waste management	• Substantial volumes of hazardous wastes generated during the media changeout process • Disposal – spent media is sent to landfill	• Generation of less volumes of waste • Disposal of elemental mercury has the option to be recycled and reused
Leaks and spills	• Mercury is absorbed in the removal media with the potential of less leaks and spills	• Significantly lower risk of major accident event due to reduced high pressure gas inventory and simpler process design with fewer potential leak paths • Increased potential of elemental mercury small leaks/spills by decanting elemental mercury (as opposed to leaks of mercury absorbed media)
Fire risk	• Pyrophoric material handling risk (spent material) and increased facility major accident event risk and associated environmental consequence	• Reduction of congestion in the process area.
Layout and engineering design	• Very large MRUs would be required, which would take up significantly more topside space, adding to congestion • Increased reservoir Hg would reduce MRU bed life resulting in more frequent shutdowns for media change out (and increased waste media).	• Decanting facilities take up considerably less space than MRUs • Mercury decanting systems represent novel technology offshore, however will reduce mercury to required export levels. • Decanting system more capable to respond to increased Hg from reservoir requiring only more frequent decanting operation (no shutdown).

By removing elemental mercury directly from the process fluids via decanting, rather than absorbing it into media, the waste stream requires less treatment (compared to MRU waste streams) prior to disposal and can be reused. The low temperature separation process facilities on the FPSO topsides are equipped with mercury collection and batchwise decanting arrangements, taking up less topside space and reducing potential leak paths when compared to MRUs. While the level of mercury removed using MRU is slightly higher (99.7%) than decanting, the level removed from decanting is 99.5% (Genesis Energies, 2021). With consideration for the environmental impacts and risks of each technology option, mercury decanting is assessed as the ALARP option and considered best available technology with respect to requirements under the Minimata Convention.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the impacts such that the residual consequence is assessed to be I - Negligible. The proposed control measures are in accordance with the Santos risk management criteria and are considered appropriate to manage impacts to ALARP.

6.4.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence from atmospheric emissions is I-Negligible.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available and Relevant Person consultation.
Are the risks and impacts consistent with the principles of ecological sustainable development?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)?	Atmospheric emissions (other than GHG emissions covered in Section 6.3) is not a threat specifically identified in the species recovery plans, threat abatement plans, conservation advice and wildlife conservation plans set out in Table 3-13. The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the Shelf break and slope of the Arafura Shelf KEF. Significant impacts to this KEF are not predicted for this Activity.

Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with the Ozone Protection and Synthetic Greenhouse Gas Management Act 1989 (and associated regulations), MARPOL VI/Marine Order 97 and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, MARPOL VI/Marine Order 97, Minamata Convention on Mercury and Emissions 2013, National Environment Protection (Ambient Air Quality) Measure and National Pollutant Inventory, OPGGS Act, OPGGS(E) Regulations, *National Environmental Protection Council Act 1994* (Cth) and *Environment Protection (National Pollutant Inventory) Objective 2004* (NT). Through acceptance of this EP, legislative and regulatory requirements will be met as per Appendix C
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes –aligns with Santos' Environment, Health and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP**.**
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with the ACF and the ECNT, have been considered when evaluating performance outcomes, control measures and associated performance standards (see section 4.7 for further information). Santos has considered and evaluated specific control measures proposed by the ACF and the ECNT within Table 6-26. However, no additional performance outcomes or control measures have been adopted. Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs have also been adopted in this EP. However, no such control measures from other Barossa EP's have been adopted for Atmospheric Emissions.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measure BAO-CM-6.4.5 adopted.

6.5 Seabed and Benthic Habitat Disturbance

6.5.1 Description of event

Event	During the Activity, seabed disturbance is expected to occur in areas that were previously disturbed when the wells, subsea infrastructure and the pipeline were installed under accepted Environment Plans (EPs) for these activities (Section 1.3.1). As detailed in Table 6-28, for this Activity the seabed disturbance will occur within OA1 and OA2 but will be of a lesser extent in comparison to the seabed disturbance associated with construction and installation activities.
	Disturbance to the seabed will occur in the OAs as a result of:
	• temporary placement of ROV, tooling baskets and equipment on the seabed from vessels, including USV
	• marine growth removal from the STP following connection to the FPSO
	• IMMR activities such as:
	  ○ cleaning requiring marine growth removal which leads to resuspension of sediment
	  ○ stabilisation of subsea infrastructure requiring the placement of material such as grout and gravel bags or mattresses on the seabed
	  ○ span rectification of subsea infrastructure
	  ○ the replacement, maintenance, and repair of subsea equipment components
	  ○ subsea infrastructure (including sections of the Barossa GEP) repair and replacement
	  ○ sediment relocation required to gain access to subsea infrastructure
	  ○ Barossa GEP subsea pig launch
	  ○ environmental monitoring activities such as sampling of seabed material (i.e. sediment) or biotic material (i.e. marine growth) for environmental studies as and if required
	• marine growth removal leading to sediment resuspension from wellheads, and temporary equipment placement during LWI (if required)
	• the ongoing physical presence of subsea infrastructure and stabilisation materials on the seabed (already described within accepted EPs).
	Disturbance to the seabed may occur from temporary placement of the turret seal plug on the seabed during FPSO hook-up, and release of sandbags to the seabed during recovery of the forerunner line.
	Concurrent Barossa activities (Section 2.3.1) in OA1 will result in additional seabed disturbance localised to the area of operation, including that associated with MODU anchoring, drilling and well completion (D&C EP activities) and the installation/ pre-commissioning of SURF (SURF EP activities). Seabed disturbance has already been considered in the respective EPs for these activities The cumulative impacts to the seabed in OA1 have been considered in this assessment.
	Operational area 1:
	All activities described above, including concurrent activities, could be expected within OA1.
	Operational area 2:
	All activities described above could be expected within OA2, except subsea pig launching during IMMR and concurrent activities

Extent	Seabed disturbance will be localised within the OAs, with the worst-case disturbance being the possibility of the need for replacement of a section of Barossa GEP. Concurrent MODU drilling and anchoring will create additional localised seabed disturbance in the vicinity of drill centres. Concurrent SURF installation and pre-commissioning will create localised seabed disturbance associated with SURF infrastructure footprints.
Duration	**Ongoing:** Some disturbance is ongoing relating to the physical presence of subsea infrastructure and stabilisation materials placed on the seabed. **Infrequent and one-off:** Campaign vessels for specific activities would be infrequent, up to two per year for approximately 14-30 days (typically IMMR occurring every three to five years) and approximately 34 days for LWI that may be undertaken every two years. One off seabed disturbance instances may occur from activities, such as placement of the turret seal plug on the seabed during FPSO hook-up, and release of sandbags to the seabed during recovery of the forerunner line **Concurrent:** The duration of overlap for each concurrent Barossa activity within OA1 is presented in full in Section 2.3.1. Ongoing seabed disturbance has already occurred from other Barossa activities within OA1 which will persist through the period of production operations activities covered under this EP, namely the installation of the Barossa GEP pipeline (under the Barossa GEP EP) and the installation of subsea production system infrastructure and FPSO mooring system (under the SURF EP). During the FPSO pre initial start-up phase, temporary seabed disturbance from the MODU mooring system will occur for a period of ~3 months; for ~1 month of this period there may also be localised seabed disturbance from SURF installation and pre-commissioning (SURF EP). There may be MODU temporary seabed disturbance (under the D&C EP) extending for a period of up to ~3 months post FPSO start-up and contingency MODU well workovers activities (nominally of 3-months duration) within a ~5-year period. Well workover activities using a MODU will be authorised under the D&C EP. For the first 6 months post FPSO start-up, there may also be up to ~2 months cumulative duration of SURF installation and pre-commissioning with associated seabed disturbance.

6.5.2 Nature and scale of environmental impacts

Potential receptors: Physical environment and habitat, threatened, migratory or local fauna, socio-economic and cultural features.

6.5.2.1 Physical environment and habitat

Benthic habitat disturbance

Seabed disturbance will be confined to the OAs and will result in a benthic habitat disturbance over the footprint of subsea infrastructure, or materials placed on the seabed. Material is placed in localised areas close to the subsea infrastructure and usually over areas of previous disturbance, such as within the Barossa GEP corridor. The activities and potential footprint of seabed disturbance is defined in Table 6-28. Localised disturbance to bare sediment habitat could result in epifauna removal or decreases in abundance and diversity of local infauna. However, over time, subsea infrastructure or materials placed on the seabed are expected to be colonised by sessile benthic biota (such as sponges, gorgonians), which may support higher biodiversity.

Table 6-28: Description and approximate footprint of seabed disturbance

Activity	Description	Footprint of disturbance (approximate m^2)
Turret seal plug	Temporary placement of the turret seal plug on the seabed during FPSO hook-up (contingency) Forerunner line sandbags (contingency)	85 m^2 (OA1) 5m^2 (OA1)
ROV use	Seabed disturbance from temporary placement of ROV, tooling baskets and equipment on the seabed.	5 m^2
	Seabed disturbance from placement of tooling baskets on the seabed, required for maintenance and repair of subsea equipment and infrastructure.	<3 m^2

Activity	Description	Footprint of disturbance (approximate m²)
Cleaning of infrastructure and equipment requiring marine growth removal	Seabed disturbance from removed marine growth settling on the seabed.	<1 m²
Environmental monitoring	Seabed sediment sampling associated with produced water management (Section 0) and any seabed / marine growth sampling that may be required associated with subsea infrastructure in OA1 and OA2.	Up to 50 m²
Placement of stabilisation or rectification materials such as grout and gravel bags or mattresses on the seabed	Seabed disturbed is typically limited to areas around subsea infrastructure within OA1 and small sections of Barossa GEP within OA2. The exact details and requirements are made after inspection and surveys. Span rectification and placement of stabilisation materials is typically required very infrequently.	up to 50 m²
Replacement, maintenance and repair of subsea infrastructure	Seabed disturbance from replacement of subsea infrastructure such as subsea equipment components and the infrastructure itself, which is typically required very infrequently. Within OA1, the largest infrastructure that could be replaced is a 140 m long flowline, routed across an area of approximately 100 by 30 m. Within OA2, the largest infrastructure that could be replaced is a section of Barossa GEP, with disturbance to the seabed localised to the corridor for the Barossa GEP. Typically, four pipe lift frames are deployed along a distance of approximately 100 m, each with a footprint of approximately 400 m².	3,000 m² (OA1) 1,600 m² (OA2)
Sediment relocation	Seabed disturbance from sediment relocation, which may be required to gain access to subsea infrastructure during IMMR. Within OA1, disturbance is localised to seabed close to the replaced infrastructure. Within OA2 disturbance is localised to the corridor for the Barossa GEP.	3 m² (OA1) <250 m² (OA2)
Barossa GEP subsea pig launch	Seabed disturbance from the footprint of the Barossa GEP subsea pig launcher placed temporarily on the seabed.	5 m² (OA1)
	Total (OA1 and OA2)	Up to 5,060 m²

The presence of subsea infrastructure and the Barossa GEP may result in localised scouring around the infrastructure due to currents, subsurface waves and seabed sediment fluid dynamics. Scour around this infrastructure may necessitate IMMR activities, such as grout and gravel bags or mattress placement on the seabed.

The seabed within OA1 consists of soft substrates and is devoid of significant bathymetric features; sediments are predominantly unconsolidated silty sand (Jacobs, 2016a). The habitat type is widely distributed and well represented in northern Australia. Benthic habitats along OA2 consist predominantly of bare sediments, with other benthic habitat types constituting relatively small portions (Section 3.4.1).

After removal of the temporarily positioned equipment, such as the turret seal plug, ROV tooling or baskets, and settling of dislodged marine growth, the sediments will be left disturbed; however, benthic habitats would remain viable and are expected to recolonise through the recruitment of new colonists from planktonic larvae in adjacent undisturbed areas (Guerra-Garcia & Garcia-Gomez, 2006).

Turbidity and sediment quality

A temporary reduction in water and sediment quality may occur due to increased turbidity and increased sediment deposition during activities, such as those requiring placement of materials on the seabed (for example, new infrastructure, Barossa GEP section, span rectification material), or from relocation of sediment to gain access to infrastructure during IMMR or LWI. Such activities may result in a localised and temporary plume of suspended sediment over the area of seabed disturbance. Sediment within the plume will subsequently settle on the seabed after a period in the water column. Localised areas of the seabed and associated biota may be smothered by this sediment.

Artificial habitat creation

The presence of the subsea infrastructure and any materials placed on the seabed (such as gravel bags and concrete mattresses) have the potential to act as artificial habitat or hard substrate for the settlement of marine organisms that would not otherwise be successful in colonising the area. Over time, the colonisation of this

infrastructure can lead to the development of a community, which subsequently provides predator or prey refuges, foraging resources for pelagic fish species and artificial reefs potentially supporting fish aggregations. The provision of this artificial habitat has no adverse environmental impact and may have a low level of positive environmental impact through increasing biological diversity.

6.5.2.2 Threatened, migratory or local fauna

Seabed disturbance at the proposed scale is not anticipated to significantly affect mobile marine fauna, such as marine mammals, marine reptiles and fish. The area of seabed disturbed within the OAs also represents a negligible portion of the habitat available for threatened, migratory or local fauna.

Santos has considered information contained in relevant recovery plans and approved conservation advice for marine fauna that identify habitat modification as a potential threat (Table 3-13). This includes the objectives and actions with the Sawfish and River Shark Multispecies Recovery Plan (CoA, 2015b) and Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017), which relate to habitat degradation and modification. Given the low level of seabed disturbance and the benthic habitats in the OAs being well represented in the wider surrounds, the activities are not inconsistent with the recovery plans and conservation advice. The seabed within the OAs is predominantly bare sediment and contains low abundance and diversity of infauna.

6.5.2.3 Commercial fisheries

Potential impacts to benthic habitats, and subsequently to associated ‘fish’ species of commercial importance (such as prawns, scampi), will be localised with the impact to, and displacement of, associated fish species at a level insignificant to stock.

6.5.2.4 Underwater cultural heritage

There is no known UCH (including First Nations) within the OAs (see Section 3.6.9). Under the UCH Act, Australia’s UCH (such as shipwrecks, sunken aircraft and other types) is protected, whether or not its existence or location is known (DCCEEW, 2023).

Ground disturbance that may occur across OA1 and OA2 (refer to Table 6-28) during the Activity is expected to occur in areas that were previously disturbed when the wells, subsea infrastructure, and the pipeline were installed under accepted Environment Plans (EPs) for these activities (Section 1.3.1). Therefore, no impacts to UCH (including First Nation UCH) sites are expected.

6.5.2.5 Cultural features

No First Nations people feedback was provided about potential seabed impacts to any geographically specific cultural features (excluding marine fauna species) during consultation (refer to Section 4.7). Any concerns related to the potential impacts to cultural features from seabed disturbance are associated with the direct impacts to culturally significant marine fauna species (refer to Section 3.7.11).

As presented in Section 3.7, some First Nations peoples’ cultural beliefs place significance on culturally important spiritual beings and the protection they afford First Nations communities from natural disasters and sickness. Santos recognises that some First Nations Relevant Persons fear sickness or other adverse effects from the actions of spiritual beings in response to impacts on the environment of sea country itself. Of direct relevance these sorts of Tiwi cultural and spiritual values were tested in the Federal Court and were found not to be consistently spread amongst relevant Tiwi Islanders and in any event did not represent a particular ‘place’ of cultural and spiritual significance.

Santos notes existing subsea infrastructure has previously been placed on the seabed in the region, such as the Bayu-Undan pipeline since approximately 2005, the Ichthys Pipeline since approximately 2016 and the North West Cable System since approximately 2016, which is in close proximity of OA2. The region also has a history of significant historic and ongoing industrial shipping, fish trawling activities and drilling of nearly 900 offshore wells. There is no evidence to support concerns that the Activity under this EP could harm imunga (spiritual places that are often connected to other sites) which could in turn harm Tiwi people.

Ground disturbance that may occur across OA1 and OA2 (refer to Table 6-28) during the Activity is expected to occur in areas that were previously disturbed when the subsea infrastructure, wells and the pipeline were installed under approved Environment Plans (Section 1.3.1). Therefore, no impacts to intangible cultural features are expected.

Dr Corrigan (2024) documented input from Larrakia people and relevant First Nations persons from Belyuen and Wagait, who advised the presence of a range of ancestral beings and dreaming stories of relevance to the Darwin Harbour, surrounding seas and the Barossa GEP footprint, within OA2 and located in NT waters. None of these cultural features are known to be associated with any specific or particular places in the OA2 (NT waters) footprint, but rather have a more general association with the wider area, as well as having associations with particular and

specific places outside of the Barossa GEP footprint. Although no impacts to intangible cultural features are expected, Santos recognises the importance of cultural and spiritual beliefs to First Nations people. Santos recognises that some First Nations people remain concerned about the potential for adverse consequences to First Nations people and natural environment, that may arise as a result of disturbance from the Barossa Gas Project to spiritual dreaming and culturally important spiritual beings. Cultural heritage training will be undertaken in order to raise awareness of cultural and spiritual beliefs of First Nations people.

6.5.2.6 Potential cumulative impacts

On the basis that concurrent activities (see Section 2.3.1) will occur within the OA1 and completed Barossa activities have already disturbed the seabed in OA1, the potential for cumulative seabed and benthic disturbance impacts is acknowledged.

The total direct seabed footprint within OA1 is approximately 0.945 ha for the drilling/completion activities (as described in the D&C EP) and 7.58 ha for the subsea production infrastructure and FPSO mooring system installation (including a 25% contingency) (as described in the SURF EP). Based on the seabed disturbance detailed in Table 6-28, an additional ~0.3 ha of seabed disturbance in OA1 could result from activities under this EP, noting that this disturbance is in the vicinity of existing infrastructure and some of this disturbance would be associated with replacing infrastructure that has already disturbed the seabed.

Seabed disturbing activities in OA1 are in water depths greater than 200 m and in predominantly bare sediment that contains a low abundance and diversity of infauna. This type of seabed and associated fauna is considered representative of the broader region. There are no known BIAs within OA1 with the closest BIA being 50km away and the closest bank/shoal being 45 km away. As noted in Section 3.5.5.8, even though the OA1 intersects the KEF (Shelf break and slope of the Arafura Shelf), the seafloor features associated with this KEF were not observed within OA1 during the Barossa marine studies program.

The seabed disturbing activities within OA1 already conducted under the D&C EP and SURF EP, and which will continue into the pre and post initial start-up phases of this EP, do not occur near any protected maritime heritage sites or objects (Cosmos Archaeology 2022, 2023). Given seabed disturbing activities under this EP will occur adjacent to previously disturbed seabed and there are no known geographically specific First Nations cultural features in OA1, there are no cumulative impacts to cultural heritage expected from Barossa activities.

The direct or indirect impacts from the concurrent activities are considered unlikely to substantially change or adversely impact on biodiversity or ecological integrity of benthic communities.

When considering the absence of BIAs and significant regional habitats within OA1, additive and cumulative seabed and benthic disturbance effects are expected to be negligible.

6.5.3 Environmental performance outcomes and control measures

The EPOs relating to this event are:

- Seabed disturbance to be limited to planned activities and impacts described as part of the Activity and will not occur outside the Operational Areas (EPO-04)
- No anchoring or mooring of the FPSO facility or vessels on shoals/banks (EPO-05)
- No significant impact to cultural features from the Activity (EPO-19)
- No impacts to underwater cultural heritage from the Activity (EPO-20)

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this Activity are shown in Table 6-29 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria that are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 6-29: Control measures evaluation for seabed and benthic habitat disturbance

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-6.5.1	Vessels will not anchor within OA1 under routine operations (elimination control)	No planned vessel anchoring within the OAs reduces seabed disturbance area as no anchor or anchor chain drag/placement will occur.	Cost of contracting activity vessels with DP equipment. Using DP requires continuous engagement of thrusters, which will increase noise emission.	**Adopted** – environmental benefits of ensuring vessels are compliant outweigh the associated costs.
BAO-CM-6.4.5	HSE inductions will include	Ensures that crew are aware of the stringent EP, Santos	Administrative costs to update existing Santos	**Adopted -** benefits considered to

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	applicable environmental requirements (administrative control)	and legislative requirements. Ensures personnel are suitably aware of cultural features and values.	procedure and induction materials and train personnel.	outweigh costs
BAO-CM-6.5.2	Maintain a subsea infrastructure inventory (administrative control)	Enables Santos to fulfil future decommissioning and removal responsibilities and reduce permanent seabed disturbance..	Cost of surveys, maintaining equipment and records.	**Adopted –** facilitates tracking of equipment laid on seabed
Additional control measures				
BAO-CM-6.1.3	Cultural ceremony for FPSO arrival and inductions for all site-based workforce will include information on cultural heritage to raise awareness about the cultural and spiritual belief of First Nations people (administrative control)	Addresses concerns raised (during consultation for the Barossa Project construction activities) of some First Nations people about the potential impacts of the Activity on their spiritual beliefs in a culturally appropriate manner.	Cost to engage First Nations representatives to perform cultural ceremony. Administrative cost to deliver cultural heritage training.	**Adopted** - benefits considered to outweigh costs
BAO-CM-6.5.3	Span correction procedures to be developed, if required (administrative control)	Provides clear direction on how spans shall be rectified and surveyed to minimise seabed disturbance.	Costs are expected as part of standard procedure	**Adopted -** benefits considered to outweigh costs
BAO-CM-6.5.4	Vessels will not anchor under routine operations within OA2 however may anchor during emergency conditions (elimination control)	No planned vessel anchoring within the OA2 reduces seabed disturbance area as no anchor or anchor chain drag/placement will occur.	Cost of contracting activity vessels with DP equipment. Using DP requires continuous engagement of thrusters, which will increase noise emission.	**Adopted -** environmental benefits of ensuring vessels are compliant outweigh the associated costs.
N/A	Eliminate IMMR activities, including rectification and stabilisation (elimination control)	Eliminates seabed disturbance from such activities, like subsea infrastructure replacement and rectification and stabilisation activities). IMMR is undertaken on identified scour and subsea infrastructure movement. Span rectification and stabilisation activities will further limit seabed disturbance from scour.	Eliminating IMMR may potentially result in more severe environmental impacts (such as a hydrocarbon leak) and compromising of safety requirements. Regular IMMR of subsea infrastructure cannot be eliminated as it is a requirement to maintain subsea equipment and property in good condition, in accordance with OPGGS Act Section 572.	**Not adopted –** increased (transferred) risk disproportionate to environmental benefit.
N/A	Use divers for subsea inspections instead of ROV (elimination control)	Reduces seabed disturbance from ROV use and temporary placement on the seabed.	The use of divers to inspect subsea infrastructure can present unacceptable health and safety risks.	**Not adopted –** increased (transferred) risk disproportionate to environmental benefit.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Monitor seabed and benthic habitats surrounding subsea infrastructure (administrative control)	Some limited environmental benefit (such as information only) from monitoring benthic habitat.	Costs associated with collecting and reviewing footage.	**Not adopted –** cost outweighs environmental benefit.

Table 6-15 of the accepted OPP (ConocoPhillips, 2018) states a number of commitments to manage seabed disturbance related to the Activity. Two commitments are considered to have been m*et al*ready and are not included as control measures within this EP:

- OPP Commitment 1: The MODU/FPSO facility mooring design analysis will include environmental sensitivity and seabed topography analysis to inform selection of mooring locations to avoid areas of seabed that are associated with the sea floor features/ values of the Shelf break and slope of the Arafura Shelf KEF (i.e. patch reefs and hard substrate pinnacles).
- OPP Commitment 2: The location of subsea infrastructure within the Barossa offshore development area will be informed by pre-installation surveys/studies that identify and avoid areas of seabed that are associated with the sea floor features/values of the Shelf break and slope of the Arafura Shelf KEF (i.e. patch reefs and hard substrate pinnacles).

The OPP commitment for a vessel anchoring plan was considered. Control measure BAO-CM-6.5.1 stipulates no planned vessel anchoring within the OAs, thereby eliminating the requirement for this OPP commitment.

6.5.4 Environmental impact assessment

Key receptors	Consequence level
Seabed and benthic habitat disturbance	
Threatened, migratory or local fauna	Marine invertebrates that may inhabit disturbed soft sediment benthic habitats are expected to occur elsewhere within the OAs and surrounds; therefore, the disturbance is not expected to affect prey availability or protected fauna species. Based on the habitat preferences (shallower coastal and estuarine waters) of sawfish and the offshore marine environment of the OAs, it is considered highly unlikely they will be present in large numbers. While OA1 does not overlap any marine turtle BIAs, the southern end of OA2 traverses nesting HC area for flatback and olive ridley turtles, overlaps a portion of the internesting BIA for flatback turtles, and is 11 km to the internesting BIA for olive ridley turtles (Table 3-16). Any impact to marine turtles from seabed disturbance or resultant turbidity in both OA1 and OA2 would likely be temporary and negligible, based on the nature and scale of impact. Given the nature and relatively small scale of seabed disturbance (refer Table 6-29, it is not expected to cause a decrease in local population size, area of occupancy of species, loss or disruption of critical habitat, or disruption to the breeding cycle of any Threatened or Migratory marine fauna. Hence, the consequence level is considered to be I – Negligible.
Physical environment and habitat	Localised disturbance to bare sediment habitat could result in epifauna removal or localised decrease in abundance and diversity of infauna. However, such disturbance will have no impact at an ecosystem or population level, given the small disturbance (refer Table 6-29). While turbidity may occur when placing infrastructure or equipment on the seabed, impacts such as smothering or burial are not expected as a result of turbidity. Given the nature and scale of the disturbance, no impact is expected. OA1 is within the Shelf break and slope of the Arafura Shelf KEF. The seafloor features associated with this KEF (as in, the shelf break and patch reefs, hard substrate pinnacles and submerged reefs on the shelf slope) were not observed within OA1 during the Barossa Marine Studies Program, nor are these topographically distinct features evident from the bathymetry data derived from multiple surveys undertaken across this area. Hence, localised seabed disturbance is unlikely to impact the KEF. Given the localised disturbance (refer Table 6-29) is restricted to the OAs, which is primarily low sensitivity habitat (bare sediments), the consequence level for physical environment and habitat is considered to be I – Negligible. However, impacts to the seabed within the Oceanic Shoals Marine Park (refer below 'Protected Areas') or overlapping Carbonate bank and terrace system of the Van Diemen Rise KEF and the Shelf break and slope of the Arafura Shelf KEF were considered to be II – Minor.

Key receptors	Consequence level
Protected areas	OA2 overlaps two sections of the Oceanic Shoals Marine Park (Figure 3-9): • the Multiple Use Zone (IUCN Category VI) to the south of OA1 • the Habitat Protection Zone (IUCN Category IV) to the north-west of Bathurst Island. The Oceanic Shoals Marine Park contains representative habitats from the region. Benthic habitat modelling and mapping along the proposed Barossa GEP route within the Multiple Use Zone and the Habitat Protection Zone indicated two benthic habitats were present – bare sediment (greater than 82.8%), filter feeders (10.1%) and burrowers and crinoids (6.2%). Potential impacts to these benthic habitats are considered above. Other environmental values of the Oceanic Shoals Marine Park, such as marine fauna and KEFs, are representative of the region. Seabed disturbance will not modify, destroy, fragment, isolate or disturb the values of the Oceanic Shoals Marine Park. Consequence level for seabed disturbance within the Oceanic Shoals Marine Park is considered to be II – Minor.
Socio-economic	The consequence of seabed disturbance on receptors is assessed as I – Negligible. Given the relatively small scale of seabed disturbance and knowledge of the existing environment, significant impacts to threatened/migratory/local marine fauna species will not occur.
Cultural features	There are no sacred sites registered or recorded under the NTASS Act or protected under the ATSIHP Act, UCH Act, ALR Act or EPBC Act that overlap the OAs. Of the culturally important sites (including underwater sites) identified by Tiwi People and other First Nations people, all of the identified sites are outside the OAs. Through consultation, Santos became aware of the presence of one registered sacred site and three recorded sacred sites which are located on the western coast of Bathurst Island that are outside the OAs but may potentially intersect the outer extent of the EMBA. For assessment of impacts to marine species of cultural significance, refer to the assessment for threatened, migratory or local fauna. Given the negligible consequence to species, subsequent impacts to socio-economic receptors including cultural features relating to species with cultural significance as totems or as a cultural food source are not anticipated. Notwithstanding, a control measure (BAO-CM-6.1.3) relating to cultural heritage training has been adopted. Santos considers the adoption of EPO-19, EPO-20, BAO-CM-6.1.3 and Table 6-29), practicable and appropriate.
Cumulative impacts	On the basis that concurrent activities will occur within OA1 (see Section 2.3.1), and completed Barossa activities have already disturbed the seabed in OA1, the potential for cumulative seabed and benthic disturbance impacts is acknowledged. The total seabed footprint in OA1 is approximately 0.945 ha for the drilling/completion activities (described in the D&C EP) and 7.58 ha (including a 25% contingency) for the subsea production infrastructure and FPSO mooring system (described in the SURF EP). Approximately 0.3 ha of additional seabed disturbance may occur in OA1 due to this Activity (Table 6-28), of which some may be previously disturbed seabed. Additional disturbance along OA2 will be approximately 0,2 ha (Table 6-28) and may also occur in previously disturbed areas. The combined seabed footprint from concurrent activities in OAs represents an incidental proportion of similarly representative regional habitat, predominantly bare sediment with a low abundance and diversity of infauna. Hence, concurrent activities in OAs are expected to not substantially change or adversely impact on biodiversity or ecological integrity of benthic communities. When considering the absence of BIAs and significant regional habitats within the OAs, adequate separation from identified anomalies and the short and intermittent duration of concurrent activities, additive and cumulative seabed and benthic disturbance effects in OA1 are considered negligible, and no change to the overall consequence level has resulted.
Overall worst-case consequence	II – Minor

6.5.5 Demonstration of as low as reasonably practicable

The assessed residual consequence for this impact is minor and cannot be reduced further. Additional control measures were considered (as detailed in Section 6.5.3). Control measures BAO-CM-6.1.3 and BAO-CM-6.5.3 and BAO-CM-6.5.4 were adopted, however the remainder were not adopted since the associated cost or effort was grossly disproportionate to any benefit. Given controls adopted it is considered that the impact is ALARP.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the impacts such that the residual consequence is assessed to be II – Minor. The proposed control measures are in accordance with the Santos risk management criteria and are considered appropriate to manage impacts to ALARP.

6.5.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence to seabed and benthic habitats is II – Minor.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available. Extensive marine studies have been completed within the OAs to inform the assessment.
Are the risks and impacts consistent with the principles of ecological sustainable development?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers principles of ESD: The impacts associated with seabed disturbance do not result in 'threats of serious or irreversible harm' as detailed within the EPBC Act and biodiversity and ecological integrity will be maintained. • Conservative assumptions on scale of impact have been applied.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)	Yes – Control measures implemented will reduce the potential impacts from Activity seabed and benthic habitat disturbance to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009b) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b) • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) **Recovery plans:** • Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013) • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (CoA, 2014) • Sawfish and River Sharks Multispecies Recovery Plan (CoA, 2015b) **Other management plans/guidelines**: • Marine bioregional plans for the North Marine Region (NMR) (CoA, 2012a). For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes and the control measures outlined in Section 6.5.3. Santos considers that the level of impact of Activity seabed and benthic habitat disturbance is not inconsistent with these recovery plans. The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the Shelf break and slope of the Arafura Shelf KEF. Significant impacts to this KEF are not predicted for this Activity. IMMR activities that may be required in the Oceanic Shoals Marine Park are not inconsistent with the IUCN principles and North Marine Parks Network Management Plan objectives (DNP, 2018a) or the DNP Commercial Activity Licence conditions, refer Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with the *Underwater Cultural Heritage Act 2018* (Cth). Through acceptance of this EP, legislative and regulatory requirements will be met as per Appendix C.

Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons, including with AMSA-NT and the Ngoy Garmak Consultative Committee, have been considered when evaluating performance outcomes, control measures and associated performance standards (see section 4.7 for further information). No specific control measures were proposed by Relevant Persons, including AMSA-NT and the Ngoy Garmak Consultative Committee, for this EP. Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have been adopted in this EP. Additional performance outcomes (EPO-19 and EPO-20) and an additional control measure (BAO-CM-6.1.3) have been adopted for seabed and benthic habitat disturbance based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measure BAO-CM-6.1.3.

The consequence of seabed and benthic habitat disturbance is assessed as II – Minor. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential impacts are considered acceptable.

6.6 Interactions with Other Marine Users

6.6.1 Description of event

Event	Sources of impact to other marine users within the OAs may occur as a result of: • vessels (including USVs) frequently moving through the OAs • FPSO presence • offtake tanker presence • the ongoing presence of subsea infrastructure, including the Barossa GEP • helicopter operations. • monitoring equipment Other marine users within the OAs are most likely to include commercial shipping, fishing and research activities (refer Section 3.6). Concurrent Barossa activities in OA1 (Section 2.3.1) will involve the operation of a MODU (with associated 500m PSZ and 2.5km cautionary zone) and the operation of a construction vessel and transportation vessel (SURF EP activities), both activities will have associated helicopter operations. On an ongoing basis, the subsea infrastructure may present a hazard to marine users due to the potential for snagging. The text below outlines further the credibility of snagging events within OA1 and OA2. **Operational area 1:** The mattresses and PLET foundations are proud with the seabed and they will not typically create a snagging hazard. **Operational area 2:** As part of managing this risk, PLET B and PLET C will be installed with protective structures. Assessments of the Barossa GEP for credible trawling loads have demonstrated loss of containment is not expected as the Barossa GEP has been designed for credible snagging loads (Santos, 2021b) therefore, a snagged trawler is not expected to cause a loss of containment from the subsea infrastructure. The Barossa GEP installed on the seabed may also present an ongoing hazard for other marine users in the area.
Extent	**Operational area 1:** OA1, as shown in Figure 1-1 and defined in Section 2.2.3, includes the area encompassing the FPSO, infield subsea infrastructure and vessels requirements. A 500 m radius PSZ will extend around the outer edge of the Barossa production wells, the subsea infrastructure and the dynamic portions of the mooring system which other marine users will be excluded from. Concurrent operation of a MODU in OA1 will have a 500m PSZ which is aligned with the production well exclusion zone. An additional 2.5km cautionary zone will also be in place around the MODU. The concurrent operation of a construction vessel and transportation vessel (SURF EP activities) will be within subsea infrastructure exclusion zones and not expected to further exclude other marine users. **Operational area 2:** OA2, as shown in Figure 1-1 and defined in Section 2.2.3, includes the area encompassing the Barossa GEP and vessel requirements; although other marine users are not excluded from this OA, the extent of potential interaction remains wholly within the OA. All activities that may occur will be within these OAs and a temporary 500 m radius exclusion zone will be maintained around the campaign vessels (including USVs) during operations.
Duration	**Continuous:** FPSO and subsea infrastructure will be present throughout field life, with PSZ and cautionary zones in place. Temporary and intermittent interaction with third-party vessels and helicopters when transiting the OAs for the duration of the field life. **Infrequent and one-off:** Support vessel presence is required for day-to-day operations and routine IMMR, including the use of USV. During HUC additional vessels will be in field for approximately 3 months for the one-off HUC activity. Following completion of hook-up and commissioning, initial start-up will occur for approximately 4 months involving support vessel(s) for this one-off activity. IMMR vessel presence occurs typically for approximately 14 to 30 days in duration every three to five years, or as needed. Campaign vessels for specific activities such as LWI would be less frequent. **Concurrent:** The duration of overlap for each concurrent Barossa activity within OA1 is presented in full in Section 2.3.1. During the FPSO pre initial start-up phase, additional potential impacts to other marine users from MODU operations (including 500m PSZ and 2.5km cautionary zone) will occur for a period of ~3 months; for ~1 month of this period there may be SURF installation and pre-commissioning activities (SURF EP) although additional exclusion to marine users over and above existing infrastructure exclusion zones is not expected.

	Post FPSO-start-up there may be similar impacts to other marine users from MODU operations for a duration of up to ~3 months and potential impacts from contingency MODU well workovers activities (nominally of 3-months duration) within a ~5-year period. Contingency well workover activities using a MODU will be authorised under a separate EP.

6.6.2 Nature and scale of environmental impacts

Potential receptors: Socio-economic.

The presence of the 500 m PSZ in OA1, which extends around the outer edge of the Barossa production wells, the subsea infrastructure and the dynamic portions of the mooring system (Figure 2-1) and encompasses vessel requirements and support operations including offtake tankers, may potentially impact on commercial and recreational fisheries in ways such as:

- loss of fishing area through displacement
- target fish species being attracted to the FPSO and infrastructure and away from nearby fishing areas due to the presence of artificial habitat and associated marine communities and additional food sources
- obstacle for shipping traffic in the region, including loss of access to the area and navigational hazard
- interference with defence activities, such as Kakadu military training exercise
- interference with or displacement of other marine users, such as commercial shipping, commercial fishing and other third party vessels.

Other marine users may be inhibited by the presence of a temporary 500 m radius exclusion zone that is maintained around the campaign vessels during operations, such as IMMR along the Barossa GEP.

On an ongoing basis, the Barossa GEP may present a hazard to marine users due to the potential for snagging. Assessments of the pipeline for credible trawling loads have demonstrated loss of containment is not expected (Santos, 2021b). Therefore, a snagged trawler is not expected to cause a loss of containment from the subsea infrastructure. Fishery studies conducted in the area indicate trawling does not occur frequently within OA2 (Section 3.6.1).

Helicopter operations within the OAs are not expected to interfere with other marine users.

6.6.2.1 Commercial fisheries

Fisheries that overlap OA1 and OA2 are presented in Section 3.6.1.1. An analysis of the current fishery closures, depth range of activity, historical fishing effort data, fishing methods and consultation feedback (refer to Section 4 has revealed there is a low potential for interaction with commercial fisheries. Only the Northern Prawn Fishery, Timor Reef Fishery and Spanish Mackerel Fishery are likely to be active in the OAs, albeit in low density. Interaction with Offshore Net and Line Fishery in the OAs is possible but highly unlikely due to concentration of fishing effort in near coastal areas.

The primary fishing effort in the Timor Reef Fishery is more than 50 km to the west and south-west of OA1. Licence holders in both the Northern Prawn Fishery and the Spanish Mackerel Fishery raised concerns regarding exclusion from, or access to, fishing grounds while licence holders in the Offshore Net and Line Fishery did not raise any concerns during consultation on the Barossa GEP installation activity.

Tourism, recreational fishing and subsistence fishing

Tourism and recreational fishing are not expected in OA1, given the water depths and distance from land. Recreational and subsistence fishing may occur near a small number of shoals located near the OAs, such as Goodrich Bank, Marie Shoal, Moss Shoal, Mesquite Shoal and Shepparton Shoal.

Significant disruption to Indonesian fisheries is not expected, given the typical water depths they operate in and the vast areas available to the fisheries. Any interactions with recreational fishing, fishing tours or traditional fishers are expected to be restricted to temporary avoidance of Activity vessels while transiting through the area.

A review of vessel traffic from April 2017 to March 2018 identified a low level of fishing effort within 10 nm of the proposed Barossa GEP route. The study identified a total of 154 fishing vessel days and 816 hours of fishing activity, resulting in a fishing intensity of less than 0.01 days/km² (Santos, 2021b). Based on vessel speed (less than 3.8 knots), it was determined a number of these vessels were trawling and therefore likely to be trawling for prawns as part of the Northern Prawn Fishery. During consultation for installation of the Barossa GEP (a separate EP), the Northern Prawn Fishery outlined that fishing effort occurs within OA2 and expressed concern about displacement from this area.

6.6.2.2 Commercial shipping and defence

The closest energy industry facility (Eni operated Blacktip Gas) is located approximately 254 km southwest from OA2. OA1 and the northern portion of OA2 are overlapped by the due regard area implemented during the biannual military training exercise (Kakadu). Hence, general shipping traffic within the OAs is expected to be low, with occasional overlap with defence training (Figure 3-24). The southern end of OA2, closest to the Commonwealth/State waters boundary, is an area of higher shipping traffic due to its proximity to Darwin.

The presence of Activity vessels has the potential to cause temporary disruption to commercial shipping. Given all shipping vessels and Activity vessels are required to comply with the International Regulations for Preventing Collisions at Sea, the *Navigation Act 2012* and associated Marine Orders, it is expected navigational and communicative aids are sufficient to prevent any negative interactions beyond basic avoidance.

6.6.2.3 Research activities

Vessels associated with research activities may also be present proximal to the OAs. AIMs have proposed voyages around Goodrich Bank (984 m from OA2) between May -June 2025 and November- December 2025. AIMS, BOM and UWA have also deployed monitoring arrays and wave buoys within the EMBA, the closest is 7.5 km east of OA2.

As AIMS proposed voyages to Goodrich bank are infrequent and outside OA2, Activity vessels are not expected to cause any disruption to AIMS proposed voyages. Monitoring equipment is also located outside OA1 and OA2, therefore impacts to monitoring activities as a result of the Activity are not expected. AIMS will be contacted on an annual basis regarding the location of any equipment that may be deployed (see Section 8.4.9).

6.6.2.4 Potential cumulative impacts

On the basis that concurrent activities (see Section 2.3.1) will occur within OA1, the potential for cumulative impacts to other marine users is acknowledged. Concurrent activities will include the presence of a MODU undertaking drilling/completion under the D&C EP (and up to 3 support vessels) for a ~3-month period pre and post FPSO start-up (i.e. up to ~6 months of concurrent activity). A MODU could also conduct contingency workover activities (indicatively a 3-month duration each activity) post FPSO start-up. A 500 m PSZ will be established around the MODU, campaign vessels, subsea infrastructure and FPSO (see Section 2.2.3). The MODU will also have a cautionary zone of 2.5km notified to other marine users via a Notice to Mariners.

For concurrent SURF EP activities, which may occur for a short duration (up to ~1 month) within the FPSO pre initial start-up period and for up to ~2 months of cumulative activity within 6 months of FPSO start-up, additional disturbance to other marine users from the construction vessel and associated transportation vessel is not expected given these activities will be conducted within and adjacent to existing subsea infrastructure exclusion zones.

Overall, these additional Barossa concurrent activities are expected to result in a small incremental increase in the exclusion area for other marine users and only for a short duration. Due to the low activity intensity of fishers and other marine users, the short duration of concurrent activities, and the existing exclusions in place, the additive or cumulative effects to marine users can reasonably be expected to be negligible.

6.6.3 Environmental performance outcomes and control measures

The EPOs relating to this event are:

- No vessel collisions or adverse interactions with other marine users (EPO-01)
- No significant impacts to cultural features from the Activity (EPO-019)
- No impacts to underwater cultural heritage from the Activity (EPO-020)

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this Activity are shown in Table 6-30 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria that are presented in Table 6-30. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 6-30: Control measures evaluation for interaction with other marine users

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-6.6.1	Notify AHS and AMSA MSI prior to relevant Activity	Maritime notifications ensure marine users are informed of the	Cost and time to perform notifications.	**Adopted** – benefits considered to outweigh costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	(administrative control)	proposed activities, reducing the likelihood of unplanned interactions.		
BAO-CM-6.1.2	Vessels equipped and crewed in accordance with Australian maritime requirements, including Marine Order 30 (Prevention of Collisions) and Marine Order 21 (Safety and Emergency Arrangements) (administrative control)	Ensures contracted vessels are operated, maintained, and crewed in accordance with industry standards and regulatory requirements. Ensures vessels meet Marine Assurance Standards to reduce the likelihood of interactions with other users (such as minimum and working lighting for maritime safety).	Regulatory requirement and therefore the cost is not identified as an issue.	**Adopted** – it is a regulatory requirement.
BAO-CM-6.6.2	Petroleum safety zone administered by NOPSEMA in accordance with the OPGGS Act and cautionary area established (administrative control)	PSZ and cautionary area marked on nautical charts alerts other marine users to the presence of the FPSO and subsea infrastructure, thereby reducing the likelihood of interactions with other marine users such as fishing gear snagging.	Negligible costs; regulatory requirement. Excludes commercial fishers from prospective fishing grounds.	**Adopted** – exclusion area is insignificant compared to the expansive fishing grounds and shipping routes.
BAO-CM-6.6.3	Collision avoidance radar (administrative control)	Errant vessels would appear on the display of the FPSO collision avoidance radar, providing range, bearing and identification information on any errant vessel entering OA1. Would alert the FPSO of errant vessel position reducing risk of vessel interactions.	Minimal cost for purchase, and maintenance of radar system.	**Adopted** – environmental benefits of identifying errant vessels on the FPSO outweighs the minimal costs.
BAO-CM-6.6.4	Activity undertaken in accordance with Santos HSE management and marine vessel vetting processes (Santos' Offshore Marine Assurance Procedure) (administrative control)	Santos marine vetting process ensures vessel lighting, radios and equipment are inspected and maintained so that other marine users are aware of the vessel's physical presence, thus reducing the potential for interaction.	Standard maritime safety and navigational equipment; regulatory requirement and therefore the cost is not identified as an issue.	**Adopted** – benefits considered to outweigh costs and regulatory requirements mandate some equipment standards.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-6.4.5	HSE inductions will include applicable environmental requirements (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted** - benefits considered to outweigh costs
Additional control measures				
BAO-CM-6.6.5	Concurrent Barossa activities will be managed under the bridging documents/ interface management plans (administrative control)	Implementation of the plan will control and manage concurrent activities occurring within OAs. This will ensure that concurrent activities can be conducted safely and reduce the risk of vessel interactions.	Cost associated with Implementing procedures.	**Adopted** – benefits considered to outweigh costs.
BAO-CM-6.6.6	Vessel speed restrictions within 500 m around the FPSO, IMMR vessels and campaign vessels (administrative control)	Reduces consequence of collisions (causing harm) and likelihood as vessels have longer to detect and avoid the vessel by restricting vessel speeds.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted** - benefits considered to outweigh costs
BAO-CM-6.6.7	Communications plan will be implemented for engagement prior to and during the Activity to raise awareness of the activity (administrative control)	Communications plan will improve awareness of the Activity, encourage engagement with stakeholders, and provide up-to-date information regarding key activities.	Cost associated with implementing procedures.	**Adopted** - benefits considered to outweigh costs
BAO-CM-6.1.3	Cultural ceremony for FPSO arrival and inductions for all site-based workforce will include information on cultural heritage to raise awareness about the cultural and spiritual belief of First Nations people (administrative control)	Addresses concerns raised (during consultation for the Barossa Project construction activities) of some First Nations people about the potential impacts of the Activity on their spiritual beliefs in a culturally appropriate manner.	Cost to engage First Nations representatives to perform cultural ceremony. Administrative cost to deliver cultural heritage training.	**Adopted** - benefits considered to outweigh costs
BAO-CM-6.6.8	Charting of infrastructure on nautical charts (administrative control)	Subsea infrastructure clearly marked on Australian nautical charts published by the AHO alerts other marine users to the presence of activity vessels and exclusion zones and restrictions, thus reducing the likelihood interactions with marine users such as fishing gear snagging.	Cost and time to prepare and distribute information	**Adopted**
N/A	Reducing the cautionary zone or PSZ	Would reduce the area of exclusion for third party vessels, thereby	Would potentially increase the risk of a negative interaction with subsea	**Not adopted** – the potential increase in likelihood of a negative interaction

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	(administrative control)	causing less disruption to ongoing activities.	infrastructure, resulting in a significant environmental impact (such as hydrocarbon spill) compared to a minor deviation to vessel routes, or a small area of exclusion.	resulting in a potentially significant environmental impact outweighs the small exclusion area.
N/A	Amend the mooring method to DP (engineering control)	Would reduce the potential area of exclusion as the mooring spread would not be required if the FPSO was on DP.	This is generally only suitable for short-term positioning in relatively calm waters – it is not suitable for a long-term, permanently stationed facility nor during extreme weather. Additionally, it generates underwater noise throughout its operation, as well as consuming electricity that results in increased air pollutants and greenhouse gas emissions.	**Not adopted** – the additional environmental impacts of air and noise emissions outweigh the potentially slightly smaller exclusion area for other users.
N/A	Installation of protection structures on all subsea infrastructure (engineering control)	Reduces the likelihood of fishing gear snagging.	Protection structures will be present on PLET B and PLET C to provide additional protection for fishers operating within proximity. It is not expected trawling will occur at PLET A or the subsea infield infrastructure as water depths are greater than 200 m and trawling does not typically occur at these depths.	**Not adopted**– PLET A will be included within the 500 m PSZ around the FPSO (once infield operations have commenced) and, given the low likelihood of trawling occurring in the deeper waters, additional protection is not considered necessary.

6.6.4 Environmental impact assessment

Key receptors	Consequence level
Interaction with other marine users	
Threatened, migratory or local fauna	Not applicable – related to socio-economic receptors only.
Physical environment and habitat	
Protected areas	
Socio-economic	Commercial fishing, shipping, military exercises, and other incidental marine traffic in the area is expected to be low. The area marine users will be excluded from is small when compared to the large area available for their use. Marine users within the OAs have co-existed with previous Barossa petroleum activities (such as exploration drilling) and other nearby marine users (such as military exercises). Communication before and during the Activity will reduce the likelihood of unplanned interaction with other marine users. The southern end of OA2, to the Commonwealth/State waters boundary, is an area of higher shipping traffic compared to OA1, due to its proximity to Darwin. Vessels are only present at this

Key receptors	Consequence level
	location for infrequent short duration IMMR activities. Any impact to other vessel that should need to deviate will be temporary. Should vessels need to deviate from planned routes to avoid the 500 m PSZ, it is unlikely to increase transit times and fuel consumption. Given the duration of exclusion from the OAs due to the PSZ, there is expected to be a detectable but insignificant loss of value of the local industry. The various types of activities were assessed separately, with the presence of subsea infrastructure and FPSO considered I- Negligible; the presence of helicopters in both OA1 and OA2 considered I – Negligible; and the presence of vessels for support and IMMR activities in both OA1 and OA2 considered II – Minor, given OA2 has higher shipping traffic compared to OA1 and therefore potential for interaction is higher. Therefore, the overall worst case consequence level for potential interaction with other marine users is II – Minor.
Cultural Features	First Nations cultural beliefs place great significance on culturally important spiritual beings and the protection they afford First Nations communities from natural disasters and sickness. Santos recognises that some First Nations people may perceive the presence of Barossa facilities and infrastructure as a disturbance to sea country connection which may harm them culturally. Santos understands the spiritual protection believed to be afforded to the Tiwi people is broadly maintained by protecting the features of the natural environment and through ceremonial practices alerting the spiritual beings to the presence of people travelling through country and the like.
Cumulative impacts	On the basis that concurrent activities will occur within OA1 (see Section 2.3.1), the potential for cumulative impact to other marine users is acknowledged. Concurrent activities include the presence of a MODU (described in the D&C EP) and vessels associate with the SURF EP pre and post FPSO start-up (see Section 6.6.2.4). A 500m PSZ will be established around the MODU, campaign vessels, subsea infrastructure and the FPSO, as well as a 2.5 km cautionary zone around the MODU. A Notice to Mariners is issued for the MODU. It is considered that negligible additive and cumulative effects associated with concurrent activities (e.g. physical presence) to other marine users may result, given the limited interaction with other marine users (including fishers) expected within the OA and the short duration of concurrent activities. Therefore, no change to the overall consequence level is expected.
Overall worst-case consequence	II – Minor

6.6.5 Demonstration of as low as reasonably practicable

The risk of interfering with other users of the sea will be reduced to ALARP by informing stakeholders of the ongoing activities, implementing navigation controls, and maintaining communications.

Relevant Persons are updated quarterly, as described in Section 4, so they are informed and aware of any Barossa production operations relevant to them. A 500 m radius petroleum safety zone (PSZ) will extend around the outer edge of the Barossa production wells, the subsea infrastructure and the dynamic portions of the mooring system. No objections or claims have been raised by Relevant Persons about the PSZ.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the impacts such that the residual consequence is assessed to be II – Minor. The proposed control measures are in accordance with the Santos risk management criteria and are considered appropriate to manage impacts to ALARP.

6.6.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence from interaction with other marine users is II – Minor.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available and Relevant Person consultation.
Are the risks and impacts consistent with the principles of ecological sustainable development?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers the principles of ESD: The nature and scale of potential impacts from interaction with other marine users is not inconsistent with the integration principle. The precautionary principle has been applied and the analysis of available fishing data and usage information was supplemented with consultation where knowledge gaps were identified.

Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)	Interaction with other marine users is not a relevant threat identified in the species recovery plans, threat abatement plans, conservation advice and wildlife conservation plans set out in Table 3-13. IMMR activities that may be required in the Oceanic Shoals Marine Park are not inconsistent with the IUCN principles and North Marine Parks Network Management Plan objectives (DNP, 2018a) or the DNP Commercial Activity Licence conditions, refer Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with SOLAS, COLREGS, UNCLOS, *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*, *Navigation Act 2012* (and associated Marine Orders), the OPGGS Act (requirement for a PSZ), *Protection of the Sea (Powers of Intervention) Act* 1981 and *Protection of the Sea (Powers of Intervention) Regulations 1983* (Cth). Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.7. Santos will not interfere with the rights of other marine users to a greater extent than is necessary for the reasonable exercise of right conferred by the titles granted, as per Section 280 of the OPGGS Act.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health, and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with AMSA and AHO, have been considered when evaluating performance outcomes, control measures and associated performance standards (see section 4.7 for further information). No specific control measures were proposed by Relevant Persons, including AMSA and AHO, for this EP. Santos has incorporated the standard advice provided by AHO and AMSA with respect to maritime safety matters into this EP, including activity notifications (Please refer to Table 8-26) Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have been adopted in this EP. Additional performance outcomes (EPO-19 and EPO-20) and an additional control measure (BAO-CM-6.1.3) have been adopted for interactions with other marine users based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with the following additional control measures adopted: • BAO-CM-6.6.5 • BAO-CM-6.6.6 • BAO-CM-6.6.7 • BAO-CM-6.1.3

The consequence of interaction with other users is assessed as II – Minor. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential impacts are considered acceptable.

6.7 Operational Discharges

6.7.1 Description of event

Event	Potential impacts may occur in the OAs from near-surface and near-seabed operational discharges: Near-surface discharges from FPSO and vessels • treated sewage and grey water • putrescible waste • desalination brine • cooling water • deck drainage • bilge water and slops system • monoethylene glycol (MEG) discharge (see Sections 2.4, 2.5, 2.6, 2.7 and 2.9 [contingency only]) From the FPSO only • steam turbine generator condensate (condensed water used in closed loop system on FPSO discharge occurring intermittently) • inert gas generator cooling water (FPSO intermittent seawater discharge occurring during start-up and cargo tank inspections) • firefighting water and foam from routine testing (PFOS and PFAS Free) • subsea commissioning fluids (during initial start-up) • riser guide tubes marine growth prevention • PW discharge is discussed in Section 0. • Ballast water discharge is discussed in Section 7.2. Near-seabed discharges • chemicals and residual hydrocarbons during IMMR, LWI (if required) and cold-commissioning • water based hydraulic fluid and subsea control fluids from the subsea system during cold-commissioning. LWI and steady state operations • treated seawater and MEG from the PLET (see Sections 2.9.2 [contingency only]). Concurrent Barossa activities (Section 2.3.1) will result in additional discharges in OA1 associated with the operation of a MODU and support vessels during drilling/completion (D&C EP activities) and the operation of a construction vessel and transportation vessel (SURF EP). Contingency MODU well workovers may also occur concurrently with FPSO activities under a NOPSEMA accepted EP. Contingency well workover activities using a MODU will be authorised under a separate EP. Concurrent discharges in OA1 will include standard vessel operational discharges (as described above) such as treated sewage/greywater, putrescible waste, brine, cooling water, bilge, deck drainage and ballast water. For concurrent MODU drilling/completion and MODU well workover activities at drill centres within OA1, additional discharges will include drilling discharges (drill fluids, drilling solids, drill cuttings and lost circulation materials), cement discharges, blowout preventer and xmas tree control fluid discharges, well completion discharges (well completion fluids, formation water, MEG, methanol), miscellaneous chemicals (tracer dyes and cement spacer), tank cleaning discharges and residual bulk products (barite, bentonite, brine and drill water). Further detail on these discharges is provided in Section 0 of the D&C EP. For concurrent SURF installation and pre-commissioning activities, concurrent discharges may include treated seawater/freshwater, freshwater, MEG and hydraulic control fluid during FCGT, dewatering, flushing and leak testing of SURF infrastructure. Further detail on these discharges is provided in Section 0 of the SURF EP. **Operational area 1:** All discharges described above could be expected within OA1. **Operational area 2**: All discharges described above could be expected within OA2, except discharge of steam turbine generator condensate and that from the inert gas generator, which occurs from the FPSO only and discharge of water-based hydraulic fluid and subsea control fluids, which is a minor release, occurring from the subsea system in OA1. The contingency discharge of treated seawater and MEG from the PLET would also only occur in OA1. The discharges from vessels are credible in OA2 during IMMR vessel activities. There are no concurrent Barossa activity discharges expected in OA2.
Extent	The small volumes of operational discharges may cause localised impacts to water quality in the direction of the prevailing current. The environment that may be affected by operational discharges will likely be contained within the OAs. Concurrent MODU and support vessel activities (with associated standard vessel discharges and drilling/completion/workover discharges) will be concentrated at drill centres >6km from the FPSO turret. Of these discharges, fine particle drilling discharges are expected to disperse over the widest area (up to 4 km).

	These discharges are not expected to overlap with any discharges from the FPSO, associated vessels and subsea infrastructure. Concurrent construction vessel and associated transportation vessel activities (with associated standard vessel discharges and SURF pre-commissioning discharges) will occur primarily at drill centres >6km from the FPSO turret. These discharges are expected to disperse on a scale of 100m and are not expected to overlap with operational discharges from the FPSO, associated vessels and subsea infrastructure. There is also the potential for pre-commissioning discharges from a gas export spool at the FPSO location to occur concurrently with FPSO hook-up and cold commissioning activities. Given the expected rapid dispersion of pre-commissioning fluids (within 100m) and the discharge being at seabed, this is not expected to interact with FPSO cold commissioning discharges at the sea surface or operational discharges associated with FPSO support vessel, also at the sea surface.
Duration	**Routine:** Operational discharges from the FPSO and vessels will occur routinely (for example, daily) while in OA1, relating to: • treated sewage and grey water • putrescible waste • desalination brine • cooling water • steam turbine generator condensate • deck drainage • riser guide tubes marine growth prevention • treated bilge water • water based hydraulic fluid and subsea control fluids from the subsea system. Occasional testing of firewater systems will result in release of firefighting foam discharge. Localised changes to water quality will occur during the period of discharges. However, water quality conditions will return to normal within minutes to hours on cessation of discharge. **Infrequent and one-off:** Planned campaign vessel presence occurs typically for approximately 14 to 30 days in duration every three to five years, and LWI (if required) could occur for approximately 34 days every two years. Operational discharges from vessels will occur during this period, as well as chemicals and residual hydrocarbons during cold commissioning. During HUC, additional vessels will be in field for approximately 3 months for the one-off activity. Following completion of hook-up and commissioning, initial start-up will occur for approximately 4 months involving support vessel(s) for this one-off activity resulting in vessel based operational discharges. Duration of discharges during HUC, such as sewage and grey water discharges, may be affected and extended as a result of unforeseen circumstances e.g. delays in DLNG facility readiness to receive Barossa gas. A contingency discharge of treated seawater is a one off event if a major pipeline repair is required. **Concurrent:** The duration of overlap for each concurrent Barossa activity within OA1 is presented in full in Section 2.3.1. For FPSO pre initial start-up activities there may be concurrent operational and/or drilling/completion discharges in OA1 from a MODU and support vessels (D&C EP activities) for a period of ~3 months; for ~1 month of this period there may also be operational discharges from a construction vessel and transportation vessel and pre-commissioning discharges from SURF infrastructure (SURF EP). There may be intermittent discharges from MODU and support vessel activities in OA1 (under the D&C EP) for up to ~3 months post FPSO start-up and discharges from contingency MODU well workovers activities (nominally of 3-months duration) within a ~5-year period. Contingency well workover activities using a MODU will be authorised under a separate EP. For the first 6 months post FPSO start-up there may be up to ~2 months cumulative duration of discharges from SURF installation and pre-commissioning activities.

6.7.1.1 Sewage and grey water

The volume of sewage and grey water generated and treated on the FPSO and vessels is directly proportional to the number of POB. Approximately 30 to 40 L of sewage and greywater is typically generated per person per day on vessels and is discharged in accordance with Marine Order 96 requirements. The volume of sewage and greywater generated from the FPSO is approximately 26 m³ per day (9454 m³ yearly) based on a 140 POB FPSO. Sewage on the FPSO is treated in a two by100% sewage treatment system, which exceeds MARPOL (Annex IV) requirements.

Wastewater (sewage and grey water) discharges from an FPSO were modelled for the Barossa Development (ConocoPhillips, 2018), which indicated discharges would be mixed to very low levels (1:5000 dilution) within a maximum distance of 53 m. A 1:100 dilution was achieved within 3.6 m of the discharge (RPS, 2017c).

The volume of sewage and greywater discharged from campaign vessels is also directly proportional to the POB number as described above. Campaign vessels including IMMR and LWIV can have up to 100 POB. There are no sewage and greywater discharges from USV as they are unmanned.

6.7.1.2 Putrescible waste disposal

Putrescible wastes are generated on the FPSO and vessels (approximately one litre of food waste per person per day). Food wastes are macerated and discharged within the OAs in accordance with MARPOL (Annex V) (FPSO) and Marine Order 95 (vessels) requirements. The FPSO is designed to discharge putrescible waste at approximately 0.27 tonnes per day (102 tonnes yearly) and 100L/day from campaign vessels including IMMR and LWI.

Food wastes that cannot be macerated will be stored on the FPSO or campaign vessels before transfer to the support vessel for transport onshore and subsequent disposal at a waste management facility. There are no putrescible waste discharges from USV as they are unmanned.

6.7.1.3 Desalination brine

Fresh water is generated at the FPSO for both process and utility requirements via a VVC desalination system (refer Section 2.7.3.2). The brine has an average salt concentration of approximately twice the initial concentration (as in, normal seawater). The volume of the desalination brine discharge is dependent on the requirement for fresh (or potable) water. The brine generated and discharged overboard from the FPSO is approximately 99 m^3 per day (35,916 m^3 yearly), based on the VVC desalination system design rate.

Volumes of desalination brine from other vessels are difficult to quantify, as they vary based on the number of people on board each vessel and their time on location but will typically be significantly lower than from the FPSO. The salinity concentration will be similar. There are no desalination brine discharges from USV as they are unmanned.

6.7.1.4 Cooling water and steam turbine generator condensate

Seawater is used as a heat exchange medium for cooling machinery engines on vessels and the FPSO and in the production process on the FPSO. Screens on the cooling water intakes are provided, with a mesh of 15 mm, to minimise entrainment of marine fauna. Cooling water is discharged from the FPSO at approximately 45°C, two metres (at minimal draft) below the surface, via a cooling water discharge caisson and the steam turbine generator condenser discharge caisson, approximately 40 m apart, typically on a continuous basis (refer Section 2.7.3.2).

Hypochlorite is injected to provide a residual chlorine less or equal to 0.5 mg/L (at the point of discharge) and prevent biofouling from marine growth. The discharge rate will vary depending on operational requirements with shock dosing required if biofouling is likely or known to be increasing within the seawater system such as following extended shutdowns, for example. The maximum cooling water discharge rate and characteristics are shown in Table 6-31, based on the FPSO design. Discharges from vessels are significantly lower.

The anti-fouling generation package generates hypochlorite in the exit stream. The feed flow is measured by individual flow transmitters and is controlled at 50% capacity during normal operation. The amount of sodium hypochlorite produced is determined by the amount of electrical current applied to the hypochlorite generator cell and sodium chloride content in feed water. By controlling the amount of feed water flow to hypochlorite generator cells, the maximum concentration of sodium hypochlorite in seawater discharged will not exceed the discharge limit of 3 mg/L (ANZECC & ARMCANZ, 2000).

Maximum concentration of 2 ppm ammonia (typically 0.1ppm for normal mode of Oxygenated Treatment program) is injected into the steam condenser closed loop to control the acidity and conductivity of the condensed water used in combine cycle power system. Draining for sampling or CPP rinsing are intermittent and limited and go to non-hazardous open drain and then onto slops tanks (refer Section 2.7.3.1). Some steam system drains go via the CCPGP Vent, Drain and Effluent system prior to joining returning seawater flow from the surface condenser. This is an intermittent stream (at a rate of 6m^3/h) is discharged in the seawater discharge (at a rate of 6,543 m^3/h). Cooling water is also discharged at surface from activity vessels.

Table 6-31: Cooling water discharge for the Barossa floating production, storage, and offloading facility

Parameter	Cooling water discharge characteristics		
	Design	Limit	Units
Seawater abstraction rate	22,564	-	m^3 / h
Cooling water discharge rate	13,959	-	m^3 / h
Steam turbine generator condensate discharge rate[1]	6,531	-	m^3 / h

Parameter	Cooling water discharge characteristics		
	Design	Limit	Units
Chlorine concentration[2]	0.5	3.0	mg / L
Discharge temperature[3]	45	45	ºC

Note 1: The steam turbine condensate system is a closed loop, and normally returned to steam generation (once through steam generator) from gas turbine exhaust, except for minor blow down to maintain water quality. This is the maximum possible discharge rate.

Note 2: The residual chlorine levels in the cooling water discharges adopted concentration of less than or equal to 3 mg/L at the point of discharge, as per OPP discharge assessment, ensuring a 3 µg/L (3 ppb) equivalent to protecting 95% of aquatic species (ANZECC & ARMCANZ, 2000).

Note 3: The discharge temperature limit of 45 ºC adopted as per OPP discharge assessment to ensure the discharge temperature does not result in an increase greater than 3°C of ambient temperature at the edge of the established mixing zone (as per International Finance Corporation (IFC) General EHS Guidelines (IFC, 2015)0.

6.7.1.5 Inert gas generator

As described in Section 2.7.3.4, the inert gas generator typically provides inert gas for the backup blanketing gas when the primary blanketing gas (LP fuel gas) is unavailable. The gas leaving the combustion chamber flows into the scrubber unit. Here the gas is cooled further and cleaned by an intensive counter-current spray of seawater, then separated from water droplets in a demister and leaves the generator as an inert gas. The seawater then goes to the overboard discharge. Low sulphur MGO is used and sulphur is scrubbed from the exhaust gas, a very low level of hydrocarbon contamination may be present in the discharge.

Inert gas generator discharge is infrequent as the generator will only operate intermittently as required. Such discharge is commonly associated with ship exhaust gas cleaning systems, required in order to meet MARPOL (Annex VI) limits. Discharge volumes are considered very minor.

6.7.1.6 Deck drainage disposal

Under normal operating conditions, scupper plugs are fitted at open deck drainage points on the vessels to contain any water accumulation on deck. However, if clean water builds up after, for example, heavy rain, these plugs may be removed, allowing the clean water to drain to sea. Deck drainage may contain small residual quantities of oil, if loss of containment occurs this would need to be pumped to the dirty slop tank using portable pumps via the Hazardous Pumped Drain Header. If the deck contains residual quantities, these are control fluid, grease, and detergents from leaks from engines, machinery, fresh or waste oil drums and residual cleaning agents if present on the decks after clean-up. These discharge volumes are low.

The FPSO main deck directs deck water to the slops tank (Section 2.7.3.7). The coaming minimises the potential for spillage of drainage water directly to the marine environment. The drains system for the helideck will direct any helifuel and firewater directly overboard, due to safety reasons.

6.7.1.7 Bilge water and slops system

Bilge water can contain water, oil, dispersants, detergents, solvents, chemicals, particles and other liquids, solids, or chemicals. The FPSO bilge water is routed to the dirty slops tank for processing. The slops water treatment system consists of a hydrocyclone for bulk oil removal, followed by a coalescer for polishing the drainage water, in order to meet an oil in water (OIW) limit of 15 ppm by volume prior to discharge, in accordance with MARPOL Annex I. Oily filtration residue separated in the treatment system will be collected in a dedicated onboard tank and will be disposed of onshore.

Vessels also routinely generate and discharge relatively small volumes of oily water in accordance with Marine Order 91.

6.7.1.8 Firewater drainage

The FPSO firewater system undergoes dry-deluge testing annually to ensure there are no deck drainage blockages and a water-based vapour and dye is used to check the nozzles are all functioning well. This reduces the requirement for annual wet testing of the system and the resultant discharge to sea, which will only be required approximately every five years.

Firefighting foam tests will be required frequently to confirm the correct proportioning of foam water mix at all proportioners. Firefighting foam products are assessed using the Santos chemical selection process (Section 2.7.3.8.4) and are PFAS- and PFOS-free on the FPSO.

6.7.1.9 Chemicals and residual hydrocarbons during cold-commissioning; LWI and inspection, maintenance, monitoring and repair

During cold commissioning (Section 2.5), fluids within the subsea infrastructure will be produced to the FPSO and then discharged overboard. Table 6-32 provides approximate volumes discharged during integrated commissioning.

Table 6-32: Approximate commissioning and start-up fluid discharges

Infrastructure	Volume	Typical fluid constituents
Subsea gas export risers	120 m³	MEG, potable water, and trace preservation chemicals.
Service system and production risers	540 m³	

As described in Section 2.9, MEG may be used for IMMR activities. Leak testing of the subsea system may also occur, in which case a small volume (estimated at <5 L) of non-toxic dye may also be used to assist in visually detecting leaks in the subsea system by ROV. Typically, these discharges are infrequent and restricted to those needed to complete a required task.

Inorganic or organic acids may be required during IMMR and LWI activities for tasks such as cleaning, approximately 2000 L per operation (for example, per soak for marine growth removal), and is released subsea.

Table 6-33 provides a summary of typical chemicals and approximate volumes discharged during IMMR.

Table 6-33: Typical inspection, monitoring, maintenance, and repair discharges

Chemical	Volume	Note
MEG	125 m³	Connection and disconnection of Barossa GEP pig launcher
Organic acids	2,000 L	Per operation
Non-toxic dye	<5 L	Per operation
Treated seawater (contingency)	Approximately 137,000 m³	Worst-case volume in the unlikely event of a major pipeline repair, typically includes MEG, biocide, oxygen scavenger, corrosion inhibitor and non-toxic dye
Inhibited MEG (contingency)	Approximately 600 m³	Worst-case volume in the unlikely event of a major pipeline repair

If discharges occur during LWI the volumes will be smaller than those released during IMMR and depend on the type of LWI activity planned. Discharges may include chemicals and hydrocarbons released during valve operation and/or subsea control fluids when connecting to the wellhead from the LWIV.

As described in Section 2.9, residual hydrocarbon and inert gas may be present in the subsea equipment and be discharged to the marine environment during IMMR and LWI. The isolated equipment will be at ambient seabed pressure; therefore, any residual hydrocarbon and inert gas will be displaced through natural seawater ingress into the equipment. A worst-case volume of approximately 137,000 m³, will be released to the marine environment to re-commission the Barossa GEP following a repair or replacement of a section of the Barossa GEP.

The STP buoy is provided with riser guide tubes, with spare tubes for future riser tie-in. The spare riser guide tubes will be dosed with biocide from the top of the riser guide tube to minimize marine growth inside tubes until the additional riser is installed in future.

All chemicals that are planned for discharge to the environment will be selected in accordance with Santos' Offshore Division Operations Chemical Approval Procedure to ensure that environmentally acceptable products are used or the risks can be demonstrated to be ALARP from the use of other chemicals (Section 2.7.3.8).

MEG

Monoethylene glycol (MEG) is a colourless, odourless, non-volatile, hygroscopic liquid. It is characterised by two hydroxyl groups, which contribute to its high water-solubility, hygroscopicity and reactivity with many organic compounds. MEG is on the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) Pose Little or No Risk to the Environment (PLONOR) list and therefore is deemed safe to discharge to the marine environment.

MEG is soluble in water, does not volatilise or undergo photodegradation, and is not adsorbed on to soil particles (Hook and Revill, 2016). Studies on a green alga (*Chlorella fusca*), a freshwater crayfish (*Procambarus* sp.) and a golden orfe carp (*Leuciscus idus melanotus*) revealed low potential for bioaccumulation in the marine environment (International Programme on Chemical Safety, 2000). Ethylene glycols biodegrade readily when released to the environment, and several strains of microorganisms can use them as an energy source.

Small volumes of MEG will be discharged via the FPSO during cold-commissioning (Table 6-32) and during IMMR (Table 6-33). In the unlikely event of a major pipeline repair, 600 m^3 of MEG may be released as a contingency when dewatering the GEP as part of the repair activity (Table 6-33).

Treated seawater (contingency)

A subsea discharge of 137,000 m^3 of treated seawater at the FPSO PLET location was modelled over a duration of approximately 9.5 days from a 4-inch vent oriented vertically upwards 3.5 m above the seabed. The concentration of the chemical treatment modelled was 550 ppm and the modelling study determined the potential extent of chemical treatment exposure for the 50th percentile is 8.35 km to reach the no observed effect concentration (NOEC) protection level of 99% (PC99%) threshold of 0.06 ppm. The upper lethal concentration (LC50) threshold of 1 ppm reduced to 170mfor the 50th percentile (RPS, 2025).

Water based hydraulic fluid and subsea control fluids

Subsea control fluid is used to control valves, such as wellhead valves on the subsea xmas trees. A waterbased hydraulic fluid is typically used and is supplied to valves via an open-loop system, designed to release fluid during operation (such as upon valve actuation).

Volumes of approximately 2.5 L of hydraulic control fluid are typically discharged during valve closure or opening on the subsea manifolds. It is estimated a maximum of approximately 80 to 100 L per day of hydraulic control fluid may be discharged to the marine environment if control valves were operated daily (not normally the case, but credible during commissioning and start-up).

6.7.2 Nature and scale of environmental impacts

Potential receptors: Physical environment and habitat, threatened, migratory or local fauna and cultural features.

6.7.2.1 Physical environment and habitat

Small volumes of operational discharges will be released to the marine environment and result in a localised reduction in water quality.

OA1 is within the Shelf break and slope of the Arafura Shelf KEF. The seafloor features associated with this KEF (as in, the shelf break and patch reefs, hard substrate pinnacles and submerged reefs on the shelf slope) were not observed within OA1 during the Barossa marine studies program, nor are these topographically distinct features evident from the bathymetry data derived from multiple surveys undertaken across this area. Hence, operational discharges are unlikely to impact the KEF. Species associated with the continental slope and patch reefs that characterise this KEF (such as demersal fish, whale sharks, sharks, and turtles) are unlikely to aggregate within OA1 due to the lack of seafloor features. However, potential impacts to these species are described below.

Specifics of potential impacts to water quality from operational discharges are described herein.

Eutrophication impacts from sewage, grey water and putrescible wastes

Discharges of macerated food waste, treated sewage and grey water can result in localised increases in:

- nutrient concentrations, such as ammonia, nitrite, nitrate and orthophosphate
- organics, such as volatile and semi-volatile organic compounds, oil and grease, phenols and endocrine-disrupting compounds
- inorganics, such as hydrogen sulphide, metals and metalloids, surfactants, phthalates and residual chlorine.

Increased biological oxygen demand on the receiving waters may promote localised elevated levels of phytoplankton, due to nutrient inputs and bacteria activity from organic carbon inputs. This could subsequently impact higher order predators.

Dispersion and dilution of discharges are expected to be rapid in the marine environment. The organic components of discharges are subject to biodegradation through bacterial action, oxidation and evaporation, and OA1, which has the most frequent discharge, is located in deep offshore waters, dominated by high currents and resulting in short-term changes to surface water quality.

Modelling of wastewater (sewage and grey water) indicated discharges from the FPSO would be mixed to very low levels (1:5000 dilution) within a maximum distance of 53 m (ConocoPhillips, 2018). Similarly, this is supported in a study of sewage discharge in deep ocean waters, Friligos (1985) reported no appreciable differences in the inorganic nutrient levels between the outfall area and background concentrations, suggesting rapid uptake of nutrients or rapid dispersion in the surrounding waters.

During IMMR and LWI activities, small volumes of sewage, grey water and putrescible wastes will be released to the marine environment and result in a reduction in water quality. Discharges will be temporary (minutes to hours), localised and limited to surface waters. The discharges are expected to disperse and dilute rapidly.

Salinity increases from brine discharge

The desalination of seawater results in a discharge of brine with an elevated salinity. On discharge to the sea, the desalination brine, being of greater density than seawater, is expected to sink and disperse in the currents. The volume of the discharge depends on the requirement for fresh (or potable) water and the number of people on board.

Most marine species are able to tolerate short-term fluctuations in salinity in the order of 20 to 30% (Walker & McComb, 1990). However, significant salinity increases may cause injury or mortality to plankton species. It is expected most marine species would be able to tolerate short-term exposure to the increase in salinity caused by the discharged brine. Given the rapid dispersion of the brine in the marine environment, salinity concentrations will dilute rapidly near the release.

Change to water quality from cooling water discharge (temperature and chlorination)

Upon discharge, cooling water will be subjected to turbulent mixing and transfer of heat to the surrounding waters. Cooling water discharge to the marine environment from all vessels could result in a localised and temporary increase in the ambient water temperature, which may cause alteration of the physiological processes (particularly enzyme-mediated processes) in marine biota.

Black *et al*. (1994) suggest cooling water discharges have detrimental effects on plankton that become entrained in the cooling water plume but the impact is likely to be localised, which is supported by Wolanski (1994). Phytoplankton photosynthesis may increase or decrease and the breeding patterns of various invertebrates can change (Black *et al.*, 1994).

Elevated seawater temperatures are known to cause alteration of the physiological processes (especially enzyme-mediated processes) of exposed biota (Wolanski, 1994). These alterations may cause a variety of effects, ranging from behavioural response (including attraction and avoidance) to minor stress to potential mortality for prolonged exposure.

The effects of chlorination on the marine environment have been summarised by Taylor (2006) who, based on a review of applications using hypochlorite as an antifoulant for the seawater cooling circuits, highlighted that long-term exposure to residual chlorination from seawater cooling circuits on fish species did not impose any apparent ecotoxicological stress.

During IMMR and LWI activities, cooling water discharge to the marine environment may result in a localised and temporary increase in the ambient water temperature, which could cause alteration of the physiological processes (particularly enzyme-mediated processes) in marine biota (Wolanski, 1994).

Modelling cooling water discharge

Water temperature impacts from cooling water discharges at the FPSO were modelled for the Barossa Development (RPS, 2023b), with the aim of determining the change in temperature and dilution of the chlorine within the combined cooling water and steam turbine generator condensate discharges.

The modelling was undertaken using both near-field (CORMIX) and far-field modelling (CHEMMAP), based on the parameters in Table 6-34.

Table 6-34: Summary of cooling water discharge modelling parameters

Parameter	Inputs	
Seasons	Summer (December to February) Transitional (March and September to November) Winter (April to August)	
Flow rate (m^3/h)	**Cooling water caisson**	**Steam turbine generator condenser caisson**
	13,959	6,531
Initial chlorine concentration (ppm)	0.5	
Number of simulations per case	75 per location (25 per season)	
Simulated discharge period (days)	30	

Nearfield modelling

The nearfield mixing and dispersion of the cooling water discharge was simulated using the 3D flow model, CORMIX. CORMIX is a mixing zone model and decision support system for assessing the environmental impact of regulatory mixing zones. It contains a series of elements for analysing and designing single or multi-port discharges. Discharges may be submerged or above surface, buoyant or denser than receiving water, and the receiving water may be stratified or unstratified. The emphasis of the model is the influence of the geometry and

dilution characteristics on the initial mixing zone (Doneker and Jirka, 1990; Jirka *et al*., 1991). CORMIX is widely applied worldwide and has been validated in many independent studies (http://www.cormix.info/validations.php).

Far field modelling

CHEMMAP predicts the movement and fate of a wide variety of chemical products, including floating, sinking, soluble and insoluble chemicals and product mixtures (French-McCay & Isaji, 2004). CHEMMAP incorporates many important chemical modelling components, including transport and spreading of floating chemicals, transport of dissolved or particulate chemicals in three dimensions, evaporation or volatilisation of chemicals at the surface, dissolution, resuspension, sedimentation, and degradation of chemicals in air, water and sediments (French-McCay *et al*., 2006).

The transport algorithm within CHEMMAP depends heavily on the precision of the input current data. The model uses a Lagrangian 3D transport model to predict the movement of the chemical in the water column, on the surface and in the air (French-McCay & Whittier, 2004).

For each time step, the model calculates the phase transfer percentages and changes the state of particular proportions of the spilled chemical (French McCay & Isaji, 2004). This may mean a chemical change from a substance floating on the surface to a gas or it is dissolved into the water column. The evaporation algorithm used in the CHEMMAP model has been tested by comparison to experimental data from Kawamura & MacKay (1987) and French-McCay & Whittier (2004).

A stochastic procedure was applied for the far-field modelling to sample a range of prevailing currents that occur at the release location and could affect the mixing and dispersion of the chlorine within the cooling water discharge. This approach involved running a total of 75 simulations: 25 simulations each commencing in summer (December to February), transitional (March and September to November) and winter (April to August) as a continuous discharge for 30 days (as in, a month), with randomly selected start times from the ten-year database.

Cooling water modelling results

The modelling outputs were evaluated against environmental criteria for both temperature and chlorine concentration, presented herein.

A temperature differential of 3˚C within 100 m from the release location was assessed in the modelling study and represents a commonly adopted industry standard as part of the World Bank Group's Environmental Health and Safety Guidelines for Offshore Oil and Gas Development (International Finance Corporation, 2015) for cooling water discharges.

Guidelines for the maximum discharge concentrations in marine waters have been set by a number of authorities around the world, which differ widely in both the levels that are set and the reactants that are considered. Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) does not specify any set threshold for chlorine or chlorine products in marine waters for Australia, citing a lack of evidence required to set a meaningful limit, but suggests a freshwater moderate reliability trigger value of 3 ppb. Additionally, the Prelude Floating LNG EP (Shell Australia, 2020) presents an assessment of water quality guidelines for chlorine from a number of jurisdictions, which had demonstrated the proposed trigger level of 3 ppb is consistent with and comparable to Department of Water and Environment Regulation (2017) and British Colombia Approved Water Quality Guidelines (British Columbia Ministry of Environment and Climate Change Strategy, 2021).

Furthermore, dilutions of 1:250 (equivalent to 2 ppb) correspond to concentrations reported by CSIRO as the predicted no-effect concentration in the event of chronic exposure to chlorine at the 99% species protection level (Chariton & Stauber, 2008) and the British Colombia Approved Water Quality Guidelines (British Columbia Ministry of Environment and Climate Change Strategy, 2021).

In summary, the modelling results showed:

- the near-field modelling revealed that due to the high flow rate from the cooling water caisson, the plume was predicted to plunge deeper to depths of 12.4 m, 11 m and 7.5 m below mean sea level under weak, moderate and strong currents, respectively. Under each current regime, AFTER the initial plunge the plume remained buoyant enough to rise quickly to the surface. As the plumes rose through the water column, it continued to mix with ambient waters. The diameter of the plumes at the sea surface ranged from 0.3 m to 4.2 m during weak and strong currents, respectively
- the plume temperature did drop below 3°C within 100 m from the release locations, therefore the temperature differential target was met (see above)
- the far-field results indicate that for the 80th and 95th percentiles, the maximum distances to the 1:250 dilution contour were 0.89 km and 3.25 km, respectively. Based on the 50th percentile analysis, the 1:250 dilution was achieved within 0.11 km from the release locations

- the maximum area of influence for the 1:250 dilution level for the 50th, 80th and 95th percentiles was 0.01 km², 0.4 km² and 7.9 km², respectively[52]
- the minimum distances from the nearest shoal and bank (Lynedoch Bank approximately 61 km east-southeast) was 59.5 km for the 95th percentile 1:250 dilution contour.

Note the percentile figures do not represent the location of a plume at any point in time; they are a statistical and spatial summary of the percentage of time dilution values occur across all replicate simulations and time steps. Also note the dilutions presented assume the background concentration of the contaminant in the receiving waters is zero and there is no significant biodegradation.

The predicted 95th percentile dilutions for the chlorine within the cooling water discharge with a flow rate of 20,490 m^3/hr is shown in Figure 6-9.

[52] *Dilutions of 1:250 (equivalent to 2 ppb) correspond to concentrations reported by CSIRO as the predicted no effect concentration in the event of chronic exposure to chlorine at the 99% species protection level (RPS,2023b).*

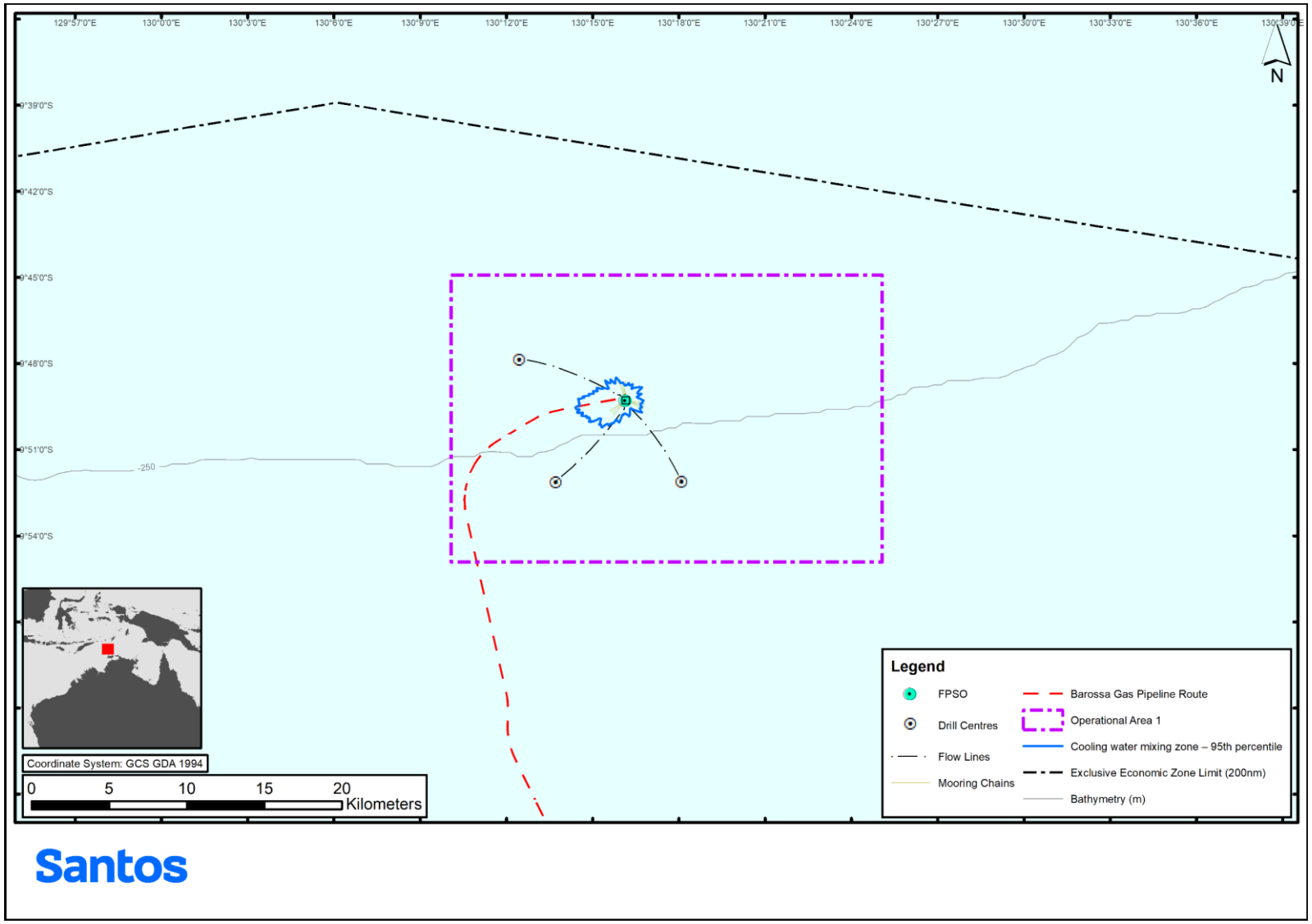

Figure 6-9: Predicted 95th percentile dilutions for the chlorine within the cooling water discharge with a flow rate of 20,490 m³/hr at 2 m below mean sea level. The initial chlorine concentration is 0.5 ppm (or 500 ppb). The results are derived from 75 simulations at each caisson

Change to water quality from treated oily water discharge

Discharges of treated oily water from the FPSO and vessels in OA1 and OA2 are expected to result in a localised reduction in water quality with highly localised impacts on plankton. Toxicity to marine organisms may result from small amounts of dissolved hydrocarbons in the treated oily water. Potential for significant impacts are mitigated through treatment of oily water to an OIW limit of 15 ppm in accordance with MARPOL Annex I and Marine Order 91. The potential for significant impact is further reduced due to the strong tidal movements experienced in the region and the naturally turbid environment.

Toxicity effects from discharged residual chemicals

Discharges from vessel and FPSO systems may include typical chemicals and contaminants used within standard maritime sewage systems, desalination systems and residues of those used for cleaning decks (as described in Section 6.7.1). Discharges are expected to be intermittent and similar to other permitted discharges from vessels.

On discharge to the marine environment, the small volumes of chemicals and residual hydrocarbons (such as MEG, methanol and organic acids) are expected to rapidly disperse in the offshore marine environment. Hence, any potential impacts would be confined to a highly localised area immediately surrounding the release location near the seabed. Toxic environmental effects to the marine environment from the release of chemicals and hydraulic fluids are unlikely to eventuate due to:

- the chemicals and hydraulic fluids will have been risk-assessed for their suitability for discharge using the Santos chemical selection process and have been selected for low toxicity and bioaccumulation potential
- the low sensitivity of the receiving environment at OA1
- relatively small volumes of discharges
- strong ocean currents mean the discharge will become further diluted upon discharge, so the duration of exposure of chemicals to marine fauna will be minimal.

There may be a localised and temporary (hours) reduction in water quality in the immediate vicinity of the releases. Toxic environmental effects on environmental receptors along the food chain, namely plankton, fish, marine reptiles, birds and cetaceans, are not expected in deep open waters of OA1, where the FPSO is located. The small volumes of operational discharges in OA2 may cause localised impacts to water quality in the direction of the prevailing current.

Residual hydrocarbon and inert gas (methane) may be discharged infrequently during IMMR, however, is not readily water soluble and so will not saturate the water column, instead rising rapidly to release to the atmosphere at the sea surface rather than being trapped at depth in the water column. Studies on the impacts of methane on fish have shown a behavioural response can be elicited through continuous exposure, such as increased activity and scattering within the water (avoidance behaviour).

Change to water quality from treated seawater discharge (contingency pipeline release)

Discharging treated seawater from the Barossa GEP would only be required if an unplanned pipeline rupture were to occur requiring filling and dewatering of the pipeline, as part of the repair process, using seawater treated with a treatment chemical mixture (containing biocide, corrosion inhibitor and oxygen scavenger). Although a rupture and treated seawater discharges are not expected, a modelling study was undertaken as part of contingency planning. This modelling was informed by ecotoxicity testing of a representative seawater treatment chemical mixture (Hydrosure) (Chevron, 2015) to determine the level of chemical dilution required to achieve 99% species protection (PC99%) based on a no observable effect concentration (NOEC). PC99% NOEC is considered an appropriately conservative level of protection to inform the spatial extent of treated seawater discharge impacts. The modelling assumed the FPSO PLET (i.e. the northern end of the Barossa GEP) as the treated seawater release location.

Treated seawater discharge modelling methodology

The modelling was undertaken using both near-field (CORMIX) and far-field (MUDMAP) modelling.

The nearfield mixing and dispersion of the cooling water discharge was simulated using the 3D flow model, CORMIX (RPS, 2025). Refer to the description of near-field modelling in the cooling water discharge section above. Parameters used for the treated seawater discharge near-field modelling are presented in Table 6-35.

Table 6-35: Summary of the treated seawater discharge characteristics used for the near-field modelling (RPS, 2025)

Parameter	
Flow rate (m^3/hr)	605.9
Internal diameter of outlet pipe (inches)	4

Parameter	
Number of outlets	1
Outlet orientation	Vertically upward
Discharge height above the seabed (m)	3.5
Water depth at discharge (m)	254
Discharge temperature (same as ambient seawater)	16.2
Discharge salinity (same as ambient seawater)	34.6

The far-field modelling expands on the near-field work by allowing the time-varying nature of currents to be included and for the potential for localised build-up when current speeds are low (e.g. at the turning of the tide) and recirculation of the plume back to the discharge location might occur. In this case, concentrations near the discharge point can be increased due to the discharge plume mixing with the remnant plume from an earlier time. This may be a potential source of episodic increases in pollutant concentrations in the receiving waters (RPS, 2025). The mixing and dispersion of the treatment chemical was predicted using the three-dimensional discharge and plume behaviour model, MUDMAP. Parameters used for the treated seawater far-field modelling are presented in Table 6-36.

Table 6-36: Summary of the chemical treatment characteristics used for the far-field modelling (RPS, 2025)

Parameter	
Total volume of chemically treated water released (m^3)	137,000
Duration of release (hours)	226.1
Simulated period (days)	10.4
Chemical treatment initial concentration (ppm)	550
Hindcast data period	2010 - 2019
Number of model simulations	75 (25 per season)
Seasons	Summer (October to March) Transitional (April and September) Winter (May to August) current conditions

Modelling results

Noting the conservative nature of the modelling undertaken, the modelling results for the contingency release of 137,000 m^3 of treated seawater are summarised below (RPS, 2025):

- Modelling predicted that discharged chemically treated seawater would initially project upward due to the vertical orientation of the outlet and the high exit velocities.
- Following the initial vertical movement the near-neutrally buoyant plume was predicted to travel horizontally at a height of approximately 100 m above the seabed.
- Within 30 meters from the release location, the concentration of the treatment chemical was predicted to reduce from the discharge level of 500 ppm to a level between 1.9 ppm and 2.6 ppm (i.e. a dilution of approximately 192 to 263 times)
- The level of dilution required to protect 99% of species (PC99%) was predicted to occur within 8.35 km of the discharge location for 50% of the modelled simulations and within 27.50 km of the discharge location for 95% of the modelled simulations.
- Importantly, no exposure was predicted at PC99% for the closest sensitive receptors, including Lynedoch Bank, Evans Shoal, and Tassie Shoal, which are located a minimum distance of 49.6 km from the modelled release site.
- The modelling results indicate that the chemical treatment concentrations did not exceed the PC99% NOEC level (0.06 ppm) for more than 6 hours within 50 meters of the release location and remained below this threshold for 24 hours after the cessation of the discharge in the environment.

6.7.2.2 Threatened, migratory or local fauna

As discussed in the sections above, the extent of impact for operational discharges is localised, and rapid dilution is predicted to occur within the offshore waters. Marine fauna within the OAs, some of which have cultural

significance as totems of cultural food sources is likely to be transient. If contact does occur with marine fauna, it will be for a short duration likely not of sufficient duration to cause a toxic effect.

Planned discharges may cause changes to behaviour in marine fauna (avoidance or attraction). Fishes and oceanic seabirds may be attracted to the discharge of macerated food scraps. However, such discharges would be isolated occurrences, so no prolonged influence on faunal behaviour is expected.

Contingency discharges of treated seawater may result in exposure of fauna (marine mammals, pelagic and demersal fish, marine reptiles, sharks and rays) to low concentrations of chemicals for a short duration of time, if fauna species are present at the time of release. Modelling demonstrated that chemical concentrations did not exceed the lowest NOEC threshold of 0.06 ppm for more than 6 hours within 50 meters of the release location.

A compilation of tracking data from marine turtle telemetry studies on and around the Tiwi Islands indicates turtle foraging areas and migration pathways did not overlap with the OA1, however migration pathways overlap OA2 (Pendoley, 2023) (Figure 3-6).Santos has considered information contained in relevant recovery plans and approved conservation advice for cetaceans that identify deteriorating water quality and chemical discharge as a potential threat (Table 3-13). This includes the objectives and actions in the Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017), which relate to discharges. Given the low level of seabed disturbance and the benthic habitats in the OAs being well represented in the wider surrounds, the activities are not inconsistent with the recovery plans and conservation advice. The seabed within the OAs is predominantly bare sediment and contains low abundance and diversity of infauna.

6.7.2.3 Cultural Features

No First Nations people feedback was provided about potential impacts from vessels or FPSO discharges to any geographically specific cultural features (excluding marine fauna species) during consultation (refer to Section 4.7). Any concerns related for impacts to cultural features from routine vessel or FPSO discharges are associated with direct or indirect impacts to culturally significant marine fauna species (refer to Section 3.7.11).

Feedback provided during consultation on the Barossa Development Drilling and Completions EP raised concerns regarding potential impacts from the Drilling Activity on totemic species and marine species that provide a food source for traditional fishing and hunting.

Other Tiwi people also provided information to Santos that impacts to totemic species could also affect Tiwi people by making them sick. Section 6.7.2.2 describes the potential impacts to marine species of cultural significance.

6.7.2.4 Potential cumulative impacts from concurrent activities

There are a number of operational discharges from the FPSO and associated vessels covered under this EP that have the potential to occur within OA1 at the same time as discharges from concurrent activities under the D&C EP and the SURF EP (see Section 2.3.1).

The greatest volume of FPSO operational discharges will be associated with the discharge of cooling water from the cooling water caisson at 13,959 m^3/h and from the steam turbine generator condenser caisson at 6,531 m^3/h (total of 24,940 m^3/h). Modelling of FPSO cooling water (heated water containing traces of chlorine and ammonia) conducted by RPS (2023b) predicts the plume temperature to drop to below 3°C above ambient seawater at 100 m from the discharge location and the plume (containing ammonia and chlorine) to dilute by 250 times (equivalent to 2ppb concentration of chlorine) within 3.25 km when analysing the 95th percentile results. The cooling water plume is expected to disperse in surface waters.

Other discharges from the FPSO will be smaller in scale. Modelling of wastewater (MARPOL compliant sewage and grey water discharges) indicate that these discharges from the FPSO would be mixed to very low levels (1:5000 dilution) within a maximum distance of 53 m (ConocoPhillips, 2018). FPSO discharges of MARPOL compliant macerated food waste, deck drainage, bilge water, slops tank water and desalination brine are also expected to rapidly dilute within a localised area.

The same types of operational discharges from other vessel supporting the FPSO (e.g. tow vessels, offtake assist vessel, support vessel, IMMR vessels, campaign (including LWI and USV) vessels) are not predicted to be greater in scale than those from the FPSO.

The above FPSO operational discharges will occur at the same time as operational discharges from concurrent MODU drilling/ completion activities at drill centres >6km from the FPSO turret. These will occur for a period of up to ~6 months (~3 months during the FPSO pre initial start-up activities and up to ~3 months following FPSO start-up). Discharges of the same composition will occur from the MODU and support vessels (i.e. cooling water, desalination brine, treated sewage/greywater, putrescible waste, bilge water, deck drainage). The MODU has a similar POB to the FPSO (estimated each at 140 POB), with MODU support vessel having a lower POB (up to 18 per vessel). Therefore, the volumes of desalination brine, putrescible waste and treated sewage/greywater discharged are expected to be similar and disperse over a similarly localised scale (i.e. 10s of metres) away from the discharge points on the FPSO and MODU. The volume of these POB-related discharges will be lower for

vessels supporting the FPSO and MODU and since MODU and support vessel activities will be centred at locations >6km from the FPSO and its support vessels there are not expected to be any interactive effects between these operational discharges. Deck drainage and bilge water discharges from the FPSO, MODU and associated vessels are expected to be infrequent, and where there is potential for hydrocarbon contamination these discharges will be filtered using MARPOL compliant oily water filtering systems to achieve and oil in water (OIW) of less than 15 mg/L. Deck drainage and bilge discharges will be highly localised and given the separation between vessels associated with MODU drilling/completion activities and production operations activities, and the low OIW content of these discharges, there is no interaction expected. Cooling water is expected to be discharged in far lesser volumes from the MODU (and associated MODU support vessels) than from the FPSO, where discharges may extend out to 3.25km to achieve a 250-fold dilution. On that basis, there is not expected to be any interaction of cooling water discharges from the MODU and the FPSO given the separation of MODU and FPSO of >6 km. Considering the nature and scale of the various routine operational discharges from MODU (and support vessels) and the FPSO (and support vessels) there is not expected to be any combination of operational discharges that would result in interactive effects within OA1.

Other discharges from a MODU conducting concurrent drilling/completion activities in OA1 will include drilling discharges (drill fluids, drilling solids, drill cuttings and lost circulation materials), cement discharges, blowout preventer and xmas tree control fluid discharges, well completion discharges (well completion fluids, formation water, MEG, methanol), miscellaneous chemicals (tracer dyes and cement spacer), tank cleaning discharges and residual bulk products (barite, bentonite, brine and drill water). Further detail on these discharges is provided in Section 0 of the D&C EP.

Of the MODU drilling/completion discharges, the greatest volume and spatial scale of discharge is expected to be associated with the discharge of drill cuttings and fluids. For the near-seabed discharges of cuttings and fluids, modelling, as presented in the D&C EP, indicates that the larger particulates (diameter >0.15 mm) would settle within 60 m from the release location while smaller particulates (diameter <0.15 mm) would be expected to be carried further away from the release location (up to 4 km), due to slower settling velocities, and will settle as a very thin layer of sediment. For drilling particulates discharged near the water surface, the modelling indicated that material would be transported further from the release location as a result of being exposed to ocean current forces for a longer period. Particulates were modelled to settle over a larger area (maximum total area of 1.27 km^2 and up to 1.2 km away). Given the spatial scale of these drilling discharges, there is not expected to be spatial overlap between MODU drilling discharges with FPSO cooling water discharges (or any other smaller volume FPSO operational discharges).

There is also the potential for contingency MODU workovers to occur at drill centres during the operational phase of the FPSO which would be covered under a separate EP. While these would be contingency only activities, they have been indicatively accounted for in Section 2.3.1 as one ~3-month duration activity during the validity period of this EP. These discharges (e.g. well completion discharges) are anticipated to be no greater than drilling/completion discharges and would be spatially separated from the FPSO by >6km.

Discharges from vessels undertaking SURF installation and pre-commissioning activities (i.e. a construction vessel and transportation vessel), concurrent with either pre FPSO start-up or post FPSO start-up activities, will include standard vessel operational discharges such as cooling water, desalination brine, treated sewage/greywater, putrescible waste, bilge water and deck drainage, and the construction vessel could have a similar POB to the FPSO. These discharges, described further in the SURF EP (Section 6.6), are expected to cause localised water quality changes within 50m of the discharge and will occur predominantly at drill centre locations >6km from the FPSO turret. In the instance that the installation and pre-commissioning of a gas export spool is required, concurrent with the FPSO pre-start phase these discharges could occur at the FPSO location. The greatest potential for these discharges to interact with FPSO discharges would be with any FPSO cooling water discharges occurring during cold commissioning.

Other SURF installation and pre-commissioning activity discharges, that could occur concurrently with FPSO pre-start-up and post initial start-up activities, include treated seawater/freshwater, freshwater, MEG and hydraulic control fluid during FCGT, dewatering, flushing and leak testing of SURF infrastructure. Further detail on these discharges is provided in Section 0 of the SURF EP. These discharges will occur predominantly at drill centre locations >6km from the FPSO turret and not interact with any discharges from the FPSO. However, it is possible that localised pre-commissioning discharges associated with the installation of a gas export spool at the FPSO location could occur during the FPSO pre initial start-up activities in which case there could be localised interaction with FPSO discharges during cold commissioning. Given the relatively low volumes and discrete nature of these SURF discharges, significant interactions are not likely.

While IMMR activities and LWIV activities under this EP will have associated operational discharges, it is unlikely that these activities will be concurrent with drilling/completion and SURF activities and their associated discharges, therefore these potential interactions are not discussed further.

On the basis of the above assessment, there is unlikely to be any significant spatial overlap of discharges from the FPSO, support vessels or subsea infrastructure with discharges associated with MODU/ support vessels (D&C EP

activities) or construction/transportation vessels undertaking SURF installation and pre-commissioning (SURF EP activities). Most operational discharges are expected to be highly localised around vessels which will maintain safe separation distances and exclusion zones as relevant. For the larger discharges associated with the FPSO and MODU (cooling water and drill fluid/drill cutting discharges, respectively), these will originate from locations >6km apart and given the expected spatial scale of these discharges, interaction is not expected.

While spatial overlap of discharges is not expected to be significant, the concurrent nature of Barossa activities means that there will be some cumulative increase in the scale of water quality impacts within OA1 for the duration of concurrent activities (which may occur for multiple months, refer Section 2.3.1). The cumulative effect of these discharges is not expected to be significant given that discharges are expected to disperse rapidly and not persist or accumulate in the environment and furthermore discharges will not affect any significant areas or habitats for marine fauna (including EPBC Act listed fauna), such as BIAs, foraging areas, breeding/nesting/calving areas or areas known to aggregate marine fauna or provide unique habitats.

The D&C EP, SURF EP and this EP have all assessed impacts from vessel discharges as minor and any additive and cumulative effects from concurrent activity discharges under these EPs are considered negligible. Therefore, there is no change to the overall consequence level for operational discharge impacts due to other Barossa activity operational discharges.

6.7.2.5 Indirect consequences from Darwin Liquefied Natural Gas Facility Operations

Onshore processing of Barossa feed gas at DLNG facility has the potential to impact on marine environmental quality values through changes in the volume and quality of wastewater discharged via the jetty outfall discharge point during future operations.

Processing of Barossa feed gas is expected to result in potential discharge of up to 228 m^3/day (approximately 83 ML/year) of a new comingled wastewater stream via the jetty outfall under a revised EPL during future operations, which would combine:

- RO reject water that is currently discharged from the jetty outfall when DLNG facility was processing Bayu-Undan feed gas (140 m^3/d, 51.1 ML/year)
- two additional wastewater streams that were previously discharged to land via irrigation when DLNG facility was processing Bayu-Undan feed gas:
  - treated sewage effluent from the STP (13 m^3/d, 4.7 ML/year)
  - oily water effluent from process area sumps, the turbine air humidification system (TAHS) and boiler blowdown (75 m^3/d, 27.4 ML/year)

The changes to DLNG facility operations associated with processing Barossa feed gas were addressed in a Notice of Intent (NOI), submitted to the NT EPA for assessment. The purpose of the NT EPA assessment was to determine if the scope of the change would require assessment under the NT Environmental Assessment Act 1982. In its assessment of the NOI[53], the NT EPA concluded that the potential environmental impacts and risks of the proposed changes to the existing operation of the DLNG facility would be mitigated to such an extent that they are not considered to be significant. The NT EPA considered that the residual risks will be sufficiently regulated through updates to the DLNG Facility Operations Environmental Management Plan, a revision to the DLNG Facility Environment Protection Licence (EPL-217) under the Waste Management Pollution Control Act and other relevant legislation and policies (NT EPA, 2020).

6.7.3 Environmental performance outcomes and control measures

The EPOs relating to this event are:

- No injury, or mortality to, EPBC Act 1999 listed marine fauna or marine fauna listed as threatened species under the Territory Parks and Wildlife Conservation Act 1976 (NT) as a result of the Activity (EPO-08)
- Planned discharges will meet relevant maritime obligations and Santos chemical assessment and approval process (EPO-14)
- Zero unplanned discharge of hazardous and non-hazardous wastes into the marine environment from the Activity (EPO-16)
- Zero unplanned discharge of hydrocarbons or chemicals to the marine environment from the Activity (EPO-18)

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- No significant impact to cultural features from the Activity (EPO-19)
- Treated seawater discharge will not exceed the 99% species protection level beyond the validated mixing zone (EPO-21)

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this Activity are shown in Table 6-37 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria which are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 6-37: Control measures evaluation for operational discharges

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-6.7.1	Routine discharges of putrescible waste, in accordance with MARPOL Annex V and Marine Order 95 (Marine Pollution Prevention – Garbage) (administrative control)	Reduces probability of garbage being discharged to sea thus reducing potential impacts to marine fauna and ensures compliance with MARPOL Annex V (and Marine Order 95: Marine pollution prevention – garbage).	Cost associated with implementing procedures	**Adopted –** environmental benefits of ensuring FPSO and vessels are compliant outweigh the potential costs.
BAO-CM-6.7.2	Routine discharges of treated sewage and grey water, in accordance with Marine Order 96 (Marine Pollution Prevention – Sewage) (administrative control)	Managing treated sewage and grey water discharges to Commonwealth and marine requirements ensures no substantial change in water quality will occur.	Cost associated with implementing and complying with legislation	**Adopted –** environmental benefits of ensuring FPSO and vessels are compliant outweigh the potential costs.
BAO-CM-6.7.3	Deck cleaning product selection according to MARPOL Annex V (and Marine Order 93: Noxious liquid) (substitution control)	Ensures deck cleaning products are not harmful to the marine environment.	Cost associated with implementing and complying with MARPOL and Marine Orders. Limits deck cleaning products available for use.	**Adopted –** environmental benefits of ensuring FPSO and vessels are compliant outweigh the potential costs.
BAO-CM-6.7.4	FPSO firefighting foam selection is confirmed PFAS and PFOS free (on FPSO) and is selected in accordance with the Santos chemical selection process (Section 2.7.3.8.4) (substitution control)	Environmentally acceptable firefighting foam.	Minor cost associated with implementing the procedure. While the range of chemicals that can be used is reduced, there is a negligible cost for selecting alternative products.	**Adopted –** environmental benefits of using environmentally acceptable chemicals outweigh procedural implementation and operational costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-6.7.5	Apply the Santos chemical selection process for chemicals planned to be discharged (Section 2.7.3.8.4) (administrative control)	Under the procedure, CHARM-rated gold/silver and non-CHARM Group E/D chemicals managed under the OCNS, or OSPAR PLONOR list, or chemicals risk assessed by Santos and deemed environmentally acceptable, will be selected (Section 2.7.3.8). Therefore, production and other chemicals pose little or no risk to the environment. Reduces the potential impacts to culturally significant marine species, including totemic species, such as marine turtles and marine mammals.	Minor cost associated with implementing the procedure. While the range of chemicals that can be used is reduced, there is a negligible cost for selecting alternative products.	**Adopted –** environmental benefits of using environmentally acceptable chemicals outweigh procedural implementation and operational costs.
BAO-CM-6.7.6	Routine discharges of treated bilge and deck water from vessels and FPSO will comply with Marine Order 91 (administrative control)	Managing bilge and deck drainage discharges to Commonwealth and marine requirements ensures no substantial change in water quality will occur. Ensures oily water is treated and discharged in accordance with MARPOL Annex I (and Marine Order 91: Marine pollution prevention – oil).	Cost associated with implementing and complying with MARPOL and Marine Orders.	**Adopted –** environmental benefits of ensuring FPSO and vessels are compliant outweigh the potential costs.
BAO-CM-6.7.7	FPSO deck drain system and bunding to reduce risk of off specification OIW reaching the marine environment (engineering control)	Reduces the likelihood of any oily or chemical content reaching the marine environment, from the FPSO.	Personnel and operational costs associated with constructing and maintaining offshore bunding and bunding procedure.	**Adopted** – environmental benefits of reducing likelihood of oil and chemical discharge outweigh the associated costs.
BAO-CM-6.7.8	Controlled feed water flow by individual flow transmitters, to limit sodium hypochlorite in seawater discharge to 3 mg/L and periodic manual verification sampling of chlorine concentrations by the FPSO laboratory to ensure residual chlorine discharged is within limit (excluding shock dosing). (engineering control)	Ensures residual chlorine concentrations discharged are within limit (less or equal to 0.5ppm)	Cost associated with implementing sampling procedure.	**Adopted –** environmental benefit of confirm chlorine concentrations prior to discharge

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-6.4.10	Barossa Facilities and vessels planned maintenance system to confirm equipment integrity is maintained in accordance with manufacturers guidelines. (administrative control)	Minimises discharges by ensuring FPSO and vessels are operated, maintained and crewed in accordance with industry standards and regulatory requirements. Ensures that discharge monitoring equipment is appropriately maintained and operating within their design parameters.	Personnel costs of implementing.	**Adopted** – benefits of operating equipment within Operational parameters will help control emissions created by equipment.
BAO-CM-6.4.5	HSE inductions will include applicable environmental requirements (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements. Ensures personnel are suitably aware of cultural features and values.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
BAO-CM-6.4.8	Mercury decanting procedure. (administrative control)	Minimises risk of mercury loss of containment to ALARP.	Cost of implementing procedures.	**Adopted**
BAO-CM-6.7.10	Waste Management Plan for management of controlled waste (administrative control)	Minimises risk of storage, handling and disposal of controlled wastes to ALARP.	Cost of implementing procedures.	**Adopted**
BAO-CM-6.7.11	Contractor contingency pipeline preservation procedure and specification (administrative control)	This control is effective in reducing potential impacts from contingency pipeline preservation activities by: • selecting a seawater treatment product that is Gold rated through OCNS CHARM rating or through a pseudo CHARM rating, which is recognised as the least environmentally hazardous chemical rating • calculating the chemical treatment dosage to result in the discharge concentration not exceeding 550ppm • metering of water and chemical injection volumes during flooding and dewatering activities • Minimising the concentration of treatment chemicals required for the	Cost of implementing procedures.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		required preservation period		
Additional control measures				
BAO-CM-6.7.12	Contractor contingency pipeline major repair procedure to be developed in the event a major repair is required (administrative control)	This control effectively reduces the likelihood of an unplanned treated seawater release during the pipeline repair activities.	Cost of implementing procedures.	**Adopted**
BAO-CM-6.7.13	In the unlikely event that the pipeline requires contingency filling and subsequent dewatering of treated seawater in response to a rupture or stuck ILI tool event and prolonged repair, pipeline dewatering of treated seawater will be discharged via an arrangement orientated to promote dispersion and direct discharge away from seabed as far as practicable (engineering control)	Promotes dispersion (reduces chemical concentration in surrounding environment). Reduces potential for sediment/seabed impacts.	Cost/effort in engineering and/or manipulating valve orientation. Constrained by specifications of pipeline recovery tool.	**Adopted**
BAO-CM-6.7.14	In the unlikely event that the pipeline requires contingency filling and subsequent dewatering of treated seawater in response to a rupture repair or stuck ILI tool event and prolonged repair, water quality monitoring at the discharge location will be conducted to confirm the concentration and dispersion of treatment chemicals (administrative control)	Confirms dilution of discharge and validity of modelling.	Cost/effort in planning and implementing water quality monitoring.	**Adopted**
N/A	Zero discharge of putrescible waste from the FPSO and vessels (elimination control)	Would eliminate putrescible waste from being discharged to sea.	This would result in an increase in environmental impacts through increased fuel consumption and increased atmospheric emissions, both by the vessel (or transport vessel) having to return to port a number of times to unload the wastes, and by land transport to the nearest disposal facility. Increased energy consumption and atmospheric emissions would also result from the disposal (e.g.,	**Not adopted**- health and safety considerations outweigh the environmental benefit for a remote offshore location; discharge of food waste is a permissible maritime discharge.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
			incineration, treatment etc.) of the wastes.	
N/A	Zero discharge of sewage from the FPSO and vessels (elimination control)	Eliminates treated sewage from being discharged to sea.	Significant health risks from storing sewage onboard. Costs associated with containment and onshore disposal of sewage. Storing sewage would create an additional hazard for working on deck.	**Not adopted** – health and safety considerations outweigh the environmental benefit for a remote offshore location; discharge of treated sewage is a permissible maritime discharge.
N/A	Zero discharge of bilge water from the FPSO and vessels (elimination control)	Would eliminate treated oily water from being discharged to sea.	Issues include vessel stability comprised, potential fire hazard and flooding risk.	**Not adopted** – safety and environmental considerations outweigh the environmental benefit for a remote offshore location. It is a permissible maritime discharge.
N/A	Capture or eliminate use of chemicals used during IMMR (elimination control)	Eliminates or reduces the chemicals discharged to the marine environment.	Capturing chemicals used during IMMR is not practical. Chemicals are assessed to ensure the discharge is environmentally acceptable in accordance with the Santos chemical selection process. Excessive use of chemicals is restricted.	**Not adopted** – safety and operational considerations outweigh the environmental benefit, given small volumes and low toxicity of the discharges.
N/A	Eliminate use of chemicals used during commissioning and start-up (elimination control)	Eliminates or reduces the chemicals discharged to the marine environment.	Elimination of chemicals is not practical as they are used for preservation of the subsea infrastructure post construction. Chemicals are assessed to ensure the discharge is environmentally acceptable in accordance with Santos chemical selection process. Excessive use of chemicals is restricted.	**Not adopted** – safety and operational considerations outweigh the environmental benefit, given small volumes and low toxicity of the discharges.
NA	Use of subsea hydraulic fluid in a closed loop system (elimination control)	Eliminates the loss of hydraulic fluid from the subsea tree valves.	Closed-loop systems would require an additional return line in the control umbilical, oil cleaning equipment and additional equipment at each subsea tree, leading to increased complexity, cost, and potential additional leak paths.	**Not adopted -** cost and additional environmental leaks risks outweigh environmental benefit.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Zero discharge of deck water from the FPSO and vessels (elimination control)	Would eliminate potential contaminants being discharged to sea.	Increased safety risks from wet deck not draining. Large amounts of water on a vessel's deck can also cause stability issues (free surface effect).	**Not adopted** – safety considerations outweigh the environmental benefit for a remote offshore location. Deck water is a permissible maritime discharge.
N/A	Zero discharge of cooling water from the FPSO and vessels (elimination control)	Eliminates potential impacts of cooling water (elevated temperature) being discharged to sea.	Technically not an available option, given volumes of cooling water that would need to be stored on the FPSO or vessels to meet the operational cooling water needs.	**Not adopted** – not technically feasible to operate the FPSO or vessel without cooling water; discharge of cooling water is a permissible maritime discharge.
N/A	Restrict use of desalination plant; or zero discharge of brine water from the FPSO and vessels (elimination control)	Eliminates or reduces brine being discharged to sea.	Cost associated with transporting potable water offshore. Health risks associated with limited supply of potable water. Costs associated with containment and onshore disposal of brine. Storing brine would create an additional hazard for working on deck.	**Not adopted** – health and safety considerations outweigh the environmental benefit for a remote offshore location; use of 'water-making' system and discharge of waste brine is a permissible maritime discharge.
N/A	With reference to the discharge of treated seawater at the FPSO PLET, restrict the depth of discharge to either the surface waters or bottom waters (engineering control).	Analysis has demonstrated that impacts from either a surface or bottom waters discharge will be localised and temporary and have negligible impact on the marine environment.	Cost and time associated with use of multiple vessels and specialist equipment.	**Not adopted** - Restricting the location of the discharge has technical risks that could result in the need to utilise multiple vessels or specialist equipment that could extend the duration of the activities thus increasing the environmental impact.
N/A	Omission of preservation activities (no addition of treatment chemicals to pipeline) following pipeline repair activity (elimination control)	This would eliminate any potential treated seawater impacts from the contingency activities.	Preservation may be required to control the potential for corrosion of the pipeline. In addition, potential loss of subsea infrastructure integrity could possibly lead to a larger environmental incident after commissioning.	**Not adopted** – not considered feasible from a technical and risk perspective.

6.7.4 Environmental impact assessment

Receptor	Consequence level
Operational discharges	
Threatened, migratory or local fauna	Sensitive receptors that may be impacted include plankton, fish, marine turtles and mammals, and seabirds. Impacts to water quality will be localised and will occur only as long as the discharges occur (as in, no sustained impacts). The routine discharges of sewage, greywater and putrescible waste from the FPSO and vessels could result in localised increases in nutrient concentrations, exert biological oxygen demand on the

Receptor	Consequence level
	receiving waters, and may promote localised elevated levels of phytoplankton and bacteria activity due to nutrient inputs. Dispersion and dilution of discharges from the FPSO are expected to be rapid as OA1 is located in deep offshore waters dominated by swift currents, resulting in short-term changes to surface water quality. Vessels are typically moving when in the OAs, which facilitates the mixing of sewage, putrescible wastes, and grey water from vessels. Changes in water quality will be temporary, with recovery measured in hours. Even when stationary, such as when undertaking IMMR or LWIV at a specific area, the duration of the activity is short (14-34 days) and discharges are intermittent, aiding in recovery time for the surrounding environment with rapid dispersion and dilution occurring in the deeper waters. Some fish and oceanic seabirds may be attracted to the FPSO by the discharge of putrescible waste. This attraction may be either direct, in response to increased food availability, or secondary as a result of prey species being attracted to the facilities. However, given the small quantities, intermittent nature of disposal and swift currents, any attraction is likely to be minor and is not anticipated to result in adverse impacts at an ecosystem or population level. A number of marine mammal species may be present in the region; however, no BIAs overlap the OAs, and it is not anticipated species will be present in significant numbers. While the marine mammals may transit through the OAs, contact with operational discharges are unlikely to result in impacts greater than a minor short-term behavioural change, limited to one or a few individual species. Impact to populations or ecosystems are not anticipated. While OA1 does not overlap any marine turtle BIAs, the southern end of OA2 traverses nesting HC area for flatback and Olive ridley turtles and overlaps a portion of the internesting BIA for flatback turtles (Table 3-16). The southern end of OA2 also traverses through the Oceanic Marine Shoals Marine Park. Therefore, there may be an increase in number of individual flatback and olive ridley in the southern end of OA2 (between June to September for flatback and April to August for Olive ridley turtles). While turtles may transit through the OAs (particularly OA2), contact with operational discharges are unlikely to result in impacts greater than a minor short-term behavioural change (such as avoidance), limited to one or a few individual species. Impacts to populations or ecosystems are not anticipated. Similarly, a contingency release of treated seawater is not expected to have impacts to population or ecosystems based on modelling results that demonstrated that chemical concentrations did not exceed the lowest NOEC threshold of 0.06 ppm for more than 6 hours within 50 meters of the release location. Given the nature of the planned operational discharges, the relatively small volumes that could be released to the marine environment, the high levels of dilution and the nature of the marine environment near the OAs, the consequence level for Threatened, migratory or local fauna is considered to be II – Minor.
Physical environment and habitat	Water quality changes will be highly localised and are not expected to persist following cessation of planned discharges. The seabed within OA1 consists of soft substrates and is devoid of significant bathymetric features; sediments are predominantly unconsolidated silty sand with little existing contaminants (Jacobs, 2016a) (refer Section 3.3.3.6). While OA1 is located within the Shelf break and slope of the Arafura Shelf KEF, species associated with the continental slope and patch reefs that characterise this KEF (such as demersal fish, whale sharks, sharks, and turtles) are unlikely to aggregate within OA1 due to the lack of seafloor features. Sub-lethal or lethal effects to infauna from chemicals and fluids discharged near the seabed (for example, from IMMR or LWI activities) is considered unlikely, given the expected low concentrations and short exposure times. It is anticipated discharges would have a negligible impact on the benthic habitats. The closest environmental values and sensitivities to the location of the modelled contingency release of treated seawater are submerged shoals and banks including Lynedoch Bank (63 km to the south-east), Evans Shoal (73 km to the west) and Tassie Shoal (84 km to the south-west). No exposure was predicted at any protection level concentration for these sensitive receptors. OA2 overlaps the Oceanic Shoals Marine Park. Impacts have been discussed under ‘protected areas’, below. Given the nature of the planned operational discharges, the relatively small volumes that could be released to the marine environment, the high levels of dilution and the nature of the marine environment near the OAs, the consequence level for physical environment and habitat is considered to be II – Minor.

Receptor	Consequence level
Protected areas	OA2 overlaps two sections of the Oceanic Shoals Marine Park (Figure 3-9): • the Multiple Use Zone (IUCN Category VI) to the south of OA1 • the Habitat Protection Zone (IUCN Category IV) to the north-west of Bathurst Island. The Oceanic Shoals Marine Park contains representative habitats from the region. Benthic habitat modelling and mapping along the proposed Barossa GEP route within the Multiple Use Zone and the Habitat Protection Zone indicated two benthic habitats were present – bare sediment (greater than 82.8%), filter feeders (10.1%) and burrowers and crinoids (6.2%). It is anticipated discharges would have a negligible impact on the benthic habitats, given the nature of the operational discharges in OA2. Other environmental values of the Oceanic Shoals Marine Park, such as marine fauna and KEFs, are representative of the region. Given the temporary nature of activities within OA2 (limited to vessel based IMMR) and the physical environmental characteristics (as in, open, relatively deep offshore environment with significant current and tidal action), impacts to water quality will be localised and will occur only for the duration of the discharge (as in, no sustained impacts within the Marine Park). Species associated with the Oceanic Shoals Marine Park have been assessed above. The consequence level for physical environment and habitat is considered to be I-Negligible due to the types of discharges that are planned within OA2 and the allowance for these discharges to occur within AMPs.
Socio-economic	Given the minor consequence to species due to the controls in place to manage the discharges in accordance with regulatory requirements, subsequent impacts to socio-economic receptors including commercial fishing and cultural features (including species with cultural significance as totems or as a cultural food source) are not anticipated. The location of discharges may overlap cultural features. Operational discharges will be of a relatively small scale and will be highly diluted. Therefore, the consequence to socio-economic receptors is assessed as I - Negligible.
Cultural features	For potential impacts to marine species of cultural significance or that provide a traditional food source, refer to the assessment for threatened, migratory or local fauna. For assessment of impacts to the physical environment to which First Nations people are connected and have raised concerns, refer to the assessment for the physical environment/threatened ecological communities / protected areas.
Cumulative impacts	On the basis that concurrent Barossa activities will occur within OA1 (see Section 2.3.1), the potential for cumulative activity discharges is acknowledged. These concurrent activities will be limited to a short duration (months) and there is unlikely to be any significant spatial overlap of operational discharges from concurrent activities. Most operational discharges are expected to be highly localised around vessels which will maintain safe separation distances and exclusion zones as relevant. For the larger discharges associated with the FPSO and MODU (cooling water and drill fluid/drill cutting discharges, respectively), these will originate from locations >6km apart and given the expected spatial scale of these discharges, interaction is not expected. While spatial overlap of discharges is not expected to be significant, the concurrent nature of Barossa activities means that there will be some cumulative increase in the scale of water quality impacts within OA1 for the duration of concurrent activities (which may occur for multiple months, refer Section 2.3.1). The cumulative effect of these discharges is not expected to be significant given that discharges are expected to disperse rapidly and not persist or accumulate in the environment and furthermore discharges will not affect any significant areas or habitats for marine fauna (including EPBC Act listed fauna), such as BIAs, foraging areas, breeding/nesting/calving areas or areas known to aggregate marine fauna or provide unique habitats. The D&C EP, SURF EP and this EP have all assessed impacts from vessel discharges as minor and any additive and cumulative effects from concurrent activity discharges under these EPs considered negligible. Therefore, there is no change to the overall consequence level for operational discharge impacts due to other Barossa activity operational discharges.
Overall worst-case consequence level	II – Minor

6.7.5 Demonstration of as low as reasonably practicable

The assessed residual consequence for this impact is minor and cannot be reduced further. Additional control measures were considered (as detailed in Section 6.7.4). Control measure BAO-CM-6.7.12, BAO-CM-6.7.13 and BAO-CM-6.7.14 are adopted; however the rest were not adopted since the associated cost and effort was grossly disproportionate to any benefit. It is therefore considered the impact is ALARP.

As part of increasing the efficiency of the FPSO cooling water system, a flexible intake hose is used for the seawater intake, located at a depth of approximately 70 m, which minimises the temperature of the incoming water and maximises the cooling achieved.

The FPSO firewater system undergoes dry-deluge testing annually to ensure there are no blockages and a water-based vapour and dye is used to check the nozzles are all functioning well. This reduces the requirement for wet testing of the system and the resultant discharge to sea, which will only be required approximately every five years.

On-board treatment of most wastes and their subsequent discharge to the marine environment is consistent with legislative requirements (such as MARPOL) and considered environmentally acceptable. As a minimum, fixed offshore facilities (such as the FPSO) can treat sewage effluent simply by way of maceration, which is in line with MARPOL requirements, and discharge the waste overboard, due to the remote offshore location of such facilities. However, the Barossa FPSO has incorporated a sewage treatment system, which is more commonplace on vessels, reducing the environmental discharge of sewage effluent. Sewage effluent, consisting of both black water and grey water from the living quarters, will be treated by biological sewage treatment systems (two at 100% capacity available), and discharged to the marine environment. Incorporation of the sewage treatment system on the FPSO provides enhanced environmental performance over the minimum MARPOL Annex IV requirements. When the grey water is not diverted into the black water tank (e.g. during system maintenance) it can be discharged directly overboard, still meeting MARPOL and Marine Order 96 requirements.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the impacts such that the residual consequence is assessed to be II – Minor. The proposed control measures are in accordance with the Santos risk management criteria and are considered appropriate to manage impacts to ALARP.

6.7.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence from planned operational discharge is rated II – Minor.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecological sustainable development?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers principles of ESD: • there are no identified health, diversity or productivity impacts that may affect the biodiversity or ecological function for future generations • the impacts from discharge do not result in 'threats of serious or irreversible harm' as detailed within the EPBC Act and biodiversity and ecological integrity will be maintained.

Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)	Yes – Control measures implemented will reduce the potential impacts from Activity operational discharges to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009b) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b) • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b) • Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c) **Recovery plans:** • Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013) • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (CoA, 2014) • Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) • Sawfish and River Sharks Multispecies Recovery Plan (CoA, 2015b) **Other management plans/guidelines**: • Marine bioregional plans for the NMR and NWMR (CoA, 2012a, 2012b). Habitat degradation or modification is identified in many conservation advices, however the nature of Activity operational discharges will not result in habitat degradation. Pollution is identified in a number of plans but pertains to more toxic discharges and therefore is not considered applicable here given the discharges are allowable in accordance with legislation or are of low toxicity. For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes and the control measures outlined in Section 6.7.3. Santos considers that the level of impact from Activity operational discharges is not inconsistent with these plans. The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the Shelf break and slope of the Arafura Shelf KEF. Significant impacts to this KEF are not predicted for this Activity. IMMR activities that may be required in the Oceanic Shoals Marine Park are not inconsistent with the IUCN principles and North Marine Parks Network Management Plan objectives (DNP, 2018a) or the DNP Commercial Activity Licence conditions, refer Appendix C.

Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – Operational discharges are compliant with the requirements of the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, which in Australian waters reflects MARPOL, and is enacted by: • Marine Order 91 (Marine pollution prevention – oil) • Marine Order 93 (Noxious liquid substances) • Marine Order 95 (Marine pollution prevention – garbage) • Marine Order 96 (Marine pollution prevention – sewage). • Management also consistent with Hazardous Waste (Regulation of Exports and Imports) Act 1989 (Cth), Navigation Act 2012 (Cth), Protection of the Sea (Powers of Intervention) Act 1981, Protection of the Sea (Powers of Intervention) Regulations 1983 (Cth), Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Cth), Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations 1994 (Cth), Dangerous Goods Act 1998 (NT) and Dangerous Goods Regulations 1985 (NT), Waste Management and Pollution Control Act 1998 (NT), Basel Convention, International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties 1969 and UNCLOS. Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.7.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health, and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with the ECNT, have been considered when evaluating performance outcomes, control measures and associated performance standards (see section 4.7for further information). No specific control measures were proposed by Relevant Persons, including ECNT, for this EP. Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have been adopted in this EP. An additional performance outcome (EPO-19) has been adopted for operational discharges based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

The consequence of operational discharges is assessed as II – Minor. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential impacts are considered acceptable.

6.8 Produced Water Discharges

6.8.1 Description of event

Event	
	Produced water (PW), consisting of both condensed (water vapour present within gas and condensate which condenses when brought to the surface) and formation water (derived from the aquifer below the hydrocarbon formation) will be produced by the FPSO with formation water not expected until after initial start-up. While PW treatment is performed before discharge, the discharge stream may contain residual dispersed oil, dissolved organic compounds (aromatic hydrocarbons, organic acids, benzene, toluene, ethylbenzene and xylenes (collectively known as BTEX) and phenols), and inorganic compounds (such as soluble inorganic chemicals, dissolved metals). It will also contain traces of added production chemicals, including those used to prevent subsea and topside hydrates (methanol and MEG), and traces of other chemicals during initial start-up (refer Sections 2.7.3.8.2 and 2.7.3.8.3). There may be a requirement for one-off dosing of the first batch of MEG with oxygen scavenger and a pH Buffer pre-RFSU depending on operational requirements. The PW treatment and discharge system is designed to separate liquid hydrocarbons (condensate) from water that is brought to the surface from the production wells and handle chemicals added in the production process. The system uses several techniques to stabilise the fluid and separate oil-in-water (OIW) before sending any returning condensate back to the process treatment system. The PW treatment and discharge system consists of multiple stages of de-oiling, solids removal and pumping equipment (refer Section 2.7.2.6 for further detail). The system consists of a: • PW surge drum • hydrocyclone • floatation vessel (induced gas flotation (IGF) unit) • tertiary PW treatment unit – macro-porous polymer extraction (MPPE). The PW treatment system has a design guarantee to treat PW to the following specifications at a flowrate of up to 20,000 bbl/d, as considered in the Barossa OPP (ConocoPhillips, 2018) (the primary environmental approval for the Barossa Development): • Oil in water (OIW) content of not greater than 30 mg/L over a rolling 24-hour average • Maximum mercury content of 10 ppbw • Discharge temperature of <60°C OIW and mercury are predicted to be key constituents within the Barossa PW in terms of the potential for toxicity effects within the marine environment and will not be discharged above these design specification limits. These limits have been used to assess the scale of impacts from the PW discharge over the life of the Activity. In consideration of PW treatment system performance data, more stringent limits have been set for OIW and mercury during steady state operations, as follows, which require PW to be diverted inboard and not discharged until the limit can be met: • OIW <25 mg/L average over a rolling 24-hour period when the PW flowrate is between 3,000 and 10,000 bbl/d • Mercury <8 ppbw For PW flowrates of 10,000 and 20,000 bbl/d the design specification limit of 30 mg/L average over rolling 24-hour period applies. If PW discharge does not meet the OIW or mercury content limits listed above (referred to as off-specification PW), the PW is automatically (in the case of OIW monitored through the OIW Analyser) or manually (in the case of mercury monitoring or when the OIW Analyser is offline) diverted to the PW off-specification storage tank in the FPSO hull, which has a capacity of 26,256 m^3. Off-specification PW will be routed from an off-specification storage tank back to the PW treatment and discharge system for further treatment. In addition, performance targets for PW treatment have been set for OIW and mercury for the purpose of reducing OIW and mercury discharges in PW to ALARP. Deviations from performance targets will be managed through an adaptive management approach outlined within the PW Adaptive Management Plan (Appendix I) and targets will be reviewed annually as per the PW target setting cycle outlined in Section 8.2.5.1. If targets are not met, response actions will be implemented while still allowing PW to be discharged in accordance with the limits. The performance targets for OIW and mercury for steady state operations are: • OIW target of <15 mg/L average over a rolling 72-hour period, when the PW production rate is between 3,000 and 10,000 bbl/d • OIW target of <25 mg/L average over a rolling 72-hour period, when the production rate is between 10,000 and 20,000 bbl/d • >80% mercury removal through the PW treatment system A PW sampling regime outlined in the PW Adaptive Management Plan (Appendix I) (including OIW and mercury sampling, overall chemical characterisation, ecotoxicity testing), adaptive management process

	and field sampling program will be in place to verify PW composition, ensure the discharge complies with limits and to set performance targets to reduce emissions in PW to ALARP. There are expected to be concurrent Barossa activities during FPSO start-up and steady state operations (Section 2.3.1) that will result in discharges in OA1 occurring concurrently with PW discharge. This includes discharges associated with the operation of a MODU and support vessels (D&C EP activities) and operation of a construction vessel and transportation vessel (SURF EP). This will include standard vessel operational discharges such as treated sewage/greywater, putrescible waste, brine, cooling water, bilge, deck drainage and ballast water. For concurrent MODU drilling/completion (covered under the D&C EP) and MODU well workover activities (which will be authorised under a separate EP) at drill centres within OA1, additional discharges will include drilling discharges (drill fluids, drilling solids, drill cuttings and lost circulation materials), cement discharges, blowout preventer and xmas tree control fluid discharges, well completion discharges (well completion fluids, formation water, MEG, methanol), miscellaneous chemicals (tracer dyes and cement spacer), tank cleaning discharges and residual bulk products (barite, bentonite, brine and drill water). Further detail on these discharges is provided in Section 6.7 of the D&C EP. For concurrent SURF installation and pre-commissioning activities, concurrent discharges may include treated seawater/freshwater, freshwater, MEG and hydraulic control fluid during FCGT, dewatering, flushing and leak testing of SURF infrastructure. Further detail on these discharges is provided in Section 6.7 of the SURF EP. **Operational area 1:** PW discharge will occur within OA1. Other Barossa activity discharges will occur concurrently. **Operational area 2:** There is no PW discharge in OA2.
Extent	Based on dispersion modelling of simulated PW discharge, the PW Mixing Zone extends for 70 m from the PW discharge point, informed by the toxicity of Barossa condensate, at a OIW concentration of 30 mg/L and inorganic mercury at 10 ppbw (Figure 6-10). Beyond the PW Mixing Zone, 99% species protection level is predicted to be achieved. The PW Mixing Zone is conservatively based on a 20,000 bbl/day discharge rate and upper limits (design specifications) of OIW and mercury concentrations. Concurrent MODU and support vessel activities (with associated standard vessel discharges and MODU drilling/completion discharges) will be concentrated at drill centres >6 km from the FPSO turret. Of these discharges, fine particle drilling discharges are expected to disperse over the widest area (up to 4 km). These discharges are not predicted to overlap with the PW Mixing Zone which is modelled at <100 m radius from the PW discharge point. Concurrent construction vessel and associated transportation vessel activities (with associated standard vessel discharges and SURF pre-commissioning discharges) will occur at drill centres >6 km from the FPSO turret during FPSO stat-up and steady state operations. These discharges are expected to disperse on a scale of 100 m and are not predicted to overlap with the PW Mixing Zone.
Duration	**Continuous:** PW will be discharged continuously from the FPSO during steady state operations when meeting the PW discharge specification for the duration of the Activity. **Concurrent:** The duration of each concurrent Barossa activity within OA1 is presented in full in Section 2.3.1. PW discharge commences following initial start-up when the water treatment system is online therefore the only overlap with discharges from concurrent Barossa activities in OA1 will be following FPSO start-up. There may be discharges from MODU and support vessel activities undertaking drilling/completion in OA1 (under the D&C EP) for a duration of ~3 months post-FPSO start-up and the potential for discharges from continency MODU well workovers (nominally 3-months duration and which will be authorised under a separate EP) within a ~5-year period. For the first 6 months post FPSO start-up there may be up to ~2 months cumulative duration of discharges from SURF installation and pre-commissioning activities.

6.8.1.1 Produced water fate modelling and Mixing Zone derivation

PW fate modelling was performed by RPS APASA in 2017 (RPS APASA, 2017) using the MUDMAP model, a three-dimensional plume behaviour model that simulates PW mixing and dispersion. The Barossa OPP (ConocoPhillips, 2018) includes full details about the RPS APASA report.

A summary of the modelled discharge volumes and key parameters are presented in Table 6-38.

Table 6-38: Summary of produced water modelling parameters

Parameter	Value
Flow rates	Steady state: 10,000 bbl/day[1] (1,590 m³/day) Peak production: 20,000 bbl/day[1] (3,260 m³/day)
Outlet pipe internal diameter	0.31 m

Depth of pipe below sea surface	10 m
Discharge salinity	15 ppt
Discharge water temperature	60°C
Discharge OIW (as in, hydrocarbon) concentration	30 mg/L
Seasons	All season (summer, winter, transitional)

Note 1: The modelled flowrates are considered conservative for the predicted PW rates. A 20,000 bbl/day discharge is consistent with the modelling performed for the Barossa OPP (ConocoPhillips, 2018).

The modelling included the following considerations and assumptions to facilitate a conservative modelling approach.

Oil in water (OIW) ecotoxicity testing

OIW is considered a key contaminant of concern within PW in terms of the potential for toxicity impacts, and while its concentration in discharged PW will be reduced to ALARP it will be present in higher concentrations compared to other constituents (such as dissolved inorganic salts, metals and process chemicals). As the exact constituents within the Barossa PW are not yet known, modelling of the OIW content (based on Barossa condensate) is considered to provide an indicative extent that may be impacted by the PW plume. The other PW constituents that may be present in very low concentrations are not expected to change the risk or impact profile beyond the discharge plume assessed, with the exception of mercury. Mercury is a known toxicant and may be present in the PW discharge at up to 10 ppbw and therefore has been modelled separately (refer below). For the purpose of OIW modelling, a conservative 30 mg/L OIW concentration was used. It is expected that the Barossa tertiary (MPPE) treatment system will be operating at rates below its design capacity, which improves OIW discharge treatment performance. As a result, the peak OIW discharge concentration coinciding with the peak PW production rate is predicted to be approximately 20 mg/L, well below the upper specification of 30 mg/L used to inform the PW impact assessment herein. The average OIW discharge concentration based on the lower PW volumes is expected to be less than 8 mg/L.

Barossa condensate ecotoxicity testing (Appendix K) was conducted by the NATA-accredited Ecotox Services Australasia (ESA) based on well-established test protocols and provided chronic toxicity tests across seven mainly tropical test species/taxonomic groups from three trophic levels (i.e. microalga (*Isochrysis aff. galbana*), macroalgae (*Ecklonia radiata*), sea urchin (*Heliocidaris tuberculata*), milky oyster (*Saccostrea echinata*), copepod (*Parvocalanus crassirostris*), sea anemone (*Aiptasia pulchella*) and barramundi (*Lates calcarifer*)). Test species were predominantly at early life stages (e.g. gamete, gametophyte, embryo, larvae, juvenile) that are typically most sensitive to hydrocarbons (Appendix K).

The Burrlioz 2.0 statistical software package, as recommended by ANZECC/ARMCANZ (2000) guidelines, was used to analyse toxicity results and produce species sensitivity distributions (SSD) to derive the greatest concentration at which no observable effect would be expected to 80, 90, 95 and 99% of species with 50% confidence (refer Appendix K). The most conservative 99% species protection moderate reliability trigger level has been used to inform PW discharge modelling. To reach this level of species protection, PW with an OIW concentration of 30 mg/L must dilute to a level of 1:65 or greater (or less than 465 µg/L OIW concentration).

Water temperature threshold

The assessment criteria for evaluating potential impacts to the marine environment from increased water temperature was a 3°C exceedance above ambient, in line with International Finance Corporation guidelines for cooling water. This criterion was conservatively applied to the PW discharge stream.

Mercury toxicity

A PW mercury discharge concentration of 10 ppbw has been applied to the modelling inputs which represents the performance specification for the Barossa tertiary MPPE treatment system with a feed mercury content of 25 ppbw (i.e. a removal efficiency of 60%). A higher level of mercury removal performance (>80%) is expected during steady state operations and a lower discharge limit of 8 ppbw has been set accordingly.

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) provides a 99% species protection default guideline value (DGV) of 0.1 µg/l (0.1 ppb) for inorganic mercury in marine waters, based on chronic exposure tests (yielding no observable effect concentrations; NOECs) of marine organisms covering 6 taxonomic groups (algae, annelids, molluscs, echinoderms, crustacea and fish). To reach this level of species protection, PW with a mercury concentration of 10 ppbw must dilute to a level of 1:100 or greater.

Model outputs

The RPS APASA (2017) modelling results for a 20,000 bbl/day PW discharge rate (representative, albeit conservative maximum PW discharge rate over the field life) showed that:

- the level of dilution was directly attributable to the speed of the current. Weaker currents had minimal effect on the PW plume during the rise process, meaning it reached the surface quicker and thus, slowed the rate of dilution. Strong currents were able to push the buoyant plume up to a maximum horizontal distance of approximately 26.3 m, allowing for additional mixing before reaching the sea surface
- the PW plume was predicted to extend downward to approximately 1 m below the outlet pipe (as in, to 11 m below the sea surface) and is influenced by the PW discharge flow rate and current strengths
- upon encountering the sea surface, the diameter of the PW plume at the sea surface ranged from approximately 2.9 m to 10 m during weak and strong currents, respectively
- the temperature of the PW plume reduced to within 3°C of ambient water temperature within approximately 2 m horizontally of the release location.
- the area influenced by PW discharges from the FPSO was relatively localised during all seasons
- The dilution level of 1:65 (or less than 465 µg/L OIW concentration), required to meet a highly conservative 99% species protection moderate reliability trigger level based on Barossa condensate, was predicted at a maximum horizontal distance from the FPSO of approximately 40m for all seasons and covers an area of <0.01 km².
- OIW dilution levels of 1:50, 1:75 and 1:100 were predicted at a maximum horizontal distances of approximately 20 m, 40 m and 70 m from the PW discharge point for all seasons
- Based on the dilution contours from the modelling, the ANZG (2018) 99% species protection DGV for mercury (a 100-fold dilution) is achieved at a horizontal distance of approximately 70 m from the PW discharge point.
- contact with shoals and banks, reefs and islands, marine parks or KEFs were not predicted during any season at the 1:65 dilution level (OIW 99% species protection level) or the 1:100 dilution level (mercury 99% species protection level).

PW Mixing Zone

A PW Mixing Zone has been determined for the Activity to designate the area beyond which levels of PW environmental impacts are considered acceptable (99% species protection based on ANZG (2018) guidance) and to allow the environmental performance outcomes for PW discharge (Section 6.8.3) to be measured. A PW Mixing Zone has been derived from toxicity and modelling, representative of design specification limits of OIW and mercury in the PW. In the absence of PW to conduct toxicity testing (given this assessment relates to a new facility), OIW and mercury toxicity are considered appropriate proxies to determine the scale of a PW Mixing Zone given:

- they are expected to be key drivers of PW toxicity
- toxicity information is available (include specific toxicity information from Barossa condensate)
- they will be managed within set discharge limits providing certainty to model inputs

Figure 6-10 presents the 99% species protection zones for OIW and mercury which are localised to the FPSO and similar in scale (40 m and 70 m, respectively). In order to capture both of these zone extents, a PW Mixing Zone has been designated based on the mercury toxicity 99% species protection and therefore extends 70 m away from the PW discharge point.

Santos will conduct PW sampling and testing to characterise the constituents of PW and determine the level of PW toxicity and will also undertake water and sediment sampling to determine the concentration and distribution of PW contaminants within the marine environment, as detailed in the PW Adaptive Management Plan (Appendix I) and Water and Sediment Quality Management Plan (Appendix J). This information will be used to validate whether impacts associated with the PW discharge (99% species protection) are within the PW Mixing Zone and therefore within acceptable limits.

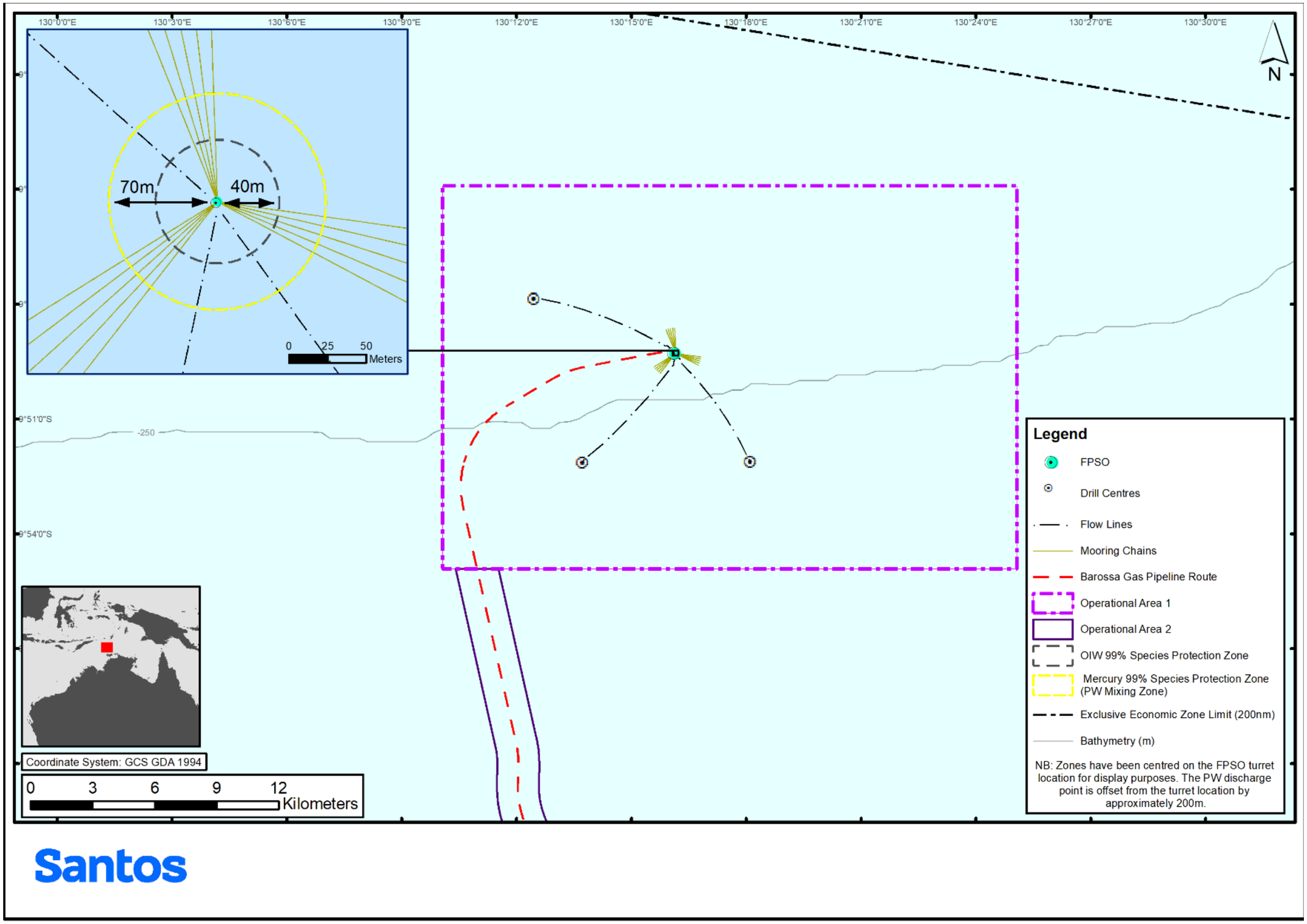


Figure 6-10: Predicted extent of the produced water dilution at a discharge rate of 20,000 bbl/day

6.8.2 Nature and scale of environmental impacts

Potential receptors: Physical environment and habitat, threatened, migratory or local fauna and cultural features.

PW is separated out from the hydrocarbon components during processing and treatment (refer Section 2.7.2.6) before being discharged to the marine environment from a caisson at least 10 m below the sea surface on the FPSO. This PW consists of formation water (derived from the aquifer below the hydrocarbon formation) and condensed water (water vapour present within gas and condensate which condenses when brought to the surface). The exact composition of PW differs depending on subsurface formations, reservoirs and the hydrocarbon product being produced (Neff *et al.*, 2011; Hardi *et al.*, 2019). While PW treatment is performed before discharge, the effluent may contain residual inorganic and organic contaminants – both naturally found within the formation or intentionally introduced during operations, such as trace production chemicals – that can have potential impacts to the marine environment (Parkerton *et al.*, 2018; Hardi *et al.*, 2019).

A summary of the potential impact mechanisms to receptors from the discharge of PW to the marine environment are presented in the next subsections and include:

- change in water quality
- bioaccumulation in marine fauna
- toxicants in sediments
- eutrophication.

Modelling was undertaken to determine the exposure extent from the PW discharge. Results are discussed in Section 6.8.1.1.

6.8.2.1 Change in water quality

The PW discharge is expected to be of low salinity (15 ppb) and warmer than receiving waters (up to 60°C) (refer Section 2.7.2.6.1). It will therefore rise to the sea surface gradually once discharged. Mixing and dilution is facilitated by the release point being 10 m below the sea surface. It is further influenced by various factors, including the composition of the PW discharged, flow rate, water depth, currents, temperature, salinity, difference in density between the PW plume and receiving waters, and the stratification of the water column (Premathilake & Khangaonkar, 2019). While PW discharge will be continuous and over the life of production operations, the risks to water quality from PW generally diminish significantly within short distances from the discharge due to rapid dilution (as demonstrated by the PW fate modelling results, Section 6.8.1.1).

PW typically contains small amounts of contaminants, including dispersed oil, dissolved organic compounds (aromatic hydrocarbons, organic acids, BTEX and phenols), and inorganic compounds (such as soluble inorganic chemicals, dissolved metals) (Manfra *et al*., 2007). It will also contain traces of added production chemicals, including those used to prevent subsea and topside hydrates (methanol and MEG), and traces of other chemicals during initial start-up (refer Sections 2.7.3.8.2 and 2.7.3.8.3).

As BTEX is highly volatile, it will evaporate and dilute such that there will only be a localised zone of increased concentrations. PAHs within PW discharge have a greater potential to accumulate within the marine environment than BTEX due to their solubility, toxicity and persistence. It is expected that PAHs will be mostly removed from the water column through volatilisation to the atmosphere upon reaching the sea surface, particularly the lower molecular-weight fractions (Schmeichel 2017). Therefore, only localised increased concentrations are anticipated.

Both BTEX and PAHs at high enough concentrations have the potential to cause acute impacts to marine organisms (e.g. lethal impacts) over short timescales (hours to days), in particular to those marine organisms susceptible to changes to water quality such as invertebrates and fish. Due to the greater potential persistence of PAHs within the marine environment, in particular higher molecular weight PAHs, PAHs can also cause chronic impacts to marine organisms, such as sub-lethal effects on growth, development and reproductive success, where exposure occurs over longer timescales.

Metals in PW typically include trace heavy metals such as arsenic, cadmium, copper, chromium, lead, mercury, nickel and zinc. Azetsu-Scott *et al.* (2007) indicated three different pathways for these inorganic elements once entering the marine environment with PW, being:

- elements that stayed in solution would dilute along with the PW plume
- elements that oxidise or precipitate to form insoluble inorganic compounds that would sink
- elements that associate with oil droplets that are lighter than seawater and rise to the surface.

While concentrations of dissolved metals in PW can be greater than those in the marine environment, they are rapidly reduced through dilution and mixing processes and other physicochemical reactions to levels that pose a

low risk to the receiving environment (International Association of Oil and Gas Producers 2005). Elevated dissolved metals concentrations are therefore only expected within close vicinity of the discharge point.

Naturally occurring radioactive materials (NORMs) are present within geological formations and are typically found in sand and PW brought to the surface during production. Within PW the most abundant radionuclides are 226Ra and 228Ra which are derived from the radioactive decay of 238U and 232Th, respectively (Bou-Rabee *et al.*, 2009). When PFW is brought to the surface with the oil, sand and gas, the rapid drop in temperature and pressure causes NORMs (primarily 226Ra and 228Ra) to precipitate out, which may result in accumulation of sludge and hard scales in the processing equipment (OGP, 2005). However, 226Ra and 228Ra may also remain dissolved within PW, albeit at low concentrations that are not expected to result in significant environmental impacts.

Low levels of elemental mercury are expected to be present in the Barossa PW. The IGF and MPPE stages of the PW treatment system provide up to 90% removal of elemental mercury from PW, which is subsequently returned to the condensate fluids (refer Section 2.7.2.6). The PW treatment system is designed to remove mercury to a concentration less than 10 ppbw, which ensures the ANZG (2018) marine water quality trigger value of 0.1 µg/l (at the 99% protection level) is met within 70 m from the discharge (refer Section 6.8.1.1).

The topsides are designed for continuous injection of methanol (a hydrate inhibitor) coupled with a regeneration system (refer Section 2.7.3.8.2), limiting chemical wastage in the PW stream. MEG (during well start-up and shutdown along with well testing activities), methanol and other production chemicals which ultimately end up being discharged with the PW will be assessed in accordance with the Santos chemical selection process so only environmentally acceptable products are used (refer Section 2.7.3.8.4). MEG and methanol are OSPAR convention PLONOR listed chemicals.

Based on PW modelling (RPS APASA, 2017) (refer Section 6.8.1.1) and toxicity data for OIW and mercury, the PW discharge is expected to dilute to a level providing 99% species protection at a maximum distance of approximately 70 m from the discharge location for a 20,000 bbl/d discharge rate. The 99% species protection level and modelled PW discharge rate are highly conservative thresholds, and potential toxicological impacts for the majority of species are expected to be limited to within this range.

6.8.2.2 Toxicants in sediments

While PW plumes occur mainly within surface waters, there is the potential for presence of suspended solids particles within the plume, depending on the nature of the reservoir. These suspended solids may comprise metal oxides and cause low-solubility hydrocarbon droplets, such as higher molecular weight PAHs, to drop out (Neff *et al.*, 2011). Suspended solid components as they settle have the potential to accumulate in sediments local to the PW discharge location, determined by current speed and direction. The concentrations of PAH in sediments near PW discharge sites are highly related to the volume and density of PW discharged, the PAH concentrations, water depths and local mixing regime (Neff *et al.*, 2011). Accumulation of contaminants in sediments is also highly dependent on the concentration of suspended solids and particle size to which they adhere. While suspended matter will eventually settle onto the seabed, once settled, the particulates will be subject to a range of physico-chemical processes such as re-suspension, bioturbation and microbial decay.

It is possible for contaminants to accumulate in sediment on the seabed; however, this is highly unlikely for Barossa PW discharge due to:

- the water depth (approximately 220 m) and elevated currents, leading to higher dispersion before settling
- natural sediment resuspension
- only the fine sand fraction would settle to the seabed, with the silts dispersing over a wide area at very low concentration levels
- high degradation rates of both biogenic (carbon) and hydrocarbons at the sediment interface (Burns *et al.*, 2003)
- the PW treatment system design
- the expected PW discharge rates and concentrations
- the relatively fast current speed, which ranges from 0.22 m/s at the near-surface to 0.14 m/s at 210 m below mean sea level (Fugro, 2015).

The seabed in the field is generally smooth and featureless with the sediments interpreted to comprise predominantly fine clayey sand (Fugro, 2016). Benthic fauna is typical of those expected in offshore environments and were consistent with studies conducted both in areas with similar features and in areas of a similar geographic location (Jacobs, 2016a) (refer Section 3.3.3.6). As discussed above, over time it is possible, albeit highly unlikely, there may be a slight accumulation of contaminants (suspended solids particles within the PW) within the

surrounding marine sediments. This will be confirmed through sediment quality sampling in accordance with Appendix J.

6.8.2.3 Bioaccumulation in marine fauna

Bioaccumulation refers to the amount of a substance taken up by an organism through all routes of exposure (water, diet, inhalation, epidermal). Increasing the total loads of contaminants in receiving waters has the potential to increase bioaccumulation of toxicants within pelagic fish, phytoplankton, crustaceans or other marine species in proximity to such discharges (such as PW).

The level of bioaccumulation depends on the contaminant concentration and exposure time, as well as biotic factors such as diet, the trophic position of the organism and its ability to metabolise these compounds (Meador *et al.*, 1995; Trevizani *et al.*, 2016). Acute exposure to contaminants will result in serious harm or mortality to the marine organism while chronic exposure can lead to bioaccumulation of the contaminant within marine organisms over time (accumulation of chemicals from the water or from food sources into tissues over time). ANZG (2018) provides an indication of contaminants for which possible bioaccumulation and secondary poisoning effects should be considered. These include dispersed oil, PAH and alkylphenols, heavy metals and naturally occurring radioactive materials (Neff *et al.*, 2011; Nepstad *et al.*, 2021).

Research has not documented impacts of PW discharges at population and community levels (Bakke *et al*., 2013). Most of the laboratory and field studies of PW support a conclusion that biological effects on pelagic organisms will be limited to a distance of less than one kilometre, due to rapid effluent dilution and very short exposure time (Bakke *et al*., 2013); or that bioaccumulation risks to marine animals near PW discharge are likely to be minor (Neff *et al.*, 2011).

Uptake of dissolved hydrocarbons is less likely for marine mammals and reptiles than for fish and invertebrates, since marine mammals and reptiles are air-breathing and do not possess gill structures that promote cellular uptake of dissolved PW constituents. Bioaccumulation of PAH has been mainly recorded within invertebrates, which are less efficient at metabolising PAH. Bakke *et al.* (2013) found PW accumulates in cod and blue mussel caged near outlets but is rapidly metabolised in cod.

Impacts to fish within a PW discharge may be caused by exposure to PAH within the PW or heavy metals across gill structures, although impacts could also occur through ingestion of hydrocarbon droplets. While PAH concentrations may be elevated in fishes attracted to the FPSO, the elimination of PAHs is generally very efficient in fish and other vertebrates, and bioaccumulation of PAH within these taxa do not generally reflect their level of exposure (van der Oost *et al.*, 2003; Nepstad *et al.*, 2021). Pelagic fish are transient marine fauna that are unlikely to remain within the discharge location and associated plume, which will move around depending on the metocean conditions. Laboratory and field studies of PW have also concluded that significant biological effects on pelagic organisms will be limited to a distance of less than one km due to rapid effluent dilution, with no expected impact at the population level (Bakke *et al*., 2013).

Methyl-mercury (the most bioavailable form of mercury that has the potential to bioaccumulate) is not present in the Barossa reservoir. Methylation of elemental mercury can also occur in the marine environment by microorganisms (Risher, 2003). However, the formation of methyl-mercury mainly occurs in anaerobic conditions and is enhanced in low pH (as in, acidic) waters (Risher, 2003; Boszke *et al.*, 2002); both of which are not characteristic of the conditions in the offshore waters of the Barossa Development. While mercury could potentially drop out of the PW plume and reach the seabed, the highly dispersive conditions at the discharge site indicate that significant accumulation is unlikely (refer Section 6.8.2.2). Furthermore, conditions at the seabed are unlikely to be suitable for the methylation of mercury. These factors indicate that the potential for methyl-mercury to enter the food chain from the benthic environment and bioaccumulate is low.

6.8.2.4 Eutrophication

Eutrophication is characterised by excessive plant and algal growth due to the increased availability of one or more limiting growth factors needed for photosynthesis (Schindler, 2006). PW contains nutrients (nitrogen and phosphorus) which when discharged into the marine environment has the potential to increase the biomass of phytoplankton and bacteria within surrounding waters of the discharge location. These increased nutrient levels stimulate the growth of primary producers such as macroalgae, potentially resulting in excessive algal blooms, which can lead to eutrophication of aquatic ecosystems. High nutrient concentrations, coupled with reduced current flow, are required for eutrophication to occur (Chislock, 2013). Given the low PW discharge rate and continuous currents in the offshore receiving environment, eutrophication is not anticipated.

6.8.2.5 Cultural features

No First Nations people provided feedback about potential impacts from PW discharges to any geographically specific cultural features (excluding marine fauna species) during consultations (refer to Section 4.7). Any concerns

related to the potential for impacts to cultural features from potential impacts from PW discharges are associated with direct or indirect impacts to culturally significant marine fauna species (refer to Section 3.7.11).

During consultation with Tiwi Clans for other Barossa EPs, concerns were raised about potential impacts from the drilling activity on totemic species and marine species that provide a food source for traditional fishing and hunting. Other Tiwi people also provided information to Santos that impacts to totemic species could also affect Tiwi people by making them sick.

Section 6.8.2.3 describes the potential impacts to marine species, which may also be of cultural significance to First Nations peoples.

6.8.2.6 Potential cumulative impacts from concurrent activities

PW discharges will only occur from the FPSO and therefore there is no potential for cumulative impact between two or more PW discharge streams. However, there may be a number of vessels within OA1 undertaking concurrent Barossa activities under the D&C EP and the SURF EP (see Section 2.3.1) that may discharge fluids/ solids in OA1 at the same time the FPSO is discharging PW.

Operational and drilling/completion discharges will occur from the MODU (and MODU support vessels in the case of operational discharges) undertaking drilling and completion activities at drill centres >6km from the FPSO location. This could occur for a period of up to ~3 months following FPSO start-up within which time the FPSO may also be discharging PW. Section 6.7.2.4 provides a description of the operational and drilling/completion discharges that will occur from the MODU and support vessels. The spatial extent of operational discharges and most drilling/completion discharges are expected to be very localised. With respect to the discharges of drill cuttings and drill fluids from the MODU, particulates may disperse over a scale of 10s of metres to kilometres, dependent upon the size of particles discharged, with the furthest extent of particle settlement on seabed modelled as up to 4 km away. Given the rapid dilution of the FPSO PW stream and the modelled mixing zone (99% species protection) extending to <100 m from the discharge location (i.e. 40 m based on condensate toxicity and 70 m based on mercury toxicity), and considering the scale of discharges from the MODU and support vessels, there is not expected to be overlap or additive effects from the FPSO PW discharge and any discharges from MODU and support vessels undertaking drilling/completions activities.

There is also the potential for contingency MODU workovers (which will be authorised under a separate EP) to occur at drill centres during the period of time the FPSO will be discharging PW. While these would be contingency only activities, they have been indicatively accounted for in Section 2.3.1 as one ~3-month duration activity during a ~5-year operational period. These discharges (e.g. well completion discharges) are anticipated to be no greater than drilling/completion discharges and would be spatially separated from the FPSO by >6 km. Therefore, there is not expected to be any potential for overlap with discharges from MODU well workovers with FPSO PW discharges. Contingency well workover activities using a MODU will be authorised under a separate EP.

Discharges from vessels undertaking SURF installation and pre-commissioning activities (i.e. a construction vessel and transportation vessel), may occur concurrently within a cumulative period of up to ~2 months for the first 6 months following FPSO start up. Therefore, there is the potential for SURF EP operational and pre-commissioning discharges (refer to Section 6.7.2.4 for further detail) to occur concurrently with FPSO PW discharge. SURF discharges would occur in the vicinity of drill centre locations >6 km from the FPSO turret during the period the FPSO is discharging PW. Given SURF EP operational discharges are expected to affect a localised area within 50m of the discharge point and pre-commissioning discharges are expected to be similarly localised (given they are relatively low volume one-off discharges), overlap or additive effects, between SURF EP discharges and the FPSO PW discharge are not expected.

On the basis of the above assessment, there is unlikely to be any spatial overlap of PW discharges from the FPSO with discharges associated with MODU/ support vessels during drilling/completion (D&C EP activities), contingency MODU well workover activities or construction/transportation vessels undertaking SURF installation and pre-commissioning (SURF EP activities). The PW Mixing Zone will be >6 km apart from the drill centres, where other concurrent Barossa activities will be centred during the FPSO operational phase.

While there is no expected spatial overlap of FPSO PW discharges with other Barossa activity discharges, the concurrent nature of other Barossa activities means that there will be some cumulative increase in the scale of water quality impacts within OA1 for the duration of concurrent activities (which may occur for multiple months, refer Section 2.3.1). The cumulative effect of these discharges is not expected to be significant given that discharges are expected to disperse rapidly and not persist or accumulate in the environment and furthermore discharges will not affect any significant areas or habitats for marine fauna (including EPBC Act listed fauna), such as BIAs, foraging areas, breeding/nesting/calving areas or areas known to aggregate marine fauna or provide unique habitats.

Any cumulative effects from concurrent activity discharges with FPSO PW discharge are considered to be negligible. Therefore, there is no change to the overall consequence level for PW impacts due to other Barossa activity operational discharges.

6.8.3 Environmental performance outcomes and control measures

The EPOs relating to this event are:

- No injury of, or mortality to, EPBC Act 1999 listed marine fauna or marine fauna listed as threatened species under the *Territory Parks and Wildlife Conservation Act 1976* (NT) as a result of the Activity. (EPO-08)
- Produced water discharge will not exceed ANZG (2018) 99% Species Protection water quality guideline values and ANZG (2018) default sediment quality values beyond the PW Mixing Zone and will meet the level of dilution required for 99% Species Protection (based on ecotoxicity testing) within the PW Mixing Zone. (EPO-13).

The control measures considered for this Activity are shown in Table 6-39. Environmental performance standards and measurement criteria for the adopted controls are presented in Table 8-2.

Table 6-39: Control measures evaluation for produced water discharges

Reference No	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard controls				
BAO-CM-6.8.1	PW is treated via primary and tertiary treatment stages to reduce OIW and mercury concentrations. (engineering control)	The use of tertiary treatment stage (MPPE) in addition to primary stages (hydrocyclone and induced gas flotation) is considered best available technology for PW treatment and provides a very high degree of dispersed and dissolved oil removal, as well as >80% mercury removal (refer Section 6.8.5.1). OIW and mercury are predicted to be key toxicants within Barossa PW and reducing the concentration and loading of these toxicants in the environment reduces the potential for environmental impacts.	The FPSO design has selected primary and tertiary PW treatment systems, which is determined to be best practice and ALARP.	**Adopted** - in engineering design. The PW treatment system configuration, consisting of primary (hydrocyclone and IGF) and tertiary (MPPE) treatment, is considered the ALARP option and provides best available technology OIW treatment, as well as high mercury removal, which the alternative tertiary treatment system options do not offer (refer Section 6.8.5.1).
BAO-CM-6.8.2	Following 12 months of steady state production and then annually thereafter, OIW and mercury performance targets and limits will be reviewed to determine if they can be reduced further. (administrative control)	Through the performance target review and setting cycle outline in Section 8.2.5.1, environmental impacts from the discharge will be continually reduced to as low as reasonably practicable.	Although the reduction in environmental impact may be small a review of the limit once operating does not incur any large cost and demonstrates continual improvement and ALARP.	**Adopted –** environmental benefits of reducing potential impacts from PW discharge by further reducing the OIW content.
BAO-CM-6.8.3	Online monitoring and/ or procedural controls in place to monitor and control PW discharge volume and OIW concentrations. (administrative control)	The OIW analyser and flow meter provides optimal process control and safeguarding to monitor, control and prevent discharge of PW with high OIW concentration to the environment. In event the online OIW analyser and flow meter are not available manual sampling via procedural controls will be implemented so that off specification PW will not be	Minor cost associated with installing online monitoring and flow meter, as well as resourcing (personnel & equipment, onboard laboratory) manual sampling.	**Adopted –** environmental benefits of accurately monitoring the OIW discharge via online process outweigh the associated costs.

Reference No	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		discharged to the marine environment.		
BAO-CM-6.8.4	PW will not be discharged during steady state operations to the marine environment with an OIW content above 25 mg/L over a rolling 24-hour period when the PW production rate is between 3,000 and 10,000 bbl/d or with an OIW content above 30 mg/L over a rolling 24-hour period when the PW production rate is between 10,000 and 20,000 bbl/d. (administrative control)	Limiting the OIW content of PW discharge reduces the potential environmental impact of PW discharge on the marine environment to within the PW Mixing Zone (Figure 6-10).	No additional engineering costs; the FPSO PW treatment system is designed to limit PW OIW discharge to less than 30 mg/L (rolling 24-hour average). The FPSO PW treatment system is designed to include an off-spec storage tank in the FPSO hull, with storage equivalent to just over eight days of storage at the design rate of 20,000 bbl/d. Given the expected PW discharge rates for the Barossa FPSO are significantly lower, off-specification capacity in terms of days of storage is significantly higher, potentially as high as 48 days for the lowest PW discharge rate. This level of storage is determined adequate for any conditions to be rectified should PW OIW specifications not be met (Section 2.7.2.6).	**Adopted** – the FPSO is designed to limit PW OIW discharge to less than 30 mg/L and expected OIW content of PW will be lower than this and related to PW production rates. Environmental benefits of limiting the OIW content of PW discharged outweigh the associated costs.
BAO-CM-6.8.5	PW will be inboarded if mercury >10 ppbw is detected during initial start-up period or >8 ppbw is detected during steady-state operations to reduce the potential environmental impact of PW discharge on the marine environment. (administrative control).	Limiting the mercury content of PW discharge reduces the potential environmental impact of PW discharge on the marine environment to within the PW Mixing Zone (Figure 6-10).	Cost associated with monitoring of mercury levels and diverting PW inboard and retreating PW.	**Adopted** – environmental benefits of reducing potential impacts by meeting acceptable mercury content outweigh the associated costs.
BAO-CM-6.8.6	PW will not be discharged at a rate above the maximum PW treatment system design rate (20,000 bbl/d) to ensure PW impacts are within acceptable levels (administrative control).	By limiting PW discharge rate to the design rate used for the basis of impact assessment, in conjunction with limits on OIW and mercury concentration, impacts are expected to remain within the PW Mixing Zone and remain within acceptable levels as defined in EPO-13.	Given the peak PW flowrate is forecast to be 16,000 bbl/d, there is no expected cost and effort associated with implementing the control. However, should forecast change or PW production exceeds forecast there is potentially a cost and effort in implementing PW flowrate restrictions.	**Adopted** – environmental benefits of reducing impacts to within acceptable levels outweigh the costs and effort.
BAO-CM-6.8.7	Implementation of PW Adaptive Management Plan (Appendix I) to reduce the potential impact of PW	Implementation of the PW Adaptive Management Plan reduces potential impacts of PW discharge on the marine environment by ensuring that if specified performance targets within	Cost of implementing procedures.	**Adopted –** environmental benefits of reducing potential impacts by meeting acceptable PW quality

Reference No	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	discharge on the marine environment (administrative control)	the PW Adaptive Management Plan are exceeded appropriate investigation and remedial actions are taken to ensure and ALARP and acceptable PW discharge is achieved. Specified criteria are included for: • PW OIW performance target of 15 mg/L over a 3-day (72h) rolling average (flowrates of 3,000 bbl/d to 10,000 bbl/d) • PW OIW performance target of 25 mg/L over a 3-day (72h) rolling average (flowrates of >10,000 bbl/d to 20,000 bbl/d) • PW mercury removal efficiency target of >80% during steady state operations • PW flowrate ≤20,000 bbl/d • OIW analyser calibration • New production chemical introduction • PW constituent characterisation • PW ecotoxicity testing • Water and sediment quality sampling		criteria outweigh the associated costs.
BAO-CM-6.7.5	Apply the Santos chemical selection process for chemicals planned to be discharged (Section 2.7.3.8) (administrative control)	Under the procedure, only environmentally acceptable chemical products are used, hence reducing potential environmental impact of PW discharge on the marine environment.	Minor cost associated with implementing the procedure. While the range of chemicals that can be used is reduced, there is a negligible cost for selecting alternative products.	**Adopted –** environmental benefits of using environmentally acceptable chemicals outweigh procedural implementation and operational costs.
BAO-CM-6.8.8	OIW analyser and mercury analysis equipment calibration and maintenance to prevent discharge of off spec OIW to the marine environment (administrative control)	Calibrating the OIW analyser and mercury analysis equipment ensures OIW and mercury readings are reliable and aids in preventing discharges of off specification PW to the marine environment.	Minor cost associated with calibration of the OIW analyser and mercury analysis equipment.	**Adopted** – environmental benefits of accurately monitoring the PW discharge outweigh the associated costs.
BAO-CM-6.8.9	Onboard manual laboratory sampling of PW to provide assurance that the PW discharged to the environment is reliably measured by the OIW analyser and	Reliable readings of OIW content aids in preventing discharges of OIW to the marine environment above the discharge OIW specification. Manual laboratory sampling (in accordance with the PW Adaptive	Cost associated with taking and analysing samples.	**Adopted –** environmental benefits of accurately monitoring the OIW discharge outweigh the associated costs.

Reference No	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	to confirm mercury content in PW. (administrative control)	Management Plan) of PW provides assurance the PW discharged to the marine environment is reliably measured by the OIW analyser and within discharge/performance limits for OIW and mercury. Manual sampling and analysis frequency for mercury will be every ~24 hours during start-up and then weekly during steady state operations thereafter unless data review (following 12 months of steady state operations) determines that less frequent mercury sampling/analysis can be justified on the basis of mercury content variation.		
BAO-CM-6.8.10	Onshore National Association of Testing Authorities (NATA) laboratory sampling for chemical characterisation and ecotoxicity of PW in accordance with ANZG (2018) (administrative control)	Chemical characterisation of PW (in accordance with the PW Adaptive Management Plan, Appendix I) provides an understanding of the composition of the PW. NATA laboratory chemical characterisation within 6 months of steady state production with the aim to understand the chemical characterisation of the PW for input into the modelling. Ecotoxicity testing of PW assists in assessing the impact of PW discharges on the marine environment. Measuring of the ecotoxicity is required to confirm safe dilution factors and can be applied to the PW modelling to verify the Mixing Zone extent, ensuring the PW Mixing Zone in Figure 6-10 is accurate.	Minor cost associated with taking and analysing samples.	**Adopted –** environmental benefits of accurately monitoring chemical characterisation of PW discharged outweigh the associated costs.
BAO-CM-6.8.11	Produced water discharge receiving environment impact monitoring program to verify that impacts are not outside PW Mixing Zone and verify PW modelling (administrative control)	Water and sediment quality sampling will provide verification that impacts are not outside of the PW Mixing Zone (Figure 6-10) and will verify the PW modelling. This will verify the modelled dilutions and the modelled mixing zone thereby confirm that the EPO is being met. Water and sediment quality sampling is undertaken in accordance with the Water and Sediment Quality Monitoring Plan (Appendix J).	Cost associated with vessel use, sampling, and analysis.	**Adopted –** environmental benefits of understanding the PW Mixing Zone extent outweigh the costs.

Reference No	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-6.8.12	PW discharge modelling will be undertaken when triggered under adaptive management to verify levels of impact are within acceptable limits (administrative control)	If triggered through the adaptive management process, PW modelling will be used to assess the potential for changes in PW profile (chemical characterisation and ecotoxicity) to effect the PW Mixing Zone based on the current and/or future PW discharge rates. This will support investigation and response measures as required through the adaptive management process outline in the PW Adaptive Management Plan (Appendix I).	Cost associated with modelling.	**Adopted –** environmental benefits of understanding the PW Mixing Zone extent outweigh the costs.
BAO-CM-6.4.10	Barossa Facilities and vessels planned maintenance system to confirm equipment integrity is maintained in accordance with manufacturers guidelines. (administrative control)	Ensures PW equipment (including all equipment associated with the processing of PW) is maintained and operating within its design parameters.	Minor cost associated with maintaining equipment.	**Adopted –** environmental benefit of PW equipment performing according to design specifications to meet PW discharge specification.
Additional control measures				
N/A	Drill reinjection well/s (elimination control)	PW reinjection well/s allow PW to be re-injected into the well/s rather than be discharged to the marine environment.	Reinjection of PW was considered during the early stages of the Barossa Development design and included review of information obtained from appraisal activities, which characterised the structure and composition of geological formations below the seabed in the Barossa field and surrounds. The information obtained from these appraisal activities did not identify any formations within the area that are suitable, in that they would not discretely contain the reinjected PW. In addition, PW cannot be reinjected into Barossa producing reservoirs for technical issues (including souring).	**Not adopted** – not feasible due to the lack of available reservoirs for reinjection in the vicinity of the development and other technical issues.
N/A	Remove the requirement for topsides hydrate inhibitor use (continuous injection of methanol within the topsides) (engineering control)	Methanol is used on the FPSO topsides for hydrate inhibition. Whilst the bulk of the methanol is captured and re-used, there are partial losses which are subsequently discharged to the marine environment within the PW stream.	While the use of molecular sieves can eliminate the use of hydrate inhibitors on the FPSO, they were ruled out of the Barossa Development design due to the large size, weight and space required for the gas processing capacity of	**Not adopted** – not feasible due to the large size, weight and space required for the alternative technology to remove the requirement for topsides hydrate inhibitor use.

Reference No	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		Removing the requirement for hydrate inhibitor use would remove its chemical discharge within the PW stream.	the FPSO (BW Offshore [BWO], 2023). The use of hydrate inhibitors cannot be eliminated for the FPSO.	
N/A	Alternative topside hydrate inhibitor to methanol (engineering control)	Hydrate inhibitor for the topsides is discharged within the PW stream. Choosing hydrate inhibitor with the best environmental performance is therefore preferred.	MEG is the alternative hydrate inhibitor for the topsides; however, its use has been determined not feasible from a technical perspective, as MEG does not work for the low hydrocarbon dewpoint specification required to meet the DLNG facility inlet gas specification. This leaves methanol as the only option for the Barossa FPSO topsides hydrate inhibition. There is also no environmental benefit of using MEG over methanol, as the environmental profile of each are the same (for example, both are PLONOR chemicals determined by the OSPAR commission).	**Not adopted** – not feasible due to the low hydrocarbon dew point specification required to meet the DLNG facility inlet gas specification. Continuous methanol injection coupled with a regeneration system for the chemical to reduce wastage is determined to be best practice and ALARP
N/A	Alternative topside hydrate inhibitor engineering (engineering control)	Engineering options for hydrate management are limited to the use of methanol due to the low hydrocarbon dewpoint specification required to meet the DLNG facility inlet gas specification. Methanol can either be used in a once-through system (with disposal to the marine environment) or with a regeneration system (to reduce chemical wastage. Methanol regeneration system reuses methanol and prevents losses and environmental discharge of methanol under a once-through system. The topside is designed for continuous injection of hydrate inhibitor coupled with a regeneration system for methanol. This design is determined best practice as it limits chemical wastage in the PW stream compared to the once-through system.	A once-through system would not be compliant with the Barossa OPP (ConocoPhillips, 2018), and hence is not a suitable option, and the Barossa design must incorporate methanol regeneration. A once-through system would not be best practice and would not be ALARP.	**Not adopted** – the topside is designed for continuous injection of hydrate inhibitor coupled with a regeneration system for methanol. This design is determined best practice as it limits chemical wastage in the PW stream compared to the once-through system.
N/A	Alternative PW treatment system design (engineering control)	The PW treatment system design should reduce both OIW and mercury content within the PW to an acceptable discharge	Alternative PW treatment system designs may not be able to meet the PW discharge specification for the Barossa PW flowrate, due to inability to remove mercury or additional	**Not adopted** – the selected PW treatment system design is determined to be best practice and ALARP.

Reference No	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		specification and ALARP levels.	chemical injection requirements. Alternative PW treatment system designs produce larger hazardous waste quantities (such as non-regenerable filters and specialised displacement fluids), requiring disposal at a hazardous landfill onshore. The FPSO design has selected primary and tertiary PW treatment systems, which is determined to be best practice and ALARP. Further detail about the selection of the PW treatment system and design decision process is provided in Section 6.8.5.1.	
N/A	Further reduction in mercury in PW (engineering control)	The PW treatment system is designed to remove mercury to a concentration less than 10 ppbw (refer Section 6.8.5.1). It is expected that the mercury concentration in the PW discharge will be well below this mercury limit and lower performance targets (>80% mercury removal) and limits (<8 ppbw) for steady state operations have been set by Santos. While most (99.5%) of the mercury is removed in the mercury decanting at the first- and second-stage low-temperature separators, the mercury partitioning study has confirmed low elemental mercury concentrations will be present in the PW stream (BWO, 2023b). While the inclusion of an IGF alone is considered potentially sufficient to reduce mercury levels to below the PW discharge specification limit for mercury, the mercury removal from the IGF unit cannot easily be quantified, and as a result no removal has been assumed during Barossa design. The MPPE system (tertiary treatment), further provides >80% removal of elemental mercury from PW (BWO, 2023b).	The tertiary (MPPE) treatment system (refer Section 6.8.5.1) provides up to 90% removal of elemental mercury from PW (BWO, 2023b). Alternative PW treatment system designs require mercury precipitation by chemical injection of a Group A chemical on the OCNS list (as in, the highest risk category and non-CHARMable) which is non-compliant with the OPP commitment of only using Group D or E (as in, the lowest risk categories) chemicals (or equivalent), project specifications and considered harmful to the marine environment. Given the MPPE system has been sized to provide the OIW removal required (and not sized just to meet the mercury limit), and the high removal efficiency of mercury by the MPPE, the expected mercury concentration in the PW discharge will be well below 10 ppbw. Further opportunities to reduce the elemental mercury levels are not possible as use of the MPPE system is already considered best practice and ALARP.	**Not adopted** – the use of the MPPE system is determined to be best practice and ALARP to reduce the mercury in PW.

Reference No	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Online monitoring of mercury concentration in PW discharge. (administrative control)	An online mercury analyser would provide process control and safeguarding to monitor, control and prevent discharge of PW with mercury concentration above discharge limits to the environment.	Online analysers currently available are not considered capable of reliably monitoring mercury continuously at the expected concentrations (<10 ppb) under production conditions.	**Not adopted** – Given the unavailability of reliable technology. The adopted mercury manual sampling and analysis process can provide relatively rapid results (on a scale of 1-2 hours) if required.
N/A	Install two OIW analysers so if one is not functioning there is redundancy in the system (engineering control)	Would allow for further readings of OIW to occur if another analyser goes offline. Provides additional verification of OIW.	Cost of installing an additional new OIW analyser is high, considering verifications of OIW already occur through onboard laboratory analysis and these laboratory samples are increased if the OIW analyser goes offline. Additional maintenance and calibration burden of having a second OIW analyser.	**Not adopted** – verification of OIW already occurs. An additional OIW analyser provides no material reduction in environmental impacts.
N/A	Transport PW to shore via vessel (elimination control)	Discharge of PW to a vessel tank for disposal onshore would result in zero PW discharge to the marine environment.	PW volumes per day are vastly more than the vessel storage and capabilities would require many vessels operating on a 24-hour basis between the FPSO and shore. This presents additional risks (such as spill risk, vessel presence, discharge) in additional GHG emissions.	**Not adopted** – considering the high cost of having multiple vessels on contract, additional environmental risks with off taking PW, plus the cost and potential environmental and safety issues associated with onshore transport and management and disposal, vessel discharge outweighs the environmental impacts that could be avoided through not discharging to the marine environment.

6.8.4 Environmental impact assessment

Receptor	Consequence Level
Discharge of produced water	
Threatened, migratory or local fauna	Discharge of PW to the marine environment has the potential to result in highly localised change to water quality in the vicinity of the PW Mixing Zone, defined as 70 m from the FPSO based on 99% species protection level for mercury and which also encompasses the 99% species protection level for OIW (refer to Section 6.8.1.1). Previous studies of PW discharges have found environmental risks are largely local, restricted to the immediate vicinity of the discharge source (Hylland *et al.*, 2008; Brooks *et al.*, 2011; Durell *et al.*, 2006; Bakke *et al.*, 2013; Nepstad *et al.*, 2021). Predicted impacts to marine fauna will be highly localised and minor, given the spatial extent of the PW Mixing Zone, the nature of the PW contaminants, the transitory nature of most marine fauna that may be present and the lack of BIAs overlapping or near OA1. No mortality to EPBC Act listed species is expected from the PW discharge. Impacts to the various marine fauna identified in the PW Mixing Zone are discussed below with a worst-case consequence assessment of II – Minor for fauna. The consequence level of Minor (as detailed in Appendix G) is based on the assessment that while there may be detectable impacts to marine fauna, the impacts are not expected to lead to any of the following unacceptable impacts: • a significant decrease in the local population sizes of a species, • a significant behavioural disruption to a local population, • a significant disruption to the breeding cycle of a local population, • a significant reduction in the area of occupancy of a species, • a significant loss of habitat critical to the survival of a species, • modify, destroy, remove, isolate or decrease availability or quality of habitat to the extent that a significant decline in local population is likely, or • introduce disease likely to cause a significant population decline. **Marine mammals** Marine mammals may be transient within OA1 and include EPBC Act listed threatened and/or migratory cetaceans (whales and dolphins) (Section 3.5.6). While marine mammals could contact the PW Mixing Zone, no BIAs (e.g. important foraging areas or migratory routes) overlap the OA1 (the nearest BIA is >170 km away) and it is not anticipated that listed species will be present in significant numbers. Based on the trace BTEX and PAH concentrations and low toxicity of production chemicals that may be present in the PW, the predicted dispersion and biodegradation and transformation rates in the receiving waters, and that marine mammals are air-breathing, it is highly unlikely there would be any acute toxicity to marine mammals in the event that they were exposed to the PW Mixing Zone. Given marine mammals are highly mobile and expected to be transitory in OA1, any exposure to the PW Mixing Zone is predicted to be short and not sufficient for there to be any potential for long term (chronic) sub-lethal effects. Any effects to marine mammals from a decrease in water quality are expected to be behavioural only (such as avoidance) very close to the release. Behavioural impacts are not expected to have any impact of key life-cycle processes or at a population level. Other potential impact pathways to marine mammals from PW discharge are considered highly unlikely, including a reduction in food resources or a contamination of food resources by toxicants that have the potential to bioaccumulate and magnify up the food chain (e.g. methyl-mercury). The OA1 does not represent a known or important foraging area for marine mammals and the PW plume is expected to have very limited impact on potential cetacean prey species (e.g. plankton and fish). The PW discharge is not expected to lead to be a source of contaminants that biomagnify through the food chain to higher order consumers (e.g. dolphins); in particular, conditions conducive to methyl-mercury formation are not expected in the offshore waters or sediments of OA1. Santos has considered information contained in relevant recovery plans and approved conservation advice for marine mammals that identify deteriorating water quality and chemical discharge as a potential threat (Table 3-13). **Marine reptiles** Six species of marine turtle may potentially transit through OA1 and therefore could potentially contact the PW Mixing Zone (Section 3.5.6). All species are listed threatened and migratory species under the EPBC Act. The OA1 is not nearby any designated BIAs for marine turtles or any known foraging or breeding/ nesting grounds. The closest designated BIA for marine turtles (flatback turtle internesting) is ~50 km away from OA1. Any marine turtles encountered within OA1 would likely be migrating through the area. Notwithstanding the lack of known foraging grounds in the area, OA1 does not contain any seabed features or habitats considered important for marine turtles (e.g. reefs, seagrass, algae or high-density sessile invertebrates), with the seabed comprising predominantly fine clayey sediments and low-density biota, similar to the seabed of the broader region. The nearest shoals/banks, which could support higher diversity and density or potential prey species, are 45 km from OA1. As with marine mammals, in the event that a marine turtle transited through the PW Mixing Zone, acute impacts are not expected given the low concentration of hydrocarbons and other contaminants within the

Receptor	Consequence Level
	PW discharge and the rapid dilution of contaminants in the highly dispersive waters within OA1. Marine turtles are susceptible to impacts from hydrocarbons in high concentrations, for example contact with hydrocarbon spills can cause irritation and damage to external surfaces and ingestion and inhalation of hydrocarbons can damage internal organs, however concentrations of hydrocarbons within discharged PW will be reduced to not more than 30 mg/L (over a 24-hour period) and following further rapid dilution would not be at a concentration within the mixing zone to cause impacts of this nature. Marine turtles are expected to be transient in the area only and given that they do not have structures that promote the cellular uptake of dissolved PW constituents, bioaccumulation of PW contaminants is not expected. While contaminants could be incidentally ingested if a turtle was to traverse the PW Mixing Zone, the contaminants expected to be present, such as PAHs, are not readily accumulated in vertebrates, and the types of contaminants that are known to readily accumulate, e.g. methyl-mercury, are not expected to be present in the PW plume. In the event that a turtle was to feed on marine organisms (e.g. pelagic invertebrates) exposed to the PW plume, the accumulation of contaminants from these organisms into turtles would not be expected for the same reasons. Behavioural impacts to individual turtles transiting through OA1 (such as avoidance) could occur as a result of the PW plume, given that the plume has physical characteristics that are different to the receiving waters that could be detected by marine turtles (e.g. temperature salinity). Given any behaviour change would be temporary and to a small number of individuals, and the PW plume is not within an area supporting key life-cycle processes, impacts at a population level are not expected. Given there are no marine turtle BIAs, foraging/ nesting grounds or foraging habitat near OA1, any marine turtles present are expected to be migrating through the area. This, combined with the localised extent of the PW Mixing Zone indicates that prolonged exposure and the potential for chronic impacts is unlikely. Similarly, the potential for indirect impact to marine turtles through potential PW impacts to prey species is considered highly unlikely. Santos has considered information contained in relevant recovery plans and approved conservation advice for marine turtles that identify deteriorating water quality and chemical discharge as a potential threat (Table 3-13). This includes the objectives and actions in the Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017), which relate to discharges. **Seabirds** Seabirds may be transient within OA1 and include EPBC Act listed threatened and/or migratory species. While a number of avifauna may be present in the PW Mixing Zone, no BIAs (e.g. important foraging areas) overlap OA1. Impact to populations or ecosystems are not anticipated. For seabirds that come into contact with the PW plume, toxic effects are considered highly unlikely, since these species are mobile and therefore will not be constantly exposed for extended durations that would be required to cause any toxic effects. The PW discharge is not expected to lead to be a source of contaminants that biomagnify through the food chain for uptake by higher order consumers (e.g. seabirds foraging for fish); in particular, conditions conducive to methyl-mercury formation are not expected in the offshore waters or sediments of OA1. Santos has considered information contained in relevant recovery plans and approved conservation advice for seabirds as a potential threat (Table 3-13). **Fishes** There are a number of fish species (sharks and rays) listed as threatened and/or migratory under the EPBC Act that could potentially occur within the OA1 and therefore in the vicinity of the PW plume (Section 3.4.3.1). However, it is unlikely that any listed species would be present in the vicinity of the PW Mixing Zone for a prolonged period of time given their habitat preferences and/or migratory nature. For example, five of the seven fish species that are listed as threatened under the EPBC Act, and may occur in the OA1, are associated with benthic habitats (freshwater sawfish, green sawfish, grey nurse shark, northern river shark and speartooth shark) and the types of habitats they are typically associated with (refer Section 3.4.3.1) are not present on the OA1. In the event they were present in the OA1 they would not be expected to be present in surface waters where the PW Mixing Zone will occur. The two remaining threatened species (great white shark and whale shark) and other non-threatened migratory species (pelagic sharks and rays) could be temporary visitors to OA1 and could potentially be present in surface waters in the vicinity of the PW Mixing Zone. There are no BIAs for any fish species overlapping or near OA1 and there are no known important foraging/aggregation areas or migratory pathways for listed EPBC Act fish species near OA1. The nearest shoals/banks, which could support higher diversity and density or potential prey species for listed fish species, are 45 km from the OA1. The presence of the FPSO and associated subsea infrastructure is likely to attract pelagic fish which use the structures for protection and/or feeding opportunities. Therefore, there is the potential for locally attracted pelagic fish to be exposed repeatedly to the PW Mixing Zone particularly if close to the discharge caisson or in surface waters where the PW plume is likely to initially form. In this scenario, chronic, sub-lethal impacts over long timescales are possible, although given the expected small size of the PW Mixing Zone (70 m based on mercury toxicity) the number of fish affected is likely to be small and insignificant on a population level. For significant impacts to occur in a fish population, either harmful exposure to PW must be sufficiently wide-scale or the population influence from locally affected individuals must be correspondingly large. Neither scenario is likely, given the PW Mixing Zone area.

Receptor	Consequence Level
	Since pelagic fish may be repeatedly exposed to the PW plume and these fish may be preyed upon by larger fish species (including pelagic sharks), there is theoretically the potential for transfer of PW contaminants (hydrocarbons and metals) through the food chain. However, the potential for high levels of PAH to be passed up through the food chain (biomagnification) from small fish to larger fish (or other vertebrate predators) is not anticipated, since the elimination of PAHs is generally very efficient in fish and other vertebrates, and bioaccumulation of PAH within these taxa do not generally reflect their level of exposure (van der Oost *et al.*, 2003; Nepstad *et al.*, 2021). In terms of the ability of metals to bioaccumulate and biomagnify up the food chain, the greatest risk is considered to be associated with mercury, in the form of methyl-mercury, which is known to accumulate in high-levels in larger individuals of some fish species. While very low levels of mercury are present in the PW, conditions conducive for the formation of methyl-mercury are not present in the surface waters of the PW Mixing Zone and are not expected in the benthic environment where PW constituents could potentially settle. As shown in Section 6.8.2.3, it is possible contaminants accumulate through sedimentation on the seabed; however significant accumulation is highly unlikely given the water depth and highly dispersive waters. Impacts to demersal (benthic) fishes are not expected, given any PW plume will be generally confined to surface waters. For large pelagic fish species, including pelagic EPBC Act listed sharks and rays, attraction to the FPSO may occur for short periods but long-term exposure to the PW Mixing Zone or long-term feeding on PW-exposed prey species is not expected. By their nature, larger pelagic species are likely to be transient through the area and no population or ecosystem levels effects are expected. Behavioural impacts (e.g. avoidance) may occur as a result of the PW discharge, given its effect on the temperature and salinity of surrounding waters. Given any behaviour change would be a temporary and to a small number of individuals, and the PW plume is not within an area supporting key life-cycle processes for EPBC Act listed species, impacts at a population level are not expected. Santos has considered information contained in relevant recovery plans and approved conservation advice for fish that identify deteriorating water quality and chemical discharge as a potential threat (Table 3-13). **Plankton** There is the potential for PW exposure to plankton from the PW discharge plume. Planktonic organisms are the most vulnerable to effects from the PW discharge as they drift freely in the water column and are unable to avoid interaction with the PW plume. Phytoplankton can accumulate hydrocarbons at a rapid rate but are generally not sensitive to hydrocarbons. Exposure to hydrocarbons has the potential to affect their photosynthetic ability, which may result in cascading effects into higher trophic levels (Hook *et al.,* 2016). At low concentrations of hydrocarbons in the water column (10 to 30 ppb), photosynthesis may be stimulated, although inhibiting effects have been shown to occur at concentrations above 50 ppb (Volkman *et al.,* 1994). Other studies have indicated that phytoplankton have been shown to be less affected by weathered oil (Bretherton *et al.,* 2018; Özhan *et al.,* 2014). Potential impacts to phytoplankton are therefore expected to be localised and transient, with phytoplankton replenishing rapidly. Exposure of zooplankton to hydrocarbons in the water column has the potential to cause mortality or a decline in egg production and hatching rates along with a decline in swimming speeds (Hook *et al.,* 2016). Low molecular-weight hydrocarbons have been shown to cause acute toxic effects in zooplankton (Almeda *et al.,* 2013; Jiang *et al.,* 2010). PAHs within PW discharge have a greater potential to accumulate within the marine environment than BTEX due to their solubility, toxicity and persistence. Based on 1:100 dilution of PW, these impacts will be restricted to less than one hundred metres of the discharge location. Rapid recovery is also expected due to the fast growth rates of zooplankton and the dispersal and mixing of zooplankton (CSIRO, 2017) from both inside and outside of the PW plume. Phyto- and zooplankton populations (and most fish species) have a much wider distribution than the PW Mixing Zone. Hence, for a significant impact to occur, either harmful exposure to PW has to be sufficiently wide-scale or the population influence from locally affected individuals has to be correspondingly large. Neither of these occurrences are likely, particularly given the size of the PW Mixing Zone (Figure 6-10). Given the PW Mixing Zone is within a highly dispersive open ocean environment and the relative size of the potential PW Mixing Zone is insignificant compared to the surrounding oceanic waters, any impacts to plankton on a population level are expected to be negligible. **Pelagic invertebrates** Pelagic invertebrates present in surface waters may be exposed to elevated concentrations of toxicants within the PW; however, this is only likely if they are present at the point of discharge for substantial durations, which is not expected. Pelagic invertebrates are mobile and transitory and will therefore not be present with the PW Mixing Zone (Figure 6-10) for a period where impact is anticipated. Any impacts are not expected to be significant on a population level, given the small impact area compared to surrounding open ocean and the widespread distribution of pelagic invertebrates. **Benthic invertebrates** As described in Section 6.8.2.2, it is possible contaminants accumulate through sedimentation on the seabed within the PW Mixing Zone; however, this is highly unlikely.

Receptor	Consequence Level
	As described in Section 6.8.2.3, low levels of elemental mercury are expected to be present in the Barossa PW. Methyl-mercury, which is of more concern as it is readily bioavailable, is not present in the Barossa reservoir. It is possible there may be a slight accumulation of PW suspended solids in marine sediments near the PW discharge (within hundreds of metres). However, when taking into account the low sensitivity and widely represented nature of the benthic communities in the PW Mixing Zone, as well as the lack of methyl-mercury in the PW an ecological risk to benthic habitat is not anticipated.
Physical environment and habitat	Water quality may be impacted for the period of the PW discharges, while most metal concentrations were below ANZG (2018). The scale of water quality impacts within the PW Mixing Zone (based on conservative 99% species protection levels from condensate and mercury toxicity) is predicted to be very localised and within 70 m of the PW discharge location (i.e. 40 m based on condensate toxicity and 70 m based on mercury toxicity) and confined to surface waters (within ~10 m of the sea surface). In the context of the open ocean location and the water depth (>250 m at the FPSO turret) the scale of water quality effects is considered negligible. **Shoals and banks** The PW plume is not expected to impact non-transitory environmental values and sensitivities, such as the surrounding shoals and banks, the nearest being Lynedoch Bank, 45 km east south-east (refer Table 3-3). This is supported by the modelling results, as discussed in Section 6.8.1.1. **Key ecological features** The PW Mixing Zone is not expected to contact the Shelf break and slope of the Arafura shelf KEF. Values associated with the KEF, a unique seafloor feature comprising patch reefs and hard substrate pinnacles, were not observed to occur during the extensive baseline studies program undertaken across the Barossa region (refer Table 3-1). The consequence assessment for impacts to the physical environment and habitat within the PW Mixing Zone was considered to be I – Negligible and therefore acceptable. The consequence level of Negligible (as detailed in Appendix G) is based on the assessment that there is expected to be a negligible reduction in physical environment/habitat area/function.
Protected areas	No protected areas are identified within or near the PW Mixing Zone and therefore the consequence assessment considered impacts to protected areas to be I – Negligible and therefore acceptable.
Socio-economic	Potential impacts to fishery resources (demersal fish species) are unlikely to result in changes in distribution and abundance of fish species outside the PW Mixing Zone. Therefore, the consequence assessment was considered to be I – Negligible and therefore acceptable. The consequence level of Negligible (as detailed in Appendix G) is based on the assessment that there is expected to be no/negligible loss of value of a local industry and/or no/negligible reduction in key natural features or populations supporting socio-economic activities.
Cultural features	For potential impacts to marine species of cultural significance or that provide a traditional food source, refer to the assessment for threatened, migratory or local fauna.
Cumulative impacts	On the basis that concurrent Barossa activities will occur within OA1 (see Section 2.3.1), the potential for cumulative activity discharges is acknowledged. These concurrent activities will be limited to a short duration (months) and there is unlikely to be any spatial overlap of PW discharges from the FPSO with discharges associated with MODU/ support vessels during drilling/completion (D&C EP activities), contingency MODU well workover activities (will be authorised under a separate EP) or construction/transportation vessels undertaking SURF installation and pre-commissioning (SURF EP activities). The PW Mixing Zone will >6km apart from drill centres where all other concurrent Barossa activities will be centred during the FPSO operational phase. While there is no expected spatial overlap of FPSO PW discharges with other Barossa activity discharges, the concurrent nature of other Barossa activities means that there will be some cumulative increase in the scale of water quality impacts within OA1 for the duration of concurrent activities (which may occur for multiple months, refer Section 2.3.1). The cumulative effect of these discharges is not expected to be significant given that discharges are expected to disperse rapidly and not persist or accumulate in the environment and furthermore discharges will not affect any significant areas or habitats for marine fauna (including EPBC Act listed fauna), such as BIAs, foraging areas, breeding/nesting/calving areas or areas known to aggregate marine fauna or provide unique habitats. Any cumulative effects from concurrent activity discharges with FPSO PW discharge are considered to be negligible. Therefore, there is no change to the overall consequence level for PW impacts due to other Barossa activity operational discharges.
Overall worst-case consequence	II – Minor

6.8.5 Demonstration of as low as reasonably practicable

To determine if impacts are reduced to ALARP, additional control measures and associated environmental performance standards that have the potential to prevent or mitigate impacts from PW discharge were considered and evaluated by environmental and operations personnel. These additional control measures and an evaluation of potential issues, costs and benefits are presented in Section 6.8.3.

In addition, Santos had regard to the need to reduce environmental impacts to ALARP in order to inform the key areas of the FPSO design relevant to potential environmental impacts associated with the PW treatment system, being:

- PW treatment technology (Section 6.8.5.1)
- treated PW OIW content (Section 6.8.5.2).
- treated PW mercury content (Section 6.8.5.3)

PW monitoring to ALARP has been discussed in Section 6.8.5.4.

6.8.5.1 Produced water treatment technology

As discussed in Section 2.7.2.6, the PW treatment system is divided into two stages, being:

- primary treatment, which involves removing bulk dispersed hydrocarbons, such as through a hydrocyclone or centrifuge, followed by a degasser vessel or floatation unit
- tertiary treatment (MPPE), which involves polishing the dispersed oil and substantially removing dissolved oil to meet the PW OIW limit, such as through a filtration system.

The selection of PW treatment technology follows a review of treatment systems used by other offshore facilities in the region, as well as the best available technology for reducing OIW and mercury content.

The options investigated for the Barossa PW treatment system design for mercury treatment were IGF, regenerable adsorption media, MPPE, or a combination. To compare the available options for PW treatment, a range of primary and tertiary configurations were reviewed to determine the ALARP option for the PW treatment system.

For primary PW treatment, the main alternatives for the initial stage were determined as:

- hydrocyclones
- centrifuges.

Hydrocyclones are used extensively for primary PW treatment systems in the Australian region and are known for their reliability. Centrifuges generally have a slightly higher OIW removal performance; however, they also have higher electricity consumption and lower reliability than hydrocyclones, with higher maintenance requirements resulting in higher personnel exposures. Given the primary treatment is required to be reliable so as not to overload the tertiary system, hydrocyclones were selected for the first stage of the primary PW treatment in the Barossa PW treatment design. Within the primary PW treatment system, the main alternatives were determined to be a degasser vessel or a flotation unit (IGF). Given an IGF unit may provide an additional degree of mercury removal, it was adopted into the primary PW treatment system. While all the treatment options investigated provide OIW removal (to varying degrees), not all provide mercury removal.

The choice of tertiary PW treatment is necessary to achieve the PW OIW discharge specification (defined in Section 6.8.1). Tertiary PW treatment can also provide a degree of mercury removal. The choices for tertiary PW treatment involved simple non-regenerable filtration units through to regenerable systems. Santos investigated three tertiary treatment options for comparison, being:

- a non-regenerable system
- a regenerable filtration system
- a regenerable extraction system (MPPE).

Aside from MPPE, which is relatively unique, the other systems have similar alternatives that were also considered, such as activated carbon or walnut shell filters. However, the chosen comparative options of non-regenerable filtration media and regenerable adsorption media are considered to be representative of available technologies that have the highest potential for removing OIW and mercury.

Based on the identified primary and tertiary PW treatment technologies discussed above, the options for consideration for Barossa are summarised as:

- Option 1: Overboard discharge with primary treatment only

- Option 2: Overboard discharge with primary and tertiary treatment. This option is broken down into three options relating to the different tertiary treatment technologies available, being:
  - Option 2a: A non-regenerable filtration media
  - Option 2b: A regenerable adsorption media
  - Option 2c: MPPE tertiary treatment
- Option 3: Overboard discharge with tertiary treatment only (MPPE).

These options have been summarised in Table 6-40.

Table 6-40: Summary of selected produced water management options

Option	PW treatment technology		
	Primary (Stage 1)	Primary (Stage 2)	Tertiary
1	Hydrocyclone	IGF	-
2a	Hydrocyclone	IGF	Non-regenerable filtration media
2b	Hydrocyclone	IGF	Regenerable adsorption media
2c	Hydrocyclone	IGF	MPPE
3	-	-	MPPE

A summary of the PW management technologies options review is shown in Table 6-41.

Table 6-41: Summary of produced water management technologies as-low-as-reasonably-practicable review

Option	OIW removal	Mercury removal	Other factors
1	OIW specification unlikely to be met with only hydrocyclone and IGF.	Mercury specification likely to be met with IGF.	Simplest option; however, does not meet project OIW specifications, so is not considered acceptable.
2a	OIW specification will be met; however, tertiary system will generate significant waste volumes which will require disposal to hazardous waste landfill onshore.	Mercury specification likely to be met with IGF.	Frequent media change-out for operations personnel, and transport of spent media to shore for disposal.
2b	OIW specification will be met and adsorption media can be regenerated with steam.	Mercury specification will be met, with removal by both IGF and the tertiary treatment system; however, mercury removal uses a Group A chemical under OCNS.	Uses a Group A chemical under OCNS and is harmful to the marine environment.
2c	OIW specification will be met; system provides best-in-class treatment technology. MPPE is a regenerable system, using LP steam.	Mercury specification will be met, with removal by both IGF and MPPE, the latter expected to remove over 80% of mercury[1].	Media requires replacement every few years (supplier will receive for recycling).
3	OIW specification will be met. However, reduced redundancy in treatment. MPPE is a regenerable system, using LP steam.	Mercury specification will be met, with removal by MPPE (expected to remove over 80% of mercury[1]).	Media requires replacement every few years (supplier will receive for recycling). High hydrocarbon loading for MPPE system reduces redundancy and increases media replacement frequency, as well as increasing the size and weight of the system.

[1] Mercury removal efficacy of >80% is based on expected treatment performance during steady state operations where feed mercury content is 25 ppbw at 20,000 bbl/d (i.e. mercury of <5 ppbw). The design specification for mercury is <10 ppbw.

The two most recent development projects in the Australian region, Prelude Floating LNG and Ichthys FPSO, both have MPPE tertiary treatment systems. MPPE was listed as best available technology by the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic (1999) for PW management on offshore oil and gas platforms based on the following:

- Unlike other methods, MPPE technology removes dispersed and dissolved components effectively

- The effective reclamation procedure of the MPPE material makes it suitable for removal of high quantities of dispersed and dissolved hydrocarbon from wastewater but without the generation of significant waste streams (e.g. spent adsorbents).
- The MPPE technology has an effective regeneration process such that one column can operate automatically while another column is regenerating at the same time.
- The MPPE unit operates automatically and operator attention is limited.

The Barossa FPSO design similarly has selected use of the MPPE tertiary treatment system, with the inclusion of a Y-type strainer (with a transmitter and a sight glass) on the MPPE column liquid outlet to address media loss from the MPPE unit in the event of an internal failure in the MPPE Columns. As can be seen in Table 6-38, the PW treatment system configuration 2c, consisting of primary (hydrocyclone and IGF) and tertiary (MPPE) treatment, is considered the ALARP option, providing both OIW and high mercury removal, which the alternative tertiary treatment system options do not offer. MPPE provides a very high degree of dispersed and dissolved oil removal, as well as >80% mercury removal.

PW is directed through columns packed with MPPE media. An extraction fluid, immobilised in the media, extracts hydrocarbons from the water phase. Two columns, each sized for 100% of the PW rate, are included in the MPPE system; PW is sent through one column, while the second column is being regenerated. After regeneration is complete (after approximately 1 hour), the process switches and the regenerated column accepts PW for treatment while the other column is regenerated, enabling continuous treatment of PW. The MPPE system is sized to meet the OIW limit at the maximum design PW flowrate of 20,000 bbl/day

A further reduction in OIW would require an increased design rate for the Barossa MPPE tertiary treatment system and would come at the expense of additional space, weight and cost impacts to the Barossa FPSO. The conservative design capacity of the MPPE tertiary treatment system, at the upper limit of the PW rate, is expected to result in improved removal efficiency (below the discharge limit) over the life of production operations. The MPPE tertiary treatment system, together with the primary (hydrocyclone and IGF) treatment, is therefore considered ALARP.

6.8.5.2 Treated produced water oil in water content

The tertiary MPPE system onboard the FPSO can provide a very high degree of OIW removal; however, the removal efficiency is a function of the MPPE column sizes and the PW flow rate. In order to decrease the OIW discharge concentration further a corresponding increase in column height would be required, with corresponding increases in weight and cost of the system.

The FPSO tertiary MPPE system is designed to provide a guaranteed OIW discharge concentration of <30 mg/L at a design feed rate of 20,000 bbl/d and a maximum influent of <2,000 mg/L (dispersed and dissolved).

Table 6-42 shows expected MPPE removal efficiency at various rates at varying feed flow rates.

Table 6-42: MPPE performance at reduced flowrates (based on 20,000 bbl/d sizing)

MPPE Feed Flow Rate	bbl/d	20,000	14,000	3,000
Removal Efficiency	%	97.0%	98.2%	99.5%
Discharge OIW Concentration	Mg/l	30	18	6

For most of the field life, the PW rate, as predicted by reservoir modelling, is expected to be significantly below the design feed rate of 20,000 bbl/d rate (Figure 6-11). The actual forecast PW rates are predicted to peak at approximately 20% below the design rate (predicted peak PW is 16,000 bbl/d with expected rates for the majority of the field life being less than 5000 bbl/d). This was considered a significant factor for the design of the Barossa tertiary (MPPE) treatment system, as the removal efficiency is a function of the PW flowrate. The lower the flowrate into the MPPE columns (of a fixed size), the higher the removal efficiency.

To account for the higher predicted performance of the MPPE system compared to the performance guarantee of <30 mg/L, Santos has set performance targets below the design guarantee for when production operations reach steady state (i.e. beyond the initial start-up period). These targets consider the predicted relationship between PW flowrate and OIW content but also account for the inherent uncertainties in operating a new facility and that the exact constituents within the Barossa PW are not yet known. As detailed in Section 8.2.5.1, Santos will review production performance data, including PW treatment performance data, to validate actual performance against targets and limits which may result in revised performance targets and limits. This will occur following one year of steady state production and then on an annual basis.

As per ALARP assessment requirements, the performance targets and rates consider the likely cost and effort associated with their implementation, including potential impacts on production, and the likely environmental benefit of meeting the OIW target and limits. An ALARP assessment for the OIW targets and limits is provided below.

Start-up period OIW limits

Prior to steady state operations, the PW treatment system will undergo commissioning and performance testing and there will likely be a greater variation in PW OIW content and potentially higher OIW than in steady state operations. During this relatively short period (anticipated as up to four months) it is considered appropriate and ALARP to set the OIW limit for PW discharge at <30 mg/L average over a rolling 24-hour period (i.e. reflecting the design guarantee) given the variation in OIW content associated with system testing. During this period, PW will be batch-processed and discharged intermittently in accordance with this limit.

Steady State Operations 3,000-10,000 bbl/d flowrate OIW targets and limits

For the majority of the field life, PW flowrate is expected to be within 3,000 to 10,000 bbl/d and for the first five years of production (i.e. the life of this EP) the flowrate is expected to be less than 5,000 bbl/d (Figure 6-11). Santos has set a performance target of 15 mg/L OIW concentration, being 50% of the OIW design specification limit, at PW flowrates (3,000 to 10,000 bbl/d) (refer Figure 6-12). This target considers the predicted range of OIW discharge concentrations at these flowrates (6 to 12 mg/L) but also takes into account the operation of a new system. To operationalise this target, accounting for potential short-term fluctuations, a performance target of 15 mg/L average over a rolling 3-day (72h) period has been set to identify longer-term trends in decreasing performance. This target will be reviewed as part of performance target review (refer Section 8.2.5.1) one year following commencement of steady-state operations (and repeated annually thereafter).

An adaptive management response to a deviation of this target (as outlined within the PW Adaptive Management Plan; Appendix I) will require investigation of root cause and corrective actions applied, which may involve diverting and re-treating PW where this is feasible, within off-spec tank and production capacity limits, to reduce OIW content further, while implementing a corrective action or change. The discharge limit has been set at 25 mg/L, whereby PW will be diverted inboard to the off-specification tank when OIW exceeds a 25 mg/L average over a 24-hour rolling period and not be discharged until the 24-hour average falls under this limit. The performance target (15 mg/L) and limit (25 mg/L) will ensure that PW is being managed to levels of predicted performance and remain under the acceptable limit of impact as defined by the PW Mixing Zone.

Based on ecotoxicity testing of Barossa condensate and modelling undertaken at a flowrate of 20,000 bbl/d, 99% species protection (assuming OIW at 30 mg/L) is predicted within 40 m of the discharge point where a 65-fold dilution is achieved (refer Section 6.8.1.1). At 10,000 bbl/d, modelling indicates that the same 65-fold dilution would be achieved at approximately 10 m (RPS APASA, 2017). This indicates that when PW flowrates are at 10,000 bbl/d or less, the reduction in toxicity impacts achieved from lowering the OIW from 30 mg/L to a lower level will be on a spatial scale of metres only. This relatively small change to the scale of water quality impacts from reducing OIW discharge concentration was an important consideration when weighing up the benefits of setting lower OIW targets, against the performance considerations and the costs and effort involved in implementation.

Based on the expected benefit of reducing targets and limits further and the potential cost and effort of implementing lower targets and limits, the current targets and limits are considered to reduce impacts to ALARP and acceptable levels, noting they will be reviewed when a year of steady state performance data is available and then annually thereafter.

Steady State Operations >10,000-20,000 bbl/d flowrate OIW targets and limits

PW flowrates above 10,000 bbl/d are only predicted after 10 years of field operation (Figure 6-11) and therefore management of OIW at these flowrates is not expected to be required within the life of this first revision of the EP. Nevertheless, OIW management at these flowrates are considered as a contingency within this EP and to demonstrate the OIW management approach for the life of the field. Santos has set a performance target of 25 mg/L OIW concentration (~80% of the design limit) for production within PW flowrates of 10,000 bbl/d to 20,000 bbl/d (refer Figure 6-12) which considers the predicted range of OIW discharge concentrations between 10,000 bbl/d and the expected peak of 16,000 bbl/d (12 to 18 mg/L), and takes into account the untested performance considerations of the system at these rates. As with the performance target for lower flowrates, this has been committed to as a rolling 3-day (72h) average to identify longer-term trends in decreasing treatment system performance.

As for the lower flowrates, the adaptive management response to a deviation of this target (as outlined within the PW Adaptive Management Plan; Appendix I) will require investigation of root cause and corrective actions applied, which may involve diverting and re-treating PW where this is feasible, within off-spec tank and production capacity limits, to reduce OIW content further, while implementing a corrective action or change. The MPPE system design guarantee of <30 mg/L OIW in PW has been retained as the upper limit for a discharge with flowrates between 10,000 bbl/d and 20,000 bbl/d and is operationalised as <30 mg/L average over a rolling 24-hour period. These targets and limits will be reviewed as per the approach outlined in Section 8.2.5.1 and additionally as part of future EP revision and resubmission requirements.

At these higher discharge rates, the maximum expected impact range, based on 99% species protection, is 40 m from the discharge point. Reductions to PW OIW concentration to levels below the design guarantee of 30 mg/L have the potential to change the spatial scale of impacts in the range of metres to 10s of metres.

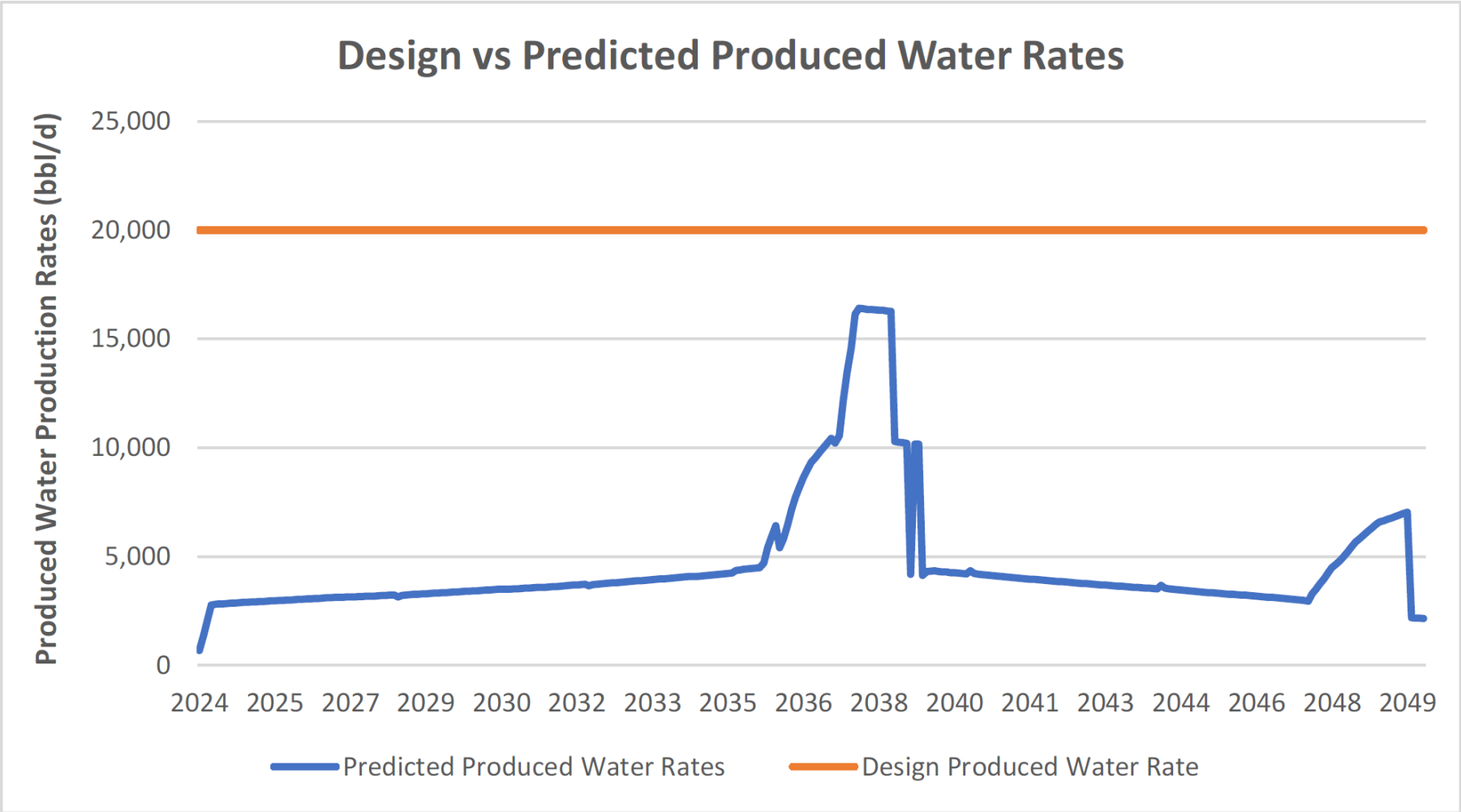


Figure 6-11: Design vs predicted produced water rates

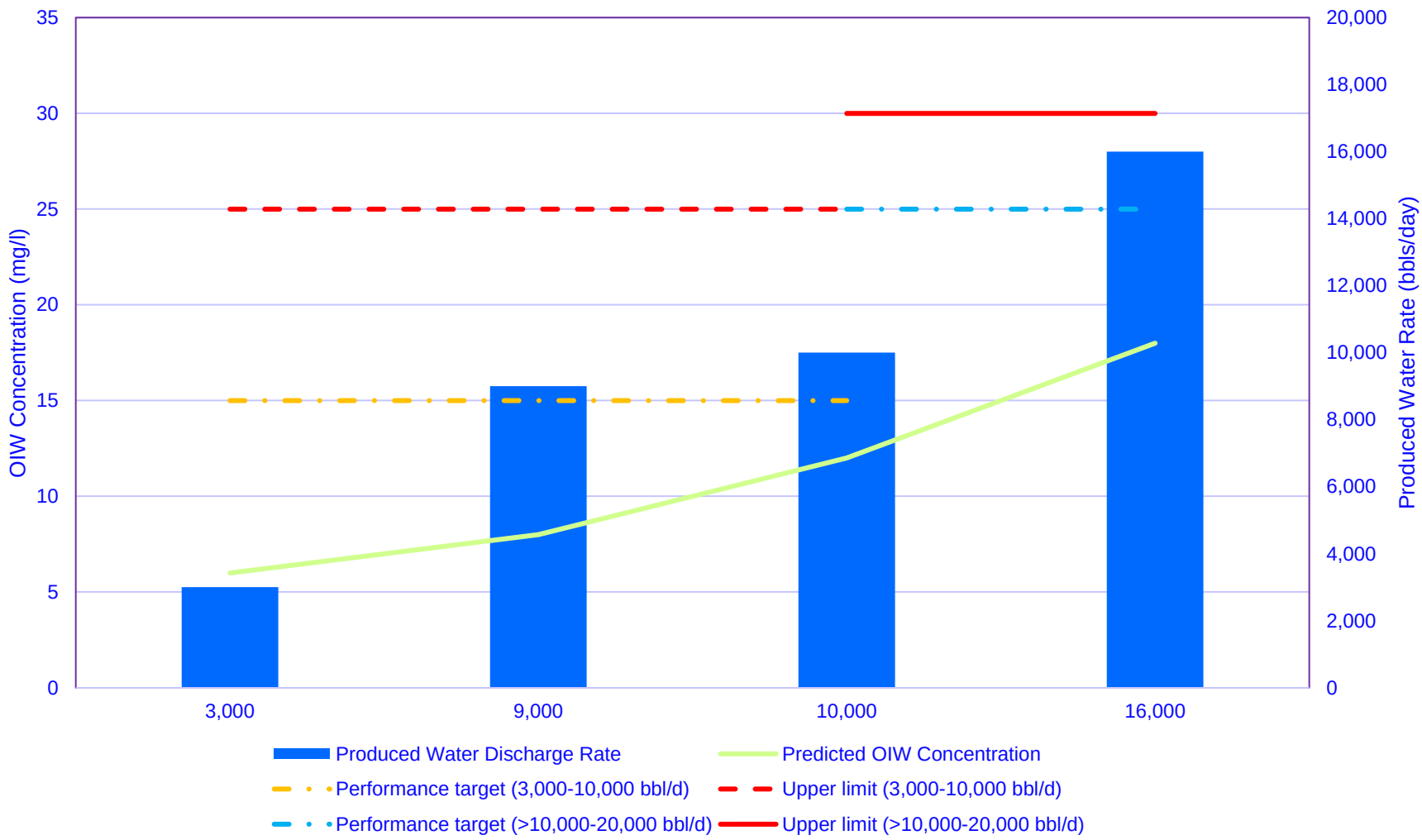


Figure 6-12: Predicted MPPE Produced Water OIW Discharge Concentrations at different rates

6.8.5.3 Treated produced water mercury content

The PW treatment system has been designed with a focus on mercury removal in addition to OIW treatment. The primary PW treatment system (IGF) is predicted to meet the design specification for <10 ppbw of mercury at a PW flowrate of up to 20,000 bbl/d and an influent concentration of up to 25 ppbw. The selected PW treatment configuration includes both an IGF system as well as an MPPE system with the application of MPPE alone expected to have a mercury removal performance greater than 80% . The selection of the tertiary treatment system (MPPE) is considered to represent best available technology in terms for the treatment of PW (refer Section 6.8.5.1) and the selection of MPPE is consistent with the guidance of the Minamata Convention (Guidance on Mercury Releases; SMCM, 2024) in that the selection has:

- considered the advantages of using techniques that are capable of controlling several pollutants simultaneously to deliver co-benefits (i.e. MPPE removes a high level of both OIW and mercury from PW)
- considered information on the performance of the technique under anticipated mercury feed conditions (i.e. vendor OIW and mercury removal performance data has been considered based on credible OIW and mercury feed input)
- considered techniques applicable to gas processing and associated physical / operational limitations (refer Section 6.8.5.1)
- been informed by an assessment of costs and benefits that has considered alternatives that could be implemented under economically and technically viable conditions (i.e. the ALARP assessment as presented in Section 6.8.5.1).

To account for the higher predicted performance of the MPPE system in removing mercury than the design guarantee, Santos has set performance targets and limits additional to the design guarantee. These targets and limits account for variabilities in mercury removal performance and the level of mercury that feeds into the PW treatment system, which is dependent on the mercury content of Barossa production well streams and the removal of mercury through the production system. The performance of the PW treatment system in meeting mercury removal targets and limits will be monitored through routine sampling and analysis of the PW stream (before and after the PW treatment system) as outlined within the PW Adaptive Management Plan (Appendix I).

The setting and monitoring of mercury performance targets is considered consistent with the Minamata Convention guidance on the implementation of best available techniques and best environmental practices (SMCM, 2024). Santos will review production performance data, including PW mercury removal data, to validate actual performance against targets which may result in revised performance targets. The annual target review/ setting cycle will commence following one year of steady state production (refer Section 8.2.5.1).

Start-up period mercury limit

Prior to steady state operations, the PW treatment system will undergo commissioning and performance testing and there may be a greater variation in PW mercury content than in steady state operations. During this relatively short period (anticipated as up to four months) it is considered appropriate and ALARP to set the mercury limit for PW discharge at <10 ppbw (i.e. reflecting the design guarantee). Where mercury exceeds this limit, through routine mercury sampling and analysis, PW will be diverted inboard for re-processing and response measures implemented such that it will be overboarded only when the limit can be reached.

Steady state mercury limits and removal targets

For steady state operations, Santos has set a performance target for mercury removal efficiency of >80%, reflective of expected performance (based on vendor data) and potential variabilities as discussed above. An adaptive management response will be implemented where removal efficiency is less than 80% as per the PW Adaptive Management Plan (Appendix I).

Santos has reduced the limit of mercury concentration in PW discharge from <10 ppbw during start up to <8 ppbw for steady state operations, noting adaptive management will be implemented prior to reaching this level as per the >80% removal performance target.

This performance target and limit for steady state operations will be reviewed as part of the annual target review/ setting cycle which will commence following one year of steady state production and annually thereafter (refer Section 8.2.5.1).

Based on the ANZG (2018) 99% species protection DGV for mercury of 0.1 ppb, the required level of dilution from a discharge concentration of 10 ppbw is 100 times, which is predicted to be achieved within 70 m from the PW discharge point (assuming a 20,000 bbl/d PW flowrate) (refer Section 6.8.1.1). At PW flowrates of less than 10,000 bbl/d, expected for the majority of field life, the same level of dilution is modelled to be achieved at 20 m (RPS APASA, 2017). This indicates that when PW flowrates are at 10,000 bbl/d or less, the reduction in toxicity impacts (via improvement in water quality) achieved from lowering mercury concentration on a scale of 1 ppbw is likely to

be on the spatial scale of 1-2 metres. At higher flowrates, above 10,000 bbl/d, this is likely to be in the range of 2-10 metres for every 1 ppbw reduction in mercury discharge concentration. This change to the scale of water quality impacts was considered when evaluating the benefits of setting lower mercury limits, against assumptions in performance and the costs and effort involved in implementation. Santos acknowledges the benefits in reducing the quantity of mercury released to the environment, additional to reducing the size of the PW Mixing Zone, and the obligations of the Minamata Convention Article 9 in "controlling and where feasible reducing release of mercury to land and water" (SMCM, 2024).

Based on the expected benefit of reducing targets and limits further, and the potential cost and effort of implementing lower targets and limits, the current limits are considered to reduce impacts to ALARP, noting they will be reviewed when a year of steady state performance data is available and annually thereafter as per Section 8.2.5.1

6.8.5.4 Monitoring

PW monitoring will be conducted as per the PW Adaptive Management Plan (Appendix I) during the discharge of PW to the marine environment to ensure that parameters of the PW discharge (flowrate, OIW, mercury, toxicity and chemical characterisation) can be checked against performance targets and adaptive management triggers and appropriate remedial actions taken to ensure ALARP and acceptable PW discharge is continually achieved. Appropriate water and sediment monitoring (refer Water and Sediment Quality Monitoring Plan; Appendix J) which will the PW Adaptive Management Plan (Appendix I) is included to provide verification that unacceptable impacts are not outside of the PW Mixing Zone and will validate the PW modelling.

The discharge of PW is considered ALARP when the adopted controls detailed in Section 6.8.3 are implemented and the criteria within the PW Adaptive Management Plan (Appendix I) are being achieved.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the impacts such that the residual consequence is assessed to be II – Minor. The proposed control measures are in accordance with the Santos risk management criteria and are considered appropriate to manage impacts to ALARP.

6.8.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence from PW discharge to the marine environment is II – Minor based on the assessment provided in Section 6.8.4. As per the impact assessment approach and criteria detailed in Section 5.6 and Appendix G, impacts with a consequence level of I – Negligible or II – Minor are considered acceptable.
Is further information required to validate the consequence assessment?	Uncertainties about the composition of PW have been offset with sufficiently conservative assumptions to inform the impact assessment. Notwithstanding the conservatism of the assessment, PW characterisation, PW modelling validation and field water and sediment quality monitoring will be undertaken following commencement of production to assess actual extent of impacts against predicted against the consequence in Section 6.8.4. Appropriate responses will be determined in accordance with the PW Adaptive Management Plan (Appendix I).
Are the risks and impacts consistent with the principles of ecological sustainable development?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers principles of ESD. The impacts associated with PW discharge do not result in 'threats of serious or irreversible harm' as detailed within the EPBC Act and biodiversity and ecological integrity will be maintained. Conservative assumptions have been applied to the PW discharge modelling. There are no identified health, diversity or productivity impacts that may affect the biodiversity or ecological function for future generations.

Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)?	Yes – Control measures implemented will reduce the potential impacts from Activity PW discharges to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009b) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b) • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b) • Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c)
	Recovery plans: • Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013) • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (CoA, 2014) • Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) **Other management plans/guidelines**: • Marine bioregional plans for the NMR and NWMR (CoA, 2012a, 2012b). Habitat degradation or modification is identified in many conservation advices, however the nature of the PW discharge will not result in habitat degradation. Pollution is identified in a number of plans but pertains to more toxic discharges and therefore is not considered applicable here given the discharges are of minor consequence. For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes and the control measures outlined in Section 6.8.3. Santos considers that the level of impact from Activity PW discharges is not inconsistent with these plans.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – through acceptance of this EP, legislative and regulatory requirements will be met as per Section Appendix C. This includes the Minamata Convention on Mercury 2013 (refer Appendix C). The international treaty seeks to protect the environment from anthropogenic emissions and releases of mercury and mercury compounds. Low levels of elemental mercury are expected to be present in the Barossa PW. The tertiary (MPPE) treatment system provides removal of elemental mercury to an acceptable level. Further opportunities to reduce the elemental mercury levels in the PW discharged are not possible and the use of the MPPE system is considered best practice and ALARP (refer Section 6.8.5). The selection of the PW treatment design is determined to meet the intention of the Minamata Convention on Mercury 2013 (Appendix C).
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.

Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA accepted OPP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with the ECNT, have been considered when evaluating performance outcomes, control measures and associated performance standards (see section 4.7 for further information). No specific additional control measures were proposed by Relevant Persons, including ECNT, for this EP. Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have been adopted in this EP. However, no control measures from other Barossa EP's have been adopted for PW discharges.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

The consequence of PW discharge is assessed as II – Minor. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential impacts are considered acceptable.

7. Unplanned Events Risk and Impact Assessment

Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)R 2023) requirements
Section 21 Environmental Assessment
Evaluation of environmental impacts and risks 21(5) The environment plan must include: a) details of the environmental impacts and risks of the activity; and b) an evaluation of all the environmental impacts and risks, appropriate to the nature and scale of each impact or risk; and c) details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable and an acceptable level. 21(6) To avoid doubt, the evaluation mentioned in paragraph (5)(b) must evaluate all of the environmental impacts and risks arising directly or indirectly from: a) all operations of the activity; and b) any potential emergency conditions, whether resulting from an accident or any other cause. *Environmental performance outcomes and standards* 21(7) The environment plan must: a) set environmental performance standards for the control measures identified under paragraph (5)(c); and b) set out the environmental performance outcomes against which the performance of the titleholder in protecting the environment is to be measured; and c) include measurement criteria that the titleholder will use to determine whether each environmental performance outcome and environmental performance standard is being met.

An environmental hazard identification workshop (ENVID) workshop (as described in Section 4) for planned activities was held in April 2022. A second ENVID workshop was held in February 2024 to review and update the impact assessment based on new information relating to receptors (including values and sensitivities obtained during consultation on other Barossa environment plans (EPs), as described in Section 5.2.3) and updates to the Activity description. New requirements (such as changes to legislation, other requirements and guidelines) were also considered.

Santos' environmental assessment identified fourteen environmental risks associated with unplanned events for this Activity. The results of the environmental risk assessment are summarised in Table 7-1 and described in the next subsections.

Table 7-1: Environmental risk assessment summary

EP Section	Unplanned event	Likelihood	Consequence	Residual risk level
7.1	Release of solid objects	C – Possible	II – Minor	Low
7.2	Introduction of Invasive Species in OA1	B – Unlikely	III – Moderate	Low
	Introduction of Invasive Species in OA2	B – Unlikely	IV – Major	Low
7.3	Marine Fauna Interaction	C – Possible	II – Minor	Low
0	Minor Releases (surface and subsea)	C – Possible	I – Negligible	Very Low
7.5	Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO	C – Possible	I – Negligible	Very Low
7.6	Subsea Release of Gaseous Hydrocarbon	A – Remote	III – Moderate	Very Low
7.7.8	Unplanned release of condendate	B – Unlikely	III – Moderate	Low
7.7.9	Unplanned Release of Marine Gas Oil (MGO)	A – Remote	III – Moderate	Very Low
7.7.10	Unplanned Release of Marine Diesel Oil (MDO)	B – Unlikely	III – Moderate	Low
7.7.11	Unplanned Release of Heavy Fuel Oil (HFO)	A – Remote	IV – Major	Low
7.7.12	Contingency Spill Response Operations	N/A	II – Minor	N/A

7.1 Release of Solid Objects

7.1.1 Description of event

Event	Solid objects can be accidentally released to the marine environment, including: • non-hazardous solid wastes, such as paper, plastics and packaging • hazardous solid wastes, such as batteries, fluorescent tubes, medical wastes and aerosol cans • equipment and materials, such as supplies, hard hats and tools • infrastructure recovered or replaced during inspection, maintenance, monitoring and repair (IMMR). Release of these solid objects may occur as a result of: • overfull or uncovered bins • incorrectly disposed items • incidents during transfers of waste or supplies • dropped objects and lost equipment through lifting operator error or mechanical failure. **Operational area 1:** The above events are credible within operational area (OA) 1. Dropped objects studies undertaken for operational lifts in OA1 (Santos, 2021b) indicate up to 100 lifts per year of smaller items (such as waste skips), and up to ten times per year for larger items (around 25 tonnes). **Operational area 2:** Within OA2, events relate to vessel and IMMR activities only.
Extent	The event will only occur within the OAs, and all non-buoyant waste material or dropped objects are expected to sink to the seabed and remain in the OAs, with the worst-case disturbance being the loss of a section of Barossa GEP, should it be accidentally released during a replacement activity. Buoyant objects could potentially move beyond the OAs.
Duration	**Constant:** An unplanned release of solids may occur during operational activities within OA1, which occur regularly, such as frequent/ daily lifts on the floating production, storage and offloading facility (FPSO) including during the HUC and initial start-up phases, and between the FPSO and vessels. Impacts may continue to occur until the solids degrade or retrieved. **Infrequent and one-off:** Campaign vessels including LWIV and USV will be infrequent, as per operational requirements for specific campaigns within OA1 and OA2. LWIV presence in OA1 if required would be for approximately 34 days up to every 2 years. Campaign vessel presence occurs typically for approximately 14 to 30 days in duration every three to five years, or as needed. Activities within OA2 are significantly less frequent than in OA1.

7.1.2 Nature and scale of environmental impacts

Potential receptors: Physical environment and habitat, threatened, migratory or local fauna and cultural features.

7.1.2.1 Physical environment

Solids such as plastics have the potential to affect benthic environments and to harm marine fauna through entanglement or ingestion. Marine turtles and seabirds are particularly at risk from entanglement and ingestion. Marine turtles may mistake plastics for food; once ingested, plastics can damage internal tissues and inhibit physiological processes, which can both potentially result in fauna fatality. Floating, nonbiodegradable marine debris has been highlighted as a threat to marine turtles, whales and whale sharks in the relevant recovery plans and approved conservation advice (refer to Appendix C). The recovery plans, approved conservation advice and wildlife conservation plans, as well as the Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (DoEE, 2018), have specified several recovery actions to help combat this threat. Of relevance is the legislation for the prevention of garbage disposal from vessels. Of relevance to the Activity is legislation for preventing garbage disposal from vessels, which Santos implements in accordance with MARPOL Annex V through the Protection of the Sea (Prevention of Pollution from Ships) Act 1983, the Navigation Act 2012 (Cth) and Marine Order 95.

Release of hazardous solids (for example, wastes such as batteries) may result in pollution of the immediate receiving environment, leading to detrimental health impacts to marine fauna. Physiological damage can occur through ingestion; or absorption may occur in individual fish, marine mammals, marine reptiles, or seabirds.

The area of potential seabed disturbance due to release of a heavier, non-hydrocarbon solid (such as equipment or infrastructure) would be restricted to the OAs (for example, accidentally dropped equipment). The seabed within OA1 consists of soft substrates and is devoid of significant bathymetric features. Sediments are predominantly unconsolidated silty sand (Jacobs, 2016a). The habitat type is widely distributed and well represented in northern Australia. Damage to substrates within the OAs and associated infauna and epifauna may occur; however, such impact is expected to be restricted to the size of the dropped object. While soft sediment benthic habits will not be destroyed, disturbance of the communities on and within them (as in, the epifauna and infauna) will occur in the event of a dropped object, and depressions may remain on the seabed for some time after the dropped object is removed as it gradually infills over time. However, the soft sediment habitat within the OAs is not expected to have a particularly high abundance, diversity or unique composition of benthic invertebrates.

The seafloor of this bioregion is strongly affected by cyclonic storms, long-period swells and large internal tides, which can resuspend sediments within the water column and move sediment across the seafloor.

Benthic habitats along OA2 consist predominantly of bare sediments, with other benthic habitat types constituting relatively small portions. All of these habitat types are well represented throughout the region (Section 3.3.8).

7.1.2.2 Threatened, migratory or local fauna

As discussed above, the impact is not anticipated to significantly affect mobile marine fauna, such as marine mammals, marine reptiles and fish. Any impact to an area of seabed disturbed within the OAs also represents a negligible portion of the habitat available for Threatened, migratory or local fauna.

Information provided during consultation identified that if culturally significant species are impacted this can impact First Nations access to food through traditional hunting and fishing, and in accordance with First Nations cultural beliefs if totemic species (e.g., turtles) are impacted by the Activity, some believe this can in turn can impact Tiwi people and make them sick.

Santos has considered information contained in relevant recovery plans and approved conservation advice for cetaceans that identify habitat modification as a potential threat (Table 3-13). This includes the objectives and actions with the Sawfish and River Shark Multispecies Recovery Plan (CoA, 2015b), Wildlife Conservation Plan for Seabirds (CoA, 2020) and Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017), which relate to marine debris, habitat degradation and modification. Given the low level of seabed disturbance and the benthic habitats in the OAs being well represented in the wider surrounds, the activities are not inconsistent with the recovery plans and conservation advice.

7.1.3 Environmental performance outcomes and control measures

The EPOs relating to this event are:

- No loss of equipment or cargo overboard from the FPSO facility or vessels. (EPO-06)
- No injury of, or mortality to, EPBC Act 1999 listed marine fauna or marine fauna listed as threatened species under the *Territory Parks and Wildlife Conservation Act 1976* (NT) as a result of the Activity. (EPO-08)
- No significant impact to cultural features from the Activity. (EPO-19)
- No impacts to underwater cultural heritage from the Activity. (EPO-20)

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this event are shown in Table 7-2 to demonstrate the potential risks are as low as reasonably practicable (ALARP). Control measures (CM) that are adopted have associated environmental performance standards (EPSs) and measurement criteria, which are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 7-2: Control measures evaluation for release of solid objects

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-7.1.1	Implement standards and procedures for lifting equipment to reduced risk of dropped objects during lifting. (administrative control)	Impacts to the environment are reduced by preventing dropped objects and dragged objects during lifting operations. Administrative costs to update induction materials and train personnel.	Cost of implementing procedures.	**Adopted** – environmental benefits of preventing dropped objects outweigh procedural compliance costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-7.1.2	Dropped objects (incident) management (administrative control)	Impacts to the environment are reduced by preventing dropped objects and by retrieving dropped objects unless the environmental consequences of the dropped object are negligible or there are risks to safety	Cost of implementing procedures.	**Adopted** – environmental benefits of recovering dropped objects outweigh procedural compliance costs
BAO-CM-6.7.1	Routine discharges of putrescible waste, in accordance with MARPOL Annex V and Marine Order 95 (Marine Pollution Prevention – Garbage) (administrative control)	Reduces probability of garbage being discharged to sea thus reducing potential impacts to marine fauna and ensures compliance with MARPOL Annex V (and Marine Order 95: Marine pollution prevention – garbage).	Cost of implementing procedures.	**Adopted** – environmental benefits of ensuring FPSO and vessels are compliant outweigh the costs; it is a legislated requirement.
BAO-CM-7.1.3	International Maritime Dangerous Goods Code (administrative control)	Regulatory requirement that reduces the risk of an environmental incident, such as an accidental container release to sea or unintended chemical reaction.	Cost of implementing procedures.	**Adopted** – it is a legislated requirement.
BAO-CM-7.1.4	Chemicals and hydrocarbons will be managed in accordance with SDS to reduce risk of release to the marine environment (administrative control)	Reduces the risk of accidental discharge to sea by controlling the storage, handling, and clean-up of chemicals.	Cost associated with implementing procedures. Regulatory requirement to manage hazardous chemicals.	**Adopted** – environmental benefits of ensuring procedures are followed outweigh the costs, plus the control is a legislated requirement.
BAO-CM-6.4.5	Health, safety and environment (HSE) inductions will include applicable environmental requirements (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements. Ensures personnel are suitably aware of cultural features and values.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
BAO-CM-6.4.8	Mercury Decanting Procedure (administrative control)	Minimises risk of mercury loss of containment to ALARP.	Cost of implementing procedures.	**Adopted**
BAO-CM-7.1.5	Mercury collection transport container (engineering)	Minimises risk of storage, handling and disposal of controlled wastes to ALARP through use of IMDG Code compliant containers	Cost of IMDG Code compliant containers	**Adopted**
BAO-CM-6.7.10	Waste Management Plan for management of controlled waste (administrative control)	Minimises risk of storage, handling and disposal of controlled wastes to ALARP.	Cost of implementing procedures.	**Adopted**
BAO-CM-7.1.6	Barossa FPSO Facility Safety Case (administrative control)	Details prevention, detection, mitigation and recovery measures provided to manage the risks. Details alarms and required emergency response in the event of a loss of containment.	Administrative costs of preparing and implementing the Safety Case.	**Adopted –** Benefits considered to outweigh costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Additional control measures				
N/A	Eliminate lifting in the field (elimination control)	Reduces the risk of dropped objects.	Eliminating lifting would require vessels storing more equipment and supplies on board, and/or additional trips to shore. Vessels will not have enough deck space to store all required equipment, materials and supplies needed for the duration of the Activity.	**Not adopted** – not feasible to eliminate lifting in the field.
N/A	Immediate removal of solid waste from the OAs (administrative control)	Reduces the risk of release of non-hazardous solid to the marine environment.	Substantial additional cost through fuel cost (emissions increase) and personnel time as the number of transfers would be increased and is not considered practicable.	**Not adopted** – cost outweighs the benefit.
N/A	Cessation of operations until all dropped objects are located and recovered (administrative control)	Would minimise potential for further disturbance due to dropped object potentially moving around on the seabed causing further disturbance or long term impacts.	Substantial additional cost due to downtime over and above value of equipment lost. Little benefit, given water depths and sparse distribution of sensitive benthic habitats in OAs.	**Not adopted** – cost outweighs the benefit.

7.1.4 Environmental impact assessment

Receptors	Physical environment and habitat Threatened, migratory or local fauna Socio-economic Cultural features
Consequence	II – Minor

Physical environment and habitat

In the event of a dropped object, there will be localised and short-term damage to the seabed. The extent of the impact is limited to the size of the dropped object; given the size of the equipment used, any impact is expected to be very small.

Marine invertebrates that may inhabit disturbed soft sediment benthic habitats are expected to occur elsewhere within the OAs and surrounds; therefore, the disturbance is not expected to affect prey availability or protected fauna species.

OA1 overlaps the Shelf break and slope of the Arafura Shelf key ecological feature (KEF). The seafloor features associated with this KEF (as in, the shelf break and patch reefs, hard substrate pinnacles and submerged reefs on the shelf slope) were not observed within OA1 during the Barossa marine studies program, nor are these topographically distinct features evident from the bathymetry data derived from multiple surveys undertaken across this area. It is, therefore, unlikely the accidental loss of solids overboard would result in any impact to this seabed feature. Furthermore, the seabed footprint that would be impacted by the Activity represents a small portion of this KEF and is not expected to impact the values of the KEF.

OA2 partially overlaps the Carbonate bank and terrace system of the Van Diemen Rise KEF and the Shelf break and slope of the Arafura Shelf KEF. Studies and habitat mapping indicate the benthic habitat within the KEFs is largely bare sediment with small areas of burrower and crinoid habitat. Therefore, potential impacts to the values of the KEFs are low. Any impacts to benthic habitats within the Oceanic Shoals Marine Park from a dropped object will be minor and localised and not expected to impact on the values of the marine park.

OA2 overlaps two sections of the Oceanic Shoals Marine Park (Figure 3-9):

- the Multiple Use Zone (International Union for Conservation of Nature (IUCN) Category VI) to the south of OA1
- the Habitat Protection Zone (IUCN Category IV) to the north-west of Bathurst Island.

The Oceanic Shoals Marine Park contains representative habitats from the region. Benthic habitat modelling and mapping along the proposed Barossa Gas Export Pipeline (Barossa GEP) route within the Multiple Use Zone and the Habitat Protection Zone indicated three benthic habitats were present: bare sediment (greater than 82.8%), filter feeders (10.1%) and burrowers and crinoids (6.2%). Potential impacts to these benthic habitats are considered above. Other environmental values of the Oceanic Shoals Marine Park, such as marine fauna and KEFs, are representative of the region and discussed below. Dropped objects will not modify, destroy, fragment, isolate or disturb the values of the Oceanic Shoals Marine Park. Consequence level for disturbance from dropped objects within the Oceanic Shoals Marine Park is considered to be II – Minor based on a large item potentially being dropped (1-25 tonnes) during transfers or incidents during vessel based activities. Impacts to benthic habitats in OA1 are considered I – Negligible, given the soft substrates within the area. However, impacts to the seabed within the Oceanic Shoals Marine Park or overlapping a KEF were considered to be II – Minor in the event of a larger item being dropped, as there would be a detectable but localised and insignificant loss of area and function of the physical environment and habitat. The worst-case consequence level is therefore considered II – Minor to both habitat and protected areas.	
Threatened, migratory or local fauna In the event of loss of a solid object, the quantities would be limited by the type of activities planned. If the solid object can be ingested by marine fauna, impacts would be restricted to a small number of individuals, if any. The southern end of OA2 traverses nesting habitat critical (HC) area for flatback and olive ridley turtles, overlaps a portion of the internesting biologically important area (BIA) for flatback turtles, and is 11 km to the internesting BIA for olive ridley turtles. The southern end of OA2 also traverses through the Oceanic Marine Shoals Marine Park. Therefore, there may be an increase in number of individual flatback and olive ridley turtles in the southern end of OA2 (between June to September for flatback turtles and April to August for olive ridley turtles) that are at risk of ingesting solid materials. While impact to an individual may occur, an impact at a population or ecosystem level is not anticipated. Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) has identified marine debris as a potential threat to marine turtles. The Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (DoEE, 2018) also identifies marine debris as a threat. These plans identify marine debris as potential threats to marine turtles and vertebrate wildlife, resulting in potential injury or death, and recommend adherence to legislation for the prevention of garbage disposal to prevent impacts. Of relevance to the Activity is legislation for preventing garbage disposal from vessels, which Santos implements in accordance with MARPOL Annex V through the Protection of the Sea (Prevention of Pollution from Ships) Act 1983, the Navigation Act 2012 (Cth) and Marine Order 95. The limited quantities associated with this event, even in a worst-case release of solid waste, impacts to fauna would be limited to individuals and are not expected to result in a decrease of the local population size. The consequence level for marine fauna is therefore considered I – Negligible for both smaller and larger objects of buoyant and non-buoyant materials.	
Socio-economic and cultural features Given the negligible consequence on species, subsequent risks or significant impacts to socio-economic receptors (including commercial fish stocks) and cultural features (relating to species with cultural significance or that provide a traditional food source) are not anticipated.	
Likelihood	C – Possible
The proposed control measures will ensure the risks of dropped objects, lost equipment or release of hazardous and non-hazardous solid waste to the environment has been reduced. These control measures will also ensure legislation for the prevention of garbage disposal from vessels is adhered to, as recommended in the Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (DoEE, 2018). The likelihood of dropped objects occurring over the duration of the Activity is considered 'Possible' for larger items that would result in a Minor consequence, as it has occurred before in Santos and is considered that it could occur within ten years, noting the smaller objects that could result in a Negligible consequence were assessed as C – Possible. The residual risk is Low for release of large solid objects.	
Residual risk	The residual risk is considered **Low**.

7.1.5 Demonstration of as low as reasonably practicable

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. The proposed management controls are in accordance with the Santos risk management criteria and are considered appropriate to manage the risk to ALARP.

7.1.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – residual risk is ranked Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks well understood through the information available. Extensive marine studies have been completed within the OAs to inform the assessment.

Are risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers the principles of ESD: • the impacts associated with unplanned minor loss of containment do not result in 'threats of serious or irreversible harm' as detailed within the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and biodiversity and ecological integrity will be maintained • conservative assumptions on scale of impact have been applied • the health, diversity and productivity of the environment will be maintained, including for future generations.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)?	Yes – Control measures implemented will reduce the risk of releasing solid objects to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009b) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b) • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b) • Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c) • Commonwealth Conservation Advice on *Dermochelys coriacea* (DEWHA, 2008b) • Approved Conservation Advice for *Limnodromus semipalmatus* (Asian dowitcher) (DCCEEW, 2024f) • Approved Conservation Advice for *Limosa limosa* (black-tailed godwit) (DCCEEW, 2024e) • Approved Conservation Advice for *Calidris tenuirostris* (great knot) (DCCEEW, 2024d) • Approved Conservation Advice for *Charadrius leschenaultii* (greater sand plover) (DCCEEW, 2023f) • Approved Conservation Advice for *Pluvialis squatarola* (grey plover) (DCCEEW, 2024g) • Approved Conservation Advice for *Limosa lapponica baueri* (Alaskan bar-tailed godwit) (DCCEEW, 2024k) • Approved Conservation Advice for *Calidris canutus* (red knot) (DCCEEW, 2024m) • Approved Conservation Advice for *Phaethon rubricauda westralis* (Indian Ocean red-tailed tropicbird) (DCCEEW, 2023g) • Approved Conservation Advice for *Arenaria interpres* (ruddy turnstone) (DCCEEW, 2024m) • Approved Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW, 2024l)

	• Approved Conservation Advice for *Xenus cinereus* (terek sandpiper) (DCCEEW, 2024i) • Conservation Advice for the Abbott's Booby *Papasula abbotti* (TSSC, 2020a) • Approved Conservation Advice for *Rostratula australis* (DSEWPaC, 2013) • Conservation Advice for *Charadrius mongolus* (lesser sand plover) (DCCEW, 2024j) **Recovery plans:** • Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013) • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (CoA, 2014) • Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) • Wildlife Conservation Plan for Seabirds (CoA, 2020) • Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c) **Other management plans/guidelines**: • Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (CoA, 2018) • Marine bioregional plans for the North Marine Region (NMR) and North-West Marine Region (NWMR) (CoA, 2012a, 2012b). For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes and the control measures outlined in Section 7.1.3. Santos considers that the level of risk of releasing solid objects is not inconsistent with these plans. The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the Shelf break and slope of the Arafura Shelf KEF. Significant impacts to this KEF are not predicted. IMMR activities that may be required in the Oceanic Shoals Marine Park are not inconsistent with the IUCN principles and North Marine Parks Network Management Plan objectives (DNP, 2018a) or the DNP Commercial Activity Licence conditions, refer Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with MARPOL Annex V (through the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), the *Navigation Act 2012* (Cth) and Marine Order 95: Marine pollution prevention – garbage) and the International Maritime Dangerous Goods Code. Through acceptance of this EP, legislative and regulatory requirements will be met as per Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted Offshore Project Proposal (OPP).

Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with the ECNT, have been considered when evaluating performance outcomes, control measures and associated performance standards (see Section 4.7 for further information). No specific control measures were proposed by Relevant Persons, including ECNT, for this risk within this EP. Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have also been adopted in this EP. Additional performance outcomes (EPO-19, EPO-20) have been adopted for the release of solid objects based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

The residual risk of an unplanned release of solid objects on receptors is assessed as Low. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential risks are considered acceptable.

7.2 Introduction of Invasive Species

7.2.1 Description of event

Event	Invasive species such as vertebrate pests, insects, weeds, diseases and invasive marine species (IMS) could potentially be introduced to the OAs or Australian mainland from the FPSO or vessels through ineffective biosecurity management of vessel topsides and/or wetsides. Equipment that is submerged in water for periods of time (such as ROVs) may acquire marine pest species, which can be spread if the equipment is not cleaned before being used in pest-free areas. The vessel topsides include galley, food storage areas, crew quarters, crib areas, waste storage areas, wheelhouses/ control rooms, decks, helipad, dunnage and general storage areas. The vessel wetsides include FPSO mooring, vessel hulls, internal sea water cooling systems, firefighting systems, ballast water systems and immersible equipment. All vessels are subject to some level of biofouling, potential sources for introducing IMS into the OAs include biofouling on vessels, including external niches (e.g. propulsion units, steering gear and thruster tunnels) and internal niches (e.g. sea chests, strainers, sea water pipework, anchor cable lockers and bilge spaces). Ballast water is responsible for up to 30% of all marine pest incursions into Australia, while biofouling (the accumulation of aquatic microorganisms, algae, plants and animals on vessel hulls and submerged surfaces) is also considered a significant pathway for the potential introduction and spread of marine pests (DAWE, 2018). Invasive species potentially introduced through the topside vector include vertebrate pests, insects, weeds and diseases. Potential sources include; - inappropriate disposal of biosecurity waste - pest translocation from vessel topside to shore - pest translocation from FPSO to shore via helicopter. IMS are potentially introduced through the vessel wetsides. Potential sources for the transfer and establishment of IMS may include: - biofouling on the FPSO or vessels' internal niches, such as sea chests, seawater systems - biofouling on the vessel's other external niches - biofouling on equipment that routinely becomes immersed in water, such as remotely operated vehicles (ROV) - ballast water exchanges - cross-contamination between vessels and the FPSO. Biofouling organisms may attach to the hull, particularly in areas such as seams and unpainted surfaces which are easy to attach to or where water turbulence is lowest (such as niches, sea chests). Biofouling organisms may also establish on the subsea infrastructure transferred from the FPSO or vessels. Organisms can also be drawn into ballast tanks during the uptake of ballast water. These organisms may potentially also translocate to vessels that undertake activities in close proximity. Some in-water maintenance and inspection work may require localised marine growth (sessile invertebrates and algae) removal to access critical ship or production operating systems. The areas affected will be small, such as around hull apertures and welds. Such activities are infrequent. Ballast water intake and discharge rates will depend on multiple factors, such as production rates and offload rates, and are standard practice for FPSOs. **Operational area 1:** The above events are credible within OA1. **Operational area 2**: Within OA2, events relate to vessel and IMMR activities only.
Extent	Topside vector (terrestrial): Localised to conveyance (vessel or aircraft) with potential to disperse to mainland and establish, if invasive species successfully translocate and colonise. Wetside vector (IMS): IMS may become widespread if successfully translocated to new areas via ocean currents or equipment transit.

Duration	**Constant:** Introduction of invasive species could occur during operational activities using vessels within OA1, which occur regularly; for example, vessels supporting the FPSO and the FPSO presence itself. Temporary to long-term impact in the event of successful species translocation. The FPSO will mobilise from Singapore to the field location for commissioning, start-up and subsequent operation. The vessel remains on location. **Infrequent:** Introduction of IMS may occur from vessel use. Campaign vessels including LWIV and USV will be infrequent, as per operational requirements for specific campaigns within OA1 and OA2. LWIV presence in OA1 if required would be for approximately 34 days up to every 2 years and IMMR activities, which occur as necessary, typically for up to 30 days in duration every two to five years or as needed. Activities within OA2 are significantly less frequent than in OA1.

7.2.2 Nature and scale of environmental impacts

Potential receptors: Physical environment and habitat, threatened, migratory, or local fauna, socio-economic and cultural features.

7.2.2.1 Invasive Species (Terrestrial)

Invasive terrestrial species in Australia present a significant ecological challenge, as they disrupt native ecosystems and threaten local biodiversity. The impact of invasive species can be profound, necessitating ongoing management and conservation efforts to mitigate their effects and protect ecosystems, agricultural industries and the Australian economy.

While the OAs are approximately 300 km offshore, there will be international vessels associated with the project calling into Australian Ports, from time to time, particularly in Darwin, Northern Territory. Additionally, domestic aircraft and vessels will also utilise local airport and port facilities, after spending time in the OA and interacting with the FPSO. This creates a potential vector for the translocation of invasive terrestrial species to the Australian mainland, should the FPSO harbor invasive species. In the Northern Territory, biosecurity risks are particularly pronounced due to the region's unique climate, diverse ecosystems, and geographical location. The tropical environment and seasonal weather patterns create conditions that are conducive to the proliferation of pests and diseases. Additionally, the region's extensive agricultural activities are vulnerable to threats from exotic pests and plant pathogens.

7.2.2.2 Invasive Marine Species

IMS are non-native marine plants or animals that harm Australia's marine environment, social amenity or industries that use the marine environment, or have the potential to do so if they were to be introduced, established or spread in Australia's marine environment (DAWE, 2018). Most climatically compatible IMS to northern Australia are found in southeast (SE) Asian countries.

A number of vectors can transport IMS outside their native ranges. Shipping is considered to be the largest contributor for the human-mediated movement of IMS around the world (Ruiz *et al.*1997; Minchin and Gollasch 2002). For instance, ocean-going vessels can transport IMS in ballast water, as biofouling attached to submerged immersible equipment, within internal seawater systems and/or on the exterior of the hull.

Some IMS pose a major threat to economy and social amenity by disrupting ecological processes (DAWE, 2018; Wells *et al.,* 2009). When IMS achieve pest status, they are commonly referred to as introduced marine pests (IMPs). IMPs can cause various adverse effects in a receiving environment, including:

- over-predation of native flora and fauna
- out-competing of native flora and fauna for food
- human illness through released toxins
- depletion of viable fishing areas and aquaculture stock
- reduction of coastal aesthetics
- damage to marine and industrial equipment and infrastructure.

The above impacts can result in flow on detrimental effects to marine parks, tourism, recreation and cultural features, noting that some native fauna may have cultural significance as dreaming totems or as a traditional food source.

Species of concern are those that are not native to the region, are likely to survive and establish in the region, and are able to spread by human-mediated or natural means. During construction, the FPSO has remained stationary alongside at SK Oceanplant Co. Ltd. in South Korea for 133 days, from May 20 to September 30, 2023, and remain alongside at Seatrium shipyard in Singapore for approximately 18 months before heading to Australia. Due to these long stays, it is possible that, in that time, the FPSO (BW Opal) could be exposed to and contaminated by IMS during these periods.

Artificial, disturbed and polluted habitats in tropical regions are susceptible to introductions, which is why ports are often areas of higher IMS risk (Neil *et al.,* 2005). However, in Australia there are limited records of detrimental impact from IMS compared with other tropical regions (such as the Caribbean).

Once IMS populations have established within an ecosystem, they are difficult to eradicate, limiting management options to ongoing control or impact minimisation. However, this depends on the environmental conditions and species. For this reason, rigorous management requirements have been implemented by Australian regulatory agencies.

If an IMS is introduced, species have been known to colonise areas outside of the areas to which it is introduced, but this depends on the diversity and extent of suitable habitat for colonisation.

IMS are generally unable to successfully establish in deep water ecosystems (Geiling, 2014), most likely due to a lack of light and suitable habitat to sustain the growth and survival of IMS. Therefore, most IMS are found in tidal and subtidal zones, with only a few species known to extend into deeper waters of the continental shelf (Bax *et al.*, 2003). Most species introduced to an area outside of their natural range (such as via ballast water) will not survive to establish or subsequently become invasive or a pest (Wells *et al.*, 2009).

IMS risks are relevant to all maritime activities, including commercial shipping, fishing, military, petroleum and recreational boating.

7.2.3 Environmental performance outcomes and control measures

The EPOs relating to this event are:

- No introduction, establishment or spread of IMS in the natural environment as a result of the Activity. (EPO-07)
- No significant impact to cultural features from the Activity. (EPO-19)
- No impacts to underwater cultural heritage from the Activity. (EPO-20)

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this event are shown in Table 7-3 to demonstrate potential risks are ALARP. Control measures that are adopted have associated EPSs and measurement criteria that are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Section 8.3.2.9 describes the biosecurity management strategy to be adopted for the Activity, consistent with the Biosecurity Act 2015 and National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2018). During the sail down to the OA, the FPSO will be towed by tugs. During the transit it will be constantly under tow at a speed of approximately five to six knots. The tow route will be designed to avoid shallow waters and areas of high risk of harbouring IMS.

It is not considered credible that IMS could establish viable populations within OA1, given the water depths. There is potential that IMS may viably transfer between the FPSO and vessels either through either direct transfer between the hull or by transfer through ballast water exchange. Vessels may operate in close proximity to the FPSO but this will only be for short and temporary time periods, and it is considered unlikely that IMS transfer could occur.

Table 7-3: Control measures evaluation for introduction of invasive marine species

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-7.2.1	Develop and implement a FPSO-specific biosecurity management plan in consultation with and approved by the Department of Agriculture Forestry and Fisheries (DAFF). (administrative control)	Reduces the risk of introducing IMS due to assessment and management procedures	Cost associated with implementing procedures and implementing the mitigation measures.	**Adopted** – cost for implementation proportionate to risk reduction
BAO-CM-7.2.2	Vessels undertake ballast water management or treatment to achieve low risk ballast water.(administrative control)	The likelihood of introducing IMS via ballasting activities is reduced by managing ballast water exchange and identifying high risk ballast water.	Inconsequential as Australian Ballast Water Management Requirements align to the International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004 (the Ballast Water Management Convention), which entered into force internationally on 8 September 2017.	**Adopted** – cost for implementation proportionate to risk reduction
BAO-CM-7.2.3	Vessels equipped with effective anti-fouling coatings.(engineering control)	The likelihood of introducing IMS is reduced by in water inspection and cleaning of the FPSO under the direction of appropriately qualified marine biologist.	Cost associated with implementing procedures and implementing the mitigation measures.	**Adopted** – cost for implementation proportionate to risk reduction
BAO-CM-7.2.4-	Vessels equipped with Marine Growth Prevention System (MGPS) (engineering control)	The likelihood of introducing IMS is reduced by preventing marine growth on the submerged surfaces of vessels.	Cost associated with implementing procedures and implementing the mitigation measures.	**Adopted** – cost for implementation proportionate to risk reduction
BAO-CM-6.4.5	HSE inductions will include environmental requirements (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**– cost for implementation proportionate to risk reduction
BAO-CM-6.6.4	Activity undertaken in accordance with Santos HSE management and marine vessel vetting processes (Santos' Offshore Marine Assurance Procedure) (administrative control)	Santos marine vetting process ensures the risk of introducing invasive marine species during activities undertaken by Santos in Australian waters is minimised through by carrying out a Biosecurity Risk Assessment prior to engagement	Costs associated with personnel time in checking vessel	**Adopted** – benefit of assuring vessels outweighs procedure compliance costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Additional control measures				
BAO-CM-7.2.5	Inspection and cleaning of FPSO hull prior to entering Australian waters under the direction of appropriately qualified marine biologist. (elimination control)	The likelihood of introducing IMS is reduced by in water inspection and cleaning of the FPSO under the direction of appropriately qualified marine biologist.	Cost associated with the engagement of direction of appropriately qualified marine biologist, dive team or ROV and appropriate specialised equipment	**Adopted** – cost for implementation proportionate to risk reduction
BAO-CM-7.2.6	Biosecurity inspection of FPSO topside prior to departure from last international port (administrative control)	Likelihood of introducing invasive species or pests via FPSO topside vector reduced	Cost associated with Biosecurity Inspector and any associated remedial actions. Cost to prepare the FPSO to standard and cost of Ship Sanitation Control Exemption Certificate that is electronically issued.	**Adopted** – cost for implementation proportionate to risk reduction
BAO-CM-7.2.7	Pest monitoring program of FPSO topsides commencing prior to mobilisation to the OA and through to Operations (administrative control)	Likelihood of introducing invasive species or pests via FPSO topside vector reduced	Costs associated of licensed pest controller attendance and materials for duration of programme. Cost to prepare the FPSO to standard and cost of Ship Sanitation Control Exemption Certificate that is electronically issued.	**Adopted** – cost for implementation proportionate to risk reduction
BAO-CM-7.2.8	Removal of loose timber that is not treated to ISPM 15 international standard (elimination control)	Likelihood of introducing invasive pests that reside in timber reduced	Costs of procuring only ISPM 15 timber and disposal of non-ISPM timber	**Adopted** – cost for implementation proportionate to risk reduction
BAO-CM-7.2.9	Deep clean of FPSO galley to remove any potential biosecurity risk material prior to mobilisation to the OA and on arrival at the OA (elimination control)	Likelihood of introducing pathogens or diseases reduced	Cost of cleaning resources and materials to prepare the FPSO to standard and cost of Ship Sanitation Control Exemption Certificate that is electronically issued.	**Adopted** – cost for implementation proportionate to risk reduction
N/A	Heat treatment of ballast water to eliminate IMS (engineering control)	Would reduce potential for IMS to establish by reducing the potential for IMS present in ballast water.	Compared to traditional ballast treatment (e.g., chemical additive) methods, heat treatment has a higher cost and increased energy consumption. Ballast requirements are adequately managed under Australian Ballast Water Management (DAWE, 2020a) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments to reduce the risk of IMS introduction.	**Not adopted –** based on high cost considered disproportionate compared with risk.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Contract vessels only operating in local, state/ territory or Commonwealth waters to reduce potential for IMS (substitute control)	Reduce potential for IMS to be transported into area since vessels would not have originated elsewhere.	Vessels and equipment suitable for the Activity may not be available in 'local' waters. Potential significant costs and delay in activity schedule by only contracting vessels working in 'local' waters.	**Not adopted** – potential for significant schedule delays and activity costs if suitable vessels are not 'locally' available. All contracted vessels must be 'low' risk of introducing IMS, regardless of their origin.
N/A	Mandatory dry docking of vessels and FPSO before entering field to clean vessel and equipment and remove biofouling (engineering control)	The risk of IMS being present on vessels or associated equipment is further reduced by the removal of biofouling	Significant cost (disproportionate to the risk) and would lead to scheduling delays. Unnecessary docking of vessels and removal of biofouling increases waste and emissions.	**Not adopted** – costs disproportionately high compared with environmental benefit, given the proposed risk-based management framework, which includes potential dry docking and cleaning if justified based on risk assessment.
N/A	Use an alternative ballast system to avoid uptake or discharge of water (engineering control)	Eliminates need for ballast water exchange, therefore decreasing risk of introducing IMS through ballast water.	Vessels suitable for the Activity may not have options for alternative ballast system, therefore would require modification at significant cost. The FPSO is considered low risk, considering its permanent position in the field and OA1.	**Not adopted** – costs disproportionately high compared with environment benefit, given the proposed risk-based management framework, which includes potential dry docking and cleaning if justified based on risk assessment.
N/A	Do not discharge ballast water (elimination control)	Would reduce the potential for introducing IMS by implementing a 'no ballast water exchange' policy on vessels.	Ballast water exchange required on the vessels for stability.	**Not adopted** – on the basis ballast water exchange is a safety critical activity for marine operations.
N/A	Removal of a fouling community in localised areas on the FPSO at dry dock rather than in-water (elimination control)	Removes requirement for removing fouling within OA1.	Is not considered practicable, given the disruption to operations and costs involved.	**Not adopted** – costs disproportionately high compared to environmental benefit, given other controls in place already reduce the risk.

7.2.4 Environmental impact assessment

Receptors	Physical environment and habitat Threatened, migratory or local fauna Socio-economic Cultural features
Consequence	IV - Major

Physical environment and habitat

The seabed in OA1 is largely bare sediment and is devoid of filter feeders (which includes sponges and soft corals) and epifauna (Jacobs, 2016a). A low abundance and diversity of infauna has been sampled in OA1 and no features associated with the Shelf Break and slope of the Arafura Shelf KEF were identified. In the event an IMS is introduced into OA1, given the lack of diversity and extensiveness of similar benthic habitat in the region, there would only be a minor reduction in the physical environment and habitat should it be established in OA1.

The northern end of OA2 is predominantly located in the mid-shelf region where water depths range between approximately 50 m and 240 m. The southern end of OA2 is in shallower waters (less than 50 m, with a minimum depth of approximately 33 m in some sections). Much of the habitat along OA2 is bare sediment, approximately 87% (Section 3.3.8). Introduction of IMS (and therefore IMS-related impacts) in deep waters or in areas of bare sediment is considered improbable.

The closest shoals and banks to the OA are Goodrich Bank and Shepparton Shoal, located 984 m east and 843 m south of OA2 respectively (refer to Figure 3-3 & Figure 3-4). The western side of Goodrich Bank is closest to OA2, which is characterised by a series of limestone plateaus in water depths of 50 m (Heyward *et al*, 2007). Shepparton Shoal is dominated by filter feeder communities with no hard or soft corals or Halimeda communities present (Redford *et al.,* 2019). Vessel activity nearest to these locations is associated with infrequent vessel undertaking IMMR activities only, including USV use, and the distance is considered sufficient to avoid IMS transfer risk. In addition, plateaus, terraces and banks of varying depths and slope aspects are characterised with strong tidally driven currents contributing to turbid water conditions, as observed by Heyward *et al*, 2007 at Goodrich Bank. These turbid waters significantly reduce light attenuation and therefore limit the amount reaching the seabed, precluding IMS establishment. Whilst it is recognised that there may be an increased risk of IMS colonising shallow areas of shoals and banks, there is often only a limited area which is conducive to IMS establishment. The consequence was assessed as III – Moderate for OA1 and IV – Major for OA2 based on the presence of the AMP and shallower waters.

Physical environment and habitat

OA2 partially overlaps the Carbonate bank and terrace system of the Van Diemen Rise KEF and OA1 partially overlaps the Shelf break and slope of the Arafura Shelf KEF (Figure 3-10). The values of these KEFs include areas of hard substrate (including patch reefs and pinnacles) that can support ecosystems with high levels of biodiversity. Water depths are greater than 100 m; therefore, the values of the KEFs are unlikely to be affected by IMS.

Threatened, migratory, or local fauna

IMS, if successfully established, can outcompete native species for food or space, prey on native species, or change the nature of the environment, and can subsequently impact on fisheries or aquaculture. Therefore, if established, the consequence level is considered III – Moderate in OA1 but IV – Major in OA2.

Socio-economic

OA2 overlaps two sections of the Oceanic Shoals Marine Park (Section 3.5.4.2.1):

- the Multiple Use Zone (IUCN Category VI) to the south of OA1
- the Habitat Protection Zone (IUCN Category IV) to the north-west of Bathurst Island.

The Oceanic Shoals Marine Park contains representative habitats from the region. Benthic habitat modelling and mapping along the proposed Barossa GEP route within the Multiple Use Zone and the Habitat Protection Zone indicated three benthic habitats were present: bare sediment (greater than 82.8%), filter feeders (10.1%) and burrowers and crinoids (6.2%). Given most of OA2 within the Oceanic Shoals Marine Park occurs in areas where seabed depths range between 50 m and 120 m and most of the areas are bare sediment, the likelihood of impacts from IMS are considered improbable.

The introduction of IMS could have a detrimental effect on commercial fisheries other marine users, tourism and cultural features (including effects on native fauna with cultural significance as totems or as a traditional food source in the area, due to the IMS outcompeting native species for food or space, preying on native species or changing the nature of the environment. Therefore, if established, the consequence level is considered III – Moderate in OA1 but IV – Major in OA2.

Cultural features

For potential impacts to marine species of cultural significance or that provide a traditional food source, refer to the assessment for threatened, migratory or local fauna.

Likelihood	B – Unlikely
The pathways for IMS introduction are well known; consequently, standard preventive measures are proposed. The ability for invasive marine species to colonise a habitat depends on several environmental conditions. It has been found that highly disturbed environments (such as marinas) are more susceptible to colonisation than are open water environments, where the number of dilutions and the degree of dispersal are high (Paulay *et al*., 2002). IMS are more likely to populate shallower areas with favourable substrates. Given the water depths across the OAs and the OAs primarily consisting of bare sediment which creates an unfavourable habitat for colonisation (light limiting and low habitat biodiversity with sparse epibiota) and it is distant from shallow coastal habitats, there is an unlikely likelihood IMS would be able to survive translocation and subsequently establish and colonise. With control measures in place to reduce the risk of introduction of IMS, the likelihood of introducing an IMS is considered 'Unlikely' (not expected to occur).	
Residual risk	The residual risk is considered **Low**.

7.2.5 Demonstration of as low as reasonably practicable

The FPSO, vessels and submersible equipment are required for the Activity. There are no alternatives to the use of activity vessels and equipment that are feasible in order to undertake the Activity. The risks from IMS are well understood and, with the proposed control measures, the activity will comply with relevant regulations and guidelines.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. The proposed management controls are in accordance with the Santos risk management criteria and are considered appropriate to manage the risk to ALARP.

7.2.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – residual risk is ranked Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks well understood through the information available. Extensive marine studies have been completed within the OAs to inform the assessment.
Are risks and impacts consistent with the principles of ESD?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers principles of ESD: - While the nature and scale of impacts have the potential to result in lasting change to benthic community dynamics, the controls that will be implemented reduce the risk to an acceptable level. Conservative assumptions have been applied to the impact assessment, including assuming conditions are conducive for IMS to establish and that vessels mobilised are a vector for IMS.

Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)?	Yes – Control measures implemented will reduce the risk of IMS introduction to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009b) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b) • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) **Recovery plans:** • Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013) • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (CoA, 2014) • Wildlife Conservation Plan for Seabirds (CoA, 2020) **Other management plans/guidelines**: Marine bioregional plans for the NMR and NWMR (CoA, 2012a, 2012b). While several plans identify habitat modification (which could occur as a result of IMS establishing) as a threat to marine fauna, significant impacts are not predicted for this Activity and IMS is not identified as a specific threat. For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes and the control measures outlined in Section 7.2.3. Santos considers that the level of risk of introducing IMS is not inconsistent with these plans. The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the Shelf break and slope of the Arafura Shelf KEF. Significant impacts to this KEF are not predicted. IMMR activities that may be required in the Oceanic Shoals Marine Park are not inconsistent with the IUCN principles and North Marine Parks Network Management Plan objectives (DNP, 2018a), or the DNP Commercial Activity Licence conditions refer Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with the *Biosecurity Act 2015,* Australian Ballast Water Management Requirements: Version 8 (DAWE, 2020a), Australian Biofouling Management Requirements (DAFF, 2023a), Offshore Installations – Biosecurity Guide (DAFF, 2023b), Marine Order 98 (Marine Pollution – anti-fouling systems), the International Maritime Organization (IMO) Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (2011), the National Biofouling Management Guidelines for (Marine Pest Sectoral Committee, 2009) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments. Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.7.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.

Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with DAFF and Tiwi Island Clan Groups and Individuals, have been considered when evaluating performance outcomes, control measures and associated performance standards (see Section 4.7 for further information). No specific control measures were proposed by Relevant Persons, including DAFF and Tiwi Island Clan Groups and Individuals, for this risk within this EP. Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have also been adopted in this EP. Additional performance outcomes (EPO-19, EPO-20) have been adopted for the introduction of invasive species based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

The residual risk of an unplanned introduction of IMS is assessed as Low. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential risks are considered acceptable.

7.3 Marine Fauna Interaction

7.3.1 Description of event

Event	The physical presence of Activity vessels and helicopters within the OAs results in the potential for marine fauna interactions. There is the potential for vessels to interact with marine fauna, including cetaceans, fish, marine reptiles, and seabirds. The main potential for interaction is through vessel collision with large, slow-moving cetaceans. Marine fauna interaction may also occur from helicopter collision, during take-off and landing. Entrainment of fauna into the FPSO seawater intake pipes (equipped with coarse grading strainer). **Operational area 1:** The above events are credible within OA1. **Operational area 2**: Within OA2, events relate to vessel and IMMR activities only.
Extent	Marine fauna interaction will be localised within the OAs, in the immediate vicinity of vessels or helicopters, while moving. While impact to individual marine fauna may occur, an impact at a population or ecosystem level is not anticipated.
Duration	**Constant:** Support vessel operations will be regularly occurring within OA1. Campaign vessel activities will be infrequent, as per operational requirements for specific campaigns within OA1 and OA2. **Infrequent and one-off:** Campaign vessels including LWIV and USV will be infrequent, as per operational requirements for specific campaigns within OA1 and OA2. LWIV presence in OA1 if required would be for approximately 34 days up to every 2 years. Campaign vessel presence occurs typically for approximately 14 to 30 days in duration every three to five years, or as needed. Activities within OA2 are significantly less frequent than in OA1. During hook-up and commissioning additional vessels will be in field for approximately 3 months for the one-off HUC activity. Following completion of hook-up and commissioning, initial start-up will occur for approximately 4 months involving support vessel(s) for this one-off activity. Helicopter presence occurs for crew changes on average five to ten times a week or during emergency situations. **Concurrent:** The duration of overlap for each concurrent Barossa activity within OA1 is presented in full in Section 2.3.1. For FPSO pre initial start-up activities there may be concurrent activities associated with a MODU and up to three support vessels (D&C EP activities) for a period of ~3 months; for ~1 month of this period there may also be concurrent activities from a construction vessel and transportation vessel undertaking SURF installation and pre-commissioning (SURF EP). There may be MODU drilling/completion activities (under the D&C EP) extending for a period of up to ~3 months post FPSO start-up and contingency MODU well workovers activities (nominally of 3-months duration) within the validity period of this EP. Contingency well workover activities using a MODU will be authorised under a separate EP. For the first 6 months post FPSO start-up, there may also be up to ~2 months cumulative duration of SURF installation and pre-commissioning.

7.3.2 Nature and scale of environmental impacts

Potential receptors: Threatened, migratory, or local fauna, socio-economic and cultural features.

Movement of vessels in the OAs introduce the potential for interaction with marine fauna present at the same location during operations. Vessel presence will be greatest during concurrent activities as described above.

Marine fauna in surface waters that would be most at risk from vessel collision include marine mammals, birds, marine turtles and whale sharks. Other faster moving species are likely to avoid or not be impacted by the presence of vessels. Consultation on other Barossa EPs identified that some marine fauna may have cultural significance.

Vessel speed has been demonstrated to be a key factor in relation to collision with marine fauna, particularly cetaceans and turtles, with faster moving vessels posing a greater collision risk than slower vessels.

7.3.2.1 Marine mammals

There are no known significant feeding, breeding, or aggregation areas for marine mammals within the OAs, though Omura's whales (not EPBC listed) have been detected consistently within the OAs. Collisions between vessels and cetaceans are most frequent on continental shelf areas where high vessel traffic and cetacean habitat

occur simultaneously (Simmonds *et al*., 2004). As presented in Department of the Environment and Energy's (DoEE's) National Strategy for Mitigating Vessel Strike of Marine Megafauna (DoEE, 2016), most of the reported vessel collisions for whales in Australian waters between 1990 and 2015 have occurred along eastern or south-eastern Australia, with no reported incidences in NT waters (DoEE, 2016). Vessel collision is identified as a threat to Sei whales in Approved Conservation Advice for Balaenoptera borealis (sei whale) (2015).

The International Whaling Commission has compiled a database of the worldwide occurrence of vessel strikes to cetaceans, within which Australia constitutes approximately 7% (35 reports) of the reported worldwide (approximately 471 reports) vessel strike records involving large whales (Peel *et al.*, 2018).

The reaction of whales to the approach of a ship is quite variable. Some species remain motionless when close to a ship while others are known to be curious and often approach ships that have stopped or are slow moving, although they generally do not approach, and sometimes avoid, faster moving ships (Richardson *et al.*, 1995).

Collisions with smaller cetaceans, such as dolphins, are very infrequent due to the mobility of these smaller cetaceans, which allows them to avoid vessels. A breeding BIA for the Indo-Pacific humpback dolphin is within Darwin Harbour, approximately 45 km from the closest point of OA2, and other dolphin species may be present within the OAs, particularly along the southern end of OA2. Therefore, collisions between vessels and dolphin species are considered possible.

Dugong are known to occur in and around seagrass growth areas and stereotypical inquisitive behaviours have been observed. While dugongs are known to occur in OA2, they spend most of their time in shallow tidal and subtidal seagrass meadows, which are not present within the OAs.

7.3.2.2 Marine reptiles

Turtles are at risk of a vessel strike while they are resting or returning to the sea surface to breathe. However, it has been noted turtles spend relatively limited (3 to 6%) time at the surface, with dive times generally lasting 15 to 60 minutes (Milton and Lutz, 2003, cited in Woodside, 2014).

Marine turtles are highly mobile and, given the low speeds of vessels typically used for operations, are likely to be able to move from an area where there is vessel activity.

A compilation of tracking data from marine turtle telemetry studies on and around the Tiwi Islands between 1994 and 2023 did not record any movements that intersected OA1, but did identify migration pathways for several marine turtle species (Olive ridley, Flatback, Green and Loggerhead) that passed over the portion of OA2 immediately north of the Tiwi Islands (Pendoley, 2023).

Marine turtle mortality due to vessel strike has been identified as an issue in Queensland waters in the Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017). However, turtles appear to be more vulnerable to boat strike in areas of high urban population, where incidents of pleasure crafts are higher. Vessel strikes (as a standalone threat) have not been shown to cause declines at a population or stock level in the NT (CoA, 2017).

7.3.2.3 Sharks, rays and other fish

Large sharks that frequent the upper portions of the water column, such as whale sharks, are most vulnerable to collision with vessels. Whale sharks are not expected to be frequent visitors of the OAs. Whale sharks spend approximately 25% of their time less than 2 m from the surface and greater than 40% in the upper 15 m of the water column (Wilson *et al.*, 2006; Gleiss *et al.,* 2013). Whale sharks, other pelagic fish and demersal fish are likely to exhibit a short-term avoidance of vessels or ROVs. This is likely to be initiated through the vibrations and underwater noise emitted from these activities (Section 6.1) rather than the physical presence. Such avoidance is likely to be temporary.

7.3.2.4 Seabirds and migratory shorebirds

A number of protected species of marine seabirds and migratory shorebirds may occur at times within the OAs (Table 3-10). Seabirds may be attracted to the area surrounding the FPSO in OA1 due to lighting and operational discharges such as macerated food waste. Lighting required for IMMR vessel activities in OA2 may attract seabirds.

It is possible shorebirds birds migrating along the East Asian-Australasian Flyway may be attracted to the flare on the FPSO and use the facilities for resting, potentially causing disorientation to flying birds, disruption to foraging activities or affect stopover selection (CoA, 2023a).

Helicopter noise is expected to elicit a behavioural response in birds to avoid collision and, given the relatively low speeds helicopters would be flying at during take-off or landing, the helicopter strike is not likely.

7.3.2.5 Cultural features

First Nations people maintain a continuing spiritual connection with sea country, including caring for sea country and access to cultural food sources. Sections 7.3.2.1 to 7.3.2.4 describe the potential impacts to marine species of cultural significance such as dreaming and totem species including mammals (e.g. whales, dolphins, dugongs), marine reptiles (e.g. turtles, crocodiles), sharks, rays, other fish and birds.

No objections or claims were raised during First Nations people feedback about potential impacts of marine fauna interactions affecting any cultural features (excluding marine fauna species) during consultation for this EP (refer to Section 4.7). Any concerns related to the potential for impacts to cultural features from marine fauna interaction are associated with direct or indirect impacts to culturally significant marine fauna species (refer to Section 3.7.11).

7.3.2.6 Potential cumulative impacts from concurrent activities

There is an increased risk of potential interaction with marine fauna during concurrent activities as described in Section 2.3.1. The overlap in Barossa activities will result in additional vessels within OA1 for short periods (up to a few months) (refer Section 7.3.1). Concurrent activities will predominantly occur in the vicinity of drill centres which are >6km from the FPSO turret and vessels will typically be either stationary or operating and slow speeds while undertaking activities under the D&C EP or SURF EP, reducing the potential for vessel collisions. The potential for any interaction is likely to be limited to individuals and/or small groups of transient marine fauna (such as cetaceans) and worst case impacts are expected to result in a behavioural disturbance only, i.e. avoidance of the project vessels due to vessel noise (refer Section 6.1.2.8), with no lasting effect.

OA1 is not near any cetacean or marine turtles BIAs or known foraging, breeding, calving or migrating areas, with the nearest designated cetacean BIA (pygmy blue whale migration) greater than 170km away and the nearest marine turtle BIA (flatback turtle internesting) 50km away. Any unplanned marine fauna interactions are therefore unlikely to affect a large number of cetaceans or marine turtles nor affect any key life-cycle processes.

7.3.3 Environmental performance outcomes and control measures

The EPOs relating to this event are:

- Vessel speeds in operational areas will not exceed applicable restrictions, to reduce the risk of physical interactions between cetaceans / marine reptiles and vessels. (EPO-02)
- Zero incidents of injury/mortality of cetaceans/marine reptiles from collision with vessels. (EPO-03)
- No injury of, or mortality to, EPBC Act 1999 listed marine fauna or marine fauna listed as threatened species under the *Territory Parks and Wildlife Conservation Act 1976* (NT) as a result of the Activity. (EPO-08)
- No significant impact to cultural features from the Activity. (EPO-19)

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this event are shown in Table 7-4 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria that are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 7-4: Control measures evaluation for marine fauna interaction

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-6.1.1	Apply Santos' Protected Marine Fauna Interaction and Sighting Procedure to vessel and helicopter activities when in the vicinity of cetaceans and turtles (isolation control)	Reduces risk of physical and behavioural impacts to marine fauna from vessels as it implements EPBC Regulations – Part 8 Division 8.1 Interacting with cetaceans. If cetaceans are sighted, vessels can slow down or move away, and helicopters can increase distances from sighted fauna if required. Reduces the potential impacts to culturally significant marine species, including totemic species, such as marine turtles and marine mammals.	Potential delay in vessel and helicopter movement, increasing activity duration and costs to Santos. Cost associated with implementing procedures. Regulatory requirements under EPBC Regulations 2000.	**Adopted**
BAO-CM-6.1.2	Vessels equipped and crewed in accordance with Australian maritime requirements, including Marine Order 30 (Prevention of Collisions) and Marine Order 21 (Safety and Emergency Arrangements) (administrative control)	Ensures contracted vessels are operated, maintained, and crewed in accordance with industry standards and regulatory requirements. Ensures vessels meet Marine Assurance Standards to reduce the likelihood of vessel collision (such as minimum and working lighting for maritime safety).	Costs are expected as part of standard procedure.	**Adopted** – benefit of assuring vessels outweighs procedure compliance costs
BAO-CM-7.3.1	Seawater extraction (engineering control)	Seawater is extracted at a depth of 70m, through flexible hoses with 15mm mesh screens. Reduces the risk of marine fauna entrainment.	Personnel and operational costs associated with constructing and maintaining offshore sweater cooling system.	**Adopted**
BAO-CM-6.4.5	HSE inductions will include applicable environmental requirements (administrative control)	Ensures that crew and helicopter operators are aware of the stringent EP, Santos, and legislative requirements. Ensures personnel as suitably aware of cultural features and values.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Additional control measures				
BAO-CM-6.6.6	Vessel speed restrictions within 500m around the FPSO, IMMR vessels and campaign vessels (substitute control)	Reduces consequence of collisions (causing harm) and likelihood as fauna have longer to detect and avoid the vessel by restricting vessel speeds in the OAs to 8 knots or less within 500m of the FPSO and Activity vessels. Reduces the potential impacts to culturally significant marine species, including totemic species, such as marine turtles and marine mammals.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
N/A	Adopt further measures to those outlined in 'EPBC Regulations 2000 — Part 8 Division 8.1 during peak periods of ecological sensitivity; for vessels outlined in the Australian National Guidelines for Whale and Dolphin Watching (DoEE, 2017) (administrative control)	Potentially provides an additional level of protection of marina fauna.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Not adopted** – the existing control ensures compliance with legislation. No additional relevant controls have been identified in government or industry guidelines.
N/A	Manage the timing of the Activity to avoid sensitive periods (administrative control)	Potentially provides an additional level of protection of marina fauna.	Protected marine fauna species are present year round, albeit in low numbers, therefore avoidance is not feasible.	**Not adopted** – the high financial cost would be grossly disproportionate to negligible environmental benefits.
N/A	Restrict vessel operating speeds in all OAs (administrative control)	Reduces consequence of collisions and likelihood (causing harm) as fauna have longer to detect and avoid the vessel.	Administrative costs to update existing Santos procedure and induction materials and train personnel. Compliance with EPBC Regulations – Part 8 Division 8.1 Interacting with cetaceans already restricts vessel speeds appropriately when marine fauna is sighted.	**Not adopted** – not considered necessary, given there are very few marine fauna aggregation areas, migration pathways or BIAs near the OAs, noting as per BAO-CM-6.1.1, vessels will comply with EPBC Regulations – Part 8 Division 8.1 Interacting with cetaceans (and applied for marine turtles), through implementation of the Santos Protected Marine Fauna Interaction and Sighting Procedure. As per BAO-CM-6.6.6 vessel speed will be restricted within 500m around the FPSO and Activity vessels.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Dedicated marine mammal observer on vessels (EPBC Policy Statement 2.1 Part B) (administrative control)	Improved ability to spot and identify marine fauna at risk of collision (that may cause harm).	Additional cost of contracting marine mammal observer on vessels.	**Not adopted** – likelihood of animals being encountered is too low to justify additional cost of marine mammal observer, personnel can observe for marine fauna when piloting vessels; cost would be grossly disproportionate to negligible environmental benefits.
N/A	Activities to only occur during daylight hours (eliminate control)	Potential for a vessel fauna collision occurring is decreased due to vessel being stationary when visibility is lower at night.	Vessels are required to support 24-hour operations and other vessels are required to meet operational needs (such as IMMR). Restricting activities would increase the duration of the Activity, resulting in significant financial costs. No other maritime industry has such a restriction.	**Not adopted** – the high financial cost would be grossly disproportionate to negligible environmental benefits.

7.3.4 Environmental impact assessment

Receptors	Threatened, migratory or local fauna Socio-economic Cultural features
Consequence	II – Minor

In the event of a collision with fauna, there is the potential for injury or death to an individual. The number of receptors present in the OAs is expected to be limited to a small number of transient individuals.

Marine mammals

A number of marine mammals may occur within the OAs including the potential for eight protected species within OA1, and 11 protected species within OA2 (Table 3-9). Blue, sei, fin, sperm and humpback whales may transit through both OAs and, while impact to an individual may occur, an impact at a population or ecosystem level is not anticipated.

The pygmy blue whale distribution BIA (approximately 60 km away from the boundary of OA1) is the closest BIA. Considering the relatively slow vessel speeds within the OAs, and the mobility of these species, it is highly unlikely Activity vessels will adversely interact with any individuals.

The breeding BIA for the Indo-Pacific humpback dolphin is in Darwin Harbour, approximately 45 km from the closest point of OA2. While some species may be present in both OAs in greater numbers at certain times of the year, the overall numbers are low. Considering this, and the wide distribution of the species, impact at a population level is not anticipated.

While dugongs are known to occur in OA2, they spend most of their time in shallow tidal and subtidal seagrass meadows, which are not present within the OAs. If any vessel interaction does occur, it is unlikely to threaten the overall viability of the population.

Marine reptiles

Marine turtles make extensive migrations throughout the region, and it is possible individual turtles of any of the species known from the region may be encountered in OA1. However, OA1 does not contain any significant feeding, breeding or aggregation areas for marine turtles; therefore, large numbers are not anticipated.

In the northern section of OA2, at least 100 km from the Tiwi Islands, few individuals of marine turtles are expected; therefore, risk of injury from vessel strikes to turtles that may be passing through the area is considered low.

The southern end of OA2 traverses nesting HC area for flatback and olive ridley turtles, overlaps a portion of the internesting BIA for flatback turtles, and is 11 km to the internesting BIA for olive ridley turtles. The southern end of OA2 also traverses through the Oceanic Shoals Marine Park. There may be an increase in number of individuals in the southern end of OA2 (between June to September for flatback turtles and April to August for olive ridley turtles) that are at risk from a vessel strike.

However, the risk of coming into contact with turtles is low as it is expected turtles will dive or move away from the vessels. While impact to an individual may occur, an impact at a population or ecosystem level is not anticipated. Individual sea snakes may transit through OA2; however, if any vessel strikes do occur, they are unlikely to threaten the overall viability of the population as the plausible number of vessel strikes is very small. **Sharks, rays and fish** Boat strike is recognised by the Approved conservation Advice for *Rhincodon typus* (whale shark) (Threatened Species Scientific Committee, 2015b) as one of the threats to their recovery. Both OAs are more than 400 km away from the nearest BIA for whale sharks and, given the offshore location, large numbers of species are not anticipated. It is possible, however, individuals may transit through the OAs and, while an impact to an individual may occur, an impact at a population or ecosystem level is not anticipated. **Seabirds and migratory shorebirds** The closest seabird BIA to both OAs is the crested tern (breeding – high numbers); however, it is located 8 km east of OA2 and more than 100 km away from OA1. The other seabird BIAs are more than 350 km away from both OAs. Given the distances of seabird BIAs to the OAs, potential interactions and subsequent physical impacts to birds from helicopter strikes and significant attraction to the lighting and flare on the FPSO resulting in disorientation or disruption to foraging behaviour are considered unlikely. Helicopter flights to the FPSO occur during daylight only. Although unlikely to occur, birds striking a helicopter may cause injury or mortality of an individual, which would cause a minor disruption to a small proportion of the population, though an impact at a population or ecosystem level is not anticipated.	
Socio-economic and cultural features Given the negligible consequence on species, subsequent risks or significant impacts to socio-economic receptors (including tourism and recreation) and cultural features relating to species with cultural significance, are not anticipated.	
Cumulative impacts Given the short duration of concurrent activities, the inherently low speeds that vessels undertaking concurrent activities will be operating at and the absence of nearby significant feeding, breeding or aggregations areas and marine fauna BIAs, cumulative effects are not expected to be significant and limited to behavioural effects to transiting marine fauna (e.g. cetaceans). Cumulative effects are not considered significant enough to change the overall consequence level of Minor.	
Likelihood	C – Possible
The likelihood of marine fauna interaction resulting in injury or death is considered 'Possible' in both OAs, given the implementation of the Santos procedure for interacting with marine fauna. While there is a lack of BIAs or significant breeding, nesting and aggregation areas of marine fauna within OA1 and the likelihood of interaction is unlikely, OA2 overlaps areas of increased marine fauna abundance; however, there remains a tendency for marine fauna to move away from vessels and helicopters.	
Residual risk	The residual risk is considered **Low**.

7.3.5 Demonstration of as low as reasonably practicable

No alternative options to the use of the vessels and helicopters are possible in order to undertake the Activity.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. The proposed management controls are in accordance with the Santos risk management criteria and are considered appropriate to manage the risk to ALARP.

7.3.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – residual risk is ranked Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.

Are the risks and impacts consistent with the principles of ecological sustainable development?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers principles of ESD: • The impacts associated with marine fauna interaction have the potential to occur to a small number of an overall population and population-level impacts will not occur so the event does not result in 'threats of serious or irreversible harm' as detailed within the EPBC Act and biodiversity and ecological integrity will be maintained. • Conservative assumptions on scale of impact have been applied including a conservative assumption on marine fauna presence. • The health, diversity and productivity of the environment will be maintained, including for future generations.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)?	Yes – Control measures implemented will reduce the risk of unplanned interactions to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b) • Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c) • Commonwealth Conservation Advice on *Dermochelys coriacea* (DEWHA, 2008b)
	Recovery plans: • Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) • Wildlife Conservation Plan for Seabirds (CoA, 2020) • Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c) **Other management plans/guidelines**: • Marine bioregional plan for the NMR (CoA, 2012a). For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes and the control measures outlined in Section 7.3.3. Santos considers that the level of risk of unplanned marine fauna interactions is not inconsistent with these plans. IMMR activities that may be required in the Oceanic Shoals Marine Park are not inconsistent with the IUCN principles and North Marine Parks Network Management Plan objectives (DNP, 2018a) or the DNP Commercial Activity Licence conditions, refer Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management is consistent with EPBC Regulations Part 8. Through acceptance of this EP, legislative and regulatory requirements will be met as per Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health, and Safety Policy.

Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with AMSA-NT, the ACF, the ECNT and Tiwi Island Clan Groups and Individuals, have been considered when evaluating performance outcomes, control measures and associated performance standards (see Section 4.7 for further information). Santos has considered and evaluated specific control measures proposed by AMSA-NT and the ACF. However, no additional performance outcomes or control measures have been adopted. Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have also been adopted in this EP. An additional performance outcome (EPO-19) has been adopted for marine fauna interactions based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measure BAO-CM-6.6.6 adopted.

The residual risk of marine fauna interaction is assessed as Low. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential risks are considered acceptable.

7.4 Minor Releases (surface and subsea)

7.4.1 Description of event

Event	Minor releases such as those listed below can be accidentally released to the marine environment from the FPSO, support and campaign vessels: • mineral oil, hydraulic fluid and lube oils for operation and maintenance of moving parts used in engines, equipment (such as pumps, cranes, winches, power packs, generators and ROVs) • helicopter fuel • chemicals (such as solvents, cleaning agents), including those in tote tanks and spare riser tubes in turret for future riser tie-in (such as biocides, inhibitors) • chemicals (MEG and methanol) bunkered to the FPSO • loss of collected mercury contained as special waste • loss of containment of controlled wastes (e.g., mercury due to inadequate isolation). The above could potentially release to the marine environment from equipment malfunction, corrosion of storage vessels or pipework, and human errors such as during filling of storage vessels or portable equipment. Sealed tote tanks and drums are typically used to transfer large quantities of lube oil and production chemicals (such as biocide and oxygen scavengers) between support vessels and the FPSO. Operator error or mechanical failure during transfer has the potential to lead to a direct release into surface waters within the OAs. In the event of a dropped or ruptured tote tank, approximately 4.5 m^3 of lube oil or chemicals may be released. In the event of a dropped and ruptured chemical drum, approximately 2.5 m^3 of hydraulic fluid may be released. In the event of a dropped and ruptured special waste container (QC80) filled with decanted mercury, up to 76L of mercury may be released. Mercury loss of containment during maintenance activities on the FPSO could also occur due to human error, however the likelihood of mercury entering the marine environment is considered remote as these activities are managed under strict mercury management plans and procedures, including the provision of suitable means of isolation, work performed within a containment bund and waste handling procedures. Other potential release pathways, such as process leaks, discharges and failures, are not considered credible sources of leak which could enter the marine environment with all process pipework subject to hydrocarbon release reduction practices any liquid releases will be gathered by the FPSO drainage system as described in Section 2.7.3.7. Chemicals (solvents, cleaning agents) are used on support and campaign vessels. Spills and leaks of chemicals and hydrocarbons onboard may arise from equipment malfunction, corrosion of storage vessels or pipework, and human errors during filling of storage vessels or portable equipment. These may end up on the vessel deck and be released to the marine environment. Typically, volumes of such spills are small (less than 20 L). Leaks or rupture of the ROV's hydraulic hoses may occur through equipment malfunction or line pinches, which would lead to the loss of a small volume of hydraulic fluids directly to the marine environment. A maximum credible release of 50 L has been assumed based on multiple leaks of hydraulic fluid on an ROV. Methanol and MEG are bunkered to tanks periodically from the support vessel (refer Section 2.7.3.8) in OA1. The potential exists for these chemicals to be spilled directly to the marine environment in the event of leaking or ruptured bunker transfer equipment as a result of: • bunkering hose failure (from erosion, corrosion, integrity failure) • supply vessel drive-off during bunkering • maintenance and operator error • process conditions exceeding design limits (high pressure). A total rupture or failure of bunker transfer equipment such as the hose or fittings during bunkering, combined with a failure in procedure to shut off fuel pumps, for a period of up to three minutes, may result in approximately 10 m^3 of chemicals reaching the marine environment. Chemical bunkering is a monitored event, with a person monitoring on the support vessel and the FPSO, allowing for almost immediate shutdown of the bunkering activity. The FPSO main deck directs deck water to the slops tank. A coaming is in place to minimise potential for spillage of drainage water overboard (refer Section 2.7.3.7). **Operational area 1:** The events are credible in OA1. **Operational area 2:** The events from vessels (such as small spills less than 20L) are credible in OA2 during IMMR activities.
Extent	The relative low volumes of spilled hydrocarbons are expected to rapidly disperse into the marine environment. Below-harmful concentrations are expected to occur at short distances from the release point. Potential impacts beyond the OAs are not expected.

Duration	**Constant:** An unplanned release may occur during HUC and initial start-up or operational activities within OA1. **Infrequent and one-off:** Campaign vessels including LWIV and USV will be infrequent, as per operational requirements for specific campaigns within OA1 and OA2. LWIV presence in OA1 if required would be for approximately 34 days up to every 2 years. Campaign vessel presence occurs typically for approximately 14 to 30 days in duration every three to five years, or as needed. Activities within OA2 are significantly less frequent than in OA1. within OA2 are significantly less frequent than in OA1. Potentially harmful concentrations limited to a very short period (hours) immediately after release.

7.4.2 Nature and scale of environmental impacts

Potential receptors: Physical environment and habitat, threatened, migratory, or local fauna, socio-economic and cultural features.

7.4.2.1 Physical environment and habitat

Hydraulic fluids and lubricating fluids behave similarly to marine diesel oil (MDO) or MGO when spilled in the marine environment; for information about MGO and MDO behaviour in the marine environment, refer to Section 7.7.3. Hydraulic fluids are medium oils of light to moderate viscosity and have a relatively rapid spreading rate and, like MGO and MDO, will dissipate quickly, particularly in high sea states, although lubricating oils are more viscous and so the spreading rate of a spill of these oils would be slower.

Mercury in the aquatic environment exists mainly as complexes of mercury (II) and as organomercurials. Inorganic forms of mercury (of relatively low toxicity and availability to bioconcentrate) may be converted by bacteria in situ into organomercury complexes (particularly methylmercury), which are more toxic and tend to bioaccumulate (ANZG, 2018).

Only a small proportion of total mercury is found in the dissolved phase. Dissolved mercury concentrations in seawater range from 0.08-2.0 ng/L (Gill & Fitzgerald 1988, Cossa *et al*. 1992). Mercury has a strong affinity for chlorine and sulfur-containing ligands, particularly sulfide. The neutral $HgCl_2$ in seawater rapidly permeates biological membranes, though the toxicity of inorganic mercury in marine environments usually increases with decreasing salinity. Sorption onto suspended matter or bottom sediments is the most important process controlling the concentration of mercury in natural waters (CCREM, 1987).

Mercury is not as toxic to fish as some other metals, such as Cu, Pb, Cd or Zn. The concentrations of mercury in most surface waters are generally much too low to cause any direct toxic effects to either adult fish or the more sensitive early life stages. The main risk is diet-derived methylmercury, which accumulates in internal organs and exerts its effects by disruption of the central nervous system. Bioconcentration factors for methylmercury for fish are consequently very high, ranging from 106 to 108, although the proportion of accumulated methylmercury is generally very low. The uptake and toxicity of mercury in aquatic organisms is often attributed to the lipid-solubility of organic mercury. The accumulation of inorganic mercury is generally regarded as being of secondary importance.

USEPA (1985) summarised data on the acute toxicity of mercuric chloride in marine water, with values ranging from 3.5 µg/L to 1700 µg/L. Generally, fish tend to be more resistant than molluscs and crustaceans. Mercury (II) concentrations ranging from 10 µg/L to 160 µg/L inhibited growth and photosynthetic activity of saltwater plants. The Australian marine amphipod *Allorchestes compressa* was sensitive to mercury, with a 96-hour LC50 of 80 µg/L. In general, marine molluscs are less sensitive to inorganic mercury, with acute LC50 values ranging from 3 to 10,000 µg/L (Florence & Stauber, 1991).

7.4.2.2 Threatened, migratory or local fauna

Changes to water quality from an unplanned minor release could potentially lead to short-term impacts on marine fauna, such as pelagic fish, marine mammals, marine reptiles and seabirds, albeit to a very localised extent and temporary duration. Minor spills are unlikely to have widespread ecological effects on Threatened or Migratory fauna, given the nature of the chemicals on board, the small volumes that could be released, and the open-ocean environment of the location. Physical coating of marine fauna, particularly those present at the sea surface (such as seabirds), by entrained or surface hazardous liquids and sublethal or lethal effects from toxic chemicals, is considered unlikely, given the expected low concentrations, small potential volumes and short exposure times.

Santos has considered information contained in relevant recovery plans and approved conservation advice for cetaceans that identify deteriorating water quality and chemical discharge as potential threats (Table 3-13). This

includes the objectives and actions in the Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017). The activities and impacts are not inconsistent with the recovery plans and conservation advice.

7.4.2.3 Cultural features

No First Nations people feedback was provided about potential impacts from the accidental release of hydrocarbons and chemicals to any geographically specific cultural features (excluding marine fauna species) during consultation (refer to Section 4.7). Any concerns related to the potential for impacts to cultural features from accidental release of minor volumes of hydrocarbons and chemicals are associated with direct or indirect impacts to culturally significant marine fauna species (refer to Section 3.7.11).

Potential impacts to marine fauna that have cultural significance as totems or as cultural food sources, could result in reduced First Nations access to food through traditional hunting and fishing, and in accordance with First Nations cultural beliefs, if totemic species (e.g. turtles) are impacted by the Activity some believe this in turn can impact First Nations people and make them sick. Section 3.7.11 describes the potential impact to marine species of cultural significance.

7.4.3 Environmental performance outcomes and control measures

The EPOs relating to this event are:

- No injury of, or mortality to, EPBC Act 1999 listed marine fauna or marine fauna listed as threatened species under the *Territory Parks and Wildlife Conservation Act 1976* (NT) as a result of the Activity. (EPO-08)
- Zero unplanned discharge of hazardous and non-hazardous wastes into the marine environment from the Activity. (EPO-16)
- No release of controlled waste generated during the Activity, except through licensed onshore treatment and disposal facilities. (EPO-17)
- Zero unplanned discharge of hydrocarbons or chemicals to the marine environment from the Activity. (EPO-18)
- No significant impact to cultural features from the Activity. (EPO-19)

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this event are shown in Table 7-5 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria which are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 7-5: Control measures evaluation for minor hydrocarbon and chemical releases

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BA0-CM-6.1.2	Vessels equipped and crewed in accordance with Australian maritime requirements, including Marine Order 30 (Prevention of Collisions) and Marine Order 21 (Safety and Emergency Arrangements) (administrative control)	Ensures contracted vessels are operated, maintained, and crewed in accordance with industry standards and regulatory requirements. Ensures vessels meet Marine Assurance Standards to reduce the likelihood of vessel collision (such as minimum and working lighting for maritime safety).	Costs are expected as part of standard procedure.	**Adopted** – benefit of assuring vessels outweighs procedure compliance costs.
BAO-CM-7.4.1	ROV operations undertaken in accordance with good industry practice (administrative control)	Maintenance (as per manufacturer specifications) and pre-deployment inspection on ROV completed as scheduled to reduce the risk of hydraulic fluid	Cost of implementing procedures.	**Adopted** – environmental benefits outweigh the costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		releases to the marine environment.		
BAO-CM-7.1.1	Implement standards and procedures for lifting equipment to reduced risk of dropped objects during lifting (administrative control)	Impacts to the environment are reduced by preventing dropped objects and dragged objects during lifting operations. Administrative costs to update induction materials and train personnel.	Cost associated with implementing procedures.	**Adopted** – environmental benefits of ensuring the procedure are followed and measures implemented outweigh the costs.
BAO-CM-7.1.2	Dropped objects (incident) management (administrative control)	Impacts to the environment are reduced by preventing dropped objects and by retrieving dropped objects unless the environmental consequences of the dropped object are negligible or there are risks to safety.	Cost of implementing procedures.	**Adopted** – environmental benefits outweigh the costs.
BAO-CM-6.7.5	Apply the Santos chemical selection process for chemicals planned to be discharged (administrative control) (Section 2.7.3.8.4)	Under the procedure, only environmentally acceptable chemical products are used, hence reducing potential impacts if an accidental release occurs	Cost of implementing procedures. Range of chemicals reduced with potentially higher costs for alternative products.	**Adopted** – environmental benefits of using environmentally acceptable chemicals outweigh procedural implementation and operational costs.
BAO-CM-7.1.4	Chemicals and hydrocarbons will be managed in accordance with SDS to reduce risk of release to the marine environment (administrative control)	Reduces the risk of accidental discharge to sea by controlling the storage, handling, and clean-up of chemicals.	Cost associated with implementing procedures. Regulatory requirement to manage hazardous chemicals.	**Adopted** – environmental benefits of ensuring procedures are followed outweigh the costs, plus the control is a legislated requirement.
BAO-CM-7.1.3	International Maritime Dangerous Goods Code (administrative control)	Regulatory requirement that reduces the risk of an environmental incident, such as an accidental container release to sea or unintended chemical reaction.	Cost of implementing procedure.	**Adopted** – environmental benefits of ensuring procedures are followed outweigh the costs; plus, the control is a legislated requirement.
BAO-CM-7.1.6	Barossa FPSO Facility Safety Case (administrative control)	Details prevention, detection, mitigation and recovery measures provided to manage the risks. Details alarms and required emergency response in the event of a loss of containment.	Administrative costs of preparing and implementing the Safety Case.	**Adopted –** Benefits considered to outweigh costs.
BAO-CM-7.4.2	Bulk liquid transfer procedure	The procedure provides details about the	Costs associated with ensuring the	**Adopted** – environmental

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	(administrative control)	chemical bunkering process to be undertaken. Implementing the procedure reduces the potential for release during bunkering. Requires use of dry break coupling (on bunkering hose) which limit the chemical losses in an emergency. Hook-up for bunkering is restricted to during daylight hours.	procedure is in place, up to date and implemented.	benefits of ensuring the procedure is followed and measures implemented outweigh the costs.
BAO-CM-6.4.10	Barossa Facilities and vessels planned maintenance system to confirm equipment integrity is maintained in accordance with manufacturers guidelines. (administrative control)	Ensures bunkering equipment is maintained through routine checks via: • visual inspections prior to use • test date/certification of the hose is checked prior to use. Maintained bunkering equipment will reduce likelihood of loss of integrity events during transfers.	Costs associated with maintenance of equipment.	**Adopted –** environmental benefits of maintaining offtake equipment integrity outweigh the costs.
BAO-CM-7.4.3	FPSO and vessel spill response plans (SOPEP/SMPEP) (administrative control)	Implements onboard response plans to deal with unplanned chemical releases and spills quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents. Generally undertaken by vessel contractor so time for Santos personnel to confirm and check SOPEP/SMPEP in place	**Adopted.**
BAO-CM-7.4.4	Spill clean-up kits available in high-risk areas (protective control)	Reduces the risk of spills and leaks to sea by controlling the clean-up of minor spills.	Cost of implementing procedures.	**Adopted**
BAO-CM-7.4.5	Helicopter refuelling procedure (administrative control)	Minimises risk of pollution to ALARP during hydrocarbon transfers to helicopters.	Personnel costs associated with ensuring procedures are in place and implemented during fuel transfers.	**Adopted**
BAO-CM-6.4.5	HSE inductions will include applicable environmental requirements (administrative control)	Ensures that crew are aware of the stringent EP, Santos, and legislative requirements. Ensures personnel as suitably aware of cultural features and values.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
BAO-CM-7.4.6	Mercury Management Plan (administrative control)	Minimises risk of mercury exposure/contamination	Cost/effort of maintaining plan	**Adopted**
BAO-CM-7.4.7	Mercury monitoring/sampling equipment (engineering control)	Provides means to evaluate mercury presence and risk of exposure/contamination	Cost/effort of training	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-7.4.8	Mercury hazard awareness training (administrative control)	Minimises risk of mercury exposure/contamination through awareness of hazards, controls and spill response requirements	Cost/effort of training	**Adopted**
BAO-CM-7.4.9	Mercury register/ mercury map (administrative control)	Assists with planning to reduce risk of mercury exposure or environment contamination	Cost/effort of maintaining register/map	**Adopted**
BAO-CM-6.4.7	Mercury collection pot gauge (engineering control)	Minimises risk of mercury overfilling of MCPs	Cost of MCP gauges and effort of daily monitoring	**Adopted**
BAO-CM-6.4.8	Mercury Decanting Procedure (administrative control)	Minimises risk of mercury loss of containment to ALARP.	Cost of implementing procedures.	**Adopted**
BAO-CM-7.1.5	Mercury collection transport container (engineering)	Minimises risk of storage, handling and disposal of controlled wastes to ALARP through use of IMDG Code compliant containers	Cost of IMDG Code compliant containers	**Adopted**
BAO-CM-6.7.10	Waste Management Plan for management of controlled waste (administrative control)	Minimises risk of storage, handling and disposal of controlled wastes to ALARP.	Cost of implementing procedures.	**Adopted**
Additional control measures				
N/A	Eliminate lifting of tote tanks and drums to the FPSO (elimination control)	Eliminates the potential for chemicals (within tote tanks and drum containers) being accidentally dropped or discharged to the marine environment during lifting.	Eliminating lifting would require FPSO and vessels storing more equipment and supplies onboard, and additional trips to shore. FPSO and vessels will not have enough deck space to store all required equipment, materials and supplies needed for operations.	**Not adopted** – not feasible to eliminate lifting.
N/A	Zero chemical bunkering via hose (elimination control)	Removes spill risk from hose operations.	Cost associated with large transfers of chemicals via drums or containers or significant modification of the FPSO to allow for additional chemical storage. Additional environmental risks (such as dropped object) associated with transferring chemicals via drums or containers to the FPSO. Health and safety risks with additional trips to port.	**Not adopted** – storage of chemicals on the FPSO would result in unacceptable transfer of environmental risks to health and safety and operational risks and would not eliminate risk of chemical spills to sea.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Eliminate ROV activities (elimination control)	Eliminates accidental hydrocarbon releases to the marine environment due to equipment failure.	ROVs contain minimal hydrocarbons (<5 L of hydraulic fluid) and as they are inspected and maintained, the risk of failure is very low. Using ROVs for IMMR activities reduces seabed disturbance, length of time in field, safety and environmental risks.	**Not adopted** – not technically or environmentally feasible to eliminate ROV activities. Hydrocarbon releases due to ROV failure has a very low risk and is considered sufficiently managed under ROV inspection and maintenance procedures (refer BAO-CM-7.4.1).
N/A	ROVs to use biodegradable hydraulic fluids only (substitution control)	Using a biodegradable hydraulic fluid reduces potential spill impacts as the oil is less persistent in the marine environment.	ROVs contain minimal hydrocarbons (<5 L of hydraulic fluid) that is likely to be a synthetic blend base oil (inherently biodegradable). ROVs are inspected and maintained, and the risk of failure is considered very low.	**Not adopted** – based on the cost to replace or modify the ROVs. The synthetic blend base oil that may be released due to ROV failure has a very low risk and is considered sufficiently managed under ROV inspection and maintenance procedures (refer BAO-CM-7.4.1).
N/A	Mercury Collection Pot (MCP) high-level alarm (engineering control)	Reduces risk of MCP overfilling by alerting operations personnel	Given the MCP capacity and relatively slow expected fill rate of the MCPs (5-7 months during steady operations) and the frequent (daily) manual reading of MCP magnetic level gauges (BAO-CM-6.4.7), a MCP high-level alarm is not considered to be required to reduce the risk of MCP overfilling to ALARP and is also not considered technically feasible.	**Not adopted** – cost outweighs the benefit.

7.4.4 Environmental impact assessment

Receptors	Physical environment and habitat Threatened, migratory or local fauna Socio-economic Cultural features
Consequence	I-Negligible

In the event of a minor hydrocarbon or chemical spill, the most likely spills would be between 50 L to 1 m³ (the size of the largest, most common storage container); but could possibly be approximately 4.5 m³ in the event of a dropped and ruptured tote tank during transfer. The worst-case size of spill is assumed to occur in OA1 with approximately 10m^3 of chemicals being discharged to sea during bunkering failure and the worst case toxicity of chemicals has been assumed for the impact assessment. **Physical environment and habitat** Impacts to water quality would be expected but due to the dispersive nature of the ocean environment and water depths, impacts to benthic habitats, including those of the Shelf break and slope of the Arafura Shelf KEF, are not predicted. Species associated with the continental slope and patch reefs that characterise this KEF – such as demersal fish, whale sharks, sharks and turtles – are unlikely to aggregate within OA1 due to the lack of seafloor features.	
OA2 overlaps two sections of the Oceanic Shoals Marine Park (Figure 3-9), being: • the Multiple Use Zone (IUCN Category VI) to the south of OA1 • the Habitat Protection Zone (IUCN Category IV) to the north-west of Bathurst Island. Water quality changes are expected to be short-term and localised due to the selection of environmentally acceptable chemicals, the relatively small size of the spill and the strong dilution forces of the open ocean environment. There will be no sustained impacts within the marine park from minor releases. Sub-lethal or lethal effects to infauna from releases near the seabed are considered unlikely, given the expected low concentrations and short exposure times, resulting in a negligible impact on the benthic habitats. Given the nature of the unplanned releases, the relatively small volumes that could be released to the marine environment, the high levels of dilution and the nature of the marine environment near the OAs, the consequence level for physical environment and habitat is considered to be I-Negligible.	
Threatened, migratory or local fauna Sensitive receptors that may be impacted include plankton, fish, marine turtles and mammals, and seabirds. Impacts to water quality will be localised and will occur for a short period while the release dilutes and disperses (as in, no sustained impacts). Marine turtles, seabirds or marine mammals may come in contact with the unplanned release for a short period should they transit through the OAs. A number of marine mammal species may be present in the region; however, no BIAs overlap the OAs, and it is not anticipated species will be present in significant numbers. While the marine mammals may transit through the OAs, contact with unplanned minor releases are unlikely to result in impacts greater than a minor short-term behavioural change, limited to one or a few individual species. Impact to populations or ecosystems are not anticipated. While OA1 does not overlap any marine turtle BIAs, the southern end of OA2 traverses nesting HC area for flatback and olive ridley turtles, overlaps a portion of the internesting BIA for flatback turtles, and is 11 km to the internesting BIA for olive ridley turtles. The southern end of OA2 also traverses through the Oceanic Marine Shoals Marine Park. Therefore, there may be an increase in number of individual flatback and olive ridley turtles in the southern end of OA2 (between June to September for flatback turtles and April to August for olive ridley turtles). While turtles may transit through the OAs (particularly OA2), contact with unplanned minor releases are unlikely to result in impacts greater than a minor short-term behavioural change, limited to one or a few individual species. Impact to populations or ecosystems are not anticipated. Given the nature of the unplanned minor releases, the relatively small volumes that could be released to the marine environment, the high levels of dilution and the nature of the marine environment near the OAs, the consequence level for Threatened, migratory or local fauna is considered to be I-Negligible. Given the negligible consequence on the physical environment or species, subsequent impacts to socio-economic receptors including commercial fishing, tourism, recreation, and cultural features relating to species with cultural significance are not anticipated.	
Socio-economic and cultural features Given the negligible consequence on species, subsequent risks or significant impacts to socio-economic receptors (including tourism and recreation) and cultural features relating to species with cultural significance, are not anticipated.	
Likelihood	C – Possible
The likelihood of minor hydrocarbon and chemical spills occurring with the control measures in place is considered to be 'Possible'.	
Residual risk	The residual risk is considered Very Low.

7.4.5 Demonstration of as low as reasonably practicable

Use of production chemicals, oils and hydraulic fluids (and similar) at the FPSO and on vessels are required to meet technical and operational requirements. All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the residual risk to a Very Low level. The proposed management controls are in accordance with the Santos risk management criteria and are considered appropriate to manage the risk to ALARP.

7.4.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – residual risk is ranked as Very Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ESD?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers principles of ESD: The impacts associated with unplanned minor releases do not result in 'threats of serious or irreversible harm' as detailed within the EPBC Act and biodiversity and ecological integrity will be maintained. • Conservative assumptions on scale of impact have been applied. The health, diversity and productivity of the environment will be maintained, including for future generations.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)?	Yes - Control measures implemented will reduce the risk of minor releases (surface and subsea) to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009b) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b) • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b) • Approved Conservation Advice for Balaenoptera borealis (sei whale) (TSSC, 2015c) **Recovery plans:** • Recovery Plan for the White Shark (Carcharodon carcharias) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013) • Recovery Plan for the Grey Nurse Shark (Carcharias taurus) (CoA, 2014) • Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) • Wildlife Conservation Plan for Seabirds (CoA, 2020) **Other management plans/guidelines**: • Marine bioregional plan for the NMR (CoA, 2012a). Habitat degradation or modification is identified in many conservation advice, however the nature of these discharges does not result in habitat degradation. For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes and the control measures outlined in Section 7.4.3. Santos considers that the level of risk of minor releases (surface and subsea) is not inconsistent with these plans.

	The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the Shelf break and slope of the Arafura Shelf KEF. Significant impacts to this KEF are not predicted. IMMR activities that may be required in the Oceanic Shoals Marine Park are not inconsistent with the IUCN principles and North Marine Parks Network Management Plan objectives (DNP, 2018a) or the DNP Commercial Activity Licence conditions, refer Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management measures are consistent with the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), MARPOL Annex V, MARPOL Annex III, Marine Order 91 (Marine Pollution prevention - oil), Marine Order 94 (Marine pollution prevention – packaged harmful substances), the International Maritime Dangerous Goods Code, and the Minamata Convention on Mercury 2013. Yes – through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.7.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – consultation with Relevant Persons for this activity has been considered when evaluating performance outcomes, control measures and associated performance standards. No specific issues, objections / claims or measures were raised by relevant persons in relation to this risk. Therefore, no additional performance outcomes or control measures have been adopted for this risk based on consultation with Relevant Persons. Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have been adopted in this EP. An additional performance outcome (EPO-19) has been adopted for minor release (surface and subsea) based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

The residual risk is assessed as Very Low. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential risks are considered acceptable.

7.5 Surface Release of Monoethylene Glycol (MEG) or Methanol from the FPSO

7.5.1 Description of event

Event	An unplanned surface release of MEG or methanol from the FPSO could occur within OA1 as a result of external impact (vessel collision) which ruptures an FPSO chemical tank. The maximum release volume would be 5,206 m³ of rich methanol over one hour. Vessel collision could occur due to factors such as human error, poor navigation, vessel equipment failure or poor weather. The FPSO is a double hull design with the MEG and methanol tanks encased in ballast tanks which would also require to be ruptured before penetrating MEG and methanol bulkheads. It is considered conservative to use the Australian Maritime Safety Authority (AMSA) guidelines (2015) for non-major collisions to determine the worst-case credible chemical spill volume. This takes 50% of the largest tank volume protected by double sides, which is the rich methanol tank (10,411 m³ capacity). The maximum credible release volume is therefore 5,206 m³ of rich methanol (including condensate). Other smaller releases may occur if other FPSO chemical tanks are ruptured, such as the smaller lean methanol tank or MEG tank (capacities of 6,246 m³). Due to the double hull design, the methanol and MEG tanks are encased in ballast tanks which would also require to be ruptured before penetrating methanol and MEG bulkheads. **Operational area 1:** The events are credible in OA1. **Operational area 2:** The events are not credible in OA2.
Extent	Water quality changes within OA1 are expected to recover within days following the spill.
Duration	**One-off:** An unplanned release may occur during HUC and initial start-up or operational activities within OA1. Release duration is limited to a short period (hours to days) depending on the time it takes to empty the chemical tank.

7.5.2 Nature and scale of environmental impacts

Potential receptors: Physical environment and habitat, threatened, migratory, or local fauna, socio-economic and cultural features.

7.5.2.1 Physical environment and habitat

There may be a temporary (hours to days) reduction in water quality in the immediate vicinity of the release of chemicals. Toxicity impacts to the marine fauna from the spill are likely be confined to a localised area immediately surrounding the release location due to:

- Both methanol and MEG being on the OSPAR Convention Pose Little or No Risk to the Environment (PLONOR) List, the chemicals are readily biodegradable and will not bioaccumulate, exhibiting a low toxicity concern for aquatic organisms and highly soluble in water.
- Both methanol and MEG will have been risk assessed for their suitability for discharge using the Santos chemical assessment process (Section 2.7.3.8) and be selected for low toxicity and bioaccumulation potential.
    - The absence of significant environmental sensitivities at OA1.
    - Strong ocean currents that mean the release will rapidly dilute upon discharge, so the duration of exposure of chemicals to marine fauna will be minimal.

7.5.2.2 Threatened or Migratory fauna

A large MEG or methanol release into surface water would have some immediate impacts to the biota in the direct vicinity of the spill. However, because of its properties, methanol would rapidly dissipate into the environment, and within short distances from the release would reach levels where biodegradation would rapidly occur.

Santos has considered information contained in relevant recovery plans and approved conservation advice for fauna that identify deteriorating water quality and chemical discharge as a potential threat (Table 3-13). This includes the objectives and actions in the Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017). The activities and impacts are not inconsistent with the recovery plans and conservation advice.

7.5.2.3 Cultural features

No First Nations people feedback was provided about potential impacts from the release of MEG to any geographically specific cultural features (excluding marine fauna species) during consultation (refer to Section 4.7). Any concerns related to the potential for impacts to cultural features from the release of MEG are associated with direct or indirect impacts to culturally significant marine fauna species (refer to Section 3.7.11).

Potential impacts to marine fauna that have cultural significance as totems or as cultural food sources, could result in reduced First Nations access to food through traditional hunting and fishing, and in accordance with First Nations cultural beliefs, if totemic species (e.g., turtles) are impacted by the Activity some believe this in turn can impact First Nations people and make them sick. Section 7.5.2.2 describes the potential impact to marine species of cultural significance.

7.5.3 Environmental performance outcomes and control measures

The EPO relating to this event is:

- No injury of, or mortality to, EPBC Act 1999 listed marine fauna or marine fauna listed as threatened species under the *Territory Parks and Wildlife Conservation Act 1976* (NT) as a result of the Activity. (EPO-08)
- Zero unplanned discharge of hydrocarbons or chemicals to the marine environment from the Activity. (EPO-18)
- No significant impacts to cultural features from the Activity (EPO-19).

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this event are shown in Table 7-6 to demonstrate the potential risks are ALARP. Control measures that are adopted have associated EPSs and measurement criteria which are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 7-6: Control measures evaluation for chemical spills

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-7.5.1	FPSO hull integrity (engineering control)	Reduces the risk of a release from vessel collision as the FPSO hull is double-sided and double-bottomed, providing two physical barriers between the chemical tanks and the marine environment.	The FPSO double-hulled design is already in place. Costs associated with maintaining hull integrity are negligible.	**Adopted** – the FPSO is double sided by design.
BAO-CM-6.1.2	Vessels equipped and crewed in accordance with Australian maritime requirements, including Marine Order 30 (Prevention of Collisions) and Marine Order 21 (Safety and Emergency Arrangements) (administrative control)	Ensures contracted vessels are operated, maintained, and crewed in accordance with industry standards and regulatory requirements. Ensures vessels meet Marine Assurance Standards to reduce the likelihood of vessel collision (such as minimum and working lighting for maritime safety).	Regulatory requirement and therefore the cost is not identified as an issue.	**Adopted** – regulatory requirement, must be adopted.
BAO-CM-6.6.2	Petroleum safety zone administered by NOPSEMA in accordance with the OPGGS Act and	The petroleum safety zone PSZ alerts other marine users to the presence of the FPSO. Third-party vessels (excluding the offtake tanker) are not	Negligible costs. Other marine users may be temporarily excluded from areas, disrupting their activities.	**Adopted** –standard requirement.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	cautionary area established (administrative control)	permitted to enter the PSZ, thereby reducing the potential for vessel interaction and collision.		
BAO-CM-7.4.3	FPSO and vessel spill response plans (SOPEP/SMPEP) (administrative control)	Implements onboard response plans to deal with unplanned chemical releases and spills quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents. Generally undertaken by vessel contractor so time for Santos personnel to confirm and check SOPEP/SMPEP in place	**Adopted** – regulatory requirement, must be adopted.
BAO-CM-6.4.10	Barossa Facilities and vessels planned maintenance system to confirm equipment integrity is maintained in accordance with manufacturers guidelines. (administrative control)	Reduces risk of vessel collision and bunkering incidents because equipment is operating within planned maintenance requirements.	Operational costs and labour or access requirements of undertaking maintenance	**Adopted.**
BAO-CM-7.1.1	Implement standards and procedures for lifting equipment to reduced risk of dropped objects during lifting. (administrative control)	Impacts to the environment are reduced by preventing dropped objects and dragged objects during lifting operations. Administrative costs to update induction materials and train personnel.	Cost of implementing procedures.	**Adopted.**
BAO-CM-6.4.5	HSE inductions will include applicable environmental requirements (administrative control)	Ensures that crew are aware of the stringent EP, Santos, and legislative requirements. Ensures personnel as suitably aware of cultural features and values.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted.**
BAO-CM-7.1.6	Barossa FPSO Facility Safety Case (administrative control)	Details prevention, detection, mitigation and recovery measures provided to manage the risks. Details alarms and required emergency response in the event of a loss of containment.	Administrative costs of preparing and implementing the Safety Case.	**Adopted –** Benefits considered to outweigh costs.
Additional control measures				
NA	Eliminate vessel to vessel lifting in field (elimination control)	Reduces the risk of dropped objects.	Eliminating lifting would require vessels storing more equipment and supplies on board, and/or additional trips to shore. Vessels will not have enough deck space to store all required equipment, materials, supplies	**Not adopted –** not feasible to eliminate lifting in the field.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
			needed for the duration of the Activity.	
N/A	Contract a standby vessel 24/7 during operations to aid third-party vessel detection at sea (protective control)	Standby vessel to monitor the cautionary zone and be equipped with an Automatic Identification System (AIS) to aid vessel detection at sea, and radar to aid in the detection of approaching third-party vessels. Reduces the potential for vessel interaction and collision.	High cost associated with contracting a standby vessel 24/7. Costs of operating navigational equipment. Additional risks from the vessel in the 500 m PSZ.	**Not adopted** – high costs which grossly outweigh the environmental benefit. Additional risks exist from additional vessel use in the PSZ.

7.5.4 Environmental impact assessment

Receptors	Physical environment and habitat Threatened, migratory or local fauna Socio-economic Cultural features
Consequence	I-Negligible
Physical environment and habitat Impacts to water quality would be expected but due to the dispersive nature of the ocean environment and water depths, impacts to benthic habitats (including those of the Shelf Break and Slope of the Arafura Shelf KEF) are not predicted. Species associated with the continental slope and patch reefs that characterise this KEF (such as demersal fish, whale sharks, sharks and turtles) are unlikely to aggregate within OA1 due to the lack of seafloor features. Water quality changes are expected to be short-term and localised due to both methanol and MEG being PLONOR listed chemicals. Given the nature of the chemical releases, and the behaviour of these releases in the marine environment (such as the high levels of dilution and mixing), the consequence level for physical environment and habitat is considered to be I-Negligible	
Threatened, migratory or local fauna Sensitive receptors that may be impacted include plankton, fish, marine turtles and mammals, and seabirds. Impacts to water quality will be localised and will occur for a short period while the chemicals dilute and disperse (as in, no sustained impacts). Marine turtles, seabirds or marine mammals may come into contact with the unplanned release for a short period should they transit through the OAs. A number of marine mammal and marine turtle species may be present in the region; however, no BIAs overlap OA1, and it is not anticipated that species will be present in significant numbers. While the marine mammals may transit through the release, contact with MEG and methanol are unlikely to result in impacts greater than a minor short-term behavioural change, limited to one or a few individual species. Impact to populations or ecosystems are not anticipated. Given the nature of the chemical releases, and the behaviour of these releases in the marine environment (such as the high levels of dilution and mixing), the consequence level for Threatened, migratory or local fauna is considered to be I-Negligible.	
Socio-economic and cultural features Given the negligible consequence on species, subsequent risks or significant impacts to socio-economic receptors (including tourism and recreation) and cultural features relating to species with cultural significance, are not anticipated.	
Likelihood	C-Possible
The likelihood of a chemical release occurring due to a vessel collision is limited, given the set of mitigation and management controls in place. The likelihood of a vessel collision releasing chemicals to the environment resulting in a negligible consequence is considered to be possible.	
Residual risk	The residual risk is considered **Very Low**.

7.5.5 Demonstration of as low as reasonably practicable

Use of MEG and methanol at the facility are required to meet technical and operational requirements. All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. The proposed management controls are in accordance with the Santos risk management criteria and are considered appropriate to manage the risk to ALARP.

7.5.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – residual risk is ranked as Very Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ESD?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers principles of ESD: • the impacts from the worst-case credible spill scenarios are inherently inconsistent with principles of ESD, given the nature and scale of impacts. Control measures are applied to ensure the impacts and risks from activities are managed to ALARP and an acceptable level.

Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)?	Yes - Control measures implemented will reduce the risk of a surface release of MEG to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009b) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b) • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b) • Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c) **Recovery plans:** • Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013) • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (CoA, 2014) • Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) • Wildlife Conservation Plan for Seabirds (CoA, 2020) **Other management plans/guidelines**: • Marine bioregional plan for the NMR (CoA, 2012a). Habitat degradation or modification is identified in many conservation advices, however the nature of these discharges does not result in habitat degradation. Pollution is identified in a number of plans but pertains to more toxic discharges and therefore is not considered applicable here. For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes and the control measures outlined in Section 7.5.3. Santos considers that the level of risk of a surface release of MEG is not inconsistent with these plans. Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the Shelf break and slope of the Arafura Shelf KEF. Significant impacts to this KEF are not predicted.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*, *Navigation Act* 2012, Marine Order 30: Prevention of Collisions, Marine Order 21: Safety of Navigation and Emergency Procedures, and the Convention on the International Regulations for Preventing Collisions at Sea 1972 (COLREGS). Through acceptance of this EP, legislative and regulatory requirements will be met as per Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.

Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – consultation with Relevant Persons for this activity has been considered when evaluating performance outcomes, control measures and associated performance standards. No specific issues, objections / claims or measures were raised by relevant persons in relation to this risk. Therefore, no additional performance outcomes or control measures have been adopted for this risk based on consultation with Relevant Persons. Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs have been adopted in this EP. An additional performance outcome (EPO-19) has been adopted for surface release of MEG based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

The residual risk is assessed as Very Low. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential risks are considered acceptable.

7.6 Subsea Release of Gaseous Hydrocarbon

7.6.1 Description of event

Event	Subsea release of gaseous hydrocarbon from: • part of the Barossa GEP within OA1 impacted by support operations, drilling activities or external event • part of the Barossa GEP within OA2 impacted by IMMR activities or external event. A subsea release of gaseous hydrocarbon within OA1 and OA2 could be caused by the following: • External impact from the following sources: • dropped objects from supply / support vessel / Campaign vessels (including LWI and USV)/ MODU (OA1 only) • MODU anchor drag during drilling activities (OA1 only) • inspection, monitoring, maintenance and repair (IMMR) campaigns • future construction • equipment failure (e.g., fatigue / stress, corrosion (internal and external), erosion) • operating outside design envelope (e.g., overpressure, exceeding design temperature) • mooring system movement / failure • natural hazards (e.g., earthquake) • structural failure. A gas plume would be released from the Barossa GEP in the event of a rupture. The plume would move towards the surface, with some of the gas becoming dissolved in seawater as the plume rises. A worst-case rupture would lead to the formation of a gas cloud, which would rapidly disperse in the atmosphere. Methane (the main component of the dry gas) is lighter than air and would rise into the atmosphere, away from the release location. The scale of the Barossa GEP leak is dependent on the nature of the rupture. Small 'pinhole' leaks will result in a stream of bubbles which may dissolve before reaching the surface. A major rupture (e.g. catastrophic failure) would result in the discharge of a volume 1,080 MMscf of dry gas forming a plume in the water column and dispersing into the atmosphere. A catastrophic failure is considered to be the worst-case credible release from the Barossa GEP. Discharge of a maximum volume up to 1,080 MMscf (24,030 tonnes) of dry gas (ref Pipeline Consequence Modelling Report) forming a large plume in the water column and dispersing into the atmosphere. As the Barossa GEP transports dry natural gas with no liquid phase hydrocarbons, a loss of containment would not release any liquid phase hydrocarbons to the environment. Given that the contents of the pipeline consist entirely of dehydrated gas, condensation of gas phase components upon release is not expected due to the pressure and temperature differential between the pipeline contents and the receiving environment. This risk is only considered credible once HUC and initial start-up has been completed and normal operations has commenced as the GEP will be operating with gaseous hydrocarbons.
Extent	The dry natural gas within the Barossa GEP is contained at a relatively high pressure of up to 180 barg. The extent of a leak from the Barossa GEP would depend on the nature of the rupture and expected to be limited to within hundreds of metres of the rupture location. Small 'pinhole' leaks may result in a stream of bubbles that could dissolve before reaching the surface.
Duration	Localised and short-term reduction in water and air quality for a short period (within days)

Dry natural gas

The Barossa GEP consists of dry natural gas that is predominantly methane (approximately 88%), carbon dioxide (up 6%), hydrogen sulphide (0.0015%) and approximately 6% of other organic compounds (including ethane, propane, butane and isobutane, and nitrogen) (Santos, 2024). However, the gas composition can vary. Physical properties indicate that dry natural gas is highly flammable and volatilise from the aquatic environment rapidly. It is noted that in practice, acute and chronic effects would not typically be observed (Shell, 2019).

7.6.2 Nature and scale of environmental impacts

Potential receptors: Physical environment and habitat, threatened, migratory or local fauna, socio-economic and cultural features.

7.6.2.1 Physical environment and habitat

A pipeline rupture and subsequent release of dry natural gas would result in a localised and short–term reduction in water and air quality. The plume would move towards the surface as methane (the main component of dry natural gas) is lighter than air, with some of the gas becoming dissolved in seawater as the plume rises. Any dissolved gas in the water column is expected to disperse rapidly. A worst-case rupture would lead to the formation of a minor gas cloud, which would rapidly disperse in the atmosphere. Potential changes to water and air quality are expected to be limited to within hundreds of meters of the rupture site and to be short term (within days).

7.6.2.2 Threatened, migratory or local fauna

Due to the limited solubility of the gas and waters depths, seabed disturbance impacts (e.g. scouring due to turbulence around the release) are expected to be limited to the immediate vicinity of a pipeline rupture. Transient fauna are likely to avoid the water turbulence which would be caused in the event of a rupture. A gas cloud may potentially impact air-breathing fauna, such as marine mammals, reptiles, and birds. Animals in the immediate vicinity of the release may be at risk of asphyxiation, potentially resulting in death. However, marine mammals, turtles and birds are very unlikely to be affected, given the rapid gas dispersion into the atmosphere. This potential effect would be highly localised (within 500 m) with a short duration and rapidly dispersed within the environment.

The recovery plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) identified pollution as a threat. However, pollution sources were primarily related to agricultural, terrestrial industrial and domestic sources. The accidental chemical releases are expected to be of very short duration and localised extent with no persistence in the environment.

Conservation advice for sawfishes and the northern river shark identified habitat degradation and modification as potential threats; their habitat is not expected to be significant around the OAs given their preference for inshore and riverine environments. Pollution is also identified as a threat to a number of cetaceans in approved conservation advice (fin whales, sei whale and bird species); but is focused on toxic pollutants and oil pollution as the potential impacts and therefore the potential unplanned gaseous hydrocarbon release here is not expected to go against the recovery plans and conservation advice for these species.

7.6.2.3 Socio-economic

A dry natural gas cloud could form an explosive mix that, if ignited, results in injury/death and property damage. A gas cloud could risk the health and safety of other users, such as fishers (traditional and commercial), tourism and recreational users. In addition, an unplanned release would enact an emergency response plan to ensure that other marine users are advised of the hazard.

7.6.2.4 Cultural features

No First Nations people feedback was provided about potential impacts from an unplanned dry natural gas release to any geographically specific cultural features (excluding marine fauna) during consultation (refer to Section 4.7). Any concerns related to potential impacts to cultural features from an unplanned dry gas release are associated with the direct impacts to culturally significant marine fauna species (refer to Section 3.7.11). In accordance with First Nations cultural beliefs, if totemic species (e.g. turtles) are impacted by the Activity some believe this in turn can impact First Nations people and make them sick. Section 7.6.2.2 describes the potential impacts to marine species.

7.6.3 Environmental performance outcomes and control measures

The EPO relating to this event is:

- No injury of, or mortality to, EPBC Act 1999 listed marine fauna or marine fauna listed as threatened species under the *Territory Parks and Wildlife Conservation Act 1976* (NT) as a result of the Activity. (EPO-08)
- Atmospheric emissions associated with the Activity will me*et al*l regulatory source emission standards. (EPO-09)
- Zero unplanned discharge of hydrocarbons or chemicals to the marine environment from the Activity. (EPO-18).
- No significant impact to cultural features from the Activity (EPO-19)
- No impacts to underwater cultural heritage from the Activity (EPO-20)

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this event are described in Table 7-7 to demonstrate that potential risks are ALARP. Control measures that are

adopted have associated EPSs and measurement criteria and are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 7-7: Control measures evaluation for unplanned release: dry natural gas

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-6.6.4	Activity undertaken in accordance with Santos HSE management and marine vessel vetting processes (Santos' Offshore Marine Assurance Procedure) (administrative control)	Ensures contracted vessels are operated, maintained, and crewed in accordance with industry standards and regulatory requirements.	Costs associated with personnel time in checking vessel.	**Adopted** – benefit of assuring vessels outweighs procedure compliance costs.
BAO-CM-6.1.2	Vessels equipped and crewed in accordance with Australian maritime requirements, including Marine Order 30 (Prevention of Collisions) and Marine Order 21 (Safety and Emergency Arrangements) (administrative control)	Ensures vessels meet Marine Assurance Standards to reduce the likelihood of vessel collision (such as minimum and working lighting for maritime safety).	Cost associated with implementing procedures.	**Adopted** – benefit of assuring vessels outweighs procedure compliance costs.
BAO-CM-6.4.10	Barossa Facilities and vessels planned maintenance system to confirm equipment integrity is maintained in accordance with manufacturers guidelines. (administrative control)	Ensures integrity management for the FPSO and subsea production system.	High cost of maintaining equipment and managing the maintenance system.	**Adopted –** environmental benefits of ensuring FPSO and subsea production system maintained outweigh the costs.
BAO-CM-6.61	Notify AHS and AMSA MSI prior to relevant Activity (Administrative control)	Maritime notifications ensure marine users are informed of the proposed activities, reducing the likelihood of unplanned interactions. Subsea infrastructure will be clearly marked on Australian nautical charts published by the AHO alerting other marine users to the presence of Activity vessels and exclusion zones and restrictions, thus reducing the likelihood of vessel collision and fishing gear snagging.	Cost and time to perform notifications.	**Adopted** – benefits considered to outweigh costs.
BAO-CM-7.1.1	Implement standards and procedures for lifting equipment to reduced risk of dropped objects during lifting. (administrative control)	Impacts to the environment are reduced by preventing dropped objects and dragged objects during lifting operations. Administrative costs to update induction	Cost of implementing procedures.	**Adopted** – environmental benefits of preventing dropped objects outweigh the procedural compliance costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		materials and train personnel.		
BAO-CM-7.1.2	Dropped objects (incident) management (administrative control)	Impacts to the environment are reduced by retrieving dropped objects unless the environmental consequences of the dropped object are negligible or there are risks to safety.	Cost of implementing procedures.	**Adopted. -** Benefits of ensuring procedures are developed and followed outweigh the costs of personnel time.
BAO-CM-7.1.6	Barossa FPSO Facility Safety Case (administrative control)	Details prevention, detection, mitigation and recovery measures provided to manage the risks. Details alarms and required emergency response in the event of a loss of containment.	Administrative costs of preparing and implementing the Safety Case.	**Adopted –** Benefits considered to outweigh costs.
BAO-CM-7.6.1	Emergency response plan (ERP) (administrative control)	This control mitigates the impact of a potential leak in the Barossa GEP. The ERP is based on the safety case for the pipeline.	Cost of implementing the procedure.	**Adopted-** Benefits of ensuring procedures are developed and followed outweigh the costs of personnel time.
BAO-CM-7.6.2	Pipeline operating procedures (administrative control)	This control is effective in maintaining the integrity of the Pipeline by providing the limitations within which the Pipeline can be safely operated. This is done by relying on design specifications and standards, which are well-developed through extensive experience within Santos and the industry more broadly.	Personnel costs of ensuring appropriate procedures are in place and followed, including compliance inspections/reviews.	**Adopted -** Benefits of ensuring procedures are developed and followed outweigh the costs of personnel time.
BAO-CM-7.6.3	Pipeline Integrity Management Plan (administrative control)	This control is effective in maintaining the integrity of the Pipeline by ensuring preventative and reactive inspections and maintenance/repairs are performed using a risk-based approach.	Personnel costs of ensuring appropriate procedures are in place and followed, including compliance inspections / surveys / reviews. Survey expenses.	**Adopted -** Benefits of ensuring procedures are developed and followed outweigh the costs of personnel time and expenses.
BAO-CM-7.6.4	Gas Export Pipeline Safety Case (administrative control)	Details alarms and required emergency response in the event of a loss of containment.	Administrative costs of preparing document.	**Adopted –** Benefits considered to outweigh costs.
BAO-CM-7.6.5	Repairs to the Pipeline carried out to design specification	Repairs undertaken incorrectly may increase the likelihood	Costs of repairs to be carried out in accordance with the	**Adopted –** benefits outweigh the costs of

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	(engineering control)	of a failure with environmental and safety impacts.	Offshore Standard for Submarine Pipeline Systems (DNV-OS-F101).	undertaking appropriate repairs
BAO-CM-7.6.6	MODU station keeping system during concurrent activities (engineering control)	Maintains the MODU at the desired location and provides for minimising length of mooring line deployed during anchor installation, therefore reducing potential risks to seabed habitat.	No cost/issue identified	**Adopted** – safety critical feature that maintains the MODU on location.
BAO-CM-7.6.7	MODU identification systems during concurrent activities (engineering control)	MODU automatic identification systems (AIS) aid in their detection at sea by third party vessels, thereby reducing the potential for interaction and collision.	Standard maritime navigational equipment; SOLAS regulated and therefore the cost is not identified as an issue.	**Adopted** – it is a regulatory requirement.
BAO-CM-7.6.8	MODU move procedure during concurrent activities (administrative control)	Eliminates risk of accidental contact with the seabed during MODU move.	Standard operating procedure.	**Adopted** – integral to safe MODU move procedure
Additional control measures				
N/A	Eliminate lifting in the operational area (elimination control)	Reduces the risk of dropped objects.	Eliminating lifting would require vessels storing more equipment and supplies on board, and/or additional trips to shore. Vessels will not have enough deck space to store all required equipment, materials and supplies needed for the duration of the Activity.	**Not adopted** – not feasible to eliminate lifting in the field.

7.6.4 Environmental impact assessment

Receptors	Physical environment and habitat Threatened, migratory or local fauna Socio-economic Cultural features
Consequence	III – Moderate

Physical environment and habitat

Impacts to water and air quality would be expected, but due to the dispersive nature of the ocean environment and water depths, impacts are expected to be short-term and localised. Potential impacts to the physical environment and habitat (water and air quality) are considered to be III – Moderate within OA2 due to the presence of the AMP and shallower waters whereas in OA1, the potential impacts from a large or small release is considered II - Minor.

Threatened, migratory or local fauna

A dry natural gas release is unlikely to have widespread ecological effects, given the nature of the product, short duration and the limited volume that could be released, and the transient nature of marine fauna in this area. This unplanned event is not considered to have the potential for significant impacts to marine fauna species at the population level. Potential impacts to marine fauna are considered to be III – Moderate within OA2 due to the presence of the AMP and shallower waters with additional marine fauna present, whereas in OA1, the potential impacts to fauna from a large or small release is considered II - Minor.

Socio-economic

Subsequent impacts to socio-economic receptors including commercial fishing and other marine users are not anticipated to be significant. It was assessed as II – Minor within OA1 due to the lack of other marine users in the vicinity and III – Moderate in OA2 given the increased number of other users. **Cultural features** For assessment of impacts to marine species of cultural significance, refer to the above paragraphs.	
Likelihood	A - Remote
A pipeline rupture incident, with the control measures in place, is considered to be remote in OA2 due to the volume of 3rd party vessels that are not under Santos control that may be present. This was the worst case consequence assessed between OA1 and OA2.	
Residual Risk	The residual risk is considered **Very Low.**

7.6.5 Demonstration of as low as reasonably practicable

A thorough set of controls has been proposed to minimise the risk of damage to the existing Barossa GEP and subsequent environmental consequences should they occur.

All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the residual risk to very low. The proposed management controls are in accordance with Santos' risk management criteria and are considered appropriate to reduce the risk to ALARP.

7.6.6 Acceptability evaluation

Is the risk ranked between Very Low and Medium?	Yes – residual risk is ranked Very Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline, which considers principles of ESD. The impacts from the spill scenarios are inherently inconsistent with principles of ESD, given the nature and scale of impacts. Control measures are applied to ensure the impacts and risks from activities are managed to ALARP and an acceptable level.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes - Control measures implemented will reduce the risk of a a subsea release of gaseous hydrocarbon to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009b) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b) • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b) • Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c) **Recovery plans:** • Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013) • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (CoA, 2014)

	• Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) • Wildlife Conservation Plan for Seabirds (CoA, 2020) **Other management plans/guidelines**: • Marine bioregional plan for the NMR (CoA, 2012a). For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes and the control measures outlined in Section 7.6.3. Santos considers that the level of risk of a subsea release of gaseous hydrocarbon is not inconsistent with these plans. The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the Shelf break and slope of the Arafura Shelf KEF. Significant impacts to this KEF are not predicted.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with OPGGS Regulations, including the Safety Case which demonstrates how the risks will be reduced to ALARP, *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*, *Navigation Act 2012*, *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, and. Through acceptance of this EP, legislative and regulatory requirements will be met as per Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with AMSA, AAPA, the ECNT, the ACF and Ngoy Garmak Consultative Committee, have been considered when evaluating performance outcomes, control measures and associated performance standards (see Section 4.7 for further information). No specific control measures were raised by relevant persons in relation to this risk. However, AMSAs marine safety division did advise Santos of the required maritime safety measures. Santos has confirmed that the required maritime safety measures identified by AMSA have been incorporated into this EP (refer to BAO-CM-6.1.2 and BAO-CM-6.6.1). Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have been adopted in this EP. Additional performance outcomes (EPO-19 and EPO-20) have been adopted for a subsea release of gaseous hydrocarbons based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

No Relevant Persons concerns have been raised regarding this aspect, and the proposed controls will reduce the residual risk to very low and ALARP. Therefore, Santos considers the residual risk associated with the unplanned dry natural gas release to be reduced to an acceptable level.

The potential impacts from a dry gas release from a pipeline rupture are broadly acceptable based on the residual risk ranking and considerations outlined above.

7.7 Unplanned Liquid Hydrocarbon Release Scenarios

7.7.1 Credible release scenarios

Unplanned events may occur during the Activity, resulting in the potential release of liquid hydrocarbons (Barossa condensate, MGO/MDO or HFO) to the marine environment. The release scenarios assessed in Sections 7.7.7 to 7.7.11 are summarised in Table 7-8 with an environmental impact assessment for the worst case scenario for each liquid hydrocarbon type provided in the sections below. The Barossa condensate and HFO scenarios are only considered credible following the completion of HUC and initial start-up as hydrocarbons are introduced into the system and normal operations commence. MDO and MGO spills are considered credible during HUC and initial-start up activities as vessel activities are undertaken in OA1.

Table 7-8: Summary of credible scenarios for unplanned release of liquid hydrocarbons

Scenario	Volume	Release duration	Scenario assumptions
Barossa Condensate			
Release of condensate from a subsea system rupture from a major loss of integrity, causing a large leak.	9.8 m^3	Approximately 1 hour	Relevant to OA1 only (FPSO and subsea system not present in OA2). This scenario assumes it takes 45 minutes to isolate identified leak and 15 minutes for residual fluids to be released. Note: Fishing gear impacts or snags are not considered credible, due to the water depth and absence of bottom trawl fishing within OA1.
Release of condensate from a subsea system rupture as a result of anchor/chain drag or dropped object during Drilling or SURF Installation activities, causing a large leak.	9.8 m^3	Approximately 1 hour	Relevant to OA1 only (MODU and subsea system not present in OA2). This scenario assumes it takes 45 minutes to isolate identified leak and 15 minutes for residual fluids to be released.
Subsea release of condensate from a production well as a result of intervening the well via light well intervention vessel.	5.01 m^3	Approximately 2 hours	This scenario assumes failure of a dynamic positioning barrier which is active when intervening the well with electric line in the hole. This scenario considers: • The Surface-controlled subsurface safety valve (SCSSSV) has been locked open to facilitate running electric line to the bottom of the completion tubing • The stuffing box at the top of the Subsea Intervention Device (SID) develops a leak that cannot be controlled, equivalent to 0.5” in diameter. • Wireline toolstring is recovered back into the lubricator allowing multiple BOP elements on the SID and/or VXT valves to be closed, either remotely or via ROV.
Subsea release of condensate from a production well as a result of anchor/chain drag or dropped object during Drilling or SURF activities.	850 m^3	90 days	Relevant only to OA1. Scenario assumes that the force applied to the production wellhead from anchor/chain drag or dropped object is not sufficient enough to completely separate the wellhead and the subsea tree off the well. It follows that since the wellhead and subsea tree remain in place, an uncontrolled release of well fluids through a full-bore blowout is not a credible scenario. The worst-case failure mechanism as a result of this event would be stress cracking at the bend point combined with failure of a primary barrier. This scenario presents a consistent spill rate at 59 bbl/day. (9.44 m^3 / day) based on flow modelling at virgin pressures as per assumptions below. Assumed leak path is as follows: • Flow up the completion • The SCSSSV fails to close • Leak through a 1mm x 30mm crack (0.25in equivalent diameter) in the tubing • Leak through crack (0.35in equivalent diameter) in the 11-7/8” casing • Leak through a crack (0.5in equivalent diameter) in the 16” casing • Discharge at mudline.

Scenario	Volume	Release duration	Scenario assumptions
			Relief well drilling is the primary strategy to control a well leak that cannot be controlled via a controlled shutdown and/or on-site systems. A leak remediated through the drilling of a relief well, will take 90 days to arrange, drill, construct and kill the well in the worst case. This scenario assumes detection within one day.

Subsea release of condensate from a production well as a result of an internal influence, such as superposition of failures of multiple barriers.	692 m³	90 days	Relevant to OA1 only (production wells are not present in OA2).
			This scenario assumes superposition of failures of multiple barriers – production packer, production casing and cement bonds. The hydrocarbons should be maintained with the primary barrier envelope during production (9-5/8 inch casing, production packer, 8-5/8 inch tubing and tubing hanger).
			This scenario presents a consistent spill rate at 48bbl/day. (7.68 m^3 / day) based on flow modelling at virgin pressures as per assumptions below.
			This scenario considers the following internal influences:
			• the primary tubing and packer barrier fails (as in, annular pressure build-up above maximum allowable) and the 11-7/8 inch by 9-5/8 inch casing becomes live through a failed connection in the 8-5/8 inch tubing (tubing collapse)
			• the secondary barrier fails through a thread leak in the 11-7/8 inch casing above the top of the cement where the 16 inch casing (B-Annulus) becomes live
			• hydrocarbon (gas) will leak through a failed 16 inch casing connection at the mudline.
			• In this scenario the leak path is:
			  ○ flow through lower completion to bottom of tubing
			  ○ flow through 1 mm by 30 mm failed connection on tubing
			  ○ flow up 11-7/8 inch by 8-5/8 inch annulus to mudline
			  ○ flow through 1 mm by 30 mm failed connection on 11-7/8 inch casing
			  ○ flow through 1 mm by 30 mm failed connection on 16 inch casing
			  ○ hydrocarbon release at the mudline.
			This scenario would be identified quickly as the A-annulus pressure is monitored by the FPSO. In the event of tubing failure, an ROV could confirm if subsequent barriers had failed in less than one month. Relief well drilling is the primary strategy to control a well leak that cannot be controlled via a controlled shutdown and/or on-site systems. A leak remediated through the drilling of a relief well, will take 90 days to arrange, drill, construct and kill the well in the worst case. All wells are anticipated to behave in a similar way during an unplanned leak or spill event.

Surface release of condensate from the FPSO or offtake tanker as a result of an external impact (vessel collision), which ruptures a condensate storage tank.	16,700 m³	1 hour	**Worst-case unplanned condensate release event in OA1 assessed in Section 7.7.7**
Surface release of condensate from a rupture or leak in the offtake equipment as a result of an external impact (station loss) or internal influence (such as integrity loss of equipment).	465 m³	5 minutes	Relevant to OA1 only. Loss of containment from offtake equipment is credible under the assumption of multiple and simultaneous failures of controls in place. These may include vessel impact, operator error, loss of vessel positioning, or loss of integrity of equipment. Major loss of containment would be detected and result in almost instantaneous emergency shutdown. The maximum credible spill is calculated based

Scenario	Volume	Release duration	Scenario assumptions
			on a transfer rate of 5,000 m³/hr multiplied by 5 minutes of flow (continuous supervision) plus the volume in the offtake hose (48.6 m³). The maximum credible release is therefore 465 m³ over five minutes.
Surface release of condensate from process upset on FPSO (liquid carry-over to flare).	6 m³	5 minutes	Relevant to OA1 only. As the FPSO and process is continuously staffed and there are barriers in place, it is considered conservative to use a five-minute response time to liquid spilling from flare, based on a process upset being almost immediately detected by the FPSO control room monitoring. The maximum credible spill is calculated based on 100% maximum flow (production) rate of 1,750 m³/day for five minutes. The maximum credible release is therefore 6 m³ over five minutes.
MGO and MDO			
Surface release of MGO from the FPSO as a result of external impact (vessel collision), which ruptures an FPSO MGO tank.	2,418 m³	1 hour	**Worst-case MGO event in OA1 assessed in Section 7.7.9.**
Surface release of MGO due to leaking or ruptured bunker transfer equipment.	10 m³	3 minutes	Could occur in OA1 only (FPSO not present in OA2). It is credible for MGO to be spilled directly or indirectly (via deck drainage) to the marine environment in the event of leaking or ruptured bunker transfer equipment as a result of: • bunkering hose failure (from erosion, corrosion, integrity failure) • supply vessel drive-off during bunkering • maintenance or operator error • process conditions exceeding design limits (high pressure). MGO released before the shutoff of fuel pumping as well as fuel remaining in the transfer line may be released to the environment. A total rupture or failure of bunker transfer equipment such as the hose or fittings during bunkering, combined with a failure in procedure to shut off fuel pumps, for a period of up to three minutes may result in approximately 10 m³ MGO reaching the marine environment. MGO bunkering is a monitored event, with a person monitoring on the vessel and the FPSO, allowing for almost immediate shutdown.
Surface release of MDO from a vessel as a result of an external impact (vessel collision), which ruptures an MDO tank.	500 m³	1 hour	**Worst-case MDO event in OA2 assessed in Section 7.7.10.**
HFO			
A surface release of HFO from the offtake tanker as a result of external impact (vessel collision), which ruptures an HFO tank on the offtake tanker.	460 m³	1 hour	**Worst-case HFO event in OA1 assessed in Section 7.7.11.**

7.7.2 Spill modelling overview

The spill modelling (RPS, 2023c, d) was performed using an advanced three-dimensional trajectory and fates model: Spill Impact Model Application Package (SIMAP). The SIMAP model calculates the transport, spreading, entrainment and evaporation of spilled hydrocarbons over time, based on the prevailing wind and current conditions and the physical and chemical properties. The modelling does not take into consideration any of the spill prevention, mitigation and response capabilities that would be implemented in response to the spill.

The modelling study was performed in stages. Firstly, a ten-year wind and current dataset (2010 to 2019) that includes the combined influence of large-scale ocean and tidal currents was prepared. Secondly, the currents, local winds and detailed hydrocarbon characteristics were used as inputs in SIMAP to simulate the drift, spread, weathering and fate of the spilled hydrocarbon.

Modelling was conducted using a stochastic (or probabilistic) approach, which involved running 100 spill simulations per season (summer [October to the following March]; transitional periods [April and September] and winter [May to August]), with each simulation having the same spill information (spill volume, duration and composition of hydrocarbons) but a randomly selected start time to ensure a range of wind and current conditions were assessed. Once all 300 simulations were run, the results were combined to determine the annualised potential exposure to the surrounding waters, shorelines and sensitive receptors based on the thresholds outlined in the NOPSEMA Oil Spill Modelling Bulletin (NOPSEMA, 2019).

Deterministic modelling is the predictive modelling of a single incident subject to a single sample of wind and weather conditions over time. Deterministic spill dispersion modelling is provided in Section 6 of the Barossa Production Operations OPEP which includes all results relevant to spill response.

Deterministic modelling is often paired with stochastic modelling to place the large stochastic footprint into perspective. This deterministic analysis is generally a single run selected from the stochastic analysis and may serve as the basis for developing the spill response, and operational and scientific monitoring plans. Deterministic modelling was also performed for three worst case scenarios to understand the potential area of influence that could be expected from the worst case Barossa condensate, MDO and HFO spill events. The worst-case deterministic scenarios selected were:

- largest swept area of hydrocarbon on the sea surface ≥50 g/m^2 (actionable sea surface hydrocarbon)
- the maximum volume of shoreline accumulation ≥100 g/m^2.

7.7.3 Hydrocarbon and weathering characteristics

7.7.3.1 Barossa condensate

Analysis of an assay obtained during the 2013–14 Barossa Appraisal Drilling Campaign was used to determine the weathering characteristics of the Barossa condensate.

Barossa condensate has a density of 782 kg/m^3 (API of 50.6), dynamic viscosity of 1.35 cP (10 °C) and a pour point of -6 °C. The condensate is characterised by a low viscosity and is considered a Group I oil (non-persistent), as per the grouping classification presented by AMSA (2015). If spilled on the sea surface, the condensate would rapidly spread and thin out, resulting in a large surface area of hydrocarbon available for evaporation. The volatile component of Group I oils (non-persistent) tends to dissipate through evaporation within a few hours (International Tankers Owners Pollution Federation [ITOPF], 2022). Based on the Barossa condensate assay (boiling point range,

Table 7-9), up to 57% of the hydrocarbon would evaporate over the first few hours, with up to 79% evaporated within a day when on the sea surface. Only 7% of the condensate is considered persistent, which would eventually break down due to the decay.

The fate of the condensate will depend greatly on the proportion that reaches the surface after rising through the water column. Condensate at surface will be subject to atmospheric weathering and will be transported by prevailing currents and wind. Condensate that entrains or dissolves in the water column will be transported by prevailing current and, hence, will follow a different path. Condensate in the water column will also be subject to different weathering processes in comparison to floating condensate. Hence, discharge conditions – which affect droplet size distributions and rise times – will have a strong influence on exposure risks for surrounding resources. The larger droplets (above 100 µm or so) would rise to the surface, spread and evaporate over time. The smaller droplets (less than around 100 µm) were predicted to rise toward the surface though readily re-entrain back into water column.

Table 7-9: Properties of Barossa condensate

Parameter		Barossa condensate
Density (kg/m³)		782 (at 16 °C)
American Petroleum Institute		50.6
Dynamic viscosity (cP)		1.35 (at 10 °C)
Pour point (°C)		-6
Hydrocarbon property category		Group I
Hydrocarbon property classification		Non-persistent
Boiling point ºC		
Non-persistent	**<180**	57
	180 to 265	22
	265 to 380	14
Persistent	**>380**	7

A series of weathering tests were conducted to illustrate the potential behaviour after a 50 m³ instantaneous surface release of condensate when exposed to:

- Five knot (2.6 m/s) constant wind speed, 27°C water temperature and currents
    - variable wind speeds (1 to 12 m/s or 2 to 24 knots), 27°C water temperature and currents.

The first case is indicative of the potential weathering rates under calm conditions that would not generate entrainment, while the second case would be more representative of the moderate winds experienced over the region.

The mass balance forecast for the constant wind case (Figure 7-1) shows that 79% of the condensate has evaporated within 24 hours. Evaporation will slow considerably and be subject to more gradual decay through biological and photochemical processes.

For the variable-wind speed case (Figure 7-2), after 24 hours 79% of the mass has evaporated and 10% remains on the water surface. Due to the higher wind speeds and breaking waves, entrainment of the condensate into the water column is shown to occur hereby. While the condensate is entrained it will decay at a higher rate of 0.4% per day or a total of 3% after seven days due to biological and photochemical degradation, compared to a rate of 0.2% per day and a total of 1.3% after seven days for the constant-wind case. Given the proportion of entrained condensate and the tendency for it to remain mixed in the water column, the remaining hydrocarbons will decay over timescales of several weeks.

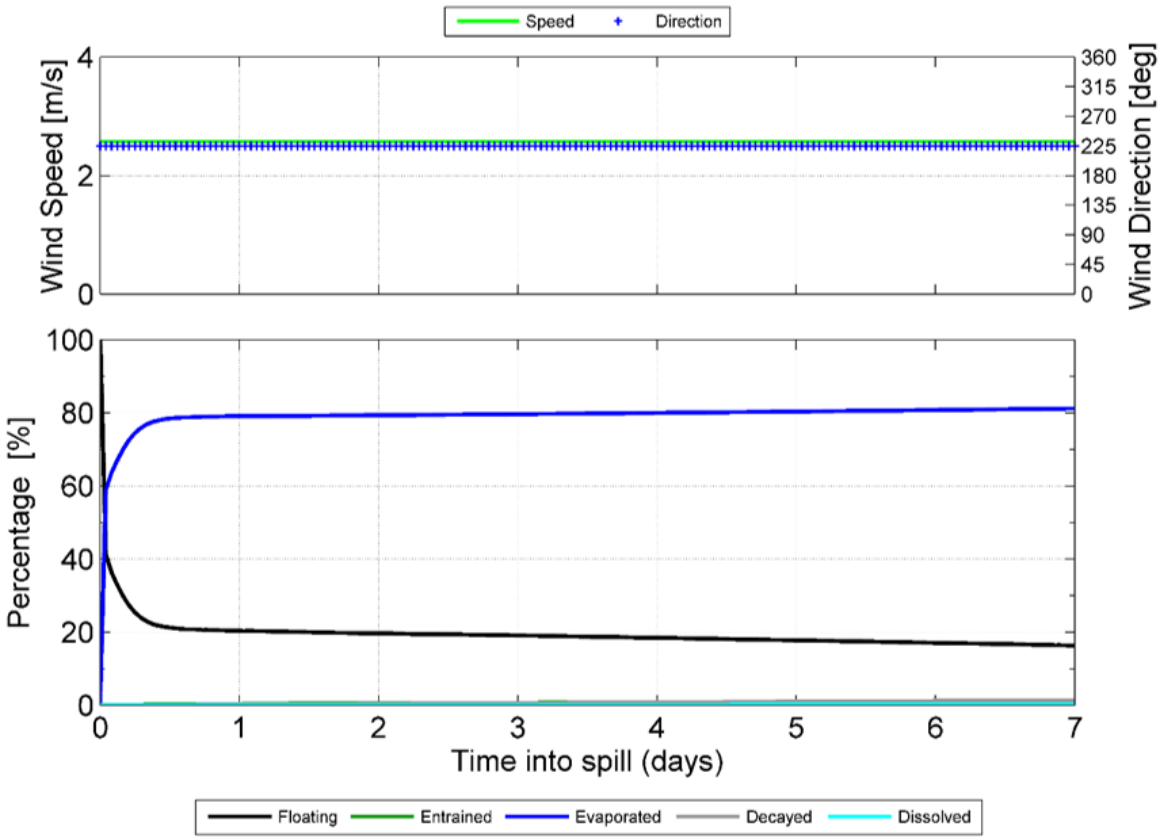


Figure 7-1: Mass balance plot for an instantaneous 50 m³ surface release of condensate subjected to a constant 5 knot (2.6 m/s) wind, currents and 27°C water temperature

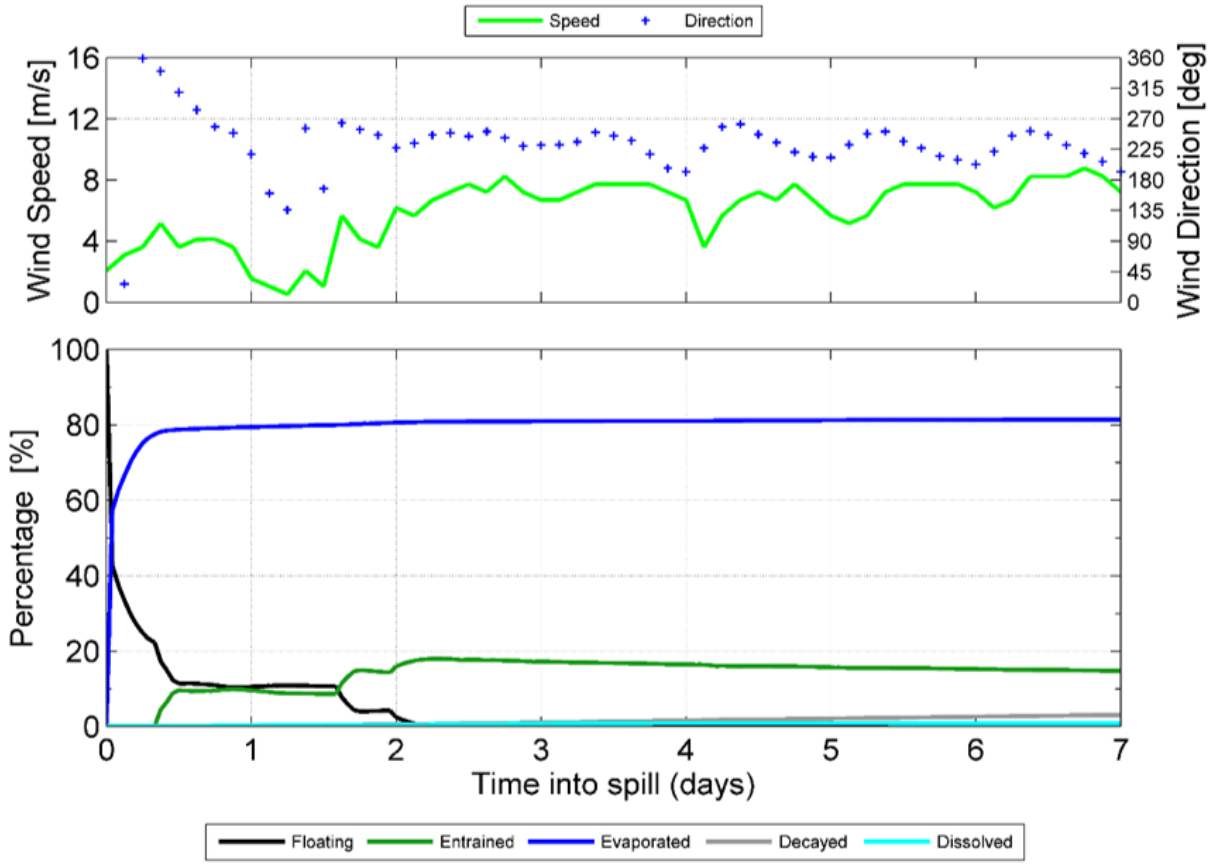


Figure 7-2: Mass balance plot for an instantaneous 50 m³ surface release of condensate subjected to variable wind speeds (1 to 12 m/s or 2 to 24 knots), currents and 27°C water temperature

7.7.3.2 Marine diesel oil and marine gas oil

MDO has a density of 829.1 kg/m³ (API of 37.6) and a low pour point of -14°C. The low viscosity (4 cP) indicates this hydrocarbon will spread quickly when released and will form a thin- to low-thickness film on the sea surface, increasing the rate of evaporation.

As presented in Table 7-10, about 6.0% of the MDO mass should evaporate within the first 12 hours (Boiling point (BP) < 180°C); a further 34.6% should evaporate within the first 24 hours (180°C < BP < 265°C); and an additional 54.4% should evaporate over several days (265°C < BP < 380°C). Approximately 5% (by mass) of MDO will not evaporate, though will decay slowly over time.

MDO is categorised as a Group II oil (light-persistent) according to ITOPF (2022) and United States Environmental Protection Agency/United States Coast Guard classifications. The classification is based on the specific gravity of hydrocarbons in combination with relevant boiling point ranges.

MGO is a Group II hydrocarbon with a 'light persistent' classification. While MDO and MGO are similar, MGO has a marginally higher density than MDO and is based on the lighter distillates, which results in a lower viscosity. MGO is considered an ultra-low sulphur fuel and emissions from MGO contain significantly less particulate matter than other fuel types. Given the similarities in MGO and MDO properties, MDO is presented in Table 7-10 and has been used for the purpose of spill modelling.

Table 7-10: Properties of marine diesel oil

Parameter		Marine diesel oil
Density (kg/m³)		829.1 (at 25°C)
American Petroleum Institute		37.6
Dynamic viscosity (cP)		4 (at 25°C)
Pour point (°C)		-14
Hydrocarbon property category		Group II
Hydrocarbon property classification		Light persistent
Boiling point ºC		
Non-persistent	**<180**	6
	180 to 265	34.6
	265 to 380	54.4
Persistent	**>380**	5

A series of weathering tests were conducted to illustrate the potential behaviour following a 50 m³ instantaneous surface release of MDO when exposed to:

- Five knot (2.6 m/s) constant wind speed, 27°C water temperature and currents
    - variable wind speeds (1 to 12 m/s or 2 to 24 knots), 27°C water temperature and currents.

The first case is indicative of the potential weathering rates under calm conditions that would not generate entrainment, while the second case would be more representative of the moderate winds experienced over the region.

The mass balance forecast for the constant wind case (Figure 7-3) shows that around 41% of the MDO has evaporated within 24 hours. Evaporation will slow considerably and be subject to more gradual decay through biological and photochemical processes.

Under the variable wind speed case (Figure 7-4), after 24 hours 40% of the mass has evaporated, 31% has entrained and 29% remains on the water surface. Due to the higher wind speeds and breaking waves, entrainment of the MDO into the water column is shown to occur. While the MDO is entrained it will decay at a higher rate of 1% per day or 7.7% after seven days due to biological and photochemical degradation, compared to a rate of 0.14% per day and total of approximately 1% after seven days for the constant-wind case. Given the proportion of entrained MDO and the tendency for it to remain mixed in the water column, the remaining hydrocarbons will decay over timescales of several weeks.

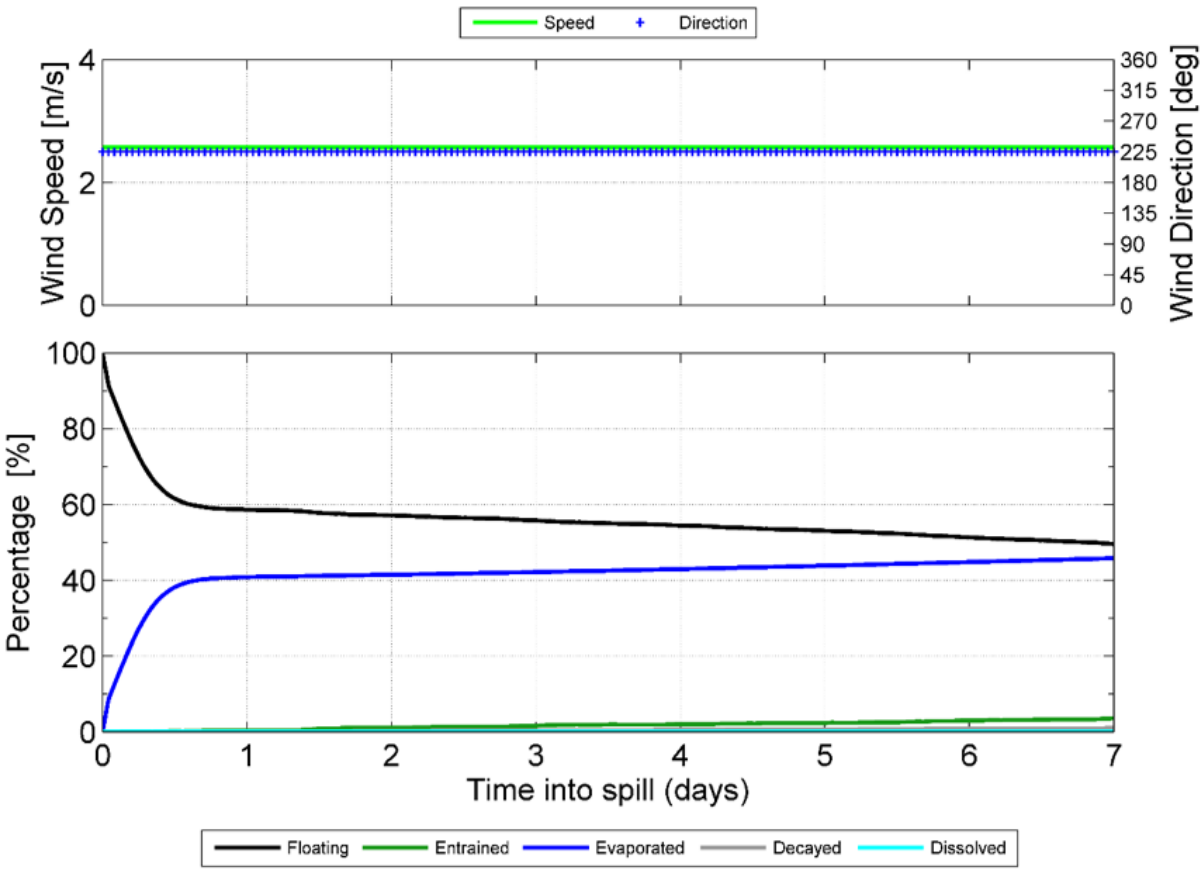


Figure 7-3: Mass balance plot for an instantaneous 50 m³ surface release of marine diesel oil subjected to a constant 5 knot (2.6 m/s) wind, currents and 27°C water temperature

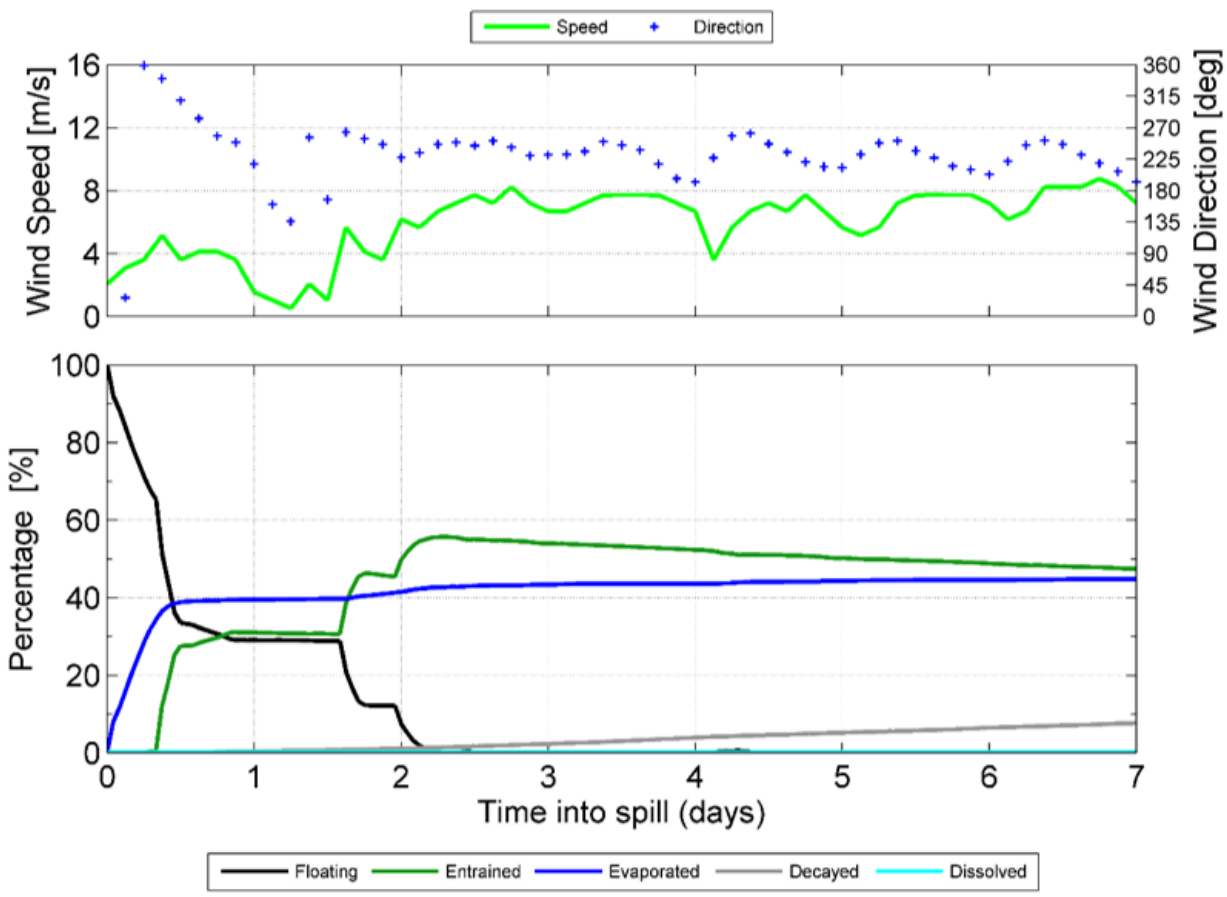


Figure 7-4: Mass balance plot for an instantaneous 50 m³ surface release of marine diesel oil subjected to variable wind speeds (1 to 12 m/s or 2 to 24 knots), currents and 27°C water temperature

7.7.3.3 Heavy fuel oil

HFO is characterised by a very high density at 974.9 kg/m³ (API Gravity of 12.3) and a high dynamic viscosity (3,180 cP @ 25ºC). It is comprised of a high percentage of persistent components (83%), which will not evaporate. When spilled at sea, the HFO will initially remain as a liquid because sea surface temperatures are above its pour point during all seasons. The volatile components (1%) are immediately lost via evaporation and the physical properties will change quickly as the lighter, more fluid components evaporate and disperse by the action of wind and waves. The residual component (83%) is expected to become semi-solid to solid at ambient temperatures and is susceptible to decay over time. Previous weathering tests with HFO used as bunker fuels have shown both the pour point and the viscosity of the oil increased with time, by an average of two orders of magnitude within 96 hours of weathering. Once the pour point of oil exceeded the seawater temperature, within nine to 12 hours during all seasons, the oil weathered to a point where mostly-solid, non-spreading oil remained; up to 70% of bunker fuel remained as a solid residue even after the most extreme weathering tests.

Laboratory tests with Bunker C crude oil (Fingas *et al*., 2002; Fingas & Fieldhouse, 2004), which has similar physical properties to the HFO modelled, have shown HFO does not form stable emulsions. Rather, when HFO is spilled at sea, it takes up water very rapidly over a short energy range and the stability of the water-oil mixture remains the same in that it does not stabilise with increasing energy. This behaviour is consistent with entrained water in oil, where spilled oil will first appear as a black, viscous liquid with large water droplets and within one week will become separated into oil and water as water energies abate.

The toxic potential of weathered HFO is low in comparison to other crudes, MDO and condensates, as weathered oil is insoluble and the bioavailable portion of the oil is soon lost through evaporation. Solid residues can persist in the marine environment for extended periods and its longevity is dependent on its unique physio-chemical properties. The heaviest fractions (greater than C_{20}) often break into discrete patches and may float or sink, depending on density relationships, and become incorporated into soils or sediments. Selective biodegradation can also deplete hydrocarbons on sediments and on the sea surface over time. Direct consumption of the residual tar patties or contaminated sediment poses the greatest risk to macrofauna and would present a greater threat for shallow coastal embayments with concentrated populations and coastal vegetation. HFO properties are presented in Table 7-11.

Table 7-11: Properties of heavy fuel oil

Parameter		HFO
Density (kg/m³)		974.9 (at 25°C)
American Petroleum Institute		12.3
Dynamic viscosity (cP)		3180 (at 25°C)
Pour point (°C)		7
Hydrocarbon property category		Group IV
Hydrocarbon property classification		Persistent (heavy)
Boiling point ºC		
Non-persistent	**<180**	1
	180 to 265	5
	265 to 380	11
Persistent	**>380**	83

A series of weathering tests were conducted to illustrate the potential behaviour after a 50 m³ instantaneous surface release of HFO when exposed to:

- Five knot (2.6 m/s) constant wind speed, 27°C water temperature and currents
- variable wind speeds (1 to 12 m/s or 2 to 24 knots), 27°C water temperature and currents.

The first case is indicative of the potential weathering rates under calm conditions that would not generate entrainment, while the second case would be more representative of the moderate winds experienced over the region.

The mass balance forecast for the constant wind case (Figure 7-5 and Figure 7-6)) shows 6% of the HFO evaporated and 93% remained floating on the sea surface 24 hours into the simulation. Evaporation will slow considerably and be subject to more gradual decay through biological and photochemical processes.

Figure 7-6 presents the mass balance forecast for the variable wind speed case. Due to the high viscosity of the HFO and its inability to spread to a thin sheen, the weathering test was the same as the constant wind case. At the

conclusion of the simulations, 7% of the HFO had evaporated during constant and variable wind cases, while 87% remained floating on the sea surface and approximately 6% was predicted to decay, at a rate of approximately 1% per day during both cases.

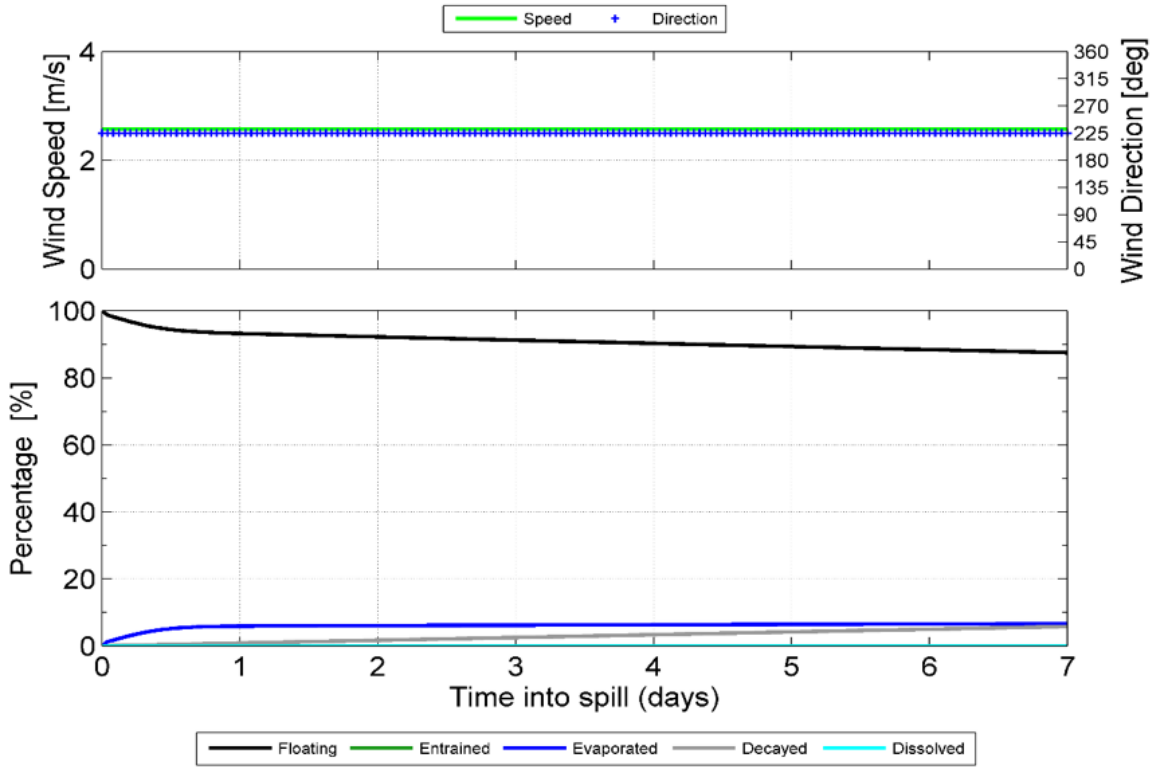


Figure 7-5: Mass balance plot for an instantaneous 50 m³ surface release of heavy fuel oil subjected to a constant 5 knot (2.6 m/s) wind, currents and 27°C water temperature

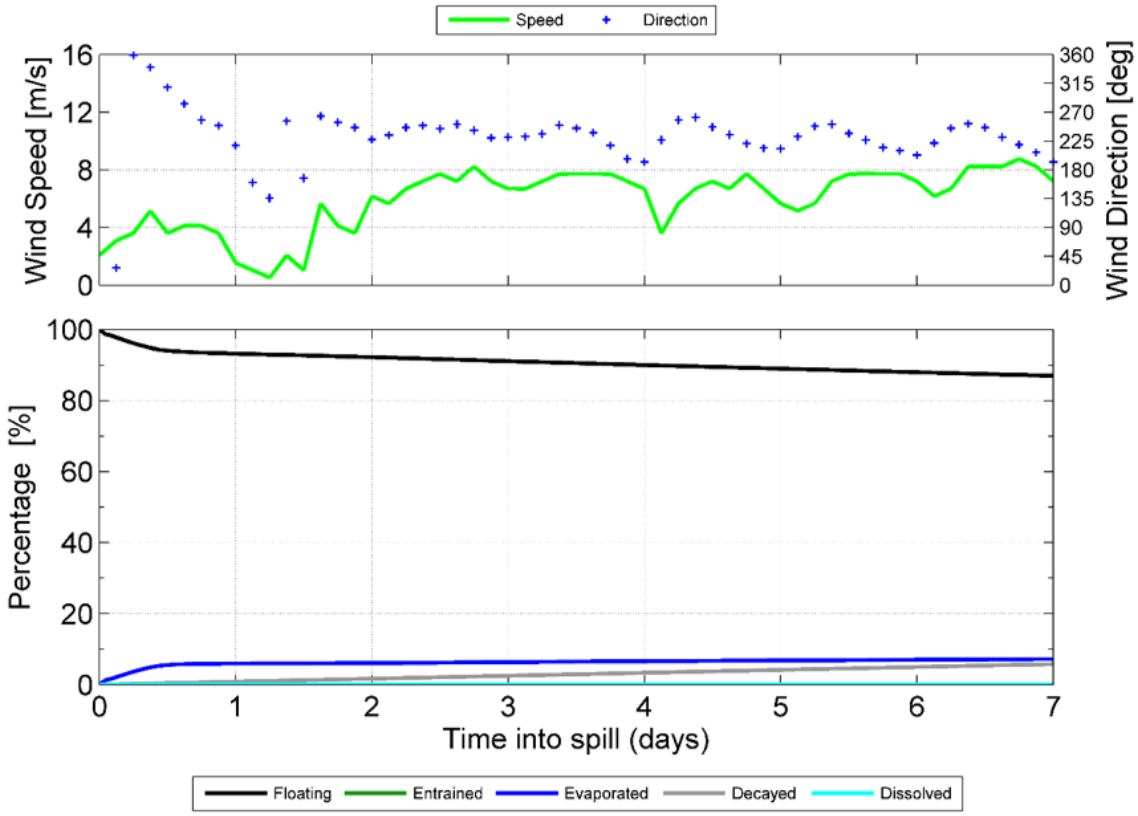


Figure 7-6: Mass balance plot for an instantaneous 50 m³ surface release of heavy fuel oil subjected to variable wind speeds (1 to 12 m/s or 2 to 24 knots), currents and 27°C water temperature

7.7.4 Hydrocarbon exposure values

To inform the environmental assessment, it is important to understand the profile of the concentrations of hydrocarbons after a spill. To do this, NOPSEMA recommends identifying hydrocarbon exposure values that broadly reflect the range of consequences that could occur at certain concentrations (NOPSEMA, 2019). The exposure values that have been applied to this EP are provided in Table 7-12.

To identify appropriate exposure values, Santos has followed the advice provided by NOPSEMA in Bulletin #1 Oil Spill Modelling (2019) and scientific literature. The selected hydrocarbon exposure values are discussed in Table 7-13 to Table 7-16. These tables explain how the exposure value is relevant to the risk evaluation and provides context on how that exposure value is used to inform response planning (which is addressed further in the Barossa Production Operations OPEP). Note NOPSEMA does not define a moderate exposure value for entrained hydrocarbon and 100 ppb is defined as the high exposure value (NOPSEMA, 2019). However, Santos has adopted 100 ppb as the moderate exposure level for impact assessment purposes in the absence of a NOPSEMA-defined moderate value and based on existing literature (Bridges *et al.*, 2018; French McCay, 2016; French McCay, 2018).

Table 7-12: Hydrocarbon exposure values for the environment that may be affected

Hydrocarbon phase	Exposure value		
	Low	Moderate	High
Floating (g/m²)	1	10	50
Shoreline accumulation (g/m²)	10	100	1,000
Dissolved aromatics (ppb)	10	50	400
Entrained (ppb)	10	N/A	100

The low exposure values contours (Figure 7-7), which approximate a range of potential socio-economic effects, are used as a predictive tool to set the outer boundaries of the EMBA, presented in Section 3. A ‘best fit’ line is drawn around the outermost limits of the low exposure value contours for all three phases of hydrocarbons (floating, dissolved and entrained) in all seasons. This results in a highly conservative and comprehensive basis to plan and prepare for spill response.

These low exposure values are not considered to be representative of a biological impact, but they are adequate for identifying the full range of environmental receptors that might be contacted by surface and sub-surface floating hydrocarbons (NOPSEMA, 2019) and a visible sheen may be apparent.

Determining exposure values that may be representative of biological impact is complex, since the degree of impact will depend on the sensitivity of the receptors contacted, the duration of the exposure, and the toxicity of the hydrocarbon type making the contact. The toxicity of a hydrocarbon will also change over time, due to weathering processes altering the composition of the hydrocarbon.

To inform the environmental assessment, exposure values that may be representative of biological impact have also been identified. These are called ‘moderate exposure values’ (defined by the moderate exposure value area, or MEVA) and ‘high exposure values’ (defined by the high exposure value area, or HEVA), and are shown in Figure 7-7. Moderate and high exposure values are modelled for each fate of hydrocarbon to identify what contact is predicted for surface (floating hydrocarbon), subsurface (entrained hydrocarbon and dissolved aromatic hydrocarbons) and shoreline accumulation of hydrocarbon at sensitivities.

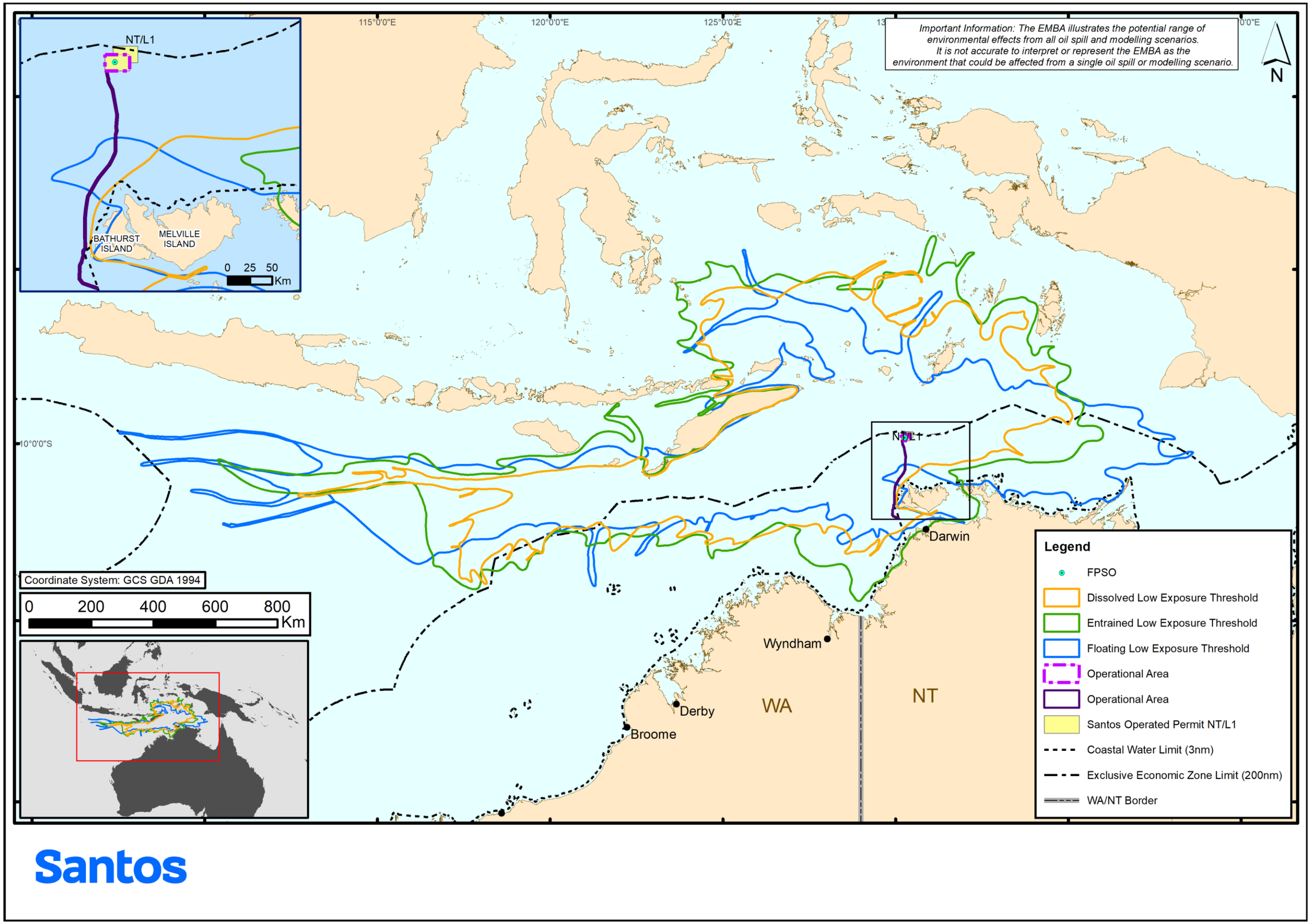


Figure 7-7: Low exposure value contours used to define the EMBA

Table 7-13: Floating hydrocarbons exposure values

Surface hydrocarbons concentration (g/m²)	Exposure value	Description
1	**Low**	**Risk evaluation** It is recognised a lower floating hydrocarbon concentration of 1 g/m² (equivalent to a thickness of 0.001 mm or 1 ml of hydrocarbon per m²) is visible as a rainbow sheen on the sea surface. Although this is lower than the exposure value for ecological impacts, it may be relevant to socio-economic receptors and has been used as the exposure value to define the spatial extent of the low exposure and EMBA from floating hydrocarbons. **Response planning** Contact at 1 g/m² (as predicted by hydrocarbon spill trajectory modelling) is used for operational and scientific monitoring planning, as described in the Northern Australia Operational and Scientific Monitoring Bridging Implementation Plan (7715-650-ERP-0003).
10	**Moderate**	**Risk evaluation** There is a paucity of data about floating hydrocarbon concentrations with respect to impacts to marine organisms. Hydrocarbon concentrations for registering biological impacts resulting from contact of surface slicks have been estimated by different researchers at about 10 to 25 g/m² (French *et al*., 1999; Koops *et al*., 2004; NOAA, 2002). The impact of floating hydrocarbon on birds is better understood than on other receptors. A conservative exposure value of 10 g/m² has been applied to impacts from floating hydrocarbons (floating hydrocarbon) in this EP. Although based on birds, this hydrocarbon exposure value is also considered appropriate for turtles, sea snakes and marine mammals (Natural Resource Damage Assessment Model for Coastal and Marine Environments, 1997). This value has been used to define the MEVA. **Response planning** Contact at 10 g/m² is not specifically used for spill response planning.
50	**High**	**Risk evaluation** At greater thicknesses, the potential for impact of floating hydrocarbon to wildlife increases. All other things being equal, contact to wildlife by floating hydrocarbon at 50 g/m² is expected to result in a greater impact. This value has been used to define the HEVA. **Response planning** Containment and recovery effectiveness drops significantly with reduced hydrocarbon thickness (McKinney *et al*., 2017; NOAA, 2014). McKinney *et al*. (2017) tested the effectiveness of various hydrocarbon skimmers at various hydrocarbon thicknesses. Their results showed the hydrocarbon recovery rate of skimmers dropped significantly when hydrocarbon thickness was less than 50 g/m² (less than Bonn Agreement Code 4). Hence, 50 g/m² has been set as a guide for planning effective containment and recovery operations. Similarly, floating hydrocarbon greater than 50 g/m² (Bonn Agreement Code 4/5 and equivalent to hydrocarbon observed as discontinuous or continuous true colour) is considered to be a lower limit for effective dispersant operations and is therefore considered for planning.

Table 7-14: Shoreline hydrocarbon accumulation exposure values

Shoreline Accumulation (g/m²)	Exposure Value	Description
10	**Low**	**Risk evaluation** An accumulated concentration of hydrocarbon above 10 g/m² on shorelines is considered to represent a level of socio-economic effect (NOPSEMA, 2019). For example, reduction in visual amenity of shorelines. This value has been used in previous studies to represent a low contact value for interpreting shoreline accumulation modelling results (French-McCay, 2005a, 2005b) and is used to define the low exposure and EMBA. **Response planning** Not specifically used for response planning because it is below the limit that can be effectively cleaned.

100	**Moderate**	**Risk evaluation** The impact exposure value for exposure to hydrocarbons stranded on shorelines is derived from levels likely to cause adverse impacts to marine or coastal fauna and habitats. These habitats and marine fauna known to use shorelines are most at risk of exposure to shoreline accumulations of hydrocarbon, due to smothering of intertidal habitats (such as mangroves and emergent coral reefs) and coating of marine fauna. Environmental risk assessment studies (French-McCay, 2009) report a hydrocarbon thickness of 0.1 mm (100 g/m²) on shorelines is assumed as the lethal exposure value for invertebrates on hard substrates (rocky, artificial or human-made) and sediments (mud, silt, sand or gravel) in intertidal habitats. Therefore, a conservative exposure value for impacts of 100 g/m² has been applied to impacts from shoreline accumulation of hydrocarbons. This value has been used to define the MEVA. **Response planning** A shoreline concentration of 100 g/m², or above, is likely to be representative of the minimum limit the hydrocarbon can be effectively cleaned (AMSA, 2020; NOPSEMA, 2019) and is therefore used as a guide for shoreline cleanup planning. This exposure value equates to approximately half a cup of hydrocarbon per square metre of shoreline contacted.
1000	**High**	**Risk evaluation** At greater thicknesses, the potential for impact of accumulated hydrocarbon to shoreline receptors increases. All other things being equal, accumulation of hydrocarbon above 1,000 g/m² is expected to result in a greater impact. This value has been used to define the HEVA. **Response planning** As hydrocarbons increase in thickness the effectiveness of hydrocarbon recovery techniques increases. This value can therefore be used to prioritise hydrocarbon recovery efforts, assuming hydrocarbon recovery is deemed to have an environmental benefit.

Table 7-15: Dissolved aromatic hydrocarbon exposure values

Dissolved hydrocarbons (ppb)	Exposure value	Description
10	**Low**	**Risk evaluation** Dissolved aromatic hydrocarbons (DAH) include the monoaromatic hydrocarbons (compounds with a single benzene ring, such as BTEX) and PAHs (compounds with multiple benzene rings, such as naphthalenes and phenanthrenes). These compounds have a greater bioavailability than hydrocarbons and are the main contributors to hydrocarbon toxicity. The toxicity of DAHs is a function of the concentration and duration of exposure by sensitive receptors, with greater concentration and exposure time causing more severe impacts. Typically tests of toxicity done under laboratory conditions measure toxicity as A proportion of test organisms affected (such as 50% mortality or LC50) at the end of a set time, often 48 or 96 hours. French-McCay (2002) found LC50 for dissolved PAHs with a 96hour exposure range between 30 ppb for sensitive species (2.5th-percentile species) and 2260 ppb for insensitive species (97.5th-percentile species), with an average of about 250 ppb. The range of LC50s for PAHs obtained under turbulent conditions (this includes fine hydrocarbon droplets) was 6 ppb to 410 ppb, with an average of 50 ppb (French-McCay, 2002). More recently, French-McKay (2018) described in-water thresholds as 10 to 100 µg/L (equivalent to ppb). For the effect of ultraviolet on PAH toxicity, French-McCay *et al.* (2018) use the findings of the Deepwater Horizon Oil Spill to adjust for this by reducing the water column exposure thresholds by ten times in the top 20 m of the water column. The dissolved hydrocarbon 10 ppb exposure value has been used to inform the low exposure and EMBA. An exposure value of 10 ppb is appropriate as it is a concentration that could have some potential negative effect. **Response planning** Can assist in establishing planning area for scientific monitoring based on potential for exceedance of water quality triggers (NOPSEMA, 2019).

Dissolved hydrocarbons (ppb)	Exposure value	Description
50	**Moderate**	**Risk evaluation** Approximates potential toxic effects, particularly sublethal effects to sensitive species (see the above text). Consistent with NOPSEMA (2019). This value has been used to define the MEVA. Ecotoxicology tests on a broad range of representative taxa of ecological relevance for mainly tropical Australia were conducted to inform the assessment of the potential for toxicity impacts from unweathered (as in, fresh) and weathered Barossa condensate to sensitive marine biota. The ecotoxicity testing focused on the DAH concentration of the water-accommodated fraction, as these hydrocarbons are more biologically available to organisms through absorption into their tissues when compared with entrained hydrocarbons (Jacobs, 2016b). Based on the ecotoxicology tests, the dissolved aromatic exposure values applied in this EP are considered highly conservative for the Barossa condensate. Specifically, the moderate exposure values of 50 ppb for 95% species protection for DAH is approximately 23 times more conservative than that for the Barossa condensate (1146 ppb for the 95% species protection threshold). **Response planning** Encompassed by response to 10 ppb. There is nothing different for higher exposure values.
400	**High**	**Risk evaluation** Approximates toxic effects, including lethal effects to sensitive species (NOPSEMA, 2019). This value has been used to define the HEVA. **Response planning** Encompassed by response to 10 ppb. There is nothing different for higher exposure values.

Table 7-16: Entrained hydrocarbon exposure values

Entrained hydrocarbons (ppb)	Exposure value	Description
10	**Low**	**Risk evaluation** Entrained hydrocarbons, as opposed to DAHs, are hydrocarbon droplets suspended in the water column and insoluble. Entrained hydrocarbons are not as bioavailable to marine organisms compared with DAHs and on that basis are considered to be less toxic, especially over shorter exposure timeframes. Entrained hydrocarbons still have potential effects on marine organisms through direct contact with exposed tissues and ingestion (National Research Council, 2005). However, the level of exposure causing effects is considerably higher than for DAHs. Much of the published scientific literature does not provide sufficient information to determine if toxicity is caused by entrained hydrocarbons, but rather the toxicity of total hydrocarbons which includes both dissolved and entrained components. Variations in the methodology of the total water-accommodated fraction (entrained and dissolved) may account for much of the observed wide variation in reported exposure values, which also depend on the test organism types, duration of exposure, hydrocarbon type and the initial hydrocarbon concentration. Total hydrocarbon toxicity acute effects of total hydrocarbon as LC50 for molluscs range from 500 to 2000 ppb (Clark *et al*., 2001; Long & Holdway, 2002). A wider range of LC50 values have been reported for species of crustacea and fish from 100 to 258,000,000 ppb (Gulec *et al*., 1997; Gulec & Holdway, 2000; Clark *et al*., 2001) and 45 to 465,000,000 ppb (Gulec & Holdway, 2000; Barron *et al*., 2004), respectively. The 10 ppb exposure value has been used to inform the EMBA and represents the very lowest concentration and corresponds generally with the lowest trigger levels for chronic exposure for entrained hydrocarbons in the ANZECC & ARMCANZ (2000) water quality guidelines. This is consistent with NOPSEMA (2019) guidance. **Response planning** Can assist in establishing planning area for scientific monitoring based on potential for exceedance of water quality triggers (NOPSEMA, 2019).

Entrained hydrocarbons (ppb)	Exposure value	Description
100	**Moderate**	**Risk evaluation** The 100 ppb exposure value is considered to be more representative of sublethal impacts to most species and lethal impacts to sensitive species, based on toxicity testing as described above. This is considered conservative, as toxicity to marine organisms from hydrocarbon is likely to be driven by the more bioavailable dissolved aromatic fraction, which is typically not differentiated from entrained hydrocarbon in toxicity tests using water-accommodated fractions. Given entrained hydrocarbon is expected to have lower toxicity than dissolved aromatics, especially over time periods where these soluble fractions have dissolved from entrained hydrocarbon, the higher moderate exposure value for entrained hydrocarbon over DAH (100 versus 50 ppb) is considered appropriate. This value has been used to define the MEVA. Note NOPSEMA does not define a moderate exposure value for entrained hydrocarbon and 100 ppb is defined as the high exposure value. However, Santos has adopted 100 ppb as the moderate exposure level for impact assessment purposes in the absence of a NOPSEMA-defined moderate value and based on existing literature (Bridges *et al.*, 2018; French-McCay, 2016; French-McCay, 2018). **Response planning** Encompassed by response to 10 ppb. There is nothing different for higher exposure values.

7.7.5 Spill risk assessment approach

A consistent risk assessment approach is applied to each unplanned hydrocarbon release scenario in Sections 7.7.7 to 7.7.11. The approach for hydrocarbon spills involves several steps outlined below:

- Identify the spatial extent of the EMBA. The EMBA is used to describe the existing environment and the values and sensitivities within it (Section 3)
- Identify the MEVA where there is the potential for impact to biological receptors at moderate exposure levels or above
- Identify areas of high environmental value (HEV) within the MEVA
- Identify areas of HEV within the EMBA (HEVs are described in Section 7.7.5.2)
- Identify hotspots and evaluate the impacts and risks to them. Hot spots are a subset of HEVs and their determination is described in Section 7.7.5.3.
- Identify priorities for response (for consideration in the Barossa Production Operations OPEP) and monitoring (for consideration in the Northern Australia Operational and Scientific Monitoring Bridging Implementation Plan [7715-650-ERP-0003]).

7.7.5.1 Environment that may be affected by a spill

For activities where there is the potential for multiple spill scenarios, the spill scenario, or combination of spill scenarios (e.g. production well leak and vessel collision), resulting in the greatest spatial extent for potential contact with hydrocarbons is used to define the overall EMBA for the Activity. The MEVA is also defined as the area within the EMBA with greater concentrations of hydrocarbons which may result in impacts to receptors (Section 7.7.2).

7.7.5.2 Areas of high environmental value

Within the EMBA areas that are considered to have high environmental value (HEV), which include receptors with one or more of the following:

- protected area status – used as an indicator of the biodiversity values contained within that area, where a World Heritage Property, Ramsar wetland and Marine Protected Area will score higher than areas with no protection assigned
- BIAs and HC of listed Threatened species – spatially defined areas where aggregations of individuals of a species are known to display biologically important behaviour, such as breeding, feeding, resting or migration. Each one of these within the predefined areas contributes to the score.
- sensitivity of habitats to impact from hydrocarbons in accordance with the guidance document Sensitivity Mapping for Oil Spill Response produced by International Petroleum Industry Environmental Conservation Association (IPIECA) (2022), the IMO and International Association of Oil and Gas Producers (IOGP)

- sensitivities of receptors with respect to hydrocarbon-impact pathways
- status of zones within protected areas (as in, IUCN [1a] and sanctuary zones compared to IUCN [VI] and multiple use zones)
- listed species status and predominant habitat (surface versus subsurface)
- social values; as in, socio-economic and heritage features like commercial fishing, recreational fishing, defence and military exercises, tourism, amenities, aquaculture and cultural features.

Tallied scores for each predefined area were then ranked from 1 to 5, with an assignment of 1 representing areas of the highest ecological value and those with 5 representing the areas of the lowest ecological value.

7.7.5.3 Hot spots

While the modelled EMBA will be considered during risk assessment and spill response planning, it is best practice to concentrate greatest effort and level of detail on those parts of the EMBA that have:

- the greatest intrinsic ecological value – as in, HEVs ranked 1 to 3
- the highest probability of contact by hydrocarbons (either floating or entrained)
- the greatest potential concentration or volume of hydrocarbon accumulating at the receptor.

These areas are termed 'Hot Spots'. Defining Hot Spots is typically the first step in undertaking detailed spill risk assessment and spill response planning. Hot Spots are a subset of HEV areas that:

- Have the highest probability of contact (at least higher than 5%) above the impact assessment exposure value for surface hydrocarbons and shoreline accumulation based on modelling results; and
- Receive the greatest concentration or volume of oil, either floating or stranded oil, entrained oil or dissolved aromatic hydrocarbons above contact exposure values described in Section 7.7.5.
- Additional areas may be selected as Hotspots for detailed risk assessment, for example if stakeholder consultation has identified areas of particular concern that are not already included in the risk assessment. Additional discretionary hotspots may also be included where they do not strictly me*et al*l of the criteria of a hotspot e.g. a HEV ranked 1-3 with <5% probability, or a HEV ranked 4 or 5 with >5% probability, depending on the concentrations and volumes of hydrocarbons presented in the modelling report. When a discretionary hotspot is added it will be identified as 'discretionary' and the rationale for its inclusion as a hotspot will be described.

'Hot spots' are presented in Sections 7.7.8.4.1, 7.7.9.4.1, 7.7.10.4.1 and 7.7.11.4.1 and in Section 6.6 of the Barossa Production Operations OPEP.

7.7.5.4 Priorities for protection

For the purposes of a spill response preparedness strategy, it is not necessary for all Hot Spots to have detailed planning. For example, wholly submerged Hot Spots may only be contacted by entrained oil, and the response would be largely to implement scientific monitoring to determine impact and recovery. Priority for protection areas are a subset of hot spots allocated for the purpose of prioritising where to send response teams to conduct certain spill response activities such as shoreline protection and shoreline clean-up, so that impacts to high environmental value areas are minimised. Priority protection areas typically have emergent features that receive the greatest concentration or volume of hydrocarbons, either floating or stranded hydrocarbons at response threshold concentrations (refer to Table 7-13 and Table 7-14) and minimum contact time. Additional information on how priority protection areas have been identified is included in the Barossa Production Operations OPEP.

The Barossa Production Operations OPEP outlines the applicable spill response strategies for the modelled scenarios, including source control, monitor and evaluate, containment and recovery, chemical dispersant application, shoreline protection, shoreline clean-up, oiled wildlife response, and operational and scientific monitoring. The Barossa Production Operations OPEP identifies wildlife priority areas and monitoring priority areas to provide guidance to the IMT on where to direct resources in the initial stages of the spill.

7.7.5.5 Net environmental benefit analysis

NEBA is a structured approach used by the response community and stakeholders to select spill response strategies that will effectively remove hydrocarbon, are feasible to use safely in particular conditions, and will reduce the impact of a spill on the environment.

The NEBA process is used during pre-spill planning (strategic NEBA) and during an actual spill response (operational NEBA). A strategic NEBA is an integral part of the contingency planning process and is used to ensure response strategies for scenarios are well informed. An operational NEBA is used throughout an actual spill to

ensure evolving conditions are understood, so response strategies can be adjusted as necessary to manage individual response actions and end points.

Spill response may involve differing and conflicting priorities, values and perceptions of the importance of sensitive receptors and balancing these requires trade-offs. There is no universally accepted way to assign perceived value or importance, and it is not a quantitative process. Overall, the NEBA process provides an estimate of potential environmental effects that are sufficient to allow the parties to compare and select preferred combinations of response strategies to reduce environmental impacts to ALARP.

A strategic NEBA has been developed for all response strategies identified as applicable to credible spills identified in the Barossa Production Operations OPEP related to an unplanned release of condensate, with the potential environmental benefit or potential impact to each protection priority area. This provides information that will help to select response strategies tailored to the key environmental values within the areas of highest priority. Section 6.7 of the Barossa Production Operations OPEP provides a summary of spill response strategies available for each of the priority protection areas and the potential impact that a response strategy has on the area's environmental values.

This information is to be considered in the NEBA process that occurs during a spill response (as in, an operational NEBA). An operational NEBA will also consider real-time monitoring of the effectiveness and potential impacts of a response and will consider accessibility, feasibility and safety of responders (refer to the Barossa Production Operations OPEP).

7.7.6 Potential hydrocarbon impact pathways and nature and scale of impact

To help inform the hydrocarbon spill risk assessment, receptors within the EMBA and potential impact pathways have been defined (Table 7-17). The potential impact pathways consider physical and chemical pathways. Physical pathways include contact from floating hydrocarbon, accumulated shoreline hydrocarbon, or entrained hydrocarbon droplets. Chemical pathways include ingestion, inhalation or contact from any hydrocarbon phase. These are summarised in Table 7-17 and the information is drawn upon within the hydrocarbon risk assessment for the spill scenario. Table 7-18 further describes the nature and scale of the hydrocarbon spills for this Activity on marine fauna and socio-economic receptors found within the MEVA.

Table 7-17: Physical and chemical pathways for hydrocarbon exposure and potential impacts to receptors

Receptor	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
Rocky shorelines	Shoreline loading and attachment may result in thin and sporadic coating of hydrocarbon residues. Degree of hydrocarbon coating is dependent upon the energy of the shoreline area, the type of rock formation and continual biodegradation of the hydrocarbon. Lighter hydrocarbons, such as MDO and condensates, are less likely to smother the rocks. HFO being more persistent has the potential to adhere to the rock surface.	Impacts to flora (mangroves) and fauna further described below. Impacts to shoreline habitats contacted within the MEVA are likely to be more prolonged from an HFO release due to its persistent nature and adherence to the rock surface.	Chemical pathway to fauna and flora via adsorption through cellular membranes and soft tissue, ingestion, irritation or burning on contact and inhalation.	Impacts to flora (mangroves) and fauna further described below.
Sandy beaches	Shoreline loading and water movement may allow hydrocarbon residue to filter down into sediments, continue to biodegrade on the surface or remobilise into surf zone. Degree of loading is dependent upon the energy and tidal reach of the shoreline, the type of the sandy shore and continual weathering of the hydrocarbon. Persistent hydrocarbons, such as HFO, that become stranded on sandy beaches are likely to remain for extended periods and become buried in the sediments.	Direct impacts on birds and turtles from becoming exposed to the hydrocarbons at the beach (e.g. loss of food source, coating, inhalation, ingestion). Direct impacts to infauna from exposure to hydrocarbons. Impacts to shoreline habitats contacted within the MEVA are likely to be more prolonged from an HFO release due to its persistent nature.	Chemical pathway to fauna and flora via adsorption through cellular membranes and soft tissue, ingestion, irritation or burning on contact and inhalation.	Indirect impacts to nesting and foraging habitats for birds and turtles. Direct impacts (mortality) to infauna through toxic effects and smothering.
Intertidal platforms	Shoreline loading and water movement may allow hydrocarbon residue to filter down into sediments (such as within wetlands) or continue to biodegrade on the surface or remobilise into surf zone. Degree of loading is dependent upon the energy and tidal reach of the shoreline, the type of the substrate and continual weathering of the hydrocarbon.	Direct impacts on birds and turtles from becoming exposed to the hydrocarbons (e.g. loss of food source, coating, inhalation, ingestion). Direct impacts to infauna from exposure to hydrocarbons. Impacts to shoreline habitats contacted within the MEVA are likely to be more prolonged from an HFO release due to its persistent nature. Both HFO and light hydrocarbons (MDO and condensates) reaching intertidal platforms are likely to be heavily weathered, reducing the toxic effects	Chemical pathway to fauna and flora via adsorption through cellular membranes and soft tissue, ingestion, irritation or burning on contact and inhalation.	Indirect impacts to foraging habitats for birds. Direct impacts (mortality) to infauna through toxic effects and smothering.
Shallow sub-tidal soft sediments	Hydrocarbon residue in the shallow waters adjacent to shorelines may settle to filter	Direct impacts on birds and turtles from becoming exposed to the hydrocarbons	Adsorption via cellular membranes and soft tissue,	Indirect impacts to foraging habitats for turtles and fish. Direct

Receptor	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
	down into sediments. Degree of loading is dependent upon the energy and tidal reach of the shoreline, the type of the substrate and continual weathering of the hydrocarbon.	(e.g. loss of food source, coating, inhalation, ingestion). Direct impacts to infauna from exposure to hydrocarbons. Impacts to shoreline habitats contacted within the MEVA are likely to be more prolonged from an HFO release due to its persistent nature. Impacts to intertidal platforms and mudflats contacted within the MEVA are likely to be more prolonged from an HFO release due to its persistent nature.	ingestion, irritation or burning on contact and inhalation.	impacts (mortality) to infauna through toxic effects and smothering.
Mangroves	Coating of root system and pneumatophores, reducing air and salt exchange. Degree of coating is dependent upon the energy and tidal reach of the shoreline, the type of the substrate and continual weathering of the hydrocarbon. The direct physical coating with hydrocarbons is more likely to occur with more persistent hydrocarbons such as HFO.	Yellowing of leaves. Defoliation. Increased sensitivity to stressors. Tree death. Reduced growth. Reduced reproductive output. Reduced seed viability.	External contact by hydrocarbon and adsorption across cellular membranes.	Yellowing of leaves. Defoliation. Increased sensitivity to stressors. Tree death. Reduced growth. Reduced reproductive output. Reduced seed viability. Growth abnormalities.
Seagrasses and macroalgae	Most seagrasses in the EMBA are sub-tidal, although there may be small areas of intertidal seagrasses. Sub-tidal seagrasses are unlikely to be exposed to floating hydrocarbons, but may be contacted by entrained or dissolved fractions, which can be absorbed into tissues. The potential for toxic effects of entrained hydrocarbons may be reduced by weathering processes that should lower the content of soluble aromatic components before contact occurs. Long-term impacts to seagrass are unlikely unless hydrocarbons are retained within the seagrass meadow for a sustained duration (Wilson & Ralph, 2011). If contacted by floating hydrocarbons, intertidal seagrasses are vulnerable to smothering, which can lead to mortality if it coats their flowers, leaves and stems (Taylor & Rasheed, 2011).	Bleaching or blackening of leaves. Defoliation. Reduced growth. Fouling.	External contact by hydrocarbon and adsorption across cellular membranes.	Mortality. Bleaching or blackening of leaves. Defoliation. Disease. Reduced growth. Reduced reproductive output. Reduced seed and propagule viability.

Receptor	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
Hard and soft corals (coral reefs)	Coating of polyps, shading resulting in reduction on light availability. Degree of coating is dependent upon the metocean conditions, dilution, if corals are emergent at all and continual weathering of the hydrocarbon.	Bleaching. Increased mucous production. Reduced growth.	External contact by hydrocarbon and adsorption across cellular membranes.	Mortality. Cell damage. Reduced metabolic capacity. Reduced immune response. Disease. Reduced growth. Reduced reproductive output. Reduced egg and larval success. Growth abnormalities. (Loya & Rinkevich, 1980; White *et al.*, 2012; Fisher *et al.*, 2014).
Non-coral benthic invertebrates	Coating of adults, eggs and larvae. Degree of coating is dependent upon the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the hydrocarbon.	Mortality. Behavioural disruption. Impaired growth.	Ingestion and inhalation. External contact and adsorption across exposed skin and cellular membranes. Uptake of DAH across cellular membranes. Reduced mobility and capacity for oxygen exchange.	Mortality. Increases in bacterial abundance leading to opportunistic community structure. Decrease in species richness, abundance and diversity. Reduced growth. Impaired growth. Growth abnormalities. Behavioural disruption. (Schwing *et al.*, 2020; Montagna *et al.*, 2013; Baguley *et al.*, 2015).
Sharks, rays and fish	Coating of adults but primarily eggs and larvae – reduced mobility and capacity for oxygen exchange.	Mortality. Oxygen debt. Starvation. Dehydration. Increased predation. Behavioural disruption.	Ingestion. External contact and adsorption across exposed skin and cellular membranes. Uptake of DAH across cellular membranes (for example, gills). Due to the filter-feeding nature of whale sharks, they may be susceptible to ingesting floating and entrained hydrocarbons, particularly if foraging at or near the sea surface.	Mortality. Decrease in biomass. Cell damage. Starvation. Increased predation. Delayed growth. Reduced reproductive output Reduced egg and larval success. Growth abnormalities. Behavioural disruption. Reduced immune response. Change in community structure.

Receptor	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
				Decrease in species richness, abundance and diversity. (Lewis *et al.*, 2020; Ainsworth *et al.*, 2018; Fisher, 2016).
Birds (seabirds and shorebirds)	Physical coating occurs upon contact of contaminated shorelines and/or exposure to floating oil during foraging at sea or resting at the sea surface.	Feather and skin irritation and damage, with the potential to cause secondary impacts such as: - physical restriction of flight and swimming movement - reduced buoyancy - more vulnerable to predation - potential for secondary infections - mortality - hypothermia or impairing of the waterproofing of feathers - disruption to feeding or starvation - disruption to breeding - disruption to migration. Typically, heavier hydrocarbons like HFO have higher impact due to their more persistent nature on the sea surface.	Ingestion (during feeding or preening). External contact and adsorption across exposed skin and membranes.	Reduced metabolic capacity. Reduced immune response. Reduced growth. Reduced hatchling success. Reduced reproductive output. Growth abnormalities. Behavioural disruption. Mortality Potential for secondary infections (Deepwater Horizon Oil Spill Natural Resource Trustee Council, 2016; Unlu *et al.*, 2018).
Marine reptiles	Physical coating occurs upon contact of contaminated shorelines and/or exposure to floating oil when at the sea surface. Eggs may also become contaminated during laying, either from the laying female or the contaminated sand.	Irritation of eyes and mouth and potential illness, which may cause secondary impacts such as: - mortality - disruption to feeding or starvation - physical restriction - behavioural disruption. Typically, heavier hydrocarbons like HFO have higher impact due to their more persistent nature on the sea surface and within the water column (as droplets).	Inhalation. Ingestion. External contact and adsorption across exposed skin and membranes. Contamination of eggs Exposure of turtle habitats.	Reduced metabolic capacity. Reduced immune response. Reduced growth. Reduced hatchling success. Reduced reproductive output. Growth abnormalities. Behavioural disruption. Mortality Potential for secondary infections (Deepwater Horizon Oil Spill Natural Resource Trustee Council, 2016; Unlu *et al.*, 2018).

Receptor	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
Marine mammals	Coating of feeding apparatus in some species (baleen whales) from exposure to floating hydrocarbons. Potential to coat the sensory hairs around the mouths of dugongs which can impact feeding.	Irritation of eyes and mouth, damage to fur and potential illness, which may cause secondary impacts such as: - mortality - disruption to feeding and starvation - physical restriction - behavioural disruption. Typically, heavier hydrocarbons like HFO have higher impact due to their more persistent nature on the sea surface and within the water column (as droplets).	Inhalation. Ingestion. External contact and adsorption across exposed skin and membranes.	Mortality. Cell damage, lesions. Secondary infections. Reduced metabolic capacity. Reduced immune response. Disease. Reduced growth. Reduced reproductive output. Growth abnormalities. Behavioural disruption. Lung, respiratory and adrenal impairment. (Deepwater Horizon Oil Spill Natural Resource Trustee Council, 2016; Bejder & Gartner, 2016).
Plankton	Coating of feeding apparatus. Reduced mobility and capacity for oxygen exchange.	Mortality. Behavioural disruption (for example, reduced mobility).	Inhalation. Ingestion. External contact.	Mortality. Impairment of biological activities (for example, feeding, respiration). Reduced mobility. Cell damage Reduced growth. Reduced reproduction. Increased opportunistic species impacting community structure. Decrease in species density and richness. Decrease in total primary production. (Ozhan, 2014).

Receptor	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
Water quality and sediment quality	Presence of hydrocarbon residue in the water, which may filter down to sediments or continue to biodegrade on the surface. Degree of loading in the water column is dependent upon the influence of wave energy and tidal range.	Impacts to flora and fauna, as discussed in rows above.	Adsorption via cellular membranes and soft tissue, ingestion, irritation or burning on contact and inhalation. Impacts to flora and fauna, as discussed in rows above.	Impacts to flora and fauna, with emphasis on the ecosystem impacts of: • trophic shifts • community structure shifts • reduced growth • impaired reproduction • adverse health effects. (Deepwater Horizon Oil Spill Natural Resource Trustee Council, 2016).
Protected areas	Coating of benthic habitats and marine fauna and flora within protected areas, as discussed in rows above.	Mortality, injury or behavioural disruption to marine fauna. Death or impairment of habitats within protected areas. Reduction in the quality of the marine environment within protected areas. Environmental value of protected areas is degraded.	Impacts to flora and fauna, as discussed in rows above.	Mortality, injury or behavioural disruption to marine fauna. Death or impairment of habitats within protected areas. Reduced growth of benthic habitats. Reduction in the quality of the marine environment within protected areas. Environmental value of protected areas is degraded.
Socio-economic environment (commercial and recreational fisheries, tourism, shipping, defence)	Presence of hydrocarbon residue in the water, which may filter down to sediments or continue to biodegrade on the surface. Presence of weathered hydrocarbon on the shoreline	Degradation of UCH sites. Disruption to tourism, recreation, defence and military exercises or shipping activities. Displacement of commercial or recreational fishing. Reduction in natural resources.	Impacts to water quality, sediment quality, flora and fauna, as discussed in rows above.	Mortality, injury or behavioural disruption to marine fauna relevant to commercial, and recreational fisheries or to tourism. Loss or degradation of habitats within protected areas. Reduced growth of benthic habitats. Reduction in the quality of the marine and shoreline environment within protected areas. Socio-economic value of protected areas is degraded.

Receptor	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
Cultural features (native title, ILUAs, IPAs, sacred sites, marine parks, cultural fishing, hunting and gathering and sea country)	Presence of hydrocarbon residue in the water, which may filter down to sediments or continue to biodegrade on the surface. Presence of weathered hydrocarbon on the shoreline.	Hydrocarbons may be present in areas with cultural features (e.g. ILUAs, IPAs, sacred sites, marine parks, cultural fishing, hunting and gathering and sea country). Displacement of traditional uses of environment. Reduction in natural resources with cultural significance, refer above rows for potential impacts on fauna.	Impacts to water quality, sediment quality, flora and fauna, as discussed in rows above.	Mortality, injury or behavioural disruption to marine fauna that has cultural significance. Loss or degradation of habitats of cultural value. Reduction in the quality of the marine and shoreline environment, including environment with cultural significance. Value of cultural features is degraded.

Table 7-18: Nature and scale of hydrocarbon spills on environment and socio-economic receptors within the moderate exposure value area

Receptor	Impacts of hydrocarbon spills	
	Entrained and dissolved aromatic hydrocarbons in the water column	Floating hydrocarbons
Threatened/Migratory fauna		
Plankton (including zooplankton, fish and coral larvae)	Direct exposure of plankton to hydrocarbons may result in lethal or sublethal impacts to plankton and impact mobility, feeding and respiration. Plankton could include the eggs and larvae of marine invertebrates and fish; therefore, entrained hydrocarbon could have secondary impacts on recruitment of invertebrate and fish species. Based on the modelling results (Section 7.7.7 to 7.7.11) plankton will be exposed to hydrocarbons in the top 25 m of the water column, with the highest concentrations in the upper 10 m of the water column and areas close to the spill source. Some studies have shown no obvious influence of hydrocarbon spills on plankton community structure (Varela *et al*., 2006), which could be a result of rapid replacement of stocks from adjacent areas due to water circulation (Batten *et al*., 1998). Other studies, however, have found the concentrations of phytoplankton reduced in the short term, and in the medium term, as outbreaks of algal blooms occurring where the Chlorophyll-a concentration increased (Lee *et al*., 2009; Sheng *et al*., 2011), particularly under warmer weather conditions (Tang *et al*., 2019) and in low energy environments such as coastal coves (Zhou *et al*., 2014). Once water quality returns to background levels, it is anticipated plankton communities can return to normal densities and community structures due to their ability to produce large numbers of eggs and juveniles, their wide distribution, and rapid water exchange.	Plankton utilising the sea surface layer could be impacted by floating hydrocarbon.
	The MEVA has the potential to overlap with spawning areas of fish species; however, the extent of impacts to plankton contact will depend on the spawning times for species. Some impacted spawn may be of commercial interest (refer socio-economic receptors below). The typical mass over-production of eggs and larvae that occurs in the lifecycle of most fish species provides a buffer for recruitment, which further reduces the likelihood that a spill would have a significant detectable impact on adult fish populations (ITOPF, 2014).	

Receptor	Impacts of hydrocarbon spills	
	Entrained and dissolved aromatic hydrocarbons in the water column	Floating hydrocarbons
Marine mammals	There is potential for sublethal or lethal impacts to marine mammals and impacts to reproduction and behaviour from an accidental release of hydrocarbons. A wide range of effects from hydrocarbons have been reported in cetaceans including poor body condition, calcium imbalance, inflammation, reproductive failure, lung and adrenal gland damage, altered hepatobiliary function, immune changes and increased susceptibility to infections, impaired stress response, and death (Godard-Codding & Collier, 2018).	Marine mammals are at risk of direct contact with floating hydrocarbons at the moderate threshold when surfacing within slick. Effects include irritation of eyes or mouth and potential illness. The direct physical coating of marine mammals with hydrocarbons is more likely to occur with more persistent hydrocarbons such as HFO. Surface respiration could lead to accidental inhalation of hydrocarbons or result in the coating of sensitive epidermal surfaces. Accidental ingestion could also occur through the ingestion of hydrocarbon during feeding or the ingestion of contaminated prey. Inhalation of vapours or the ingestion of hydrocarbons can potentially have lethal effects due to damage to the whale's respiratory and nervous systems. However, cetaceans and dugongs are highly mobile, capable of long migrations, and typically in low numbers/densities in the MEVA. Experimental and field observations indicate that whales and dolphins may be able to detect and actively avoid floating hydrocarbon slicks, but this may not always be possible and exposure to floating oil may still occur (Smith *et al*. 1983, Geraci & St. Aubin 1990).
	Marine mammals and the potential of them occurring within the EMBA are presented in Section 3.4.3.2. Of these, one is listed as Endangered (pygmy blue whale) and two as Vulnerable (fin whale and sei whale). Omura's whales are also known to occur in the vicinity of the MEVA. There is the potential that surface, entrained and dissolved aromatic hydrocarbons intersect the pygmy blue whale distribution and migration BIA (Figure 3-12). Impacts to pygmy blue whale may include behavioural impacts (such as avoidance of impacted areas), sub-lethal biological effects and, in rare circumstances, mortality. Pygmy blue whale migration extends over several months in April to July (northern migration) and October to January (southern migration) and encompasses a large geographical area. Feeding during these migrations is generally low level- and opportunistic and, as such, the opportunity for ingestion of hydrocarbons should a spill occur is reduced. A vessel collision releasing large volumes of MDO at the southern end of OA2 has potential to encompass a small portion of the breeding BIA for the Indo-Pacific humpback dolphin in the vicinity of Darwin Harbour. Impacts may include behavioural impacts (such as avoidance of impacted areas), sub-lethal biological effects and, in rare circumstances, mortality. Dugongs are known to occur in coastal waters, including those of the Tiwi Island such as the seagrass sites on the north-west of Melville Island, and around Indonesian offshore islands, particularly in areas of seagrass. Direct impacts to dugongs could occur through foraging or ingesting seagrass coated with hydrocarbon or through direct exposure to hydrocarbons. Dugongs could also be indirectly affected if hydrocarbons cause the dieback of seagrass, reducing feeding areas. The MEVA overlaps with a dugong BIA near Ashmore Reef.	

Receptor	Impacts of hydrocarbon spills	
	Entrained and dissolved aromatic hydrocarbons in the water column	Floating hydrocarbons
Marine reptiles	There is potential for sublethal or lethal impacts to marine reptiles from an accidental release of hydrocarbons. Exposure can alter biochemical and haematological parameters, weight, skin function, metabolism, immune responses, diving patterns, and respiration (Ruberg *et al.*, 2021). Marine turtles are susceptible to the effects of hydrocarbon spills during all life stages and are not expected to exhibit avoidance behaviour if they encounter hydrocarbon spills.	Marine turtles are at risk of direct contact with floating hydrocarbons when surfacing within slick. Effects include irritation of eyes or mouth and potential illness as adults can suffer mucus membrane inflammation, increasing susceptibility to infection (ITOPF, 2011). Surface respiration could lead to accidental ingestion of hydrocarbons or result in the coating of sensitive epidermal surfaces. Breathing and inhalation of toxic vapours may occur from exposure to hydrocarbons in surface waters. Physical coating of marine turtles also occurs upon contact of contaminated shorelines. Eggs may also become contaminated during laying, either from the laying female or the contaminated sand.
	Marine reptiles and the potential of them occurring within the EMBA are presented in Section 3.4.3.3. Nine species of threatened marine reptile were identified, including loggerhead, green, leatherback, hawksbill, flatback and olive ridley turtles. The migratory saltwater crocodile was also identified within the EMBA and MEVA. Various BIAs and habitat critical to the survival of marine turtles in proximity to the Tiwi Islands are within the MEVA. This includes internesting and foraging BIAs for flatback, green, olive ridley and hawksbill turtles, and foraging BIAs for loggerhead turtles; habitat critical for flatback, green, olive ridley and hawksbill turtles is also present in the MEVA (refer Section 3.5.6). A vessel releasing MDO at the southern end of OA2 may lead to a greater probability of impact to flatback and olive ridley turtles, given the proximity to the Tiwi Islands. Potential impacts offshore would be greatest during the internesting season: between June and September for flatback turtles and April to August for olive ridley turtles. Population level impacts are considered unlikely as the hydrocarbons are not predicted to contact the entire BIAs or areas of habitat critical to the survival of these species. Hydrocarbons may accumulate on shorelines, including Tiwi Islands and Indonesian Islands where turtle nesting beaches are present. Marine turtles rely on nesting beaches seasonally to reproduce, which makes them vulnerable to impacts from hydrocarbon accumulated on shorelines, through oiling of nesting females and emergent hatchlings (Lauritsen *et al*., 2017). Potential impacts would be greatest during the peak nesting periods. A worst-case HFO release, which is of greater concern, given its persistent nature, may potentially result in 278 m^3 of hydrocarbons accumulating on shorelines of the Tiwi Islands. A worst-case release of MDO as a result of vessel collision at the southern end of OA2 may also result in smaller quantities of MDO accumulating on the Tiwi Islands (16 m^3). Any accumulated hydrocarbons interacting with the nesting beaches is likely to represent the persistent fraction in the form of viscous liquid and as tar balls (particularly for HFO) as the hydrocarbon weathers. As the hydrocarbon weathers, the potential impact of egg viability is reduced. Fresh hydrocarbons may have a significant impact on success rate (Milton *et al*., 2002). Adult and juvenile turtles during nesting seasons may become coated in the hydrocarbon as they move to and from shore and may also ingest hydrocarbons as they pass through the affected area. While turtle eggs are unlikely to be exposed to shoreline hydrocarbons, as most turtles nest well above the high tide level, they may be directly exposed through the transfer of hydrocarbons from the oiled female turtle (Shigenaka, 2003). Sea snakes may be found throughout the MEVA, particularly at nearby shoals and banks, as well as at locations close to Ashmore Reef and Cartier Island. While little is known about their sensitivity to hydrocarbons, impacts from direct contact with surface hydrocarbons are likely to be similar to those experienced by marine turtles; for example, potential skin damage and irritation of mucous membranes of the eyes, nose and throat. Saltwater crocodiles may be present in the inshore/coastal areas and could be contacted by hydrocarbons.	

Receptor	Impacts of hydrocarbon spills	
	Entrained and dissolved aromatic hydrocarbons in the water column	Floating hydrocarbons
Birds (seabirds and migratory shorebirds)	There is potential for injury or mortality to seabirds and shorebirds and a change in their behaviour from an accidental release of hydrocarbons. Seabirds may encounter entrained hydrocarbons while diving and foraging. Seabirds and shorebirds encounter hydrocarbon contaminated materials when foraging at intertidal areas. Lethal or sub-lethal physical and toxic effects include those such as such as irritation of eyes or mouth and potential illness.	Seabirds are particularly vulnerable to floating hydrocarbons. As most fish survive beneath floating slicks, they will continue to attract foraging seabirds, which typically do not exhibit avoidance behaviour. Smothering can lead to reduced waterproofing of feathers and ingestion while preening. In addition, direct contact with hydrocarbons can erode feathers, causing chemical damage to the feather structure that subsequently affects ability to thermoregulate and maintain buoyancy on water. Physical coating may also occur on contact of contaminated shorelines. Typically, heavier hydrocarbon like HFO have higher impact due to their more persistent nature on the sea surface. Studies have reported large spills can potentially deplete bird populations and cause desertion of single seabird colonies, although resilience of seabird populations to these single catastrophic events has also been observed (Oates, 2016).
	18 threatened species and the potential of them occurring within the MEVA are presented in 3.4.3.4. Hydrocarbons from worst-case releases may accumulate on shorelines, including Tiwi and Indonesian islands. A worst-case HFO release, which is of greater concern, given its persistent nature, may potentially result in 278 m³ (at 0.33% probability) of hydrocarbons accumulating on shorelines of the Tiwi Islands. A worst-case release of MDO as a result of vessel collision at the southern end of OA2 may also result in smaller quantities of MDO accumulating on the Tiwi Islands (16 m³). A portion of the BIA for a large breeding colony of crested terns, which includes a 20 km foraging buffer extending off the northern tip of Melville Island, has the potential to be contacted by hydrocarbons at the moderate threshold. Potential impacts are likely to be greatest during the nesting period between April and July. The MEVA also overlaps breeding BIAs for Brown booby, Bridled tern, Greater frigatebird, Lesser crested tern, Lesser frigatebird, Little tern, Roseate tern, Red-footed booby and the White-tailed tropic bird. It is possible seabird populations can recover from large-scale spills. For example, species with long life spans and high survival rates contain a substantial number of non-breeders in the population that may buffer the loss of reproductive adults, while other species have a higher reproductive potential such that adult losses can be more rapidly replaced (Oates, 2016). Other long-term studies have indicated seabird populations affected by significant spills, such as the Prestige hydrocarbon spill in the North Atlantic, had not recovered to pre-spill levels eight to ten years after the spill occurred. However, it is acknowledged predicting population recovery times is difficult, as the effects of hydrocarbon pollution cannot always be differentiated from natural environmental variation and population dynamics (Oates, 2016).	

Receptor	Impacts of hydrocarbon spills	
	Entrained and dissolved aromatic hydrocarbons in the water column	**Floating hydrocarbons**
Sharks, rays and fish	There is potential injury or mortality to sharks, rays and fish and a change in their behaviour from an accidental release of hydrocarbons. As fish dwell in the water column, impacts are most likely from exposure to entrained or dissolved hydrocarbons, through the pathways of ingestion or the coating of gill structures, resulting in reduced oxygen exchange and incidence of irritation and infection. Fish may also ingest hydrocarbon droplets or contaminated food, leading to reduced growth. There is potential for localised mortality of fish eggs and larva due to reduced water quality and toxicity. Based on the modelling results (Section 7.7.7 to 7.7.11), fish eggs and larva will be exposed to hydrocarbons in the top 25 m of the water column, with the highest concentrations in the upper 10 m of the water column and areas close to the spill source. Demersal fish are highly unlikely to be impacted by the hydrocarbon releases, as they generally inhabit waters near the seabed (hydrocarbons will be concentrated in the upper 25 m of the water column). Environmental monitoring of pelagic and demersal fishes immediately after the Montara oil spill indicated fish were exposed to hydrocarbons, although no adverse effects were detected (Gagnon & Rawson, 2011). Further sampling and testing over time indicated fish captured in proximity to the Montara wellhead were comparable to those collected from reference sites (Gagnon & Rawson, 2012).	While fish, sharks and rays do not generally break the sea surface, individuals may feed at the surface. Prolonged exposure to floating hydrocarbons by fish, shark and ray species is unlikely. Due to the filter-feeding nature of whale sharks, they may be susceptible to ingesting floating and entrained hydrocarbons, particularly if foraging at or near the sea surface.
	Seven threatened species of fish were identified by the PMST, including the white shark, whale shark, speartooth shark, sawfishes (dwarf, freshwater, green) and northern river shark. Site-attached fish associated with shallow shoals and banks in the MEVA may be exposed to hydrocarbons at harmful levels for longer durations. A foraging BIA for whale sharks has been identified within the MEVA; however, only in the event of a HFO release would floating hydrocarbons at moderate thresholds reach the extent of the BIA, and in low probabilities (<0.33 - 7.67% probability). Whale sharks do not spend all their time in surface water; rather, routinely move between surface and to depths of greater than 30 m, and in offshore regions can spend most of their time near the seafloor, reducing the likelihood of impact, given the modelling (Section 7.7.7 to 7.7.11) predicts hydrocarbon concentrations are not expected to exceed depths greater than approximately 25 m.	
Benthic communities		
Benthic communities	Shallow banks and shoals within the top 20 m of the water column occur within the MEVA. Modelling results (Section 7.7.7 to 7.7.11) show entrained hydrocarbons may contact a number of offshore banks and shoals, including Margaret Harris Bank, Lynedoch Bank, Evans Shoal, Franklin Shoal, Flinders Shoal, Blackwood Shoal and Tassie Shoal, all of which rise to water depths shallower than 20 m. Banks and shoals support a diverse and varied range of benthic communities, reef-building soft corals, hard corals and filter-feeders. Surveys of Tassie, Evans and Blackwood shoals and Lynedoch Bank recorded coral and algae species, filter-feeder communities, sponges, demersal fish and pelagic fish (Heyward *et al*., 2012, 1997b). It is expected other shoals in the region – such as Margaret Harris Bank, Franklin Shoal and Flinders Shoal – would be characterised by similar communities. Benthic communities on the banks and shoals are vulnerable to hydrocarbons. The loss of habitat-forming benthic biota may impact an entire bank or shoal ecosystem, affecting species of fish communities and other marine invertebrates. Filter feeders are particularly susceptible as they are likely to directly ingest hydrocarbons while feeding over the area. This may cause mortality or sublethal impacts such as alteration in respiration rates, decreases in filter-feeding activity and reduced growth rates.	

Receptor	Impacts of hydrocarbon spills	
	Entrained and dissolved aromatic hydrocarbons in the water column	Floating hydrocarbons
Shoreline habitats		
Shoreline habitats	Rocky and sandy shorelines occur within the MEVA, throughout the coastlines of the NT, Indonesia and Timor-Leste. Based on the modelling (Section 7.7.7 to 7.7.11), there is the potential (albeit in low probabilities [4.66%]) for accumulation of hydrocarbons at the moderate threshold at multiple shorelines locations. A worst-case HFO release, which is of greater concern, given its persistent nature, may potentially result in 367 m³ of hydrocarbons on the Indonesian coastline and 278 m³ of hydrocarbons accumulating on Tiwi Islands coastline. A worst-case release of MDO as a result of vessel collision at the southern end of OA2 may also result in smaller quantities of MDO accumulating on the Tiwi Islands (16 m³ at 0.33% probability). The severity of impact of hydrocarbon on rocky shorelines largely depends on the hydrocarbon type, the incline of the rocky shoreline and the energy environment. On steep or vertical rock faces on wave-exposed coasts, there is likely to be little impact from a spill event, as the hydrocarbon does not typically accumulate due to wave action. Lighter hydrocarbons, such as MDO and condensates, are less likely to smother the rocks. HFO being more persistent has the potential to adhere to the rock surface. Most impacts to rocky shorelines would occur as a result of physical effects, such as smothering of attached organisms. Sandy beach ecosystems are attributable to the benthic invertebrate fauna – such as polychaetes, molluscs, marine crustaceans, semi terrestrial crustaceans and insects – inhabiting the sediments. However, sandy beaches also provide important habitats for nesting turtles, breeding and foraging seabirds, and shorebirds (impacts discussed in prior section). Persistent hydrocarbons, such as HFO, that become stranded on sandy beaches are likely to remain for extended periods and become buried in the sediments. The long-term persistence of the hydrocarbons on sandy beaches will depend on the wave exposure and concentrations within sediments. Fernandez-Fernande *et al*. (2011) studied the long-term persistence of HFO in sandy beaches on the coast of Spain. The study recorded low concentrations of HFO buried within the sand as tar balls or oil coatings (last step of physio-chemical degradation) seven years after the spill. Impacts to shoreline habitats contacted within the MEVA are likely to be more prolonged from an HFO release due to its persistent nature. Shoreline contact at the low threshold is anticipated to result in a reduction in visual amenity of shorelines only.	
Intertidal/subtidal habitats		
Seagrasses and macroalgae	Seagrasses and macroalgae occur within the MEVA, along the coastlines of the NT, Indonesia and Timor-Leste, particularly in sheltered coastal bay areas. Based on the modelling (Sections 7.7.7 to 7.7.11) there is the potential (albeit in low probabilities) for accumulation of hydrocarbons at the moderate threshold at multiple locations where seagrasses are present. A worst-case HFO release, which is of greater concern, given its persistent nature, may potentially result in 367 m³ of hydrocarbons on the Indonesian coastline and 278 m³ of hydrocarbons accumulating on Tiwi Islands coastline. A worst-case release of MDO as a result of vessel collision at the southern end of OA2 may also result in smaller quantities of MDO accumulating on the Tiwi Islands (16 m³). Most seagrasses are subtidal, although there may be relatively small areas of intertidal seagrasses. The potential for toxicity effects of entrained hydrocarbon may be reduced by weathering processes that should serve to lower the content of soluble aromatic components before contact occurs. Hydrocarbons are expected to be highly weathered before reaching shallow areas where seagrasses may occur. The highest impact on seagrasses have been observed when leaves of intertidal plants have been exposed to direct contact with hydrocarbons (Durako *et al*., 1993; Jackson *et al*., 1989). Smothering through algal blooms (Jacobs, 1980), shoot mortality (Peirano *et al*., 2005) and a reduction in seagrass tolerance to other stress factors (Zieman *et al*., 1984) have also been documented as a result of hydrocarbon spills. Long-term impacts to seagrass are unlikely unless hydrocarbon is retained within the seagrass meadow for a sustained duration (Wilson & Ralph, 2011). Impacts to seagrasses contacted within the MEVA are likely to be more prolonged from an HFO release due to its persistent nature.	

Receptor	Impacts of hydrocarbon spills	
	Entrained and dissolved aromatic hydrocarbons in the water column	Floating hydrocarbons
Mangroves	Intertidal mangrove habitats occur within the MEVA, along the coastlines of the NT, Indonesia and Timor-Leste. Based on the modelling (Sections 7.7.7 to 7.7.11), there is the potential (albeit in low probabilities) for accumulation of hydrocarbons at the moderate threshold at multiple locations where mangroves are present. A worst-case HFO release, which is of greater concern, given its persistent nature, may potentially result in 367 m^3 of hydrocarbons on the Indonesian coastline and 278 m^3 of hydrocarbons accumulating on Tiwi Islands coastline. A worst-case release of MDO as a result of vessel collision at the southern end of OA2 may also result in smaller quantities of MDO accumulating on the Tiwi Islands (16 m^3). The severity of exposure for mangroves largely depends on the amount and type of hydrocarbon entering the intertidal zone (Duke, 2016). While heavy hydrocarbons (high specific gravity, like HFO) are particularly proficient at coating and smothering small plants and aerial root systems, lighter hydrocarbons (MDO and condensates) with low specific gravity, are more toxic to mangroves (Hensel *et al.*, 2014; Connolly *et al.*, 2020). The potential for toxicity effects from hydrocarbons may be reduced overtime by weathering processes that should serve to lower the content of soluble aromatic components. Observations of offshore hydrocarbon spill events have shown large scale hydrocarbon spills can result in persistent or permanent loss of mangrove habitat, with some capacity to recover over time (Duke, 2016). Impacts to mangroves contacted within the MEVA are likely to be more prolonged from an HFO release due to its persistent nature.	
Intertidal platforms	Intertidal platforms and mudflats occur within the MEVA, along the coastlines of the NT, Indonesia and Timor-Leste. Based on the modelling (Sections 7.7.7 to 7.7.11), there is the potential (albeit in low probabilities) for accumulation of hydrocarbons at the moderate threshold at multiple locations where intertidal sand and mudflats are present. A worst-case HFO release, which is of greater concern, given its persistent nature, may potentially result in 367 m^3 of hydrocarbons on the Indonesian coastline and 278 m^3 of hydrocarbons accumulating on Tiwi Islands coastline. A worst-case release of MDO as a result of vessel collision at the southern end of OA2 may also result in smaller quantities of MDO accumulating on the Tiwi Islands (16 m^3). Intertidal platforms and mudflats are typically a low-energy environment heavily influenced by tidal cycle. They therefore have the potential to trap hydrocarbons, increasing their susceptibility to impacts. Sediment quality in mudflats will be reduced in the area of the mud or sand flat from hydrocarbon accumulation, with finer sediments being more susceptible as persistent hydrocarbons such as HFO can penetrate through animal burrows and root pores. Intertidal mudflats provide important resting and feeding areas for migratory bird species. Impacts to intertidal platforms and mudflats contacted within the MEVA are likely to be more prolonged from an HFO release due to its persistent nature. Both HFO and light hydrocarbons (MDO and condensates) reaching intertidal platforms are likely to be heavily weathered, reducing the toxic effects.	

Receptor	Impacts of hydrocarbon spills	
	Entrained and dissolved aromatic hydrocarbons in the water column	Floating hydrocarbons
Socio-economic		
Commercial, recreational and traditional fisheries	Hydrocarbons in the water column can have toxic effects on fish (as outlined above) and lead to a reduction in catch rates. Fish may also be tainted by the hydrocarbons, rendering them unsafe for human consumption. Impacts on spawning fish can also result in impacts to commercial fisheries.	In addition to the effects of entrained and DAHs, exclusion zones surrounding a spill can directly impact fisheries by restricting access for fishers. Weathered slicks may form tar balls, which may result in oiling of nets and fishing infrastructure.
	A number of commercial fisheries may operate within the MEVA, given the extent. Impacts to these fisheries from a spill include a disruption or displacement of fishing activities caused by the physical presence of the slick, loss of catch, decline in commercially important fish stocks and suspension of fishing operations. Southern bluefin tuna are known to spawn within the MEVA; therefore, a hydrocarbon spill occurring during spawning or movement from spawning grounds to the southern coast could have effects on the commercial fishery stock. It is likely other commercial fish that are targeted in the region (refer to Section 3.6.1) could also be affected if spawning occurs during a hydrocarbon spill event. Exposure to entrained and dissolved oils could result in the accumulation of hydrocarbon in fish tissues to the extent that could result in hydrocarbon taint of fish flesh. Connell and Miller (1981a, 1981b) compiled a summary of studies listing the exposure value concentrations at which tainting occurred for hydrocarbons. The results contained in their review indicate tainting of fish occurs when they are exposed to ambient concentrations of 4 to 300 ppm (4000 to 300,000 ppb) of hydrocarbons in the water, for durations of 24 hours or more, with response to phenols and naphthenic acids being the strongest. Given entrained hydrocarbons are predicted to exceed the moderate exposure value at some locations in the MEVA, hydrocarbon taint is possible in fish flesh. Although it is difficult to assess how long fish might be exposed for, small, less mobile fishes would be more susceptible. It is possible impacts could be detected to fisheries on a stock level, although it is more likely natural variation in fish abundance would be on a greater scale than any impacts attributable to a hydrocarbon spill. This would most likely be the case for fisheries species that use shallow waters around the banks and shoals and could occur through direct impacts to fish or to fish habitats (for example, seagrass, coral reef, mangrove habitats which are present within the MEVA). In general, fish are not expected to retain a taint for longer than a week after exposure to entrained or dissolved hydrocarbons (Gagnon & Holdway, 2000, cited in Westera & Babcock, 2016) The same negative impacts could also occur to important traditional Indonesian and recreational fish target species. Commercial, recreational and traditional fisheries may be impacted within the EMBA due to wider implications of taint on fish species.	
Recreation and tourism	There is limited tourism and recreation in remote, offshore waters; however, some shoals and banks may be frequented. A hydrocarbon spill may temporarily displace recreation and tourism users from the EMBA, and impact upon natural resources (such as fish) targeted and seascapes valued by these users. Contact at the low exposure threshold has the potential to result in a reduction in visual amenity of shorelines. It is considered highly unlikely there will be long-term impacts to tourism and recreation activities.	
Shipping	There is limited shipping activity in the MEVA (Section 3.6.6). However, the southern end of OA2 (within the MEVA), to the Commonwealth/State waters boundary, is an area of high shipping traffic due to its proximity to Darwin. Hydrocarbons in the water column will have no effect on shipping.	Exclusion zones surrounding a spill will reduce access for shipping vessels for the duration of the response undertaken for spill clean-up (if applicable. Ships may have to chart alternative routes, leading to potential delays and increased costs.
Defence	The level of defence activities performed near the OAs is low, though the MEVA does overlap some of the NAXA and the due regard area in Kakadu for the military training exercise. An exclusion zone surrounding a spill has the potential to adversely affect defence activities. Interference with defence activities due to a hydrocarbon spill is expected to be minimal.	

Receptor	Impacts of hydrocarbon spills	
	Entrained and dissolved aromatic hydrocarbons in the water column	Floating hydrocarbons
Shipwrecks	Floating hydrocarbons will have no impact on shipwrecks as all shipwrecks within the MEVA are submerged and therefore will not extensively be contacted by floating hydrocarbons. The potential for in-water hydrocarbons to impact on shipwrecks is poorly documented. Based on the modelling results (Section 7.7.7 to 7.7.11), hydrocarbons are present in the top 25 m of the water column; therefore, extensive contact with submerged shipwrecks is not anticipated. Exposure to hydrocarbon may alter bacterial community composition (biofilms) inhabiting shipwrecks, possibly altering corrosion potential (Salerno *et al.,* 2018). The biofilms promote the recruitment of macro-organisms and can form protective surfaces that may decrease access for abiotic corrosion and may assist with the preservation of historic metal shipwrecks (dependent on the environmental conditions). Further studies have provided evidence that exposure of shipwreck surfaces to residual spill contaminants has the potential to alter biofilm taxonomy and functional potential, which may place the biodiversity and the preservation of historic metal structures in the deep sea at risk (Mugge *et al.*, 2019).	
Cultural features	Marine resource use by Indigenous people is generally restricted to coastal waters. Fishing, hunting and the maintenance of maritime cultures and heritage through ritual, stories and traditional knowledge continue as important uses of the nearshore region and adjacent areas. While the MEVA is largely offshore, it may overlap with cultural features. Impacts to these features from a spill include, but are not limited to, a disruption/displacement of cultural activities caused by the physical presence of hydrocarbon, decline in traditional food sources and / or mortality of fauna with cultural significance e.g. totemic species.	
Existing energy industry	A number of energy industry operators have existing infrastructure within, and would transit through, the MEVA (such as Santos Bayu-Undan and INPEX Ichthys gas export pipelines). An exclusion zone surrounding a spill has the potential to adversely affect such operators. Interference of existing energy industry activities due to a hydrocarbon spill is expected to be minimal.	
Protected areas		
Marine parks and Commonwealth heritage areas	A number of marine parks overlap the EMBA (listed in Table 3-14). The MEVA overlaps the: • Oceanic Shoals Marine Park • Arafura Marine Park • Ashmore Reef Marine Park • Cartier Island Marine Park • Joseph Bonaparte Gulf. In addition, the MEVA overlaps the Ashmore Reef National Nature Reserve. Given OA2 overlaps the Oceanic Shoals Marine Park, there is the potential for immediate contact with MDO from a vessel spill. Other marine parks are more than 200 km from the OAs. Therefore, any contact will be with highly weathered hydrocarbons, reducing the potential impacts. Hydrocarbons contacting marine parks may impact the value of the marine parks for a period. These values include: • natural • cultural • socio-economic. Section 3.5.4 details the values of the individual marine parks. **Natural values** Extensive contact with deeper features such as KEFs associated with the marine parks is not predicted, given the modelling predicts hydrocarbon concentrations are not expected to exceed depths greater than approximately 25 m (Sections 7.7.7 to 7.7.11). The main risks of impact to the subsea natural values of a marine park from spills are those from HFO spills entering the marine park and, as HFO weathers or gets mixed with sand or sediment, it may become dense enough to sink, resulting in some localised smothering of benthic habitats.	

Receptor	Impacts of hydrocarbon spills	
	Entrained and dissolved aromatic hydrocarbons in the water column	Floating hydrocarbons
	Marine parks support increased productivity or abundance of marine fauna that use the waters – including plankton, pelagic invertebrates and fish, marine mammals, marine reptiles and seabirds – which may be impacted by hydrocarbons, as previously described in this table. **Socio-economic values** Marine parks may be used by a number of other users, including tourism and recreational fisheries, and may be impacted by hydrocarbons, as previously described in this table.	
KEFs	KEFs are described in Section 3.5.5	
	A number of KEFs overlap the EMBA (listed in Table 3-14). The MEVA overlaps the: • Ashmore Reef, Cartier Island and surrounding Commonwealth Waters • continental slope demersal fish communities • carbonate bank and terrace system of the Sahul Shelf • carbonate bank and terrace system of the Van Diemen Rise • Pinnacles of the Bonaparte Basin • shelf break and slope of the Arafura Shelf • tributary canyons of the Arafura Depression. While some features associated with the KEFs are subtidal or submerged and would not be directly contacted by a surface slick, they all may support increased productivity or abundance of marine fauna that use surface waters above the features – including plankton, pelagic invertebrates and fish, marine mammals, marine reptiles, and seabirds – which may be impacted by hydrocarbons, as previously described in this table. KEFs are typically geomorphic features. The likelihood of extensive impact is reduced, given the modelling (Sections 7.7.7 to 7.7.11) predicts hydrocarbon concentrations are not expected to exceed depths greater than approximately 25 m. The main risks of impact to the subsea features of the KEF from spills are those from HFO spills entering the marine park and, as HFO weathers or gets mixed with sand or sediment, it may become dense enough to sink, resulting in some localised smothering of benthic habitats.	
Ramsar wetlands	Ramsar wetlands are present at Ashmore Reef and provide key habitats that support a high diversity and abundance of migratory birds and various wetland habitats. Impacts to migratory birds have been described above.	
Threatened ecological communities	There are no threatened ecological communities within the MEVA.	

7.7.7 Environmental performance outcomes

The EPOs relating to liquid hydrocarbon events are:

- No injury of, or mortality to, EPBC Act 1999 listed marine fauna or marine fauna listed as threatened species under the *Territory Parks and Wildlife Conservation Act 1976* (NT) as a result of the Activity. (EPO-08)
- Zero unplanned discharge of hydrocarbons or chemicals to the marine environment from the Activity. (EPO-18)
- No significant impact to cultural features from the Activity. (EPO-19)
- No impacts to underwater cultural heritage from the Activity. (EPO-20).

7.7.8 Unplanned Release of Condensate

A full list of credible unplanned condensate release scenarios is presented in Table 7-8. The worst case scenario is the surface release of condensate from the FPSO which is detailed further in Section 7.7.8.1.

7.7.8.1 Description of worst-case event (Surface release of condensate from the FPSO)

Event

Table 7-19: Worst case unplanned condensate release scenario

Scenario	Volume maximum credible volume
Surface release of condensate from the FPSO or offtake tanker as a result of an external impact (vessel collision) that ruptures a condensate storage tank	16,700 m^3 over one hour

Surface release of condensate from the FPSO or offtake tanker as a result of an external impact (vessel collision) that ruptures a condensate tank

An external impact (vessel collision) scenario may occur between:

- vessel (third-party or Activity vessel) and the FPSO
- vessel (third-party or Activity vessel) and the offtake tanker.

The FPSO has centreline condensate storage (cargo) tanks that are double-sided and double bottomed design and provide two physical barriers between hydrocarbon and the marine environment for bottom and side impact. A rupture of the FPSO main centreline condensate cargo tanks resulting in 100% release is determined not credible as a result of vessel collision, given the position of these tanks within the centreline of the FPSO hull.

It is credible, however, that the FPSO's off-specification condensate cargo tank (Section 7.7.1) is ruptured in the event of a vessel collision, which has a maximum storage volume of 16,700 m³ and is positioned adjacent to the ballast tanks on the port midships of the FPSO. The FPSO has been designed to withstand all reasonable vessel collision scenarios, except passing traffic, which could potentially involve impact energies beyond the FPSO design case. It is considered precautionary to use the AMSA guidelines (2015) for major collisions, which is 100% volume of tank protected by double sides (as in, one water ballast tank and double bottomed hull protection). The maximum credible release is therefore 16,700 m³.

The offtake tankers have cargo tanks that are double-hull design and provide two physical barriers between hydrocarbon and the marine environment for side impact. Offtake tanker cargo tanks are smaller than the FPSO off-specification condensate storage tank, and any release would be smaller than the FPSO release detailed above. A major collision per AMSA guidelines (2015) would result in a loss of 6,400 m³ from the offtake tanker. A spill from the offtake tanker is only relevant to the scope of the EP while the tanker is under Santos' navigational control in OA1, when the offtake tanker is connected to the FPSO and when performing an offtake.

Operational area 1:

The events are credible in OA1.

Operational area 2:

The events are not credible in OA2 (FPSO and offtake tanker not present).

Extent

The spill modelling results at or above moderate exposure values (as used to define the MEVA) are summarised in Section 7.7.8.2.1.

The low threshold, MEVA and HEVA contours for this event are presented in Figure 7-8.

For information about the extent of potential impact associated with this event, refer to Section 7.7.8.2.

Duration	An unplanned release may occur during operational activities within OA1, this scenario is not applicable to OA2. Approximately one hour in the worst-case scenario. The Barossa condensate is characterised by a low viscosity and is considered a Group I oil (non-persistent) and is expected to weather quickly (few hours to a day) through evaporation and dispersion.

7.7.8.2 Nature and scale of environmental impacts

Potential receptors: Physical environment and habitat, protected areas, threatened, migratory, or local fauna, socio-economic and cultural features.

Hydrocarbon spills will cause a decline in water quality and may cause chemical (for example, toxic) and physical (such as coating of emergent habitats, oiling of wildlife at sea surface) impacts to marine species. The severity of the impact of a hydrocarbon spill depends on the magnitude of the spill (as in, extent, duration) and sensitivity of the receptor.

The magnitude of potential environmental impact from a condensate release (which behaves in a similar manner in the marine environment to MGO and MDO) is dependent on multiple factors, including hydrocarbon type, release volume and rate, and ocean and weather conditions.

The impact assessment of the sensitive environmental receptors at risk from a worst case condensate release (surface release of condensate from the FPSO) (Section 0) has been determined based on a literature review and trajectory and fate modelling described in Section 7.7.8.2.1.

Potential impact pathways (physical and chemical) of hydrocarbon exposure for receptors and potential impacts to receptors found within the MEVA are further described in Table 7-17.

Table 7-18 summarises the potential impacts of hydrocarbon spills to sensitive receptors and values within the MEVA.

There are a number of smaller volume credible condensate spill scenarios detailed in Table 7-8, including subsea releases of condensate from production wells and the subsea system, release from offtake equipment and release from flare carry-over, that would result in a lesser scale of environmental impacts than the surface release from FPSO scenario.

For the three production well leak scenarios, stochastic spill dispersion modelling (RPS, 2023c) undertaken for a 1,383 m^3 subsea release of condensate was considered applicable (albeit a higher volume) and used to inform the potential scale of impacts. This modelling showed:

- no floating oil exposure observed at the ≥1 g/m^2 threshold
- no shoreline accumulation was observed at the ≥10 g/m^2 threshold
- no entrained hydrocarbon concentrations observed at the ≥10 ppb threshold, and;
- only 1 submerged receptor (Sunrise Bank) exposed to dissolved hydrocarbons at a probability of <1%, with the highest concentration being 15 ppb.

These results demonstrate that the scale of impacts from production well leaks would be significantly less than that for a surface release of condensate from the FPSO (refer Section 7.7.8.2.1).

7.7.8.2.1 Stochastic spill dispersion modelling (surface release of condensate from the FPSO)

The spill modelling results at or above moderate exposure values (as used to define the MEVA) are summarised below for a condensate release from the FPSO. More detailed results are provided in Appendix H.

Further parameters required to inform spill response strategies are described in the Barossa Production Operations OPEP. Deterministic spill dispersion modelling is provided in Section 6 of the Barossa Production Operations OPEP which includes all results relevant to spill response.

The currents in the region are dominated by tidal and wind-driven currents which are dependent on the season. These will influence the direction the hydrocarbons (entrained and floating) travel in a particular season.

Accumulated shoreline hydrocarbon

Modelling results for accumulated shoreline hydrocarbon indicate:

- the highest probability of shoreline hydrocarbon accumulation at the 10 g/m^2 threshold is predicted for Indonesia-East – Timor Leste (less than 4%), which had also recorded the maximum volume of hydrocarbon ashore as 156 m^3
- the shortest time for shoreline hydrocarbon accumulation at the 10 g/m^2 threshold is predicted at Indonesia-East – Timor Leste after 238 hours (approximately ten days) after commencement of the spill
- no shoreline accumulation is predicted on the Tiwi Islands.

Floating hydrocarbon greater than 10 g/m²

Modelling results for floating hydrocarbon greater than 10 g/m² indicate:

- floating hydrocarbon may extend up to 342 km west from the release location
- Sunrise Bank and Margaret Harries Bank are predicted to be contacted at probabilities less than 2%
- The Oceanic Shoals Marine Park is predicted to be contacted at a probability of less than 1%.

Entrained hydrocarbon greater than 100 ppb

Modelling results for entrained hydrocarbon greater than 100 ppb indicate:

- entrained hydrocarbon may occur within 0 to 25 m water depth, with a maximum distance from the release location of 1520 km to the west
- the shortest time for entrained hydrocarbon exposure at any receptor is predicted for Sunrise Bank (33 hours)
- the worst-case concentration of entrained hydrocarbons is predicted at Sunrise Bank as 44,778 ppb
- The Oceanic Shoals Marine Park is predicted to be contacted at a probability of less than 21%.

Dissolved hydrocarbon greater than 50 ppb

Modelling results for dissolved hydrocarbon greater than 50 ppb indicate:

- dissolved hydrocarbon may extend a maximum distance from the release location of 1763 km to the west
- Sunrise Bank and Margaret Harries Bank are predicted to be contacted at probabilities of less than 16% and less than 8%, respectively
- the Oceanic Shoals Marine Park is predicted to be contacted at a probability of less than 8%.

7.7.8.3 Control measures

An assessment of the environmental benefits and the potential costs or issues associated with control measures for all credible scenarios relevant to unplanned condensate release events are shown in Table 7-20, Table 7-21 and Table 7-22 to demonstrate reduction of potential risks to ALARP. Control measures that are adopted have associated EPSs and measurement criteria that are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 7-20: Control measure evaluation for surface release of condensate from the FPSO (worst-case scenario)

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-7.1.6	Barossa FPSO Facility Safety Case (administrative control)	Details prevention, detection, mitigation and recovery measures provided to manage the risks. Details alarms and required emergency response in the event of a loss of containment.	Administrative costs of preparing and implementing the Safety Case.	**Adopted –** Benefits considered to outweigh costs.
BAO-CM-7.5.1	FPSO hull integrity (engineering control)	Reduces the risk of a release from vessel collision. The FPSO is double-sided and bottomed by design, providing multiple physical barriers between the cargo tanks and the marine environment for side impact. The offtake tanker hulls are	The FPSO is double-sided and bottomed by design and the control is already in place. Offtake tanker hulls are double-sided by design and the control is already in place. Costs associated with maintaining FPSO hull integrity.	**Adopted** – the FPSO and offtake tanker are double-sided by design.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		double-sided by design.		
BAO-CM-7.7.8.1	FPSO Hull tank inspection and maintenance regime (administrative control)	The FPSO hull tank inspection and maintenance regime as outlined in the hull structure integrity management plan, supported by the Hull Risk Based Inspection (RBI) study, outlines a schedule for inspection and maintenance of the FPSO tank, thus assuring hull integrity	Costs associated with maintaining and inspecting the tanks.	**Adopted** – environmental benefits of ensuring inspection and maintenance are conducted outweigh the costs.
BAO-CM-7.7.8.2	Emergency shutdown and blowdown systems (engineering control)	Detects abnormal process conditions and alerts the operators to execute preventative and mitigative actions on hydrocarbon containing equipment, such as initiating blowdown and shutdown during abnormal processes. This both prevents and minimises release volumes from hydrocarbon containing equipment.	Costs associated with maintaining and inspecting the emergency shutdown and blowdown systems.	**Adopted** – environmental benefits of ensuring emergency shutdown and blowdown systems are maintained outweigh the costs.
BAO-CM-7.7.8.3	FPSO unplanned gas release escalation prevention controls – blowdown system functionality (engineering control)	Prevents escalation of loss of containment from the topsides hydrocarbon containing equipment through the depressurisation of process inventories. A functioning blowdown and flare system aims to assure a blowdown system is available so escalation of spill events can be prevented by depressurising process inventories via a release to flare when initiated, rather than to the marine environment.	Costs associated with maintaining and inspecting the blowdown and flare system.	**Adopted** – environmental benefits of ensuring blowdown and flare system is maintained outweigh the costs.
BAO-CM-6.6.3	Collision avoidance radar (protective control)	FPSO would appear on the display of the triggering radars, providing range, bearing and identification information. Would alert vessels of FPSO position reducing collision risk	Minimal cost for purchase, and maintenance of radar system.	**Adopted** – environmental benefits of identifying the FPSO to other marine users outweigh the minimal costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-6.6.6	Vessel speed restrictions within 500m around the FPSO, IMMR vessels and campaign vessels (substitute control)	Reduces consequence of collisions (causing harm) and likelihood as fauna have longer to detect and avoid the vessel by restricting vessel speeds in the OA to 8 knots or less within 500m of the FPSO and Activity vessels. Reduces the potential impacts to culturally significant marine species, including totemic species, such as marine turtles and marine mammals.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted** - benefits considered to outweigh costs
BAO-CM-7.7.8.4	Barossa Terminal Handbook, including offtake operations and pilotage procedure (administrative control)	Reduces the risk of a release from vessel collision by providing details for safe approach (such as daylight hours, speed, pilot accreditation) and berthing of the offtake tanker to the FPSO. The Barossa Terminal Handbook also defines parameters (such as metocean) for offtake to occur and reduces the risk of release events. The Santos Marine Assurance Manual sets acceptance criteria that are used to assess the suitability of the proposed offtake tanker to comply with the equipment and operational procedures developed to ensure safe offtake.	Costs associated with ensuring the Barossa Terminal Handbook is maintained and implemented.	**Adopted** – environmental benefits of ensuring procedures are followed and measures implemented outweigh the costs.
BAO-CM-7.7.8.5	Barossa Terminal Handbook, including offtake operations (administrative control)	Reduces the risk of spills from offtake operations. The offtake hose has Emergency Release Coupling. Also requires competent operators monitoring the offtake. Berthing of offtake is restricted to during daylight hours.	Costs associated with ensuring the Barossa Terminal Handbook is maintained and implemented.	**Adopted** – environmental benefits of ensuring procedures are followed and measures implemented outweigh the costs.
BAO-CM-7.6.1	Emergency Response Plan (ERP) (administrative control)	Implements response plan to isolate the leaking infrastructure quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents and large costs of preparing for and implementing response strategies.	**Adopted** – regulatory requirement, must be adopted.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-7.7.8.6	Inspection of hydrocarbon-containing equipment (administrative control)	Inspection and maintenance of topsides hydrocarbon containing equipment assures hydrocarbon pressure containment measures are in place and functioning to prevent the uncontrolled release of hydrocarbons from topsides. Requires that hydrocarbon containing equipment is maintained and inspected, reducing the likelihood of a release from the subsea system. IMMR is set in accordance with the Barossa Project Integrity Management Plan – Subsea, which provides inspection frequencies for subsea hydrocarbon containing equipment, to ensure integrity is maintained. The frequency of inspection varies dependent on the subsea component. Post-cyclone inspection by ROV may also provide additional surveillance of anomalies or areas of interest flagged by inspections or analysis.	Costs associated with maintenance and inspections of the topsides hydrocarbon containing equipment.	**Adopted –** environmental benefits of preventing a hydrocarbon release outweigh the procedural compliance costs.
BAO-CM-6.6.1	Notify AHS and AMSA MSI prior to relevant Activity (Administrative control)	Maritime notifications ensure marine users are informed of the proposed activities, reducing the likelihood of unplanned interactions. Subsea infrastructure, FPSO and Barossa GEP location and exclusion zones are charted on Australian Hydrographic Service (AHS) nautical charts alerting other marine users to the presence of Activity vessels and exclusion zones and restrictions, thus reducing the likelihood of vessel collision and fishing gear snagging.	Negligible costs. Excludes commercial fishers from prospective fishing grounds.	**Adopted** – environmental benefits of identifying the FPSO to other marine users outweigh the process of arranging charting with AHS.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-6.6.4	Activity undertaken in accordance with Santos HSE management and marine vessel vetting processes (Santos' Offshore Marine Assurance Procedure) (administrative control)	Ensures contracted vessels are operated, maintained, and crewed in accordance with industry standards and regulatory requirements.	Costs associated with personnel time in checking vessel.	**Adopted** – benefit of assuring vessels outweighs procedure compliance costs.
BAO-CM-6.1.2	Vessels equipped and crewed in accordance with Australian maritime requirements, including Marine Order 30 (Prevention of Collisions) and Marine Order 21 (Safety and Emergency Arrangements) (administrative control)	Ensures vessels meet Marine Assurance Standards to reduce the likelihood of vessel collision (such as minimum and working lighting for maritime safety).	Cost associated with implementing procedures.	**Adopted** – benefit of assuring vessels outweighs procedure compliance costs.
BAO-CM-6.6.2	Petroleum safety zone administered by NOPSEMA in accordance with the *OPGGS Act* and cautionary area established (administrative control)	The PSZ alerts other marine users to the presence of the mooring buoy and FPSO. Third-party vessels (excluding the offtake tanker) are not permitted to enter the PSZ, thereby reducing the likelihood of other marine user interactions with the offtake tanker. Ships must navigate with particular caution in order to reduce the risk.	Negligible costs. Other marine users may be temporarily excluded from areas, disrupting their activities.	**Adopted** –standard requirement.
BAO-CM-7.7.8.7	NOPSEMA-accepted Barossa Production Operations Oil Pollution Emergency Plan (OPEP) (administrative control)	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment.	Personnel and administrative costs associated with preparing documents, ongoing management (spill response exercises) and implementation of the Barossa Production Operations OPEP.	**Adopted** – regulatory requirement, must be adopted.
BAO-CM-7.4.3	FPSO and vessel spill response plans (SOPEP/SMPEP) (administrative control)	Implements response plans (SOPEP/SMPEP) aboard vessels to deal with unplanned hydrocarbon releases and spills quickly and efficiently in order to reduce impacts to the marine environment.	Administrative costs of preparing documents. Generally undertaken by vessel contractor so also time for Santos personnel to confirm and check SOPEP/SMPEP in place.	**Adopted** – regulatory requirement, must be adopted.
BAO-CM-6.4.10	Barossa Facilities and vessels planned maintenance system to confirm equipment integrity is maintained in accordance with	Ensures offtake equipment, including the offtake floating hose, is maintained through routine:	Costs associated with maintaining equipment.	**Adopted** – benefits of maintaining offtake equipment integrity outweigh the costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	manufacturers guidelines. (administrative control)	• visual inspections • string hydrotest. A maintained floating hose will reduce the likelihood of loss of integrity events during condensate transfers.		
Additional control measures				
N/A	Pipe the condensate to the mainland (elimination control)	Constructing and installing a pipeline to the mainland would negate the requirement for offtake tanker presence, therefore remove collision risk and offtake release risk and subsequent crude release to the environment.	Significant costs involved in constructing, installing, and operating a pipeline. Additional environmental impacts associated with constructing and installing a pipeline as well as condensate release risks associated with transporting the condensate via the pipeline. The Barossa OPP (ConocoPhillips, 2018) further evaluated this control. Adopting this control is not in compliance with the OPP.	**Not adopted**– high costs which grossly outweigh the environmental benefit.
N/A	Contract a standby vessel 24/7 during operations to aid third-party vessel detection at sea (protective control)	Standby vessel to monitor the cautionary zone and be equipped with an AIS to aid vessel detection at sea, and radar to aid in detecting approaching third-party vessels. Reduces risk of vessel collision and subsequent unplanned release of hydrocarbons.	High cost associated with contracting standby vessel 24/7. Costs of operating navigational equipment. Additional risks from the vessel being in the 500 m PSZ.	**Not adopted** – high costs which grossly outweigh the environmental benefit. Additional risks exist from additional vessel use in the PSZ.
N/A	Limit offtake frequency (protective control)	Limiting offtake frequency will reduce the likelihood of collisions between the FPSO and offtake tanker as less offtakes will be undertaken.	Significant cost as production would have to decrease as there is not enough storage capacity on the FPSO to limit offtake frequency.	**Not adopted**– high costs which grossly outweigh the environmental benefit.
N/A	Reduce loading rates (engineering control)	Reducing load rates has the potential to reduce the release volume, should there be an integrity failure in the offtake equipment.	Significant cost as offtakes will take longer. Additional risks involved with the offtake tanker remaining on location for a longer period.	**Not adopted**– high costs which grossly outweigh the environmental benefit. Rates for offtake are given in the Barossa Terminal Handbook and monitored during loading.
N/A	Response equipment above and beyond	May allow for quicker response to a spill as	Lack of room on the FPSO. High costs	**Not adopted**– not feasible due to lack of

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	SOPEP/SMPEP requirements (such as booms) on the FPSO ready to respond to a loss of hydrocarbons (protective control)	resources will be within proximity.	associated with a dedicated resource on location.	room on the FPSO and large cost associated with dedicated resources on location deemed grossly disproportionate compared to risk.
N/A	Offtake lines to be monitored for pressure drops during condensate offtake activities (administrative control)	May allow for identifying a leak during offtake activities	It is not practical to install instrumentation on the hose, given it is reeled on and off the hose reel.	**Not adopted** – There is no facility for monitoring of pressure on the hose itself. There is a low pressure trip upstream of the floating hose. Also requires competent operators monitoring the offtake (visual observations are made during the entire duration of the offtake activity and the amount transferred and received are checked hourly in accordance with the Barossa Terminal Handbook.

Table 7-21: Control measure evaluation for subsea release of condensate from the subsea system

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-7.1.6	Barossa FPSO Facility Safety Case (administrative control)	Details prevention, detection, mitigation and recovery measures provided to manage the risks. Details alarms and required emergency response in the event of a loss of containment.	Administrative costs of preparing and implementing the Safety Case.	**Adopted –** Benefits considered to outweigh costs.
BAO-CM-7.7.8.6	Inspection of hydrocarbon-containing equipment (administrative control)	Requires that hydrocarbon containing equipment is maintained and inspected, reducing the likelihood of a release from the subsea system. IMMR is set in accordance with the Barossa Project Integrity Management Plan – Subsea, which provides inspection frequencies for subsea hydrocarbon containing equipment, to ensure integrity is maintained. The inspection frequency varies dependent on the subsea component.	Costs associated with preparing and implementing (such as field inspections and maintenance) the Barossa Project Integrity Management Plan – Subsea.	**Adopted –** environmental benefits of preventing a subsea condensate release outweigh the procedural compliance costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		Post-cyclone inspection by ROV may also provide additional surveillance of anomalies or areas of interest flagged by inspections or analysis.		
BAO-CM-7.7.8.8	Inspection and integrity monitoring of risers (administrative control)	Ensures the integrity and functioning of risers are fit-for-purpose and able to provide hydrocarbon containment. Risers and flowlines, including all mounted fittings, fixtures and supports, are inspected, tested and maintained.	Costs associated with implementing the inspections, testing and maintenance on risers.	**Adopted** – environmental benefits of ensuring the integrity of the risers are maintained as intended outweigh the costs.
BAO-CM-7.7.8.9	Mooring equipment integrity verified and maintained, in accordance with the Mooring Line Monitoring System (MSMS) preventing interaction with risers and subsequent release of hydrocarbons (engineering control)	Ensures integrity of the mooring equipment through inspection and testing so the FPSO remains within the mooring excursion limits therefore cannot impact risers, and lead to a hydrocarbon release. Mooring equipment is inspected, tested and maintained.	Costs associated with implementing the inspections, testing and maintenance on mooring equipment.	**Adopted** – environmental benefits of ensuring the integrity of the mooring equipment are maintained as intended outweigh the costs.
BAO-CM-7.7.8.10	FPSO position monitoring to identify loss of FPSO position (engineering control)	An excursion alarm is functioning to alert the operator when FPSO excursion limits are exceeded. FPSO procedures are in place for extreme weather conditions to prevent excessive movements damaging the risers.	Costs associated with maintaining alarm and monitoring excursion.	**Adopted** – environmental benefits of ensuring the integrity of the risers are maintained outweigh the costs.
BAO-CM-6.6.2	Petroleum safety zone administered by NOPSEMA in accordance with the *OPGGS Act* and cautionary area established (administrative control)	The PSZ alerts other marine users to the presence of the mooring buoy and FPSO. Third-party vessels (excluding the offtake tanker) are not permitted to enter PSZ, thereby reducing the likelihood of other marine user interactions with the subsea infrastructure. A cautionary zone extends around the subsea infrastructure in order to alert other marine users of its presence.	Negligible costs. Other marine users may be temporarily excluded from areas, disrupting their activities.	**Adopted** – standard requirement.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-7.1.1	Implement standards and procedures for lifting equipment to reduced risk of dropped objects during lifting. (administrative control)	Impacts to the environment are reduced by preventing dropped objects and dragged objects during lifting operations. Administrative costs to update induction materials and train personnel.	Cost of implementing procedures.	**Adopted –** environmental benefits of preventing dropped objects outweigh the procedural compliance costs.
BAO-CM-7.1.2	Dropped objects (incident) management (administrative control)	Impacts to the environment are reduced by preventing dropped objects and by retrieving dropped objects unless the environmental consequences of the dropped object are negligible or there are risks to safety.	Cost of implementing procedures	**Adopted.**
BAO-CM-6.4.10	Barossa Facilities and vessels planned maintenance system to confirm equipment integrity is maintained in accordance with manufacturers guidelines. (administrative control)	Requires that equipment is maintained and certified, reducing the likelihood of dropped objects falling through the water column onto the risers or subsea systems.	Operational costs and labour and access requirements of undertaking equipment maintenance on the FPSO and vessels.	**Adopted** – environmental benefits of operating equipment within operational parameters will help reduce the likelihood of dropped objects.
BAO-CM-7.7.8.3	FPSO unplanned gas release escalation prevention controls – blowdown system functionality (engineering control)	Prevents escalation of loss of containment from the subsea system through the depressurisation of process inventories. A functioning blowdown and flare system aims to assure a blowdown system is available so escalation of spill events can be prevented by the depressurisation of process inventories via a release to flare, when initiated, rather than to the marine environment. The FPSO is also fitted with active and passive fire protection systems to minimise escalation risk, as described in the Barossa FPSO Safety Case.	Costs associated with maintenance and inspections of the blowdown and flare system and fire protection.	**Adopted** – environmental benefits of ensuring blowdown and flare system and fire protection are maintained outweigh the costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-7.7.8.2	Emergency shutdown and blowdown systems (engineering control)	Detects abnormal process conditions and alerts the operators to execute preventative and mitigative actions on hydrocarbon containing equipment (including subsea system), such as initiating blowdown and shutdown during abnormal processes. This both prevents and minimises release volumes from hydrocarbon containing equipment.	Costs associated with maintenance and inspections of the emergency shutdown and blowdown systems.	**Adopted** – environmental benefits of ensuring emergency shutdown and blowdown systems are maintained outweigh the costs.
BAO-CM-7.7.8.11	SIMOPS plans and procedure and safe operating envelope (administrative control)	Vessels undertaking a project or campaign activity (as opposed to IMMR activities) will undertake activities in accordance with a SIMOPS and procedures, which reduces potential for interactions between FPSO operation and campaign, which could cause a loss of hydrocarbons.	Costs associated with developing SIMOPS plans and procedure and cost associated with implementation.	**Adopted** – environmental benefits considered to outweigh costs.
BAO-CM-7.7.8.12	Production flowline monitoring (administrative control)	Alerts operators to drops in gas pressure in flowline.	Costs associated with maintaining and inspecting the production flowline monitoring system.	**Adopted** – environmental benefits considered to outweigh costs.
BAO-CM-7.7.8.7	NOPSEMA-accepted Barossa Production Operations Oil Pollution Emergency Plan (OPEP) (administrative control)	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents and large costs of preparing for and implementing response strategies.	**Adopted** – regulatory requirement, must be adopted.
BAO-CM-7.6.1	Emergency response plan (ERP) (administrative control)	Implements response plans to isolate the leaking infrastructure quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents and large costs of preparing for and implementing response strategies.	**Adopted** – regulatory requirement, must be adopted.
BAO-CM-6.6.1	Notify AHS and AMSA MSI prior to relevant Activity (administrative control)	Subsea infrastructure, FPSO and Barossa GEP location and exclusion zones are charted on Australian Hydrographic Service (AHS) nautical charts alerting other marine users to the presence of Activity vessels and exclusion zones and restrictions, thus reducing the likelihood of vessel collision and fishing gear snagging.	Negligible costs. Excludes commercial fishers from prospective fishing grounds.	**Adopted** – environmental benefits of identifying the FPSO to other marine users outweigh the process of arranging charting with AHS.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-6.6.5	Concurrent Barossa activities will be managed under relevant bridging documents/interface management plans (administrative control)	Implementation of the plan will control and manage concurrent activities occurring within the OA. This will ensure that concurrent activities can be conducted safely and reduce the risk of unplanned vessel interactions.	Cost associated with implementing procedures.	**Adopted** – standard requirement.
BAO-CM-7.6.6	MODU station keeping system during concurrent activities (engineering control)	Maintains the MODU at the desired location and provides for minimising length of mooring line deployed during anchor installation, therefore reducing potential risks to subsea infrastructure[54].	No cost/issue identified	**Adopted** – safety critical feature that maintains the MODU on location.
BAO-CM-7.6.7	MODU identification systems during concurrent activities (engineering control)	MODU automatic identification systems (AIS) aid in their detection at sea by third party vessels, thereby reducing the potential for interaction and collision[54].	Standard maritime navigational equipment; SOLAS regulated and therefore the cost is not identified as an issue.	**Adopted** – it is a regulatory requirement.
BAO-CM-7.6.8	MODU move procedure during concurrent activities (administrative control)	Eliminates risk of accidental contact with subsea infrastructure during MODU move[54].	Standard operating procedure.	**Adopted** – integral to safe MODU move procedure
Additional control measures				
N/A	Dedicated spill response resources and facilities close to the OAs (protection control)	Would enable a faster spill response as resources will be within proximity.	Significant additional costs associated with securing dedicated resources. Modelling shows no shoreline loading of hydrocarbons.	**Not adopted** - significant costs grossly disproportionate to environmental benefits, given the remote likelihood of a release from the subsea system, lack of shoreline contact and low persistence of condensate in a tropical climate.
N/A	Protection and burying seabed infrastructure to protect from external impacts (protection control)	Protection and burying of the seabed infrastructure will reduce the risk from external impacts as the infrastructure will be covered.	Significant costs and seabed disturbance associated with burying and protection. Also causes technical inspection and maintenance activity issues.	**Not adopted**– significant costs grossly disproportionate to environmental benefits, given the remote likelihood of a release from the subsea system. May also cause operational issues.

[54] *For implementation only while MODU is in field, during Concurrent Drilling and Operation activities. For specific Drilling controls, please refer to the D&C EP.*

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Rock dump of flowline to protect from external impacts (protection control)	Rock dump of flowline will reduce the risk from external impacts as the infrastructure will be covered.	Significant costs and seabed disturbance associated with rock dump. Also causes technical inspection and maintenance activity issues.	**Not adopted** – significant costs grossly disproportionate to environmental benefits, given the remote likelihood of a release from the subsea system. May also cause operational issues.
N/A	Response equipment (such as booms) on location, ready to respond to a loss of hydrocarbons (protection control)	May allow for quicker response to a spill as resources will be within proximity.	Large costs associated with a dedicated resource on location.	**Not adopted**– large cost associated with dedicated resources on location deemed grossly disproportionate compared to the benefit of a quicker response time.

Table 7-22: Control measure evaluation for subsea release of condensate from production well

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-7.1.6	Barossa FPSO Facility Safety Case (administrative control)	Details prevention, detection, mitigation and recovery measures provided to manage the risks. Details alarms and required emergency response in the event of a loss of containment.	Administrative costs of preparing and implementing the Safety Case.	**Adopted –** Benefits considered to outweigh costs.
BAO-CM-7.7.8.6	Inspection of hydrocarbon containing equipment (administrative control)	Requires that hydrocarbon containing equipment is maintained and inspected, reducing the likelihood of a leak from a production well. IMMR is set in accordance the Barossa Project Integrity Management Plan – Subsea, which provides inspection frequencies for subsea hydrocarbon containing equipment, to ensure integrity is maintained. The inspection frequency varies dependent on the subsea component. Post-cyclone inspection by ROV may also be able to provide additional surveillance of anomalies or areas of interest flagged by inspections or analysis.	Costs associated with preparing and implementing (such as field inspections and maintenance) the Barossa Project Integrity Management Plan – Subsea.	**Adopted –** environmental benefits of preventing a subsea condensate release outweigh procedural compliance costs.
BAO-CM-7.7.8.13	NOPSEMA-accepted WOMP (administrative control)	The WOMP describes the systems in place to ensure well design and integrity is managed for the well lifecycle. The WOMP ensures the risks to well integrity are managed to ALARP. All production wells will be in compliance with the NOPSEMA accepted WOMP at all times, reducing the likelihood of a leak from a production well.	Costs associated with preparing and implementing the WOMP.	**Adopted –** environmental benefits of preventing or reducing the likelihood of a leak from a production well outweigh the costs.
BAO-CM-7.7.8.7	NOPSEMA-accepted Barossa Production Operations Oil Pollution Emergency Plan (OPEP) (administrative control)	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment.	Personnel and administrative costs associated with preparing documents, ongoing management (spill response exercises) and implementation of the Barossa Production Operations OPEP.	**Adopted** – regulatory requirement, must be adopted.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-7.7.8.11	SIMOPS plans and procedure and safe operating envelope (administrative control)	Vessels undertaking a project or campaign activity will undertake activities in accordance with a SIMOPS plan and procedures, which reduces potential for interactions between FPSO operation and campaign, which could cause a loss of hydrocarbons.	Costs associated with developing SIMOPS plans and procedure and cost associated with implementation.	**Adopted** – environmental benefits considered to outweigh costs.
BAO-CM-7.7.8.2	Emergency Shutdown and blowdown systems (engineering control)	Detects abnormal process conditions and alerts the operators to execute preventative and mitigative actions on hydrocarbon containing equipment (including subsea system), such as initiating blowdown and shutdown during abnormal processes. This both prevents and minimises release volumes from hydrocarbon containing equipment.	Costs associated with maintenance and inspections of the emergency shutdown and blowdown systems.	**Adopted** – environmental benefits of ensuring emergency shutdown and blowdown systems are maintained outweigh the costs.
BAO-CM-7.1.1	Implement standards and procedures for lifting equipment to reduced risk of dropped objects during lifting (administrative control)	Impacts to the environment are reduced by preventing dropped objects and dragged objects during lifting operations. Administrative costs to update induction materials and train personnel.	Cost of implementing procedures.	**Adopted –** environmental benefits of preventing dropped objects outweigh the procedural compliance costs.
BAO-CM-7.1.2	Dropped objects (incident) management (administrative control)	Impacts to the environment are reduced by preventing dropped objects and by retrieving dropped objects unless the environmental consequences of the dropped object are negligible or there are risks to safety.	Cost of implementing procedures	**Adopted.**
BAO-CM-6.6.1	Notify AHS and AMSA MSI prior to relevant Activity (administrative control)	Subsea infrastructure, FPSO and Barossa GEP location and exclusion zones are charted on Australian Hydrographic Service (AHS) nautical charts alerting other marine users to the presence of Activity vessels and exclusion zones and restrictions, thus reducing the likelihood of vessel collision and fishing gear snagging.	Negligible costs. Excludes commercial fishers from prospective fishing grounds.	**Adopted** – environmental benefits of identifying the FPSO to other marine users outweigh the process of arranging charting with AHS.
BAO-CM-6.6.5	Concurrent Barossa activities will be managed under relevant	Implementation of the plan will control and manage concurrent	Cost associated with implementing procedures.	**Adopted** – standard requirement.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	bridging documents/interface management plans (administrative control)	activities occurring within the OA. This will ensure that concurrent activities can be conducted safely and reduce the risk of unplanned vessel interactions.		
BAO-CM-7.6.6	MODU station keeping system during concurrent activities (engineering control)	Maintains the MODU at the desired location and provides for minimising length of mooring line deployed during anchor installation, therefore reducing potential risks to subsea infrastructure[54].	No cost/issue identified	**Adopted** – safety critical feature that maintains the MODU on location.
BAO-CM-7.6.7	MODU identification systems during concurrent activities (engineering control)	MODU automatic identification systems (AIS) aid in their detection at sea by third party vessels, thereby reducing the potential for interaction and collision[54].	Standard maritime navigational equipment; SOLAS regulated and therefore the cost is not identified as an issue.	**Adopted** – it is a regulatory requirement.
BAO-CM-7.6.8	MODU move procedure during concurrent activities (administrative control)	Eliminates risk of accidental contact with the subsea infrastructure during MODU move[54].	Standard operating procedure.	**Adopted** – integral to safe MODU move procedure
BAO-CM-7.7.8.14	Source Control Plan during concurrent activities with MODU" (administrative control)	Ensures source control arrangements are effectively and efficiently implemented in order to reduce the volume of hydrocarbons released to the environment.	Costs associated with preparing documents, assurance (audits) and maintaining response capability (spill response exercises, service provider contract administration).	**Adopted –** environmental benefits of ensuring source control arrangements in place outweighs the financial costs.
Additional control measures				
N/A	Real-time leak detection using pressure and temperature instrumentation (engineering control)	Would ensure leak and subsequent release to be detected immediately. Well would then be shut in, limiting a release.	Significant costs grossly disproportionate to environmental benefits, given the remote likelihood of a release from the subsea system, lack of shoreline contact and low persistence of condensate in a tropical climate.	**Not adopted** – pressure and temperature instrumentation are ineffective at detecting fugitive leaks and emissions in the subsea environment.
N/A	Continuous ROV monitoring of the subsea system (engineering control)	Would ensure leak and subsequent release to be detected quickly during visual inspection of the valves. Well would then be shut in, limiting a release.	The cost for 24-hour monitoring in the field, including vessel hire, would be approximately $200,000 per day. Increased potential for risk to subsea infrastructure from ROV operations.	**Not adopted** – significant costs grossly disproportionate to environmental benefits, given the remote likelihood of a production well leak, lack of shoreline contact and low persistence of condensate in a tropical climate.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Dedicated spill response resources and facilities in proximity to the OAs (protective control)	Would enable a faster spill response as resources will be in proximity.	Significant additional costs associated with securing dedicated resources. Modelling shows no shoreline loading of hydrocarbons.	**Not adopted** – significant costs grossly disproportionate to environmental benefits, given the remote likelihood of a production well leak, lack of shoreline contact and low persistence of condensate in a tropical climate.
N/A	Drill top holes of a relief well (protective control)	Would enable a relief well to be drilled faster, as the top holes have been drilled.	Significant additional costs associated with the MODU drilling, which is estimated at approximately $555,000 per day. Additional environmental risks associated with drilling (such as vessel and MODU use).	**Not adopted** – significant costs grossly disproportionate to environmental benefits, given remote likelihood of a production well leak, lack of shoreline contact and low persistence of condensate in a tropical climate.
N/A	A dedicated MODU on standby for the purpose of workover (protective control)	Could reduce the length of time taken to remediate the leak.	For the dedicated MODU to be ready for workover, it would need to be contracted, crewed and hold a valid NOPSEMA Safety Case. This could cost around US$250,000 to US$600,000 per day for a minimum negotiated contract term, plus a cost associated for MODU mobilisation and demobilisation (depending on MODU type). Introducing a MODU and support equipment and personnel on standby would result in additional environmental and safety risks.	**Not adopted**– significant costs considered grossly disproportionate to the environmental benefit, considering the remote likelihood of a leak event requiring workover. In addition, it is envisaged a MODU would be made available through the Australian Petroleum Production and Exploration Association (APPEA) administered MoU (MODU and Well Services). The MoU documents the commitment to share rigs, equipment and service personnel in the event of a major 'loss of containment' incident, significantly increasing the resources available to a titleholder company.

7.7.8.4 Environmental impact assessment

The environmental impact assessment in the next subsections follows the approach detailed in Section 7.7.5.

7.7.8.4.1 Identification of hot spots for consequence assessment (surface release of condensate from the FPSO)

Hot spots that are predicted to be contacted by hydrocarbons within the LEVA and MEVA for a surface condensate release from the FPSO are listed in Table 7-23. The values and sensitivities associated with these areas are described in Section 3. These hot spots meet the criteria described in Section 7.7.5.3.

Note, the worst-case values were taken from the modelling scenarios to identify the hot spots and therefore is taken from any season and any hydrocarbon phase at any water depth (surface or subsea).

The low threshold, MEVA and HEVA contours for a surface condensate release from the FPSO are presented in Figure 7-8.

Table 7-23: Identified high environmental value and hot spot receptors.

Receptor	Exposure values			Hot spot
	Low (LEVA)	Moderate (MEVA)	High (HEVA)	
Afghan Shoal	✓			
Ashmore Reef Marine Park	✓			
Ashmore-Cartier - Outer	✓	✓		
Barracouta Shoals	✓	✓		
Cartier Island Marine Park	✓	✓		
Echo Shoals	✓	✓	✓	
Eugene McDermott Shoal	✓			
Fantome Shoals	✓	✓		
Flat Top Bank	✓	✓		
Gale Bank	✓			
Hibernia Reef	✓			
Indonesia-East – Timor Leste	✓	✓	✓	✓
Johnson Bank	✓			
Joseph Bonaparte Gulf Marine Park	✓			
Margaret Harries Bank	✓	✓	✓	
Minor Indonesian Islands	✓	✓	✓	✓
Newby Shoal	✓	✓		
Northern Arafura Marine Park	✓	✓		
Outer Argo-Rowley Terrace Marine Park	✓			
Outer Oceanic Shoals Marine Park	✓	✓	✓	
Sahul Banks	✓	✓	✓	
Shepparton Shoal	✓	✓		
Southern Arafura Marine Park	✓	✓		
Sunrise Bank	✓	✓	✓	
The Boxers Area	✓	✓	✓	
Tiwi Islands	✓			
Van Cloon-Deep Shoals	✓	✓		
Vulcan Shoals	✓			
Western Sahul Bank Shoals	✓	✓		
Woodbine Bank	✓			

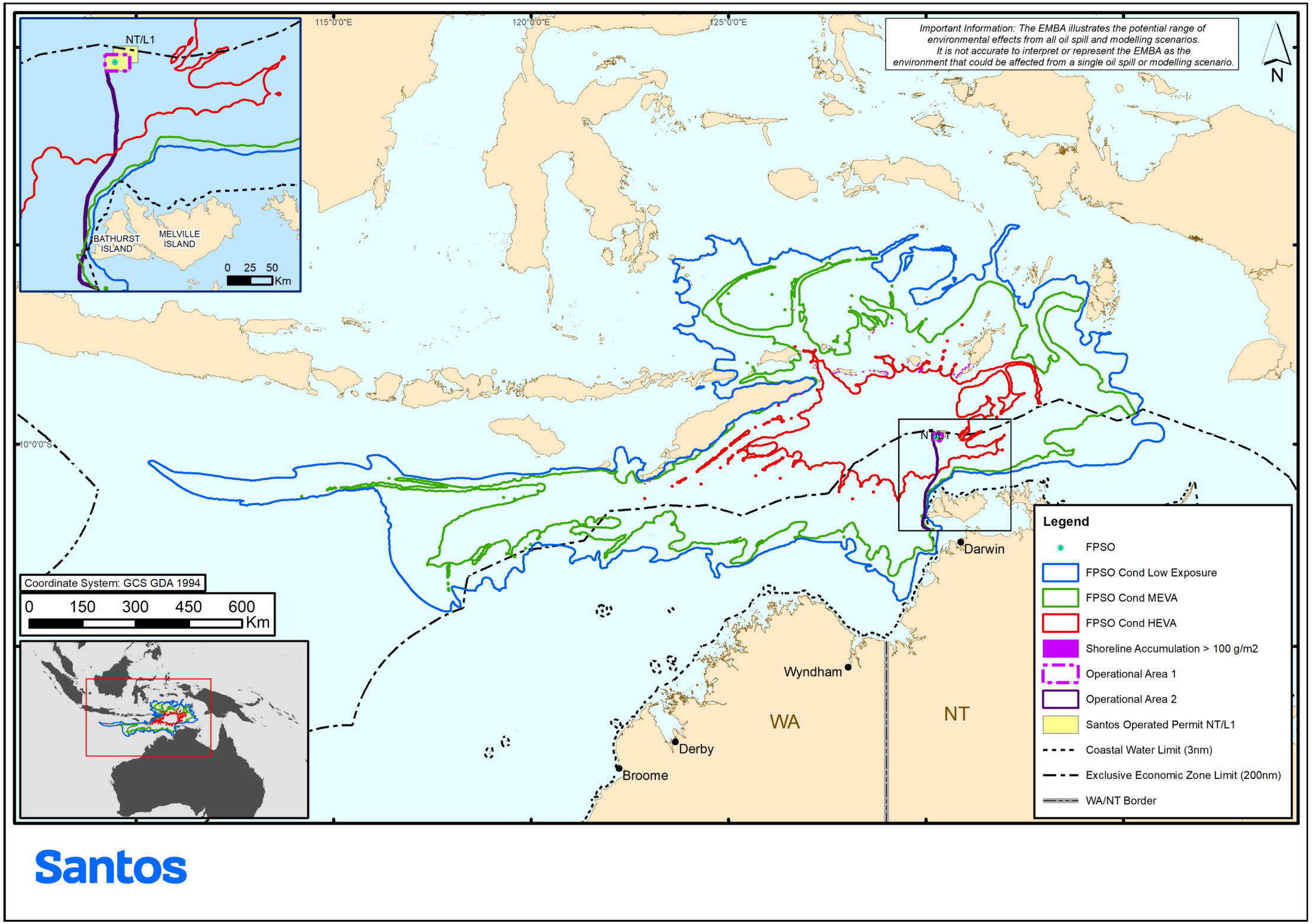


Figure 7-8: Low, moderate and high exposure value areas from a surface condensate release from the floating production, storage and offloading facility

7.7.8.4.2 Impact, likelihood, and consequence ranking

The assessment of impact, consequence and likelihood of the worst-case condensate release (surface release of condensate from FPSO) is provided in detail below. Additional credible subsea release scenarios (as detailed in Table 7-8) were assessed as having a lower consequence level as per below.

Subsea release of condensate

Scenario	Consequence	Likelihood	Residual risk
Release of condensate from a subsea system rupture from a major loss of integrity, causing a large leak.	II - Minor	C - Possible	Low
Release of condensate from a subsea system rupture as a result of anchor/chain drag or dropped object during Drilling or SURF Installation activities, causing a large leak.	II - Minor	C - Possible	Low
Subsea release of condensate from a production well as a result of intervening the well via light well intervention vessel.	II - Minor	B - Unlikely	Very Low
Subsea release of condensate from a production well as a result of anchor/chain drag or dropped object during Drilling or SURF activities.	II - Minor	B - Unlikely	Very Low
Subsea release of condensate from a production well as a result of an internal influence, such as superposition of failures of multiple barriers.	II - Minor	B - Unlikely	Very Low

Surface release of condensate from FPSO (worst case)

Receptors	Physical environment and habitat Protected areas Threatened, migratory or local fauna Socio-economic Cultural features
Consequence	III – Moderate

The consequence assessment for each receptor category is summarised below. Potential impact pathways (physical and chemical) of hydrocarbon exposure for receptors are summarised in Table 7-17, and potential impacts to receptors that may be found within the MEVA are further described in Table 7-18.

Physical environment and habitat

Water quality will be reduced due to hydrocarbon contamination (both at the sea surface and in the upper water column as a result of entrained and dissolved hydrocarbons) at the location of the spill, as well as within surrounding marine waters. Given the light nature of condensate, it undergoes rapid spreading and evaporation losses in warm waters and any floating hydrocarbons will be temporary. Water quality changes within the water column are also expected to be temporary, due to the rapid natural degradation and dispersion of condensate in the marine environment.

A number of banks and shoals, as well as the Oceanic Shoals, Cartier Island and Arafura marine parks, are within the MEVA. Banks and shoals support a diverse and varied range of benthic communities, reef-building soft corals, hard corals and filter-feeders (Heyward *et al.*, 2012, 1997b). Shoals and banks close to OA1 have the greatest potential to be contacted by entrained hydrocarbons; however, at relatively low probabilities (up to 21%).

Shallower shoals (for example, where the top of the shoal is within the top 25 m of the water column) within the MEVA are more likely to be contacted by entrained hydrocarbons. Lethal and sub-lethal effects to filter feeders from hydrocarbons include mortality and changes in population recruitment, growth and reproduction, which may lead to changes in community composition and structure. Filter feeders are particularly susceptible as they are likely to directly ingest hydrocarbons while feeding. This may cause mortality, or sub-lethal impacts such as alteration in respiration rates, decreases in filter feeding activity and reduced growth rates, and biochemical effects. However, as the hydrocarbon concentration decreases and weathers, the communities are expected to recover.

Cartier Island Marine Park and Indonesia-East – Timor Leste shorelines may accumulate hydrocarbons in low volumes, but the predicted probabilities of hydrocarbons accumulating on shorelines for this scenario is <5% (refer Section 7.7.8.2.1). These locations include areas of benthic coral reefs and mangroves. Contact by hydrocarbons may result in a localised decrease in ecological value of the shoreline, due to the associated toxic components of hydrocarbons. Secondary impacts may occur to the fauna using the shoreline, as described in the sub-section below.

The MEVA overlaps waters above the Shelf break and slope of the Arafura Shelf KEF and the Carbonate bank and terrace system of the Van Diemen Rise KEF. Given the nature of the release (at surface), hydrocarbons are predicted to remain in the top 25 m of the water column; therefore, extensive contact with the seabed of the KEFs is not anticipated.

Potential impacts to the physical environment and habitat are expected to be III-Moderate, due to the evaporative and dispersive nature of condensate, which largely remains in the top 25 m of the water column, and the low volume of shoreline accumulation.

Threatened or migratory fauna

In the event of a surface release of condensate, a reduction in water quality (described above) has the potential to impact marine fauna within the MEVA, as described in Table 7-18. Impacts would be greatest within several kilometres of the release location, where the hydrocarbon is at its thickest on the sea surface and where the toxic aromatic components of the condensate will be at their highest concentration. Given the nature of the release (at surface), hydrocarbons are predicted to remain in the top 25 m of the water column; therefore, extensive contact with marine fauna below this level is not anticipated. Upon release to the marine environment, the condensate will also rapidly lose toxicity with time and will spread thinner at the surface as evaporation continues or due to entrainment within the water column.

Breeding and foraging BIAs for seabirds or migratory shorebirds are predicted to be contacted by hydrocarbons within the MEVA. Therefore, seabirds may contact floating hydrocarbons while foraging in offshore, open-water locations and may cause secondary effects through ingestion after preening or ingestion of oiled fish (as described in Table 7-18). Potential impacts are likely to be limited to individuals that may be transiting through the area so impact to overall population viability is not anticipated.

The MEVA overlaps the pygmy blue whale distribution BIA and a number of marine mammal species may come into contact with hydrocarbons either on the sea surface or within the water column. Potential impacts are likely to be limited to individuals that may be transiting through the area, with potential for coating of baleen (in whales) and ingestion of oiled prey (plankton and fish), as described in Table 7-18. Impacts to overall population viability or ecosystems are not anticipated.

The MEVA overlaps the whale shark foraging BIA. There is the potential for behavioural disruption to the local population as individuals traverse the release; impact to overall population viability or ecosystems is not anticipated.

A number of marine mammal species may come into contact with hydrocarbons either on the sea surface or within the water column. Potential impacts are likely to be limited to individuals that may be transiting through the area, with potential for coating of baleen (in whales) and ingestion of oiled prey (plankton and fish), as described in Table 7-18. Impact to overall population viability or ecosystems is not anticipated.

Dugongs are known to occur in coastal waters, including those of the Tiwi Islands such as the seagrass sites on the north-west of Melville Island. Direct impacts to dugongs could occur through foraging or ingesting seagrass coated with hydrocarbon. Dugongs could also be indirectly affected if the released hydrocarbons cause the dieback of seagrass, reducing dugong feeding area. Impacts at a population level are considered highly unlikely as the extent of the condensate release is not anticipated to result in the loss of entire seagrass meadow habitats.

The MEVA overlaps various marine turtle BIAs and internesting buffer HC in proximity to the Tiwi Islands. Marine turtle species may come into contact with hydrocarbons either on the sea surface or within the water column and any potential impacts (as described in Table 7-18) are likely to be limited to individuals that may be transiting through the area or feeding at nearby submerged shoals and banks. A compilation of tracking data from marine turtle telemetry studies on and around the Tiwi Islands between 1994 and 2023 did not record any movements that intersected the OA1 (Pendoley, 2023). Given the non-persistent nature of the condensate, along with the expected rapid evaporation and dispersion, the timeframe during which marine turtles may be exposed to hydrocarbons above impact thresholds is low. The spatial extent of the MEVA, along with the wide distribution of turtle species in the region, indicates impact to overall population viability or ecosystems is not anticipated. Potential impacts would be greatest during the internesting season for flatback and olive ridley turtles; between June and September for flatback turtles and April to August for olive ridley turtles.

Cartier Island Marine Park and Indonesia-East – Timor Leste shorelines may accumulate hydrocarbons, which could impact marine fauna that use beaches, such as shorebirds and turtles. Impacts to turtles could occur from hydrocarbons that accumulate on turtle nesting beaches, with the greatest impact being during nesting seasons. Turtle nests are typically made above the high-water mark, which is typically the highest point along the shoreline that hydrocarbon will reach. As such, direct contact between turtle eggs and the hydrocarbons is very unlikely. Impacts may occur to nesting females as they move up and down beaches or to turtle hatchlings as they emerge from nests six to eight weeks after nesting. Given the low volumes (up to 156 m^3 at Indonesia-East – Timor Leste) and non-persistent nature of condensate on shorelines, the impact to nesting beaches (including nesting turtles, egg clutches and hatchlings) is anticipated to relate to a very localised disruption to individuals using the nesting beach. If the spill was to occur during nesting season, recovery would be expected over the short term.

The potential sensitive receptors in the surrounding areas of the hydrocarbon release include fish, marine mammals, marine reptiles and seabirds. Potential impacts (as described in Table 7-18) to Threatened or Migratory fauna are expected to be III-Moderate and relate to a potentially significant disruption to the behaviour of local populations but impacts to overall population viability or ecosystems are not anticipated.

Protected areas

The MEVA overlaps the Oceanic Shoals, Cartier Island and Arafura marine parks. Given the nature of the release (at surface), hydrocarbons are predicted to remain in the top 25 m of the water column; therefore, extensive hydrocarbon contact with the seabed and sediment contamination is not anticipated. These marine parks support habitats and faunal groups as described above. Impacts to these receptors (as described in Table 7-18) may impact on the values of the marine parks. The potential impact is anticipated to be III – Moderate, relating to a significant impact to one or more of the protected area's values such as natural, cultural, heritage and socio-economic.

Socio-economic and cultural features

There is potential for temporary disruption to fishing activities (traditional, recreational, and commercial) due to surface, dissolved or entrained hydrocarbons. However, given the dispersive nature of the condensate, disruptions are expected to be temporary. Potential impacts to fishing activity are expected to relate to a short-term loss of value to the local industry due to local disruptions and displacement of fishing ground.

The EMBA does overlap cultural features (Section 3.7). Impacts to cultural features within the EMBA, including a disruption/displacement of cultural activities caused by the physical presence of the hydrocarbon, decline in traditional food sources and / or mortality of fauna with cultural significance and contact to sacred sites, may result in the event of a significant spill of hydrocarbons.

The operations of other energy industry titleholders in the region may also be disrupted in the event of a hydrocarbon release (such as Santos' Bayu-Undan operations) and defence and military exercises and commercial shipping may be excluded or displaced temporarily. Potential impacts (as described in Table 7-18) to socio-economic receptors and cultural features are expected to be III-Moderate and relate to a temporary, local disruption or displacement in activities.	
Likelihood	B – Unlikely
The likelihood of a hydrocarbon release occurring due to a vessel collision is unlikely, given the set of mitigation and management controls in place. External impacts to FPSOs have not occurred within Santos and controls are in place that limit such events. The Barossa Ship Collision Study examines potential ship impact scenarios at the FPSO location and calculates the frequency of ship impacts with various outcomes. The potential to damage the FPSO is shown to be rare, particularly given the impact energies and the FPSO position away from areas of high concentrations of shipping movements. The likelihood of a vessel collision releasing hydrocarbons to the environment resulting in an III – Moderate consequence is considered to be B – Unlikely	
Residual risk	The residual risk is considered **Low**.

7.7.8.5 Demonstration of as low as reasonably practicable (FPSO worst-case)

Additional control measures were considered (as detailed in Section 7.7.8.3) but not adopted since the associated cost and effort was grossly disproportionate to any benefit.

Floating production, storage and offloading facility design

Given the design premise of the Barossa FPSO, which will store condensate for subsequent offloading, the risk of loss of containment of condensate cannot be eliminated nor substituted. Therefore, there has been a focus on FPSO design.

Many FPSOs in current use around the world are conversions of tankers to add on processing capabilities. These conversions are often older vessels, many of which are single-hulled designs, and often repaired hulls, which have a higher potential for loss of containment over the 25-year life of the Activity.

The engineering option to design a new-build FPSO for Barossa has resulted in a higher robustness of the hull and its materials contributing to the prevention of loss of containment.

The Barossa OPP (ConocoPhillips, 2018) requires the FPSO be either double-hulled or double-sided with compartmentalised storage tanks, as a minimum requirement to reduce the potential for loss of containment and reduce the environmental risk if loss of containment eventuates.

The options selected for consideration in the Barossa FPSO are:

- Option 1: double-sided FPSO conversion
- Option 2: double-sided new-build FPSO
- Option 3: double-hulled (double-sided and double-bottomed) new-build FPSO.

The pros and cons of the above options are summarised in Table 7-24. The environmental ALARP option for the FPSO hull is the newbuild double-hulled option (Option 3), which has been chosen as the FPSO design.

Table 7-24: Summary of floating production, storage, and offloading facility hull design as-low-as-reasonably practicable- review

Option	Details	Environmental Factors	Other Factors
1	Double-sided FPSO conversion	• Older retrofitted vessels can have lower structural integrity, and higher potential for loss of containment than new-build facilities. • A single-bottomed FPSO does not have secondary protection against damage to the hull bottom that could result in loss of containment. • Conversions allow for upcycling of steel used in the original vessel construction. • Conversions can have legacy contamination issues that make ultimate decommissioning difficult.	• A converted FPSO can be cheaper than a new build; however, there are risks associated with uncertain repair and replacement works and associated costs. • Generally built to older standards (including safety), and lack of detailed knowledge regarding build design. • Can have layout restrictions due to fixed size.

Option	Details	Environmental Factors	Other Factors
2	Double-sided new-build FPSO	• A double-sided FPSO provides a degree of secondary protection against loss of containment. • A single-bottomed FPSO does not have secondary protection against damage to the hull bottom that could result in loss of containment. • A new-build FPSO has higher and more certain longevity for materials to minimise potential for loss of containment.	• The new-build design offers appropriate configuration and layout specifically for topsides processing. • A new-build FPSO can be more expensive than a conversion. • A new build has in general increased safety in design. • A new build allows for in-depth knowledge of the facility design.
3	Double-hulled (double-sided and double-bottomed) new-build FPSO	• A double-sided FPSO provides a degree of secondary protection against loss of containment. • A double-bottomed FPSO provides a degree of secondary protection against loss of containment, particularly in terms of potential for unseen damage sustained during installation, hook-up and commissioning, or other significant operation factors contributing to loss of containment. • A new-build FPSO has higher and more certain longevity for materials to minimise potential for loss of containment.	• The new-build design offers appropriate configuration and layout specifically for topsides processing. • A new-build FPSO can be more expensive than a conversion. • A new build has in general increased safety in design. • A new build allows for in-depth knowledge of the facility design.

The FPSO has also been designed with void spaces around the condensate tanks, effectively adding an additional protection in the event of a collision event.

Offtake controls

Offtake tankers are subject to acceptance criteria as prescribed in Santos' vessel vetting process in accordance with the Marine Assurance Standard (Section 8.4.8). This includes details for safe approach (such as daylight hours and speed limits) and berthing of the offtake tanker to the FPSO. Acceptance criteria are used to assess the suitability of the proposed offtake tanker to comply with the equipment and operational procedures, to ensure safe offtake.

Opportunity to add controls to the already extensive requirements within the Barossa Terminal Handbook to reduce risks during offtake includes:

- further restricting safe weather berthing limits
- reducing loading rates.

As assessed in Section 7.7.8.3, these controls present costs that grossly outweigh environmental benefit.

The Terminal Handbook includes the requirement for an initial safety and environmental inspection by the Pilot or Mooring Master when boarding the offtake tanker for pilotage. Additional checks and pre-berthing inspections may be conducted on the tanker by Santos appointed personnel if the triggers are present, being:

- constrained tanker availability due to market conditions
- older tonnage (tanker more than 20 years old)
- new buyers of the condensate
- previous detentions and adverse reports.

External impact controls

The FPSO is marked on AHS nautical charts that identify to other sea users the location of the FPSO and offtake tanker berthing activities. Collision prevention equipment (as in, navigation and radio equipment) and seagoing qualifications used on vessels, FPSO and offtake tankers will comply with applicable AMSA Marine Orders and MARPOL requirements.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. The proposed management controls are in accordance with the Santos risk management criteria and are considered appropriate to manage the risk to ALARP.

In terms of spill response activities, Santos will implement hydrocarbon spill response as specified within the Barossa Production Operations OPEP. A detailed ALARP assessment on the adequacy of arrangements available to support spill response strategies and control measures is presented in the Barossa Production Operations OPEP.

7.7.8.6 Demonstration of as low as reasonably practicable (Subsea release from the subsea system)

A number of ALARP reviews were undertaken to inform the design of the Barossa Development. Flowlines, risers, and subsea structures have been designed to appropriate codes and standards as defined in the system specifications:

- risers are designed for one mooring line failure. The FPSO mooring system is designed for a 10,000-year return period survival case
- the subsea system includes protection systems comprising appropriate materials selections (such as corrosion resistant alloy material to suit all likely reservoir conditions), wall thickness allowance, coatings and CP system design, as well as sand and erosion monitoring
- subsea structures are designed for a dropped object impact load of 20 kJ and a snag load of 200 kN
- hydrate prevention and mitigation is incorporated into the design, reducing the risk of internal influence failure (such as corrosion)
- quality controls, including design validation and verification, factory acceptance testing, pre-commissioning and commissioning.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. For the Drilling and SURF concurrent operations, detailed within Section 2.3.1, the demonstration of ALARP arguments and control measures detailed in Sections 7.5.3 and 7.5.5 of the SURF EP and Sections 7.6.3, 7.6.5, 7.8.3 and 7.8.5 of the D&C EP will remain in place for concurrent operations. Control measures regarding concurrent activities (BAO-CM-6.6.5, BAO-CM-7.6.6, BAO-CM-7.6.7 and BAO-CM-7.6.8) have also been adopted in this EP to reduce the risk to ALARP. Eliminating the potential for dropped objects and anchoring is not feasible since MODU/vessel activity is also inherent for the activities and equipment or materials are required to be lowered and positioned on the seabed.

Specific to the concurrent Drilling and SURF activities taking place within 2025 Campaigns, Santos are also committing to introducing additional practicable risk reduction measures further to those described in the SURF and D&C EP. Post 2025, any future concurrent drilling campaigns will be subject to campaign specific Risk Assessments and Safety Case Revisions.

The SURF activities will conduct lifting operations as per the relevant SS7 lifting standards and procedures. Major lifting operations shall be conducted in accordance with approved Engineering Procedures.

Equipment being installed in the vicinity of the N1 drill centre/well locations, will be over-boarded at safe distances from subsea infrastructure (safe handling zone), lowered to a height above seabed and then walked to the final location. All critical lifts will also be subject to independent Validation and Verification. Other requirements include:

- Lifts are planned, and the rigging and lifting will be conducted by certified personnel.
- The maximum weights and dimensions of the load is known and is within the rated capacity of the lifting and rigging equipment.
- All lifting and rigging equipment is to be in certification, with valid certificates present.
- A documented lift plan is prepared for complex lifts.
- Lifting equipment is checked, within inspection date and in good condition prior to use.
- Clear communications are established and maintained between all personnel involved in the lifts.
- A controlled zone is established to exclude persons from the lifting footprint and ensure no personnel is positioned under a suspended load or between a suspended load and fixed objects

Dropped object studies have been conducted to define the minimum distance that safe handling zones should be located away from subsea infrastructure when lifting/over-boarding selected equipment. The studies were based on DNV-RP-F07. In addition, the CSV operates on Dynamic Positioning and will not use anchors in field.

During the SURF activities, while at S1 drill centre, the subsea production system (SPS) will be depressurised to reduce the likelihood of a flammable plume in air and minimise LOC risks.

A MODU activity-specific Interface Management Plan will be in place to manage concurrent operations, as well as SIMOPS between a MODU and other vessels/facilities in field including the FPSO. Specific controls within the

Interface Management Plan will be in accordance with NOPSEMA-accepted MODU Safety Case and/or Safety Case Revision. The Interface Management Plan will describe the following:

- Expected vessels/facilities in the field and their planned activities, including potential SIMOPS and concurrent activities.
- Interface roles and responsibilities.
- Communication protocols.
- Incident reporting and emergency response arrangements.
- Any requirements to shut-in well(s) during specific MODU operations to reduce risk of subsea release from well(s) to ALARP.
- Any requirements to shut-in or shut-in and deisolate the SPS during specific MODU operations to reduce risk of subsea release from subsea systems to ALARP.
- Matrix of Permissible Operations (MOPO) between the MODU and other vessels/facilities in field including the FPSO, defining the combinations of activities that can be performed simultaneously and the controls required to manage each combination.

MODU operations including lifting, and deployment and recovery of items through the sea column will be managed in accordance with NOPSEMA-accepted MODU Safety Case and/or Safety Case Revision.

MODU station-keeping system (anchors) will be designed considered applicable metocean conditions and industry standards to reduce the risk of dropped objects during deployment and recovery, system failure and/or anchor drag, as per the NOPSEMA-accepted MODU Safety Case and/or Safety Case Revision.

The Barossa FPSO Facility Safety Case Addendum for SURF Installation and the Campaign Specific HSE Case Revision for the MS-1 will further details these controls.

The proposed management controls are in accordance with the Santos risk management criteria and are considered appropriate to manage the risk to ALARP.

In terms of spill response activities, Santos will implement hydrocarbon spill response as specified within the Barossa Production Operations OPEP. A detailed ALARP assessment on the adequacy of arrangements available to support spill response strategies and control measures is presented in the Barossa Production Operations OPEP.

7.7.8.7 Demonstration of as low as reasonably practicable (subsea production well release)

The industry standard safe drilling methodologies, including the well design and its operations with primary (as in, maintaining the appropriate hydrostatic pressure) and secondary well control features will be implemented to reduce the probability of a loss of containment. All safety options have been considered in well design and equipment choice for the Activity.

The NOPSEMA approved WOMP includes control measures to prevent loss of well integrity and well control, including specified barriers. Operating in accordance with the WOMP is considered ALARP.

As detailed within Section 7.7.8.6, all reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. For the Drilling and SURF concurrent operations, detailed within Section 2.3.1, the demonstration of ALARP arguments and control measures are detailed in Sections 7.5.3 and 7.5.5 of the SURF EP and Sections 7.6.3, 7.6.5, 7.8.3 and 7.8.5 will remain in place for concurrent operations. Control measures regarding concurrent activities (BAO-CM-6.6.5, BAO-CM-7.6.6, BAO-CM-7.6.7, BAO-CM-7.6.8 and BAO-CM-7.7.8.16) have also been adopted in this EP to reduce the risk to ALARP. Eliminating the potential for dropped objects and anchoring is not feasible since MODU/vessel activity is also inherent for the activities and equipment or materials are required to be lowered and positioned on the seabed.

Specific to the concurrent Drilling and SURF activities taking place within 2025 Campaigns, Santos are also committing to introducing additional practicable risk reduction measures further to those described in the accepted SURF and D&C EP. Post 2025, any future concurrent drilling campaigns will be subject to campaign specific Risk Assessments and Safety Case Revisions.

In addition to the measures presented within Section 7.7.8.6 for a subsea release from the subsea system event, Santos are also committed to introducing additional practicable risk reduction measures specific for a production well LOC event, as described below.

A MODU activity-specific Interface Management Plan will be in place to manage concurrent operations, as well as SIMOPS between a MODU and other vessels/facilities in field including the FPSO. Specific controls within the Interface Management Plan will be in accordance with NOPSEMA-accepted MODU Safety Case and/or Safety Case Revision. The Interface Management Plan will describe the following:

- Expected vessels/facilities in the field and their planned activities, including potential SIMOPS and concurrent activities
- Interface roles and responsibilities
- Communication protocols
- Incident reporting and emergency response arrangements
- Any requirements to shut-in well(s) during specific MODU operations to reduce risk of subsea release from well(s) to ALARP
- Any requirements to shut-in or shut-in and deisolate the SPS during specific MODU operations to reduce risk of subsea release from subsea systems to ALARP
- Matrix of Permissible Operations (MOPO) between the MODU and other vessels/facilities in field including the FPSO, defining the combinations of activities that can be performed simultaneously and the controls required to manage each combination.

MODU operations including lifting, and deployment and recovery of items through the sea column will be managed in accordance with NOPSEMA-accepted MODU Safety Case and/or Safety Case Revision.

MODU station-keeping system (anchors) will be designed considering applicable metocean conditions and industry standards to reduce the risk of dropped objects during deployment and recovery, system failure and/or anchor drag, as per the NOPSEMA-accepted MODU Safety Case and/or Safety Case Revision.

For the SURF works, S1 will be shut-in during the works. All critical lifts will also be subject to independent Validation and Verification.

Within the operational phase of the Barossa wells, their location is not near shipping corridors/lanes, marine traffic density in the vicinity is very low and there is no nearby subsea infrastructure of other operators. The design of the XT, as per existing asset design/philosophy, is inherently robust minimising risk of damage should a dropped object occur. Pressure monitoring of the subsea system during operation will be capable of detecting significant LOC events and tripping the well and any loss of communication and/or control of Barossa wells would result in the XT valves failing closed.

The Barossa FPSO Facility Safety Case Addendum for SURF Installation and the Campaign Specific HSE Case Revision for the MS-1 will further details these controls.

The proposed management controls are in accordance with the Santos risk management criteria and are considered appropriate to manage the risk to ALARP.

In terms of spill response activities, Santos will implement hydrocarbon spill response as specified within the Barossa Production Operation OPEP. A detailed ALARP assessment on the adequacy of arrangements available to support spill response strategies and control measures is presented in the Barossa Production Operations OPEP.

7.7.8.8 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – residual risk is ranked as Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ESD?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers principles of ESD: • The impacts from the spill scenarios are inherently inconsistent with principles of ESD, given the nature and scale of impacts. Control measures are applied to ensure the impacts and risks from activities are managed to ALARP and an acceptable level.

Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)	Yes - Control measures implemented will reduce the risk of an unplanned release of condensate to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009b) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b) • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b) • Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c) • Approved Conservation Advice for *Limnodromus semipalmatus* (Asian dowitcher) (DCCEEW, 2024f) • Approved Conservation Advice for *Limosa limosa* (black-tailed godwit) (DCCEEW, 2024e) • Approved Conservation Advice for *Calidris tenuirostris* (great knot) (DCCEEW, 2024d) • Approved Conservation Advice for *Charadrius leschenaultii* (greater sand plover) (DCCEEW, 2023f) • Approved Conservation Advice for *Pluvialis squatarola* (grey plover) (DCCEEW, 2024g) • Approved Conservation Advice for *Limosa lapponica baueri* (Alaskan bar-tailed godwit) (DCCEEW, 2024k) • Approved Conservation Advice for *Calidris canutus* (red knot) (DCCEEW, 2024m) • Approved Conservation Advice for *Phaethon rubricauda westralis* (Indian Ocean red-tailed tropicbird) (DCCEEW, 2023g) • Approved Conservation Advice for *Arenaria interpres* (ruddy turnstone) (DCCEEW, 2024m) • Approved Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW, 2024l) • Approved Conservation Advice for *Xenus cinereus* (terek sandpiper) (DCCEEW, 2024i) • Conservation Advice for the Abbott's Booby *Papasula abbotti* (TSSC, 2020a) • Approved Conservation Advice for *Rostratula australis* (DSEWPaC, 2013) • Conservation Advice for *Charadrius mongolus* (lesser sand plover) (DCCEW, 2024j) • Approved Conservation Advice for *Aipysurus fuscus* (dusky sea snake) (DCCEEW, 2024p)

	Recovery plans: • Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013) • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (CoA, 2014) • Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) • Wildlife Conservation Plan for Seabirds (CoA, 2020) • Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c) **Other management plans/guidelines**: • Marine bioregional plans for the NMR and NWMR (CoA, 2012a, 2012b). For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes in Section 7.7.7 and the control measures outlined in Section 7.7.8.3. Santos considers that the level of risk of an unplanned release of condensate is not inconsistent with these plans. The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the Shelf break and slope of the Arafura Shelf KEF. Significant impacts to this KEF are not predicted.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with the Safety Case, *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*, *Navigation Act 2012*, Marine Order 30: Prevention of Collisions, Marine Order 21: Safety of Navigation and Emergency Procedures, *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, MARPOL Annex I (Prevention of Pollution by Oil), Marine Order 91: Marine Pollution Prevention – Oil and National Plan for Maritime Environmental Emergencies (AMSA, 2020). Through acceptance of this EP, legislative and regulatory requirements will be met as per Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health, and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with AMSA, AAPA, the ECNT, the ACF and Ngoy Garmak Consultative Committee, have been considered when evaluating performance outcomes, control measures and associated performance standards (refer to Section 4.7 for further information). Santos has confirmed that the required maritime safety measures identified by AMSA have been incorporated into this EP refer to (BAO-CM-6.1.2 and BAO-CM-6.6.1). Santos has also considered and evaluated specific control measures proposed by the ACF (refer to Table 7-20). Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have been adopted in this EP. Additional performance outcomes (EPO-19, EPO-20) have been adopted for an unplanned release of condensate based on consultation with Relevant Persons on other Barossa EPs.

Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

The residual risk is assessed as Low. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential risks are considered acceptable.

7.7.9 Unplanned Release of Marine Gas Oil (MGO)

7.7.9.1 Description of worst-case event

Event

Table 7-25 presents the worst-case credible scenario for an unplanned MGO release from the FPSO.

Table 7-25: Worst case credible scenario for an unplanned marine gas oil release

No.	Scenario	Volume maximum credible volume
1	Surface release of MGO from the FPSO as a result of external impact (vessel collision) which ruptures an FPSO MGO tank	2,418 m³ over one hour

Surface release of MGO from the FPSO as a result of an external impact (vessel collision) which ruptures an FPSO MGO tank

A collision scenario between a vessel and the FPSO could occur during supply or IMMR activities or offtake tanker berthing activities, the FPSO will also require MGO during HUC and initial start-up activities, therefore the risk is also credible during these phases. When undertaking LWIV or activities from USV, these vessels are unlikely to need to be in close proximity to the FPSO and therefore a collision between them and the FPSO is not considered credible. A combined inventory of 9,137 m³ MGO exists in FPSO bunker tanks, with the largest bunker tank having a capacity of 2,418 m³ MGO. It is not credible that the total storage volume of MGO from the FPSO would be lost, as it is stored in more than one tank and the hull provides for double bottom and sides. It is considered conservative to use the AMSA guidelines (2015) for major collisions, which is 100% volume of the tank. It is assumed an MGO storage tank rupture would release 2,418 m³ over one hour.

Operational area 1:

The events are credible in OA1.

Operational area 2:

The events are not credible in OA2.

Scenarios relevant to vessel spills are discussed in Section 7.7.10.

Extent

The spill modelling results at or above moderate exposure values (as used to define the MEVA) are summarised in Section 7.7.9.2.1.

The LEVA, MEVA and HEVA contours for this event are presented in Figure 7-9.

For information about the extent of potential impact associated with this event, refer to Section 7.7.9.4

Duration

Constant:

An unplanned release may occur during HUC, initial start-up and operational activities within OA1.

Approximately one hour through the rupture in the worst case scenario. Hydrocarbons would persist within the environment for a longer period of time, although MGO is expected to weather quickly through evaporation and dispersion.

7.7.9.2 Nature and scale of environmental impacts

<u>Potential receptors: Physical environment and habitat, threatened, migratory, or local fauna, socio-economic and cultural features.</u>

Hydrocarbon spills will cause a decline in water quality and may cause chemical (for example, toxic) and physical coating and asphyxiation of organisms like by heavy hydrocarbons is not expected, but toxic effects from water-soluble components are a possibility. The severity of the impact of a hydrocarbon spill depends on the magnitude of the spill (as in, extent, duration) and sensitivity of the receptor. The nature and scale of a hydrocarbon spill is described throughout this chapter for a vessel collision scenario releasing MGO, given smaller hydrocarbon spills (from MGO bunkering and refuelling) will impact a smaller area.

The impact assessment of the sensitive environmental receptors at risk from an MGO release (Section 7.7.9.4) has been determined based on a literature review and trajectory and fate modelling described in Section 7.7.9.2.1.

Potential impact pathways (physical and chemical) of hydrocarbon exposure for receptors and potential impacts to receptors found within the MEVA are further described in Table 7-17.

Table 7-18 summarises the potential impacts of hydrocarbon spills to sensitive receptors and values within the MEVA.

7.7.9.2.1 Stochastic spill dispersion modelling

The spill modelling results at or above moderate exposure values (as used to define the MEVA) are summarised below for an MGO release from the FPSO. More detailed results are provided in Appendix H.

Further parameters required to inform spill response strategies are described in the Barossa Production Operations OPEP.

The currents in the region are dominated by tidal and wind driven currents that are dependent on the season. These will influence the direction the hydrocarbons (entrained and floating) travel in a particular season.

Accumulated shoreline hydrocarbon

Modelling results for accumulated shoreline hydrocarbon indicate:

- The highest probability of shoreline hydrocarbon accumulation at the 10 g/m² threshold is forecast for Indonesia East – Timor Leste (less than 3%), which had also recorded the maximum volume of hydrocarbon ashore as 25 m³.
- The shortest time for shoreline hydrocarbon accumulation at the 10 g/m² threshold is predicted for Indonesia East – Timor Leste after 210 hours (approximately nine days) after commencement of the spill.
- Shoreline accumulation at the Tiwi Islands at the 10 g/m² threshold is low probability (less than 1%), 941 hours (approximately 39 days) after commencement of the spill. Maximum shoreline hydrocarbon accumulation predicted to occur at the Tiwi Islands is <1 m³.

Floating hydrocarbon greater than 10 g/m²

Modelling results for floating hydrocarbon greater than 10 g/m² indicate:

- Floating hydrocarbon may extend up to 266 km west from the release location.
- Locations potentially contacted include areas over Margaret Harries Bank (less than 1%), Outer Oceanic Shoals Marine Park (less than 1%), Sunrise Bank (less than 2%) and The Boxers Area (less than 1%).

Entrained hydrocarbon greater than 100 ppb

Modelling results for entrained hydrocarbon greater than 100 ppb indicate:

- Entrained hydrocarbon would occur within 0 to 25 m water depth, with a maximum distance from the release location of 1,480 km.
- The shortest time for entrained hydrocarbon exposure at any receptor is predicted for Sunrise Bank (30 hours).
- The worst-case concentration of entrained hydrocarbons is predicted at Sunrise Bank as 10,647 ppb.
- The Oceanic Shoals Marine Park is predicted to be contacted at a probability of less than 10%.

Dissolved hydrocarbon greater than 50 ppb

Modelling results for dissolved hydrocarbon greater than 50 ppb indicate:

- Dissolved hydrocarbon may extend a maximum distance from the release location of 250 km to the west.
- Sunrise Bank is predicted to be contacted at probability of less than 3%, and a maximum exposure value of 250 ppb.
- The Oceanic Shoals Marine Park is predicted to be contacted at a probability of less than 1%.

7.7.9.3 Control measures

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this Activity are shown in

Table 7-26 to demonstrate the potential risks are ALARP. Control measures that are adopted have associated EPSs and measurement criteria that are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 7-26: Control measure evaluation of a surface release of MGO, from the FPSO MGO tank or bunkering equipment

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-7.1.6	Barossa FPSO Facility Safety Case (administrative control)	Details prevention, detection, mitigation and recovery measures provided to manage the risks. Details alarms and required emergency response in the event of a loss of containment.	Administrative costs of preparing and implementing the Safety Case.	**Adopted –** Benefits considered to outweigh costs.
BAO-CM-7.5.1	FPSO hull integrity (engineering control)	Reduces the risk of a release from vessel collision as the FPSO hull is double-sided by design, providing two physical barriers between the MGO tanks and the marine environment for side impact.	The FPSO hull is double-sided by design and the control is already in place. Costs associated with maintaining hull integrity.	**Adopted** – the FPSO is double-sided by design.
BAO-CM-7.7.8.1	FPSO Hull tank inspection and maintenance regime (engineering control)	The FPSO tank monitoring system as outlined in the hull structure integrity management plan, supported by the Hull Risk Based Inspection (RBI) study, outlines a schedule for inspection and maintenance of the FPSO tank, thus assuring hull integrity.	Costs associated with maintaining and inspecting the tank monitoring system.	**Adopted** – environmental benefits of ensuring tank monitoring systems are maintained outweigh the costs.
BAO-CM-6.6.3	Collision avoidance radar (protective control)	FPSO would appear on the display of the triggering radars, providing range, bearing and identification information. Would alert vessels of FPSO position reducing collision risk.	Minimal cost for purchase, and maintenance of radar system.	**Adopted** – environmental benefits of identifying the FPSO to other marine users outweigh the minimal costs.
BAO-CM-6.6.6	Vessel speed restrictions within 500m around the FPSO, IMMR vessels and campaign vessels (substitute control)	Reduces consequence of collisions (causing harm) and likelihood as fauna have longer to detect and avoid the vessel by restricting vessel speeds in the OA to 8 knots or less within 500m around the FPSO and Activity vessels. Reduces the potential impacts to culturally significant marine species, including totemic species, such as marine turtles and marine mammals.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted –** benefits outweigh costs
BAO-CM-6.6.4	Activity undertaken in accordance with Santos HSE	Ensures contracted vessels are operated, maintained, and	Costs associated with personnel time in checking vessel.	**Adopted** – benefit of assuring vessels

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	management and marine vessel vetting processes (Santos' Offshore Marine Assurance Procedure) (administrative control)	crewed in accordance with industry standards and regulatory requirements.		outweighs procedure compliance costs.
BAO-CM-6.1.2	Vessels equipped and crewed in accordance with Australian maritime requirements, including Marine Order 30 (Prevention of Collisions) and Marine Order 21 (Safety and Emergency Arrangements) (administrative control)	Ensures vessels meet Marine Assurance Standards to reduce the likelihood of vessel collision (such as minimum and working lighting for maritime safety).	Cost associated with implementing procedures.	**Adopted** – benefit of assuring vessels outweighs procedure compliance costs.
BAO-CM-6.6.1	Notify AHS and AMSA MSI prior to relevant Activity (administrative control)	Subsea infrastructure, FPSO and Barossa GEP location and exclusion zones are charted on Australian Hydrographic Service (AHS) nautical charts alerting other marine users to the presence of Activity vessels and exclusion zones and restrictions, thus reducing the likelihood of vessel collision and fishing gear snagging.	Negligible costs. Excludes commercial fishers from prospective fishing grounds.	**Adopted** – environmental benefits of identifying the FPSO to other marine users outweigh the process of arranging charting with AHS.
BAO-CM-6.6.2	Petroleum safety zone administered by NOPSEMA in accordance with the OPGGS Act and cautionary area established (administrative control)	The PSZ alerts other marine users to the presence of the mooring buoy and FPSO. Third-party vessels (excluding the offtake tanker) are not permitted to enter PSZ, thereby reducing the likelihood of other marine user interactions with the offtake tanker.	Negligible costs. Other marine users may be temporarily excluded from areas, disrupting their activities.	**Adopted** – standard requirement, must be adopted.
BAO-CM-7.7.8.7	NOPSEMA-accepted Barossa Production Operations Oil Pollution Emergency Plan (OPEP) (administrative control)	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents and large costs of preparing for and implementing response strategies.	**Adopted** – regulatory requirement, must be adopted.
BAO-CM-7.4.2	Bulk liquid transfer procedure (administrative control)	The procedure provides details on the fuel bunkering process to be undertaken. Following the procedure reduces the potential for release during bunkering. Requires the use of dry-break coupling (on bunkering hose) which	Costs associated with ensuring the procedure is in place, up to date and implemented.	**Adopted** – environmental benefits of ensuring the procedure is followed and measures implemented outweigh the costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		limit the MGO losses in an emergency. Hook-up for bunkering is restricted to during daylight hours.		
BAO-CM-7.4.3	FPSO and vessel spill response plans (SOPEP/SMPEP) (administrative control)	Implements response plans (SOPEP/SMPEP) on board vessels to deal with unplanned hydrocarbon releases and spills quickly and efficiently in order to reduce impacts to the marine environment.	Administrative costs of preparing documents. Generally undertaken by vessel contractor so time for Santos personnel to confirm and check SOPEP/SMPEP in place.	**Adopted** – regulatory requirement, must be adopted.
BAO-CM-6.4.10	Barossa Facilities and vessels planned maintenance system to confirm equipment integrity is maintained in accordance with manufacturers guidelines. (administrative control)	Ensures bunkering equipment is maintained through the following routine checks: • visual inspections • string hydrotest. Maintained bunkering equipment will reduce likelihood of loss of integrity events during transfers.	Costs associated with maintaining equipment.	**Adopted –** environmental benefits of maintaining offtake equipment integrity outweigh the costs.
Additional control measures				
N/A	Contracting a standby vessel 24/7 during operations to aid third-party vessel detection at sea (protective control)	Standby vessel to monitor the 500 m PSZ and be equipped with an AIS to aid vessel detection at sea, and radar to aid in the detection of approaching third-party vessels. Reduces risk of vessel collision and subsequent unplanned release of hydrocarbons.	High cost associated with contracting standby vessel 24/7. Costs of operating navigational equipment. Additional risks from the vessel in the 500 m PSZ.	**Not adopted** – high costs which grossly outweigh the environmental benefit. Additional risks exist from additional vessel use in the PSZ.
N/A	No fuel bunkering via hose (elimination control)	Removes spill risk from hose operations.	Cost associated with transfer of MGO via drums or containers or significant modification of the FPSO to allow additional fuel storage. Cost associated with vessel transits and risk transfer to health and safety issues with additional trips to port instead. Would significantly increase the schedule to include multiple trips.	**Not adopted**– Eliminating bunkering via hoses introduces new risks related to dropped objects and vessel transfers. The bunkering method is consistent with industry and maritime practices.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Response equipment above and beyond SOPEP/SMPEP requirements (such as booms) on vessels ready to respond to a loss of hydrocarbons (protective control)	May allow for quicker response to a spill as resources will be nearby.	Lack of room on vessels. Large costs associated with a dedicated resource on location.	**Not adopted**– not feasible due to lack of room on vessels and large cost associated with dedicated resources on location deemed grossly disproportionate compared to risk.

7.7.9.4 Environmental impact assessment

The environmental impact assessment in the next subsections follows the approach detailed in Section 7.7.5.

7.7.9.4.1 Identification of hot spots for consequence assessment

Hot spots that are predicted to be contacted by hydrocarbons within the LEVA and the MEVA for a MGO release from the FPSO are listed in Table 7-27. The values and sensitivities associated with these areas are described in Section 3. These hot spots meet the criteria as described in Section 7.7.5.

Note the worst-case values were taken from the modelling scenarios to identify the hot spots and therefore is taken from any season and any hydrocarbon phase at any water depth.

Table 7-27: Identified high environmental value and hot spot receptors

Receptor	Exposure values			Hot spot
	Low	Moderate (MEVA)	High (HEVA)	
Ashmore Reef Marine Park	✓	✓		
Ashmore-Cartier – Outer	✓	✓		
Echo Shoals	✓	✓		
Fantome Shoals	✓	✓		
Flat Top Bank	✓	✓		
Hibernia Reef	✓	✓		
Indonesia-East – Timor Leste	✓	✓		✓
Joseph Bonaparte Gulf East Coast	✓	✓		
Johnson Bank	✓			
Margaret Harries Bank	✓	✓		
Minor Indonesian Islands	✓	✓		✓
Newby Shoal	✓	✓		
Northern Arafura Marine Park P	✓	✓		
Outer Oceanic Shoals Marine Park	✓	✓	✓	
Sahul Banks	✓	✓		
Shepparton Shoal	✓			
Southern Arafura Marine Park	✓			
Sunrise Bank	✓	✓		
The Boxers Area	✓	✓		
Tiwi Islands	✓			
Van Cloon-Deep Shoals	✓	✓		

Receptor	Exposure values			Hot spot
	Low	Moderate (MEVA)	High (HEVA)	
Western Sahul Bank Shoals	✓	✓		
Woodbine Bank	✓			

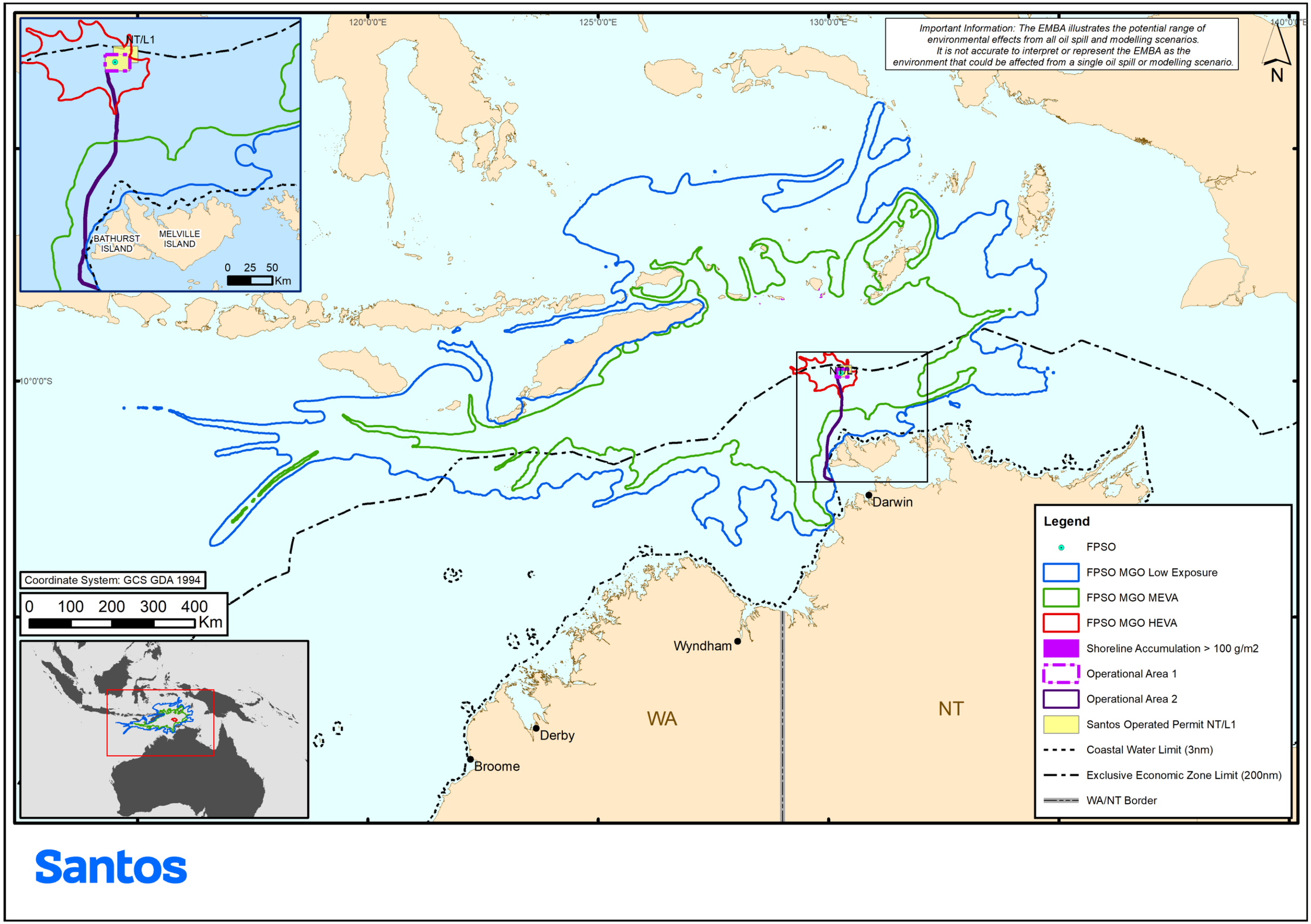


Figure 7-9: Low, moderate and high exposure value areas from a marine gas oil spill from the floating production, storage and offloading facility

7.7.9.4.2 Impact, likelihood and consequence ranking – surface release of MGO (FPSO worst-case)

Receptors	Physical environment and habitat Threatened, migratory or local fauna Socio-economic Cultural features
Consequence	III – Moderate

The consequence assessment for each receptor category is summarised below. Potential impact pathways (physical and chemical) of hydrocarbon exposure for receptors are summarised in Table 7-17, and potential impacts to receptors that may be found within the MEVA are further described in Table 7-18.

Physical environment and habitat

Water quality will be reduced due to hydrocarbon contamination (both at the sea surface and in the upper water column as a result of entrained and dissolved hydrocarbons) at the location of the spill, as well as within surrounding marine waters. Given the light nature of MGO, it undergoes rapid spreading and evaporation losses in warm waters and any floating hydrocarbons will be temporary. Water quality changes within the water column are also expected to be temporary, due to the rapid natural degradation and dispersion of MGO in the marine environment.

A number of banks and shoals, as well as the Oceanic Shoals, Ashmore Reef and Arafura marine parks, are within the MEVA. Banks and shoals support a diverse and varied range of benthic communities, reef-building soft corals, hard corals and filter-feeders (Heyward *et al.*, 2017, 2015b). Shoals and banks close to OA1 have the greatest potential to be contacted by entrained hydrocarbons; however, at relatively low probabilities (up to 30%).

Shallower shoals (for example, the top of the shoal is within the top 25 m of the water column) within the MEVA are more likely to be contacted by entrained hydrocarbons. Lethal and sub-lethal effects to filter feeders from hydrocarbons include mortality and changes in population recruitment, growth and reproduction, which may lead to changes in community composition and structure (Wei *et al.*, 2012). Filter feeders are particularly susceptible as they are likely to directly ingest hydrocarbons while feeding. This may cause mortality or sub-lethal impacts, such as alteration in respiration rates, decreases in filter feeding activity and reduced growth rates, and biochemical effects (Keesing & Edgar, 2016). However, as the hydrocarbon concentration decreases and weathers, the communities are expected to recover.

Indonesia-East – Timor Leste shoreline may accumulate hydrocarbons in low volumes (refer Section 7.7.9.2.1). This location includes areas of benthic coral reefs and mangroves. Contact by hydrocarbons may result in a localised decrease in ecological value of the shoreline, due to the associated toxic components of hydrocarbons. Secondary impacts may occur to the fauna using the shoreline, as described in the next subsection.

The MEVA overlaps waters above the Shelf break and slope of the Arafura Shelf and Carbonate bank and the terrace system of the Van Diemen Rise KEFs. Given the nature of the release (at surface), hydrocarbons are predicted to remain in the top 25 m of the water column; therefore, extensive contact with the seabed of the KEFs is not anticipated.

Potential impacts to the physical environment and habitat are expected to be III-Moderate, due to the potential for a significant loss of area and/or function of the local physical environment and habitat. Though the evaporative and dispersive nature of MGO, which largely remains in the top 25 m of the water column, has a low volume of shoreline accumulation.

Threatened or migratory fauna

In the event of a surface release of MGO, a reduction in water quality (described above) has the potential to impact marine fauna within the MEVA, as described in Table 7-18. Impacts would be greatest within several kilometres of the release location, where the hydrocarbon is at its thickest on the sea surface and where the toxic aromatic components of the MGO will be at their highest concentration. Given the nature of the release (at surface), hydrocarbons are predicted to remain in the top 25 m of the water column; therefore, extensive contact with marine fauna below this level is not anticipated. Upon release to the marine environment, the MGO will also rapidly lose toxicity with time and will spread thinner at the surface as evaporation continues or due to entrainment within the water column.

Breeding and foraging BIAs for seabirds or migratory shorebirds are predicted to be contacted by hydrocarbons within the MEVA. Therefore, seabirds may contact floating hydrocarbons while foraging in offshore, open water locations and may cause secondary effects through ingestion after preening or ingestion of oiled fish (as described in Table 7-18). Potential impacts are likely to be limited to individuals that may be transiting through the area so impact to overall population viability is not anticipated.

The MEVA overlaps the pygmy blue whale distribution BIA and a number of marine mammal species may come into contact with hydrocarbons either on the sea surface or within the water column. Potential impacts are likely to be limited to individuals that may be transiting through the area, with potential for coating of baleen (in whales) and ingestion of oiled prey (plankton and fish), as described in Table 7-18. Impacts to overall population viability or ecosystems are not anticipated.

The MEVA overlaps the whale shark foraging BIA. There is the potential for behavioural disruption to the local population as individuals traverse the release; impact to overall population viability or ecosystems is not anticipated.

A number of marine mammal species may come into contact with hydrocarbons either on the sea surface or within the water column. Potential impacts are likely to be limited to individuals that may be transiting through the area, with potential for coating of baleen (in whales) and ingestion of oiled prey (plankton and fish), as described in Table 7-18. Impact to overall population viability or ecosystems is not anticipated.

Dugongs are known to occur in coastal waters, including those of the Tiwi Islands such as the seagrass sites on the north-west of Melville Island. Direct impacts to dugongs could occur through foraging or ingesting seagrass coated with hydrocarbon. Dugongs could also be indirectly affected if the released hydrocarbons cause the dieback of seagrass, reducing dugong feeding area. Impacts at a population level are considered highly unlikely as the extent of the MGO release is not anticipated to result in the loss of entire seagrass meadow habitats.

The MEVA overlaps and is close to various marine turtle BIAs and internesting buffer HC close to the Tiwi Islands. Marine turtle species may come into contact with hydrocarbons either on the sea surface or within the water column. Any potential impacts (as described in Table 7-18) are likely to be limited to individuals that may be transiting through the area or feeding at nearby submerged shoals and banks. Given the non-persistent nature of the MGO, along with the expected rapid evaporation and dispersion, the timeframe during which marine turtles may be exposed to hydrocarbons above impact thresholds is low. The spatial extent of the MEVA, along with the wide distribution of turtle species in the region, indicates impact to overall population viability or ecosystems is not anticipated. Potential impacts would be greatest during the internesting season for flatback and olive ridley turtles; between June and September for flatback turtles and April to August for olive ridley turtles. Indonesia-East – Timor Leste shoreline may accumulate hydrocarbons, which could impact marine fauna that use these areas, such as shorebirds and turtles. Impacts to turtles could occur from hydrocarbons that accumulate on turtle nesting beaches, with the greater impact being during nesting seasons. Turtle nests are typically made above the high-water mark, which is typically the highest point along the shoreline that hydrocarbon will reach. As such, direct contact between turtle eggs and the hydrocarbons is very unlikely. Given the low volumes (up to 25 m³ at Indonesia-East – Timor Leste) and non-persistent nature of MGO on shorelines, the impact to nesting beaches (including nesting turtles, egg clutches and hatchlings) is anticipated to relate to a very temporary local disruption of individual turtles using the nesting beach, if the spill was to occur during nesting season. The potential sensitive receptors in the surrounding areas of the hydrocarbon release include fish, marine mammals, marine reptiles and seabirds. Potential impacts (as described in Table 7-18) to Threatened or migratory fauna are expected to be III-Moderate and relate to a significant behavioural disruption to local populations. Impacts to overall population viability or ecosystems are not anticipated. **Protected areas** The MEVA overlaps the Oceanic Shoals, Ashmore Reef and Arafura marine parks. Given the nature of the release (at surface), hydrocarbons are predicted to remain in the top 25 m of the water column; therefore, extensive hydrocarbon contact with the seabed and sediment contamination is not anticipated. These marine parks support habitats and faunal groups as described above. Impacts to these receptors (as described in Table 7-18) may impact on the values of the marine parks. The potential impact is anticipated to be III-Moderate, relating to a significant impact on one or more of the protected area's values (such as natural, cultural, heritage and socio-economic), as identified in Table 7-18. **Socio-economic** There is potential for temporary disruption to fishing activities (traditional, recreational and commercial) due to surface, dissolved or entrained hydrocarbons. However, given the dispersive nature of the MGO, disruptions are expected to be temporary. Potential impacts to fishing activity are expected to relate to a short-term loss of value to the local industry due to local disruptions and displacement of fishing ground. The EMBA may overlap cultural features. Impacts to cultural features, including a disruption/displacement of cultural activities caused by the physical presence of the hydrocarbon, decline in traditional food sources and / or mortality of fauna with cultural significance, may result in the event of a significant spill of hydrocarbons. Other energy operations in the region may also be disrupted in the event of a hydrocarbon release (such as Santos' Bayu-Undan operations) and defence and military exercises and commercial shipping may be excluded or displaced temporarily. Potential impacts (as described in Table 7-18) to socio-economic receptors are expected to be III-Moderate and relate to a temporary, local disruption or displacement in activities.	
Likelihood	A – Remote
The likelihood of a hydrocarbon release occurring due to a vessel collision is limited, given the set of mitigation and management controls in place. External impacts to the FPSOs have not occurred within Santos and controls are in place that limit such events. The Barossa Ship Collision Study examines potential ship impact scenarios at the FPSO location and calculates the frequency of ship impacts with various outcomes. The potential to damage the FPSO is shown to be remote, particularly given the impact energies and the FPSO position away from areas of high concentrations of shipping movements. The likelihood of a vessel collision releasing hydrocarbons to the environment resulting in an III – Moderate consequence is considered to be A – Remote.	
Residual risk	The residual risk is considered **Very Low**.

7.7.9.5 Demonstration of as low as reasonably practicable

Additional control measures were considered (as detailed in Section 7.7.9.3) but not adopted since the associated cost and effort were grossly disproportionate to any benefit.

Given the requirement to use MGO for fuelling, the risk of loss of containment of MGO cannot be eliminated nor substituted. Therefore, there has been a focus on FPSO design and vessel selection, which has been discussed in Section 7.7.8.5.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. The proposed management controls are in accordance with the Santos risk management criteria and are considered appropriate to manage the risk to ALARP.

In terms of spill response activities, Santos will implement hydrocarbon spill response as specified within the Barossa Production Operations OPEP. A detailed ALARP assessment on the adequacy of arrangements available

to support spill response strategies and control measures is presented in the Barossa Production Operations OPEP.

7.7.9.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – residual risk is ranked as Very Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ESD?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers principles of ESD: • The impacts from the spill scenarios are inherently inconsistent with principles of ESD, given the nature and scale of impacts. Control measures are applied to ensure the impacts and risks from activities are managed to ALARP and an acceptable level.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)?	Yes - Control measures implemented will reduce the risk of an unplanned release of MGO to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009b) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b) • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b) • Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c) • Approved Conservation Advice for *Limnodromus semipalmatus* (Asian dowitcher) (DCCEEW, 2024f) • Approved Conservation Advice for *Limosa limosa* (black-tailed godwit) (DCCEEW, 2024e) • Approved Conservation Advice for *Calidris tenuirostris* (great knot) (DCCEEW, 2024d) • Approved Conservation Advice for *Charadrius leschenaultii* (greater sand plover) (DCCEEW, 2023f) • Approved Conservation Advice for *Pluvialis squatarola* (grey plover) (DCCEEW, 2024g) • Approved Conservation Advice for *Limosa lapponica baueri* (Alaskan bar-tailed godwit) (DCCEEW, 2024k) • Approved Conservation Advice for *Calidris canutus* (red knot) (DCCEEW, 2024m) • Approved Conservation Advice for *Phaethon rubricauda westralis* (Indian Ocean red-tailed tropicbird) (DCCEEW, 2023g) • Approved Conservation Advice for *Arenaria interpres* (ruddy turnstone) (DCCEEW, 2024m) • Approved Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW, 2024l)

	• Approved Conservation Advice for *Xenus cinereus* (terek sandpiper) (DCCEEW, 2024i) • Conservation Advice for the Abbott's Booby *Papasula abbotti* (TSSC, 2020a) • Approved Conservation Advice for *Rostratula australis* (DSEWPaC, 2013) • Conservation Advice for *Charadrius mongolus* (lesser sand plover) (DCCEW, 2024j) • Approved Conservation Advice for *Aipysurus fuscus* (dusky sea snake) (DCCEEW, 2024p)
	Recovery plans: • Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013) • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (CoA, 2014) • Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) • Wildlife Conservation Plan for Seabirds (CoA, 2020) • Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c) **Other management plans/guidelines**: • Marine bioregional plans for the NMR and NWMR (CoA, 2012a, 2012b). For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes in Section 7.7.7 and the control measures outlined in Section 7.7.9.3. Santos considers that the level of risk of an unplanned release of MGO is not inconsistent with these plans. IMMR activities that may be required in the Oceanic Shoals Marine Park are not inconsistent with the IUCN principles and North Marine Parks Network Management Plan objectives (DNP, 2018a) or the DNP Commercial Activity Licence conditions; refer Appendix C. The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the Shelf break and slope of the Arafura Shelf KEF. Significant impacts to this KEF are not predicted.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with Safety Case, *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*, *Navigation Act* 2012, Marine Order 30: Prevention of Collisions, Marine Order 21: Safety of Navigation and Emergency Procedures, *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, MARPOL Annex I (Prevention of Pollution by Oil), Marine Order 91: Marine Pollution Prevention – Oil. and National Plan for Maritime Environmental Emergencies (AMSA, 2020). Through acceptance of this EP, legislative and regulatory requirements will be met as per Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.

Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with AMSA, AAPA, the ECNT, the ACF and Ngoy Garmak Consultative Committee, have been considered when evaluating performance outcomes, control measures and associated performance standards (refer Section 4.7 for further information). No specific control measures were raised by relevant persons in relation to this risk. However, AMSAs marine safety division did advise Santos of the required maritime safety measures required across the activity. Santos has confirmed that the required maritime safety measures identified by AMSA have been incorporated into this EP refer to (BAO-CM-6.1.2 and BAO-CM-6.6.1). Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have been adopted in this EP. Additional performance outcomes (EPO-19, EPO-20) have been adopted for an unplanned release of MGO based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

The residual risk is assessed as Low. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential risks are considered acceptable.

7.7.10 Unplanned Release of Marine Diesel Oil (MDO)

7.7.10.1 Description of event

Event

Table 7-28 presents the worst-case credible release for an unplanned MDO release event at the sea surface.

Table 7-28: Worst-case credible release for a marine diesel oil release at the sea surface

No.	Scenario	Volume maximum credible volume
1	Surface release of MDO from a vessel as a result of an external impact (vessel collision) which ruptures an MDO tank	500 m³ over one hour

A collision scenario between a vessel and another vessel (third-party or other Santos vessel) or with the FPSO could occur due to factors such as human error, poor navigation, vessel equipment failure or poor weather. A number of prerequisite conditions must exist for a vessel collision to result in the loss of fuel to the environment:

1. The vessel must be involved in a collision: collisions involving offshore support vessels, comparable to those that will used during the Activity, are very uncommon. Statistics compiled by the Australian Transport Safety Bureau for offshore support vessels indicated zero collision-related incidents between 2014 and 2024.
2. The collision must occur with sufficient force to rupture a fuel tank: fuel tanks are typically located at various positions around a vessel within the hull.
3. The rupture must be of such a nature that the fuel can be released into the environment: a tank rupture must be above or near the fuel level within the tank to result in a loss of containment from the tank. Once lost from the tank, fuel may leak to the environment or drain into the vessel hull. Fuel from ruptured tanks may be transferred to other tanks onboard, reducing the volume in the ruptured tank.

Note, it is not credible that the total storage volume of the vessel would be lost, as MDO is stored in more than one tank.

The southern end of OA2, close to the Commonwealth/State waters boundary, is an area of high shipping traffic due to its proximity to Darwin. It is therefore considered that the risk of collision is greater at this location relative to other locations in OA2 and OA1.

All vessels used to undertake activities within the scope of this EP will be fuelled using MDO or lighter fuels (such as MGO). Heavier fuel types, such as intermediate fuel oil or HFO, will not be used (offtake tankers excepted, refer to Section 7.7.11).

Operational area 1:

The event is credible in OA1. Collisions between a vessel and a third-party vessel or the FPSO could occur during HUC, initial start-up or operations.

Operational area 2:

The event is credible in OA2.

Extent	The spill modelling results at or above moderate exposure values (as used to define the MEVA) are summarised in Section 7.7.10.2.1. The low threshold, MEVA and HEVA contours for this event are presented in Figure 7-10. For information about the extent of potential impact associated with this event, refer to Section 7.7.10.4
Duration	**Constant:** An unplanned release may occur during HUC, initial start-up or operations activities within OA1 or during operational activities in OA2. Release occurs over approximately one hour. Hydrocarbons would persist within the environment for a longer period of time, although MDO is expected to weather quickly through evaporation and dispersion.

7.7.10.2 Nature and scale of environmental impacts

Potential receptors: Physical environment and habitat, threatened, migratory, or local fauna, socio-economic and cultural features.

Hydrocarbon spills will cause a decline in water quality and may cause chemical (for example, toxic) and physical (such as coating of emergent habitats, oiling of wildlife at sea surface) impacts to marine species. The severity of the impact of a hydrocarbon spill depends on the magnitude of the spill (as in, extent, duration) and sensitivity of the receptor.

Potential impact pathways (physical and chemical) of hydrocarbon exposure for receptors and potential impacts to receptors found within the EMBA are further described in Table 7-17.

The impact assessment of the sensitive environmental receptors at risk from an MDO release (Section 7.7.10.4) has been determined based on a literature review presented in Section 7.7.6 and trajectory and fate modelling described in Section 7.7.10.2.1.

7.7.10.2.1 Stochastic spill dispersion modelling

The spill modelling results at or above moderate exposure values (as used to define the MEVA) are summarised below for an MDO release from an IMMR vessel, which is assumed to have a larger fuel tank size than other support vessels, and therefore presents a worst case scenario for an MDO release. More detailed results are provided in Appendix H.

The southern end of OA2, close to the Commonwealth/State waters boundary, is an area of high shipping traffic due to its proximity to Darwin. It is considered the risk is of collision is greater at this location relative to other locations in OA2 and OA1. The location is also in proximity of the Tiwi Islands and the Australian mainland coast. A spill release at the southern end of OA2 has therefore been chosen as the release location for the surface release of MDO from a vessel.

Further parameters required to inform spill response strategies are described in the Barossa Production Operations OPEP.

The currents in the region are dominated by tidal and wind-driven currents which are dependent on the season. These will influence the direction the hydrocarbons (entrained and floating) travel in a particular season.

Accumulated shoreline hydrocarbon

Modelling results for accumulated shoreline hydrocarbon indicate:

- the highest probability of shoreline hydrocarbon accumulation at the 10 g/m² threshold is predicted for the Vernon Islands Conservation Reserve (less than 2%), which has a maximum volume of hydrocarbon ashore of 9 m³
- the shortest time for shoreline hydrocarbon accumulation at the 10 g/m² threshold is predicted at Tiwi Islands after 79 hours (approximately six days) after the commencement of the spill
- the Tiwi Islands receptor recorded a volume of hydrocarbon ashore of 16 m³ (probability of 0.33%).

Floating hydrocarbon greater than 10 g/m²

Modelling results for floating hydrocarbon greater than 10 g/m² indicate floating hydrocarbon may extend up to 44 km from the release location.

Entrained hydrocarbon greater than 100 ppb

Modelling results for entrained hydrocarbon greater than 100 ppb indicate:

- entrained hydrocarbon may occur within 0 to 25 m water depth, with a maximum distance from the release location of 229 km

- the shortest time for entrained hydrocarbon exposure at any receptor is predicted for Shepparton Shoal (six hours)
- the worst-case concentration of entrained hydrocarbons is predicted at Shepparton Shoal as 5,032 ppb.

Dissolved hydrocarbon greater than 50 ppb

Modelling results for dissolved hydrocarbon greater than 50 ppb indicate:

- Dissolved hydrocarbon may extend a maximum distance from the release location of 38 km to the west.
- Afghan Shoal and Shepparton Shoal were the only receptors to be exposed by concentrations at or above 50 ppb and the probability was less than 1%.

7.7.10.3 Control measures

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this Activity are shown in Table 7-29 to demonstrate the potential risks are ALARP. Control measures that are adopted have associated EPSs and measurement criteria that are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 7-29: Control measures evaluation of a surface release of marine diesel from a vessel

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-6.6.4	Activity undertaken in accordance with Santos HSE management and marine vessel vetting processes (Santos' Offshore Marine Assurance Procedure) (administrative control)	Ensures contracted vessels are operated, maintained, and crewed in accordance with industry standards and regulatory requirements.	Costs associated with personnel time in checking vessel.	**Adopted** – benefit of assuring vessels outweighs procedure compliance costs.
BAO-CM-6.1.2	Vessels equipped and crewed in accordance with Australian maritime requirements, including Marine Order 30 (Prevention of Collisions) and Marine Order 21 (Safety and Emergency Arrangements) (administrative control)	Ensures vessels meet Marine Assurance Standards to reduce the likelihood of vessel collision (such as minimum and working lighting for maritime safety).	Cost associated with implementing procedures.	**Adopted** – benefit of assuring vessels outweighs procedure compliance costs.
BAO-CM-7.1.6	Barossa FPSO Facility Safety Case (administrative control)	Details prevention, detection, mitigation and recovery measures provided to manage the risks. Details alarms and required emergency response in the event of a loss of containment.	Administrative costs of preparing and implementing the Safety Case.	**Adopted –** Benefits considered to outweigh costs.
BAO-CM-7.7.10.1	Radio communication prior to entering PSZ (administrative control)	Reduces the collision risk as it allows for communication to be established between vessels and FPSO within the PSZ, prior to another vessel entering.	Costs associated with communicating presence.	**Adopted** – benefits of ensuring communications are established outweigh the costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-7.7.8.7	NOPSEMA-accepted Barossa Production Operations Oil Pollution Emergency Plan (OPEP) (administrative control)	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents and large costs of preparing for and implementing response strategies.	**Adopted** – regulatory requirement, must be adopted.
BAO-CM-7.4.3	FPSO and vessel spill response plans (SOPEP/SMPEP) (administrative control)	Implements response plans (SOPEP/SMPEP) aboard vessels to deal with unplanned hydrocarbon releases and spills quickly and efficiently in order to reduce impacts to the marine environment.	Administrative costs of preparing documents. Generally undertaken by vessel contractor so time for Santos personnel to confirm and check SOPEP/SMPEP in place.	**Adopted** – regulatory requirement, must be adopted.
BAO-CM-6.4.10	Barossa Facilities and vessels planned maintenance system to confirm equipment integrity is maintained in accordance with manufacturers guidelines. (administrative control)	Requires that bunkering equipment is maintained and certified, reducing the probability of an unplanned MDO spill.	High cost of maintaining vessel equipment and managing the maintenance system.	**Adopted** – environmental benefits of ensuring vessels are maintained outweigh the costs.
BAO-CM-6.6.6	Vessel speed restrictions within 500m around the FPSO, IMMR vessels and campaign vessels (substitution control)	Reduces consequence of collisions (causing harm) and likelihood as fauna have longer to detect and avoid the vessel by restricting vessel speeds in the OA to 8 knots or less within 500m of the FPSO, and Activity vessels. Reduces the potential impacts to culturally significant marine species, including totemic species, such as marine turtles and marine mammals.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted.**
BAO-CM-6.6.1	Notify AHS and AMSA MSI prior to relevant Activity (administrative control)	Ensures other marine users are aware of the presence of the vessels and the relatively slow speed and restricted manoeuvrability. Alerts other marine users to the presence of Activity vessels and 500 m exclusion zone around the installation vessels, thus reducing the likelihood of vessel collision and fishing gear snagging.	Negligible costs.	**Adopted** – it is a regulatory requirement.
Additional control measures				
N/A	Response equipment above and beyond SOPEP/SMPEP requirements (such as booms) on vessels ready to respond to a loss of hydrocarbons (protective control)	May allow for quicker response to a spill as resources will be within proximity.	Lack of room on vessels. Large costs associated with a dedicated resource on location.	**Not adopted** – not feasible due to lack of room on vessels and large cost associated with dedicated resources on location deemed grossly disproportionate compared to risk.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Require all vessels to be double hulled (engineering control)	Reduces the likelihood of a loss of hydrocarbon inventory minimising potential environmental impact.	Vessels are subject to availability and are required to meet Santos standards during activities; requirement of a double hull on vessels would limit the number available to Santos; requiring vessels to be refitted to ensure double hulls would also be of high cost.	**Not adopted** – large costs associated with vessel selection and by having an activity schedule determined by vessel availability deemed grossly disproportionate compared to low risk of a vessel collision and low risk of a large MDO spill.

7.7.10.4 Environmental impact assessment

The environmental impact assessment in the next subsections follows the approach detailed in Section 7.7.5.

7.7.10.4.1 Identification of hot spots for consequence assessment

Hot spots that are predicted to be contacted by hydrocarbons in any phase within the LEVA and MEVA for an MDO release from an IMMR vessel are listed in Table 7-30. The values and sensitivities associated with these areas are described in Section 3. These hot spots meet the criteria as described in Section 7.7.5.

Note the worst-case values were taken from the modelling scenarios to identify the hot spots and, therefore, is taken from any season and any hydrocarbon phase at any water depth.

Table 7-30: Identified high environmental value and hot spot receptors

Receptor	Exposure values			Hot spot
	Low (LEVA)	Moderate (MEVA)	High (HEVA)	
Afghan Shoal	✓	✓		
Beagle Gulf-Darwin Coast	✓	✓		✓
Cobourg Peninsula-Nhulunbuy	✓			
Cape Hotham#	✓	✓		✓
Flat Top Bank	✓	✓		
Hancox Shoal	✓	✓		
Harris Reef	✓	✓		
Joseph Bonaparte Gulf East Coast	✓	✓		✓
Joseph Bonaparte Gulf South Coast	✓			
Jones Bank	✓			
Joseph Bonaparte Gulf Marine Park	✓	✓		
Lowry Shoal	✓	✓		
Marsh Shoal	✓	✓		
Moresby Shoals	✓	✓		
Newby Shoal	✓	✓		
Outer Oceanic Shoals Marine Park	✓	✓		
Shepparton Shoal	✓	✓		
Skottowe Shoal	✓	✓		
The Boxers Area	✓	✓		
Tiwi Islands	✓	✓		✓
Van Cloon-Deep Shoals	✓	✓		
Van Diemen Gulf Coast	✓	✓		

Receptor	Exposure values			Hot spot
	Low (LEVA)	Moderate (MEVA)	High (HEVA)	
Van Diemen Gulf Shoals (Bill, Barbara, Wells, Giles and Mataram Shoals)	✓	✓		
Vernon Islands Conservation Reserve	✓	✓		✓

Djukbinj National Park polygon named in the modelling report (RPS, 2023c) refers to the area Cape Hotham. There is no hydrocarbon contact with Djukbinj National Park.

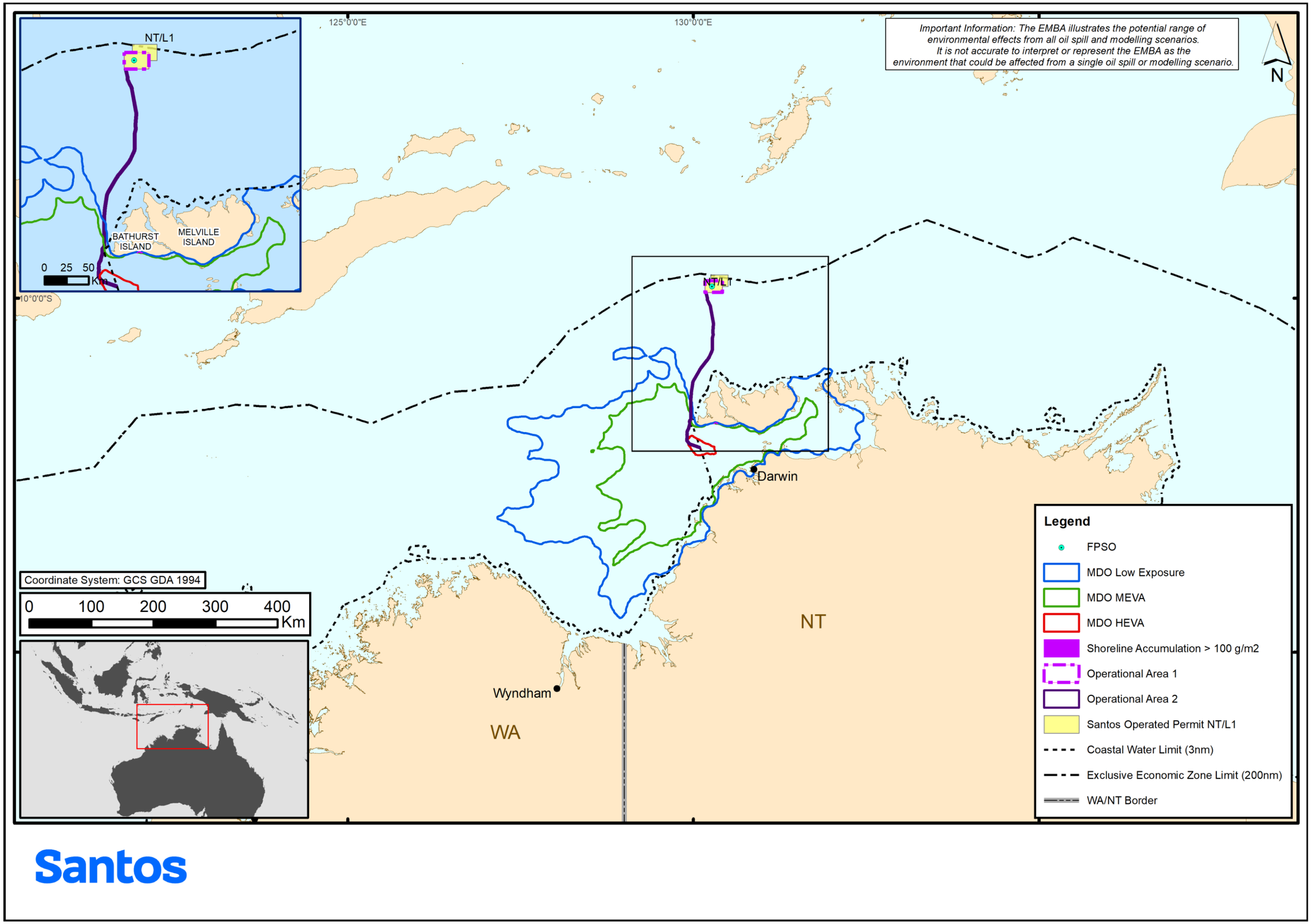


Figure 7-10: Low, moderate and high exposure value areas from a marine diesel oil spill from a vessel

7.7.10.4.2 Impact, likelihood and consequence ranking – surface release of MDO

Receptors	Physical environment and habitat Protected areas Threatened, migratory or local fauna Socio-economic Cultural features
Consequence	III – Moderate

The consequence assessment for each receptor category is summarised below. Potential impact pathways (physical and chemical) of hydrocarbon exposure for receptors are summarised in Table 7-17, and potential impacts to receptors that may be found within the MEVA are further described in Table 7-18.

Physical environment and habitat

It is likely that water quality will be reduced due to hydrocarbon contamination, both at the sea surface and in the upper water column as a result of entrained and dissolved hydrocarbons, at the location of the spill as well as within surrounding marine waters. Given the light nature of MDO, it undergoes rapid spreading and evaporation losses in warm waters and any floating hydrocarbons will be temporary. Water quality changes within the water column are also expected to be temporary, due to the rapid natural degradation and dispersion of MDO in the marine environment.

A number of banks and shoals, as well as the Oceanic Shoals and Joseph Bonaparte Gulf marine parks, are within the MEVA. Banks and shoals support a diverse and varied range of benthic communities, reef-building soft corals, hard corals and filter-feeders (Heyward *et al.*, 2017, 2015b). Shoals and banks close to the release have the greatest potential to be contacted by entrained hydrocarbons; however, at relatively low probabilities (for example, up to 24% at Shepparton Shoal).

Shallower shoals (for example, the top of the shoal is within the top 25 m of the water column) within the MEVA are more likely to be contacted by entrained hydrocarbons. Lethal and sub-lethal effects to filter feeders from hydrocarbons include mortality and changes in population recruitment, growth and reproduction which may lead to changes in community composition and structure (Wei *et al.*, 2012). Filter feeders are particularly susceptible as they are likely to directly ingest hydrocarbons while feeding. This may cause mortality or sub-lethal impacts such as alteration in respiration rates, decreases in filter-feeding activity, reduced growth rates, biochemical effects (Keesing & Edgar, 2016). However, as the hydrocarbon concentration decreases and weathers, the communities are expected to recover.

The Tiwi Islands shoreline may accumulate hydrocarbons in low volumes (refer to Section 7.7.10.2.1). This location includes areas of benthic coral reefs, seagrass and mangroves. Hydrocarbon coating of prop roots of mangroves can occur from surface hydrocarbons when they are deposited on the aerial roots. Hydrocarbons deposited on the aerial roots can block the pores used by the plants to breathe or interfere with the trees' salt balance resulting in sub-lethal and potentially lethal effects. Mangroves can also be impacted by entrained aromatic hydrocarbons that may adhere to sediment particles. In low-energy environments such as mangroves, deposited sediment-bound hydrocarbons are unlikely to be removed naturally by wave action and may be deposited in layers by successive tides (NOAA, 2014).

Tidal mudflats, like mangroves, are a low-energy environment and are, therefore, susceptible to potential impacts from persistent surface or stranded hydrocarbons. Hydrocarbons in contaminated sediments can persist for years and significantly impact benthic infauna and their dependent migratory shorebird populations (Duke and Burns, 2003). Saenger (1994) noted that mudflats were the most severely affected habitat 2 years after the Gulf War spill, with no sign of living epibiota. However, the hydrocarbon type in the Gulf was crude oil with a larger fraction of persistent components, compared to MDO. Given the low persistent hydrocarbons in MDO, the persistence of hydrocarbons is expected to be short-term.

Seagrasses in the subtidal and intertidal zones have different degrees of exposure to hydrocarbon spills. Subtidal seagrass is generally considered much less vulnerable to surface hydrocarbon spills than intertidal seagrass, primarily because freshly spilled hydrocarbons float under most circumstances. Dean *et al*. (1998) found that hydrocarbons mainly affect flowering. Therefore, species that can spread through apical meristem growth (growth at the tips of the root) are not as affected (such as *Zostera, Halodule* and *Halophila* species).

MDO tends to entrain within the water column, which can lead to seagrass coming into contact with or absorbing the water-soluble fraction. Contact and absorption have the potential to reduce photosynthesis and tolerance to other stress factors (Runcie *et al*., 2010; Taylor & Rasheed, 2011). Seagrass in the intertidal zone, such as that of the Tiwi Islands, is particularly vulnerable as it may come into direct contact with surface hydrocarbons and entrained components, which can smother and kill seagrasses if it coats their leaves and stems (Taylor & Rasheed, 2011). This conclusion is supported by Howard *et al*. (1989), who noted that surface hydrocarbon spills that become stranded on the seagrass and smother it during the rise and fall of the tide could result in reduced growth rates, blackened leaves and mortality. Wilson & Ralph (2011) concluded that long-term impacts to seagrass are unlikely unless hydrocarbon is retained within the seagrass meadow for a sustained duration.

Contact by hydrocarbons may result in a localised decrease in ecological value of the shoreline due to the associated toxic components of hydrocarbons. Secondary impacts may occur to the fauna using the shoreline, as described in the next subsection.

Potential impacts to the physical environment and habitat are expected to be III-Moderate, due to the potential for a significant loss of area and/or function of the local physical environment and habitat. Though the evaporative and dispersive nature of MDO, which largely remains in the top 25 m of the water column, and the low volume of shoreline accumulation (for example, 16 m³ at Tiwi Islands) does reduce the potential for long term effects.

Water soluble hydrocarbon fractions associated with surface slicks also cause high coral mortality (Shigenaka, 2001) via direct physical contact of hydrocarbon droplets with sensitive coral species (such as the branching coral species). Inter-tidal and shallow water corals may be impacted by surface and entrained hydrocarbons. Impacts may include increased mortality and sub-lethal effects such as changes in feeding, bleaching (loss of zooxanthellae), and increased mucous production,

resulting in reduced growth rates and impaired reproduction (Negri & Heyward, 2000). The habitat around the Tiwi Islands is restricted to coastal reef areas and inter-tidal platforms. Given the patchy distribution of inter-tidal and shallow water corals and the non-persistent nature of the hydrocarbon, impacts to corals in the event of an MDO release are expected to be restricted to sub-lethal impacts.

Threatened or Migratory fauna

In the event of a surface release of MDO, a reduction in water quality (described above) has the potential to impact marine fauna within the MEVA, as described in Table 7-18. Impacts would be greatest within several kilometres of the release location, where the hydrocarbon is at its thickest on the sea surface and where the toxic aromatic components of the MDO will be at their highest concentration. Given the nature of the release (at surface), hydrocarbons are predicted to remain the top 25 m of the water column; therefore, extensive contact with marine fauna below this level is not anticipated. Upon release to the marine environment, the MDO will also rapidly lose toxicity with time and will spread thinner at the surface as evaporation continues or due to entrainment within the water column.

Plankton

Plankton communities may be impacted by a hydrocarbon release, particularly entrained fractions. Toxic effects from exposure to entrained hydrocarbons may cause impacts such as blocked filter feeding organs and impacts resulting from ingesting hydrocarbons. Modelling of the credible release scenario predicts that entrained hydrocarbons above impact thresholds are expected to be highly localised around the release location. Given the high productivity of planktonic communities and the nature and scale of the credible release, these impacts are expected to be temporary and highly localised to the release location.

Seabirds and migratory shorebirds

The Wildlife Conservation Plan for Seabirds (CoA, 2020) identified pollution as a threat to seabirds and their habitats. As outlined in the Wildlife Conservation Plan for Seabirds (CoA, 2020), one of the objectives is to enhance contingency plans to prevent and respond to environmental emergencies that impact seabirds and their habitats, which is adopted in the control measure BAO-CM-7.7.8.7 (refer to Table 7-29).

Breeding and foraging BIAs for seabirds or migratory shorebirds are predicted to be contacted by hydrocarbons within the MEVA. Therefore, seabirds may contact floating hydrocarbons while foraging in offshore, open water- locations and may cause secondary effects through ingestion after preening or ingestion of oiled fish (as described in Table 7-18). Potential impacts are likely to be limited to individuals that may be transiting through the area so impact to overall population viability is not anticipated.

Marine mammals

The MEVA overlaps the pygmy blue whale distribution BIA and a number of marine mammal species may come into contact with hydrocarbons either on the sea surface or within the water column. Potential impacts are likely to be limited to individuals that may be transiting through the area, with potential for coating of baleen (in whales) and ingestion of oiled prey (plankton and fish), as described in Table 7-18. Impacts to overall population viability or ecosystems are not anticipated.

A number of marine mammal species may come into contact with hydrocarbons either on the sea surface or within the water column. Potential impacts are likely to be limited to individuals that may be transiting through the area, with potential for coating of baleen (in whales) and ingestion of oiled prey (plankton and fish), as described in Table 7-18. Impact to overall population viability or ecosystems is not anticipated.

Dugongs are known to occur in coastal waters, including those of the Tiwi Islands such as the seagrass sites on the north-west of Melville Island. Direct impacts to dugongs could occur through foraging or ingesting seagrass coated with hydrocarbon. Dugongs could also be indirectly affected if the released hydrocarbons cause the dieback of seagrass, reducing dugong feeding area. Impacts at a population level are considered highly unlikely as the extent of the MDO release is not anticipated to result in the loss of entire seagrass meadow habitats.

Pelagic and demersal fish communities (including sharks and rays)

Fish mortalities are rarely observed to occur as a result of hydrocarbon releases (ITOPF, 2014). This has generally been attributed to the possibility that pelagic fish can detect and avoid surface waters underneath hydrocarbon releases by swimming into deeper water or away from the affected areas. Fish that have been exposed to dissolved aromatic hydrocarbons are capable of eliminating the toxicants once in clean water, thus individuals exposed to a release are likely to recover (King *et al*., 1996). Where fish mortalities have been recorded, the releases (resulting from the groundings of the Amoco Cadiz [1978] and Florida [1969] tankers, which were significantly bigger than the worst-case credible release scenario considered in this EP) occurred in sheltered bays, which limited the ability of fish to access clean water and eliminate toxicants. Given the nature and scale of the credible release scenario and the open-ocean environment of the credible release location, impacts to pelagic and demersal fish are expected to be highly localised and temporary.

The MEVA overlaps the whale shark foraging BIA. There is the potential for behavioural disruption to the local population as individuals traverse the release; impact to overall population viability or ecosystems is not anticipated.

Marine reptiles

The MEVA overlaps various marine turtle BIAs and internesting buffer HC in proximity to the Tiwi Islands. Marine turtle species may come into contact with hydrocarbons either on the sea surface or within the water column, but any potential impacts are likely to be limited to individuals that may be transiting through the area or feeding at nearby submerged shoals and banks. Hydrocarbons are not predicted to contact the entire BIAs or areas of habitat critical to the survival of these species.

Approximately 260 km of sandy beaches surround the Tiwi Islands, many of which are documented to host turtle nesting. It is important to acknowledge that turtles have a strong affinity for specific nesting beaches and are unlikely to relocate to an alternative beach if their preferred nesting site is affected by hydrocarbons. Deterministic modelling predicts that the longest length of oiled shoreline at the moderate exposure threshold was 5 km with a low probability (5%) of occurring. At the end of this modelling simulation (40 days), only 1% of the total MDO volume remained ashore. No high (>1,000 g/m^2) shoreline exposure was predicted during the model simulation. Therefore, even considering the longest length of oiled shoreline predicted by the model, it will not have a significant impact on the nesting turtle population, and the duration of the impact will be limited.

Turtle nests are also typically located above the high water mark, typically the highest point along the shoreline that stranded oil will reach. Direct contact between turtle eggs and the stranded hydrocarbons is very unlikely. Nesting females and hatchlings emerging from nests may be exposed to stranded hydrocarbons when moving on nesting beaches, potentially resulting in contamination. Exposure may result in light oiling of nesting females and hatchlings, subsequently leading to sub-lethal effects such as skin irritation; no mortality is expected. Given the non-persistent nature of MDO and low levels of hydrocarbons potentially stranding on shorelines, the potential for impacts to nesting turtles, egg clutches and hatchlings on beaches is considered low.

Given the non-persistent nature of the MDO, along with the expected rapid evaporation and dispersion, the timeframe during which marine turtles may be exposed to hydrocarbons above impact thresholds is low. The spatial extent of the MEVA, along with the wide distribution of turtle species in the region, indicates impact to overall population viability or ecosystems is not anticipated. Potential impacts would be greatest during the internesting season for flatback and olive ridley turtles; between June and September for flatback turtles and April to August for olive ridley turtles.

Summary

The Tiwi Islands may accumulate hydrocarbons, which could impact marine fauna that use these areas such as shorebirds and turtles. Impacts to turtles could occur from hydrocarbons that accumulate on turtle nesting beaches, with the greatest impact being during nesting seasons. Turtle nests are typically made above the high water mark, which is typically the highest point along the shoreline that hydrocarbon will reach. As such, direct contact between turtle eggs and the hydrocarbons is very unlikely. Given the low volumes (up to 16 m^3) and non-persistent nature of MDO on shorelines, the impact to nesting beaches (including nesting turtles, egg clutches and hatchlings) is anticipated to relate to a very temporary local disruption of individual turtles using the nesting beach, if the spill was to occur during nesting season.

The potential sensitive receptors in the surrounding areas of the hydrocarbon release include fish, marine mammals, marine reptiles, and seabirds. Potential impacts (as described in) to Threatened or Migratory fauna are expected to be II – Minor and relate to a temporary disruption to local populations. Impact to overall population viability or ecosystems is not anticipated.

Protected areas

The MEVA overlaps the Oceanic Shoals and Joseph Bonaparte Gulf marine parks. Given the nature of the release (at surface), hydrocarbons are predicted to remain the top 25 m of the water column; therefore, extensive hydrocarbon contact with the seabed and sediment contamination is not anticipated. These marine parks support habitats and faunal groups described above. Impacts to these receptors (as described in) may impact on the values of the marine parks. The potential impact is anticipated to be III-Moderate since there could be significant decrease in the local population size but no threat to overall population viability; or a significant behavioural disruption to the local population in the event of an unpanned release of marine diesel oil.

The open waters above the seabed KEF, Carbonate bank and terrace system of the Van Diemen Rise overlap the MEVA. Impacts to this seabed KEF and the values of the KEF are considered to be negligible, given their location on the seabed and the surface nature of the releases in which the concentration of the entrained hydrocarbons is highest in the upper water column (RPS, 2023a).

Socio-economic and cultural features

There is potential for temporary disruption to fishing activities (traditional, recreational and commercial) and tourism and recreational activities if the surface, shoreline or entrained hydrocarbons moves through frequented areas. However, the high rate of evaporation means that little MDO will become entrained and few aromatic hydrocarbons to become dissolved. Given the volume of MDO that could potentially be released, it is unlikely that impacts could be detected to fisheries on a stock level although it is more likely that natural variation in fish abundance would be on a greater scale than any impacts attributable to a hydrocarbon spill. A hydrocarbon release may also temporarily displace activities such as fishing, tourism and recreation from within sections of the MEVA. This displacement would be localised and short-term (days). A hydrocarbon release may result in tainting of fished species. This could potentially result in commercial fishers being unable to sell their catch, which may result in a loss of income or other fishers unable to eat their catch. Spilt hydrocarbons may also contaminate fishing gear, which may require cleaning. Potential impacts to fishing activity are expected to relate to a short-term, but potentially significant, loss of value to the local industry due to local disruptions and displacement of fishing ground.

The EMBA overlaps cultural features (Section 3.7). Impacts to cultural features, including a disruption/displacement of cultural activities caused by the physical presence of the hydrocarbon, decline in traditional food sources and / or mortality of fauna with cultural significance and contact to sacred sites, may result in the event of a significant spill of hydrocarbons.

Other energy operations in the region may also be disrupted in the event of a hydrocarbon release (such as Santos' Bayu-Undan operations) and defence and military exercises and commercial shipping may be excluded or displaced temporarily.

Potential impacts (as described in) to socio-economic receptors and cultural features are expected to be III-Moderate and relate to a temporary, local disruption or displacement in activities.

Likelihood	B – Unlikely

The likelihood of a hydrocarbon release occurring due to a vessel collision is unlikely, given the set of mitigation and management controls in place. External impacts to vessels have not occurred within Santos and controls are in place that limit such events.

The southern end of OA2, close to the Commonwealth/State waters boundary, is an area of high shipping traffic due to its proximity to Darwin. It is therefore considered the risk of collision is greater at this location compared to other locations in OA2 and OA1. The likelihood of a collision event occurring at the southern end of OA2 is unlikely. The likelihood of a vessel collision releasing hydrocarbons to the environment resulting in an III-Moderate consequence is considered to be B – Unlikely.	
Residual risk	The residual risk is considered **Low**.

7.7.10.5 Demonstration of as low as reasonably practicable

The use of vessels is integral to the Activity. Therefore, vessels and associated risks of unplanned hydrocarbon releases cannot be completely eliminated.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. The proposed management controls are in accordance with the Santos risk management criteria and are considered appropriate to manage the risk to ALARP.

In terms of spill response activities, Santos will implement hydrocarbon spill response as specified within the Barossa Production Operations OPEP. A detailed ALARP assessment on the adequacy of arrangements available to support spill response strategies and control measures is presented in the Barossa Production Operations OPEP.

7.7.10.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – residual risk is ranked as Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ESD?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers principles of ESD: • The impacts from the spill scenario are inherently inconsistent with principles of ESD, given the nature and scale of impacts. Control measures are applied to ensure the impacts and risks from activities are managed to ALARP and an acceptable level.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)?	Yes – Control measures implemented will reduce the risk of an unplanned release of MDO to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009b) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b) • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b)

- Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c)
- Approved Conservation Advice for *Limnodromus semipalmatus* (Asian dowitcher) (DCCEEW, 2024f)
- Approved Conservation Advice for *Limosa limosa* (black-tailed godwit) (DCCEEW, 2024e)
- Approved Conservation Advice for *Calidris tenuirostris* (great knot) (DCCEEW, 2024d)
- Approved Conservation Advice for *Charadrius leschenaultii* (greater sand plover) (DCCEEW, 2023f)
- Approved Conservation Advice for *Pluvialis squatarola* (grey plover) (DCCEEW, 2024g)
- Approved Conservation Advice for *Limosa lapponica baueri* (Alaskan bar-tailed godwit) (DCCEEW, 2024k)
- Approved Conservation Advice for *Calidris canutus* (red knot) (DCCEEW, 2024m)
- Approved Conservation Advice for *Phaethon rubricauda westralis* (Indian Ocean red-tailed tropicbird) (DCCEEW, 2023g)
- Approved Conservation Advice for *Arenaria interpres* (ruddy turnstone) (DCCEEW, 2024m)
- Approved Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW, 2024l)
- Approved Conservation Advice for *Xenus cinereus* (terek sandpiper) (DCCEEW, 2024i)
- Conservation Advice for the Abbott's Booby *Papasula abbotti* (TSSC, 2020a)
- Approved Conservation Advice for *Rostratula australis* (DSEWPaC, 2013)
- Conservation Advice for *Charadrius mongolus* (lesser sand plover) (DCCEW, 2024j)
- Approved Conservation Advice for *Aipysurus fuscus* (dusky sea snake) (DCCEEW, 2024p)

Recovery plans:

- Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013)
- Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (CoA, 2014)
- Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015–2025 (CoA, 2015a)
- Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017)
- Wildlife Conservation Plan for Seabirds (CoA, 2020)
- Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c)

Other management plans/guidelines:

- Marine bioregional plans for the NMR and NWMR (CoA, 2012a, 2012b).

For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes in Section 7.7.7 and the control measures outlined in Section 7.7.10.3. Santos considers that the level of risk of an unplanned release of MDO is not inconsistent with these plans.

IMMR activities that may be required in the Oceanic Shoals Marine Park are not inconsistent with the IUCN principles and North Marine Parks Network Management Plan objectives (DNP, 2018a) or the DNP Commercial Activity Licence conditions; refer to Appendix C.

The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the Shelf break and slope of the Arafura Shelf KEF. Significant impacts to this KEF are not predicted.

Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with Safety Case, *Marine Safety (Domestic Commercial Vessel) National Law Act* 2012, *Navigation Act 2012,* Marine Order 30: Prevention of Collisions, Marine Order 21: Safety of Navigation and Emergency Procedures, *Protection of the Sea (Prevention of Pollution from Ships) Act* 1983, MARPOL Annex I (Prevention of Pollution by Oil), Marine Order 91: Marine Pollution Prevention – Oil and National Plan for Maritime Environmental Emergencies (AMSA, 2020). Through acceptance of this EP, legislative and regulatory requirements will be met as per Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with AMSA, AAPA, the ECNT, the ACF, Ngoy Garmak Consultative Committee and Djulidki (Bradshaw) Consultative Committee have been considered when evaluating performance outcomes, control measures and associated performance standards (refer to Section 4.7 for further information). No specific control measures were raised by relevant persons in relation to this risk. However, AMSAs marine safety division did advise Santos of the required maritime safety measures. Santos has confirmed that the required maritime safety measures identified by AMSA have been incorporated into this EP refer to (BAO-CM-6.1.2 and BAO-6.6.1). Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have been adopted in this EP. Additional performance outcomes (EPO-19, EPO-20) have been adopted for an unplanned release of condensate based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

The residual risk is assessed as Low. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential risks are considered acceptable.

7.7.11 Unplanned Release of Heavy Fuel Oil (HFO)

7.7.11.1 Description of event

Event

Table 7-31 presents the worst-case credible scenario for an unplanned HFO release to the sea surface.

Table 7-31: Worst-case credible scenario for an unplanned heavy fuel oil release at the surface

No.	Scenario	Volume maximum credible volume
1	A surface release of HFO from the offtake tanker as a result of external impact (vessel collision) which ruptures an HFO tank on the offtake tanker	460 m³ over 1 hour

A surface release of HFO from the offtake tanker as a result of external impact (vessel collision) which ruptures an HFO tank on the offtake tanker

A collision scenario between the offtake tanker and another Activity vessel or an errant vessel (third party) within OA1 could occur due to factors such as human error, poor navigation, vessel equipment failure or poor weather, potentially rupturing an offtake tanker HFO tank.

Based on five ships with doublehull bunker tanks used by Santos during 2020 to 2022, the average size of the largest HFO tank on a sample of typical offtake tankers is deemed to be 1,063 m³. Tanker fuel tanks will not be at 100% capacity as the fuel tanks are commonly loaded to only 98% (which translates to a departure

	volume of 1,041 m^3 HFO stored in the largest tank) and fuel will be drawn down during transit from the previous destination. The minimum distance assumed to transit from Singapore to the Barossa Field is 2,070 nautical miles. Estimate of fuel consumption is 245 m^3 across two HFO tanks (approximately 35 m^3 per day consumption), resulting in a reduction of maximum assumed capacity to 919 m^3. Assuming that it would be possible to lose 50 % of the volume of the largest tank on the offtake tanker resulting from a non-major collision as the fuel tank is protected by double hull, the maximum credible release from this event is therefore 460 m^3 over 1 hour. Tankers delivered after August 2010 are required to have a cofferdam (double hull) protecting the vessel's fuel tanks. Santos will only accept tankers built after 2010 to ensure the fuel tanks are protected. Given the above it is considered appropriate and precautionary to assume a worst-case loss of 50% of HFO from the largest tank on the offtake tanker (460 m^3) resulting from a non-major collision, noting the fuel tank is protected by double hull. This approach is consistent with AMSA Guidelines (2015). Tankers are able to detach and manoeuvre away from the path of an oncoming errant vessel. • the location of the offtake is not in an area of high shipping density • the location of the offtake will occur within a PSZ, which is marked on navigation charts. While the offtake tanker could potentially collide with the FPSO during berthing, the offtake tanker aligns with the FSPO into the prevailing wind and current during this process; therefore, only the bow of the offtake tanker (which does not house HFO tanks) could be impacted from collision. An impact between the offtake tanker and FPSO during berthing that could rupture a lateral HFO tank on the offtake tanker is not considered credible. **Operational area 1:** The event is credible in OA1. *Note: the scenario is only within the scope of the EP while the tanker is connected to the FPSO and performing an offtake and when the tanker under Santos operational control.* **Operational area 2:** The event is not credible in OA2.
Extent	The spill modelling results at or above moderate exposure values (as used to define the MEVA) are summarised in Section 7.7.11.2.1. The low exposure, MEVA and HEVA contours for this event are presented in Figure 7-11 For information about the extent of potential impact associated with this event, refer to Section 7.7.11.2.
Duration	**Constant:** An unplanned release may occur during operational activities within OA1. Release occurs instantaneously (one hour) through the rupture. Hydrocarbons would persist within the environment for a longer period of time.

7.7.11.2 Nature and scale of environmental impacts

<u>Potential receptors: Physical environment and habitat, threatened, migratory, or local fauna, socio-economic and cultural features.</u>

Hydrocarbon spills will cause a decline in water quality and may cause chemical (for example, toxic) and physical (such as coating of emergent habitats, oiling of wildlife at sea surface) impacts to marine species. The severity of the impact of a hydrocarbon spill depends on the magnitude of the spill (as in, extent, duration) and sensitivity of the receptor.

Potential impact pathways (physical and chemical) of hydrocarbon exposure for receptors and potential impacts to receptors found within the EMBA are further described in Table 7-17.

The impact assessment of the sensitive environmental receptors at risk from an HFO release (Section 7.7.11.4) has been determined based on a literature review (Section 7.7.6) and trajectory and fate modelling described in Section 7.7.11.2.1.

7.7.11.2.1 Stochastic spill dispersion modelling

The spill modelling results at or above moderate exposure values (as used to define the MEVA) are summarised below for an HFO release from the offtake tanker. More detailed results are provided in Appendix H. Further parameters required to inform spill response strategies are described in the Barossa Production Operations OPEP.

The currents in the region are dominated by tidal and wind-driven currents which are dependent on the season. These will influence the direction the hydrocarbons (entrained and floating) travel in a particular season.

Accumulated shoreline hydrocarbon

Modelling results for accumulated hydrocarbon indicate:

- The highest probability of shoreline hydrocarbon accumulation at the 10 g/m² threshold is forecast for Indonesia East – Timor Leste (less than 8%), which had also recorded the maximum volume of hydrocarbon ashore as 367 m³.
- The shortest time for shoreline hydrocarbon accumulation at the 10 g/m² threshold is predicted for Indonesia-East – Timor Leste after 220 hours (approximately nine days) after commencement of the spill.
- Shoreline accumulation at the Tiwi Islands at the 10 g/m² threshold is low probability (less than 1%), 893 hours (approximately 37 days) after commencement of the spill. Maximum shoreline hydrocarbon accumulation predicted for the Tiwi Islands is 278 m³ (0.33%).

Floating hydrocarbon greater than 10 g/m²

Modelling results for floating hydrocarbon greater than 10 g/m² indicate:

- floating hydrocarbon may extend up to 840 km west from the release location
- locations potentially contacted include areas over Sunrise Bank (less than 8%) and Outer Oceanic Shoals Marine Park (less than 2%).

Entrained hydrocarbon greater than 100 ppb

Modelling results for entrained hydrocarbon greater than 100 ppb indicate:

- entrained hydrocarbon at 100 ppb would occur within 0 to 25 m water depth, with a maximum distance from the release location of 186 km to the west
- the shortest time for entrained hydrocarbon exposure at any receptor is predicted for Sunrise Bank (37 hours)
- the worst-case concentration of entrained hydrocarbons is predicted at outer Oceanic Shoals Marine Park as 260 ppb
- the outer Oceanic Shoals Marine Park is predicted to be contacted at a probability less than 1%.

Dissolved hydrocarbon greater than 50 ppb

Modelling results for dissolved hydrocarbon greater than 50 ppb indicate there is no exposure to receptors.

7.7.11.3 Control measures

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this Activity are shown in Table 7-32 to demonstrate the potential risks are ALARP. Control measures that are adopted have associated EPSs and measurement criteria that are presented in Table 8-2. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 7-32: Control measures evaluation of a surface release of heavy fuel oil

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-7.1.6	Barossa FPSO Facility Safety Case (administrative control)	Details prevention, detection, mitigation and recovery measures provided to manage the risks. Details alarms and required emergency response in the event of a loss of containment.	Administrative costs of preparing and implementing the Safety Case.	**Adopted –** Benefits considered to outweigh costs.
BAO-CM-7.7.8.4	Barossa Terminal Handbook, including pilotage procedure (administrative control)	Reduces the risk of a release from vessel collision by providing details for safe approach (such as daylight hours, speed, pilot accreditation) and berthing of the offtake tanker to the FPSO. The Barossa Terminal Handbook also defines parameters (such as metocean) for offtake to occur and reducing risk of release events. The FPSO will complete a pre-berthing toolbox talk before each offtake, including a check of the	Costs associated with ensuring the Barossa Terminal Handbook is maintained and implemented.	**Adopted** – environmental benefits of ensuring procedures are followed and measures implemented outweigh the costs.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
		key controls, functioning equipment and communication, which mitigates against vessel-to-vessel interaction and loss of containment incidents.		
BAO-CM-6.6.4	Activity undertaken in accordance with Santos HSE management and marine vessel vetting processes (Santos' Offshore Marine Assurance Procedure) (administrative control)	Ensures contracted vessels are operated, maintained, and crewed in accordance with industry standards and regulatory requirements.	Costs associated with personnel time in checking vessel.	**Adopted** – benefit of assuring vessels outweighs procedure compliance costs.
BAO-CM-6.1.2	Vessels equipped and crewed in accordance with Australian maritime requirements, including Marine Order 30 (Prevention of Collisions) and Marine Order 21 (Safety and Emergency Arrangements) (administrative control)	Ensures vessels meet Marine Assurance Standards to reduce the likelihood of vessel collision (such as minimum and working lighting for maritime safety).	Cost associated with implementing procedures.	**Adopted** – benefit of assuring vessels outweighs procedure compliance costs.
BAO-CM-7.4.5	Helicopter refuelling procedure (administrative control)	Minimises risk of pollution to ALARP during hydrocarbon transfers to helicopters.	Personnel costs associated with ensuring procedures are in place and implemented during fuel transfers.	**Adopted.**
BAO-CM-7.7.10.1	Radio communication prior to entering PSZ (administrative control)	Reduces the collision risk as it allows for communication to be established between vessels and FPSO within the PSZ, prior to another vessel entering.	Costs associated with communicating presence.	**Adopted** – environmental benefits of ensuring communications are established outweigh the costs.
BAO-CM-6.6.2	Petroleum safety zone administered by NOPSEMA in accordance with the OPGGS Act and cautionary area established (administrative control)	The PSZ alerts other marine users to the presence of the mooring buoy and FPSO. Third party vessels (excluding the offtake tanker) are not permitted to enter the PSZ, thereby reducing the likelihood of other marine user interactions with the offtake tanker.	Negligible costs. Other marine users may be temporarily excluded from areas, disrupting their activities.	**Adopted** – standard requirement.
BAO-CM-7.7.8.7	NOPSEMA-accepted Barossa Production Operations Oil Pollution Emergency Plan (OPEP) (administrative control)	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents and large costs of preparing for and implementing response strategies.	**Adopted** – regulatory requirement, must be adopted.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-7.4.3	FPSO and vessel spill response plans (SOPEP/SMPEP) (administrative control)	Implements response plans (SOPEP/SMPEP) on board vessels to deal with unplanned hydrocarbon releases and spills quickly and efficiently in order to reduce impacts to the marine environment.	Administrative costs of preparing documents. Generally undertaken by vessel contractor so time for Santos personnel to confirm and check SOPEP/SMPEP in place.	**Adopted** – regulatory requirement, must be adopted.
BAO-CM-6.6.6	Vessel speed restrictions within 500m around the FPSO, IMMR vessels and campaign vessels (substitution control)	Reduces consequence of vessel-to-vessel collision impacts.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted** - benefits considered to outweigh costs
Additional Control Measures				
N/A	Only accept offtake tankers which use MDO (administrative control)	Should a release occur from the offtake tanker, MDO will cause less impact to the marine environment compared to HFO, largely due to its rapid evaporations and lower volatiles.	Significant cost implications as this requirement would limit the amount of offtake tankers able to berth and offtake. Most offtake tankers use HFO. Offtake frequencies may also be limited while Santos finds suitably fuelled offtake tankers. Therefore, production may have to reduce.	**Not adopted –** high costs which grossly outweigh the environmental benefit. Majority of tankers use HFO. Santos cannot control what the offtake tankers use for fuel.
N/A	Pipeline the condensate to the mainland (engineering control)	Construction and installation of a pipeline to the mainland would negate the requirement for offtake tanker presence, therefore remove collision risk and offtake release risk and subsequent crude release to the environment.	Significant costs involved in constructing, installing and operating a pipeline. Additional environmental impacts associated with constructing and installing a pipeline as well as condensate release risks associated with transporting the condensate via the pipeline.	**Not adopted** – high costs which grossly outweigh the environmental benefit.
N/A	Contract a standby vessel 24/7 during operations to aid third-party vessel detection at sea (protective control)	Standby vessel to monitor the cautionary zone and be equipped with an AIS to aid vessel detection at sea, and radar to aid in the detection of approaching third-party vessels. Reduces risk of vessel collision and subsequent unplanned release of hydrocarbons.	High cost associated with contracting standby vessel 24/7. Costs of operating navigational equipment. Additional risks from the vessel in the 500 m PSZ.	**Not adopted** – high costs which grossly outweigh the environmental benefit. Additional risks exist from additional vessel use in the PSZ.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
N/A	Limit offtake frequency (administrative control)	Limiting offtake frequency will reduce likelihood of collisions between the FPSO and offtake tanker as less offtakes will be undertaken, noting frequency is already low at approximately four per year.	Significant cost as production would have to decrease as there is not enough storage capacity on the FPSO to limit offtake frequency.	**Not adopted** – high costs which grossly outweigh the environmental benefit.
N/A	Double hull around bunker tanks on an offtake tanker (engineering control)	Reduces the risk of the potential HFO spill from the offtake tanker if impact occurs.	Santos does not own offtake tankers, and there is no maritime regulatory requirement for double hull around bunker tanks on offtake tankers.	**Not adopted** – unfeasible requirement of the offtake tanker, given the low likelihood of event.
N/A	Reduce loading rates (administrative control)	Reducing load rates has the potential to reduce the release volume should there be an integrity failure in the offtake equipment.	Significant cost, as offtakes will take longer. Additional risks involved with the offtake tanker remaining on location for a longer period.	**Not adopted** – high costs which grossly outweigh the environmental benefit. Rates for offtake are given in the Barossa Terminal Handbook and monitored during loading.

7.7.11.4 Environmental impact assessment

The environmental impact assessment in the next subsections follows the approach detailed in Section 7.7.5.

7.7.11.4.1 Identification of hot spots for consequence assessment

Hot spots that are predicted to be contacted by hydrocarbons within the LEVA and MEVA for an HFO spill from an offtake tanker are listed in Table 7-33. The values and sensitivities associated with these areas are described in Section 3. These hot spots meet the criteria as described in Section 7.7.5.

Note the worst-case values were taken from the modelling scenarios to identify the hot spots and therefore is taken from any season and any hydrocarbon phase at any water depth.

Table 7-33: Identified high environmental value and hot spot receptors

Receptor	Exposure values			Hot spot
	Low (LEVA)	Moderate (MEVA)	High (HEVA)	
Arnhem Marine Park	✓			
Ashmore-Cartier - Outer	✓			
Ashmore Reef Marine Park	✓	✓	✓	✓
Beagle Gulf-Darwin Coast	✓	✓	✓	
Britomart Shoal	✓			
Central Arnhem Marine Park	✓			
Cobourg Peninsula-Nhulunbuy^	✓	✓	✓	✓
Cape Hotham#	✓	✓	✓	
Echo Shoals	✓	✓		
Fantome Shoals	✓			
Flat Top Bank	✓			
Hancox Shoal	✓			
Hibernia Reef	✓			

Receptor	Exposure values			Hot spot
	Low (LEVA)	Moderate (MEVA)	High (HEVA)	
Indonesia-East – Timor Leste	✓	✓	✓	✓
Johnson Bank	✓			
Lowry Shoal	✓			
Margaret Harries Bank	✓	✓		
Marsh Shoal	✓			
Minor Indonesian Islands	✓	✓	✓	✓
Moresby Shoals	✓			
Newby Shoal	✓			
Northern Arafura Marine Park	✓	✓		
Orontes Reef	✓			
Outer Oceanic Shoals Marine Park	✓	✓		
Sahul Banks	✓			
Shepparton Shoal	✓			
Skottowe Shoal	✓			
Southern Arafura Marine Park	✓	✓		
Sunrise Bank	✓	✓	✓	
The Boxers Area	✓	✓		
Tiwi Islands	✓	✓	✓	✓
Van Cloon-Deep Shoals	✓			
Van Diemen Gulf Coast	✓	✓		✓
Van Diemen Gulf Shoals (Bill, Barbara, Wells, Giles and Mataram Shoals)	✓			
Vernon Islands Conservation Reserve	✓	✓	✓	✓
Western Sahul Bank Shoals	✓			

^ Spill modelling does not identify hydrocarbon contact with Nhulunbuy.

Djukbinj National Park polygon named in the modelling report (RPS, 2023c) refers to the area Cape Hotham. There is no hydrocarbon contact with Djukbinj National Park.

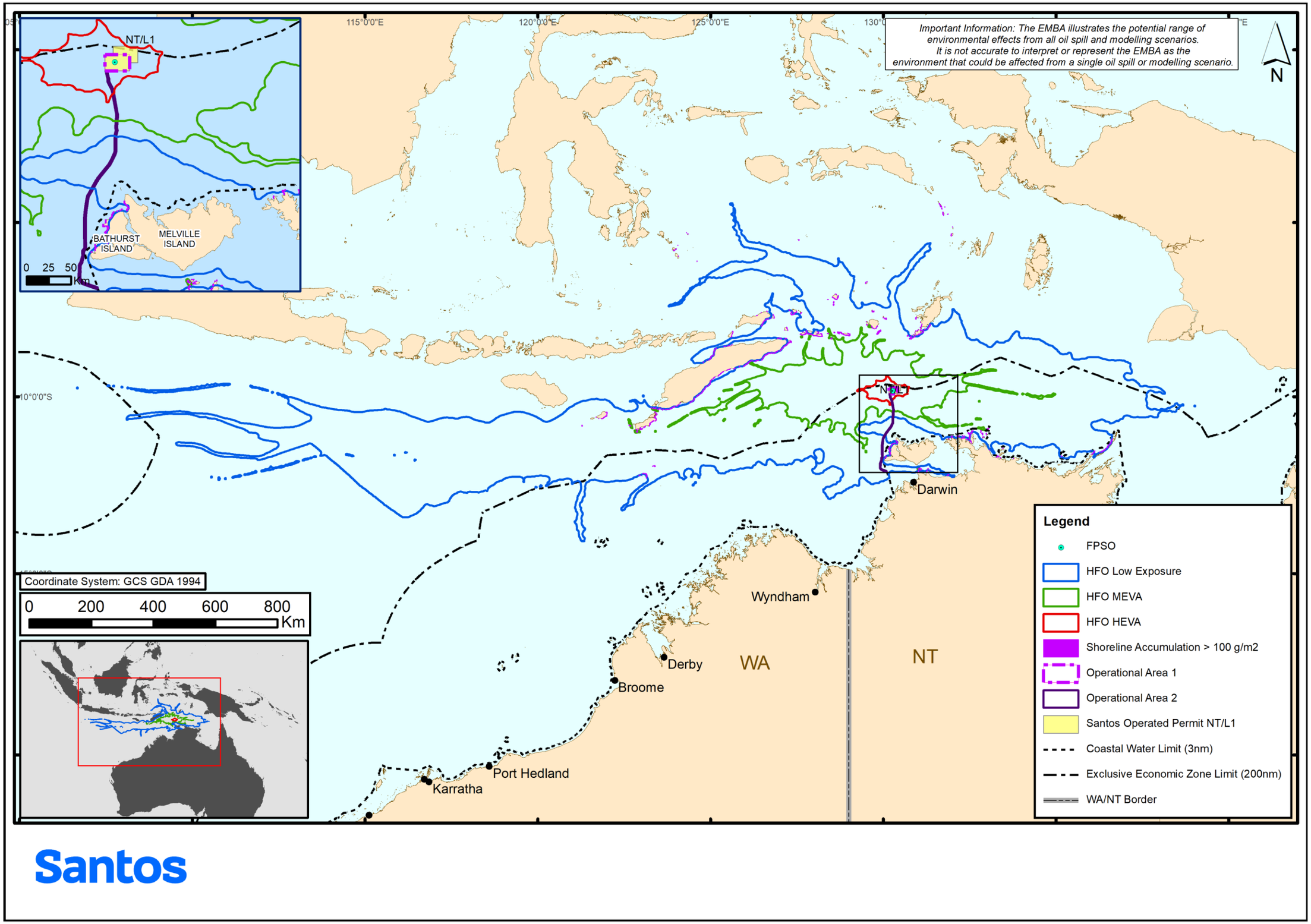


Figure 7-11: Low, moderate and high exposure value areas from a heavy fuel oil spill from an offtake tanker

7.7.11.4.2 Impact, likelihood and consequence ranking – surface release of HFO

Potential receptors	Physical environment and habitat Protected areas Threatened, migratory or local fauna Socio-economic Cultural features
Consequence	IV – Major

The consequence assessment for each receptor category is summarised below. Potential impact pathways (physical and chemical) of hydrocarbon exposure for receptors are summarised in Table 7-17, and potential impacts to receptors that may be found within the MEVA are further described in Table 7-18.

Physical environment and habitat

HFO is persistent at the sea surface and shows little entrainment under the sea surface, but a gradual decrease in volume over time from evaporation and decay (biodegradation). Emulsion is more typical with HFO over a few days and delays further weathering processes at the sea surface. Water quality will be reduced due to hydrocarbon contamination at the location of the spill, as well as within surrounding marine waters out to an extent 840 km west from the release location, which is influenced by the floating hydrocarbon. Water quality changes are expected to be temporary due to the natural degradation and dispersion of the HFO in the marine environment.

The MEVA overlaps waters above the Shelf break and slope of the Arafura Shelf KEF and the Carbonate bank and terrace system of the Van Diemen Rise KEF. Given the nature of the release (at surface), hydrocarbons are predicted to remain in the top 25 m of the water column; therefore, extensive contact with the seabed of the KEFs is not anticipated.

A number of banks and shoals and marine parks are within the MEVA (refer to Table 7-27). HFO is predicted to largely remain on the sea surface due to its persistency. However, shallower shoals (for example, the top of the shoal is within the top 25 m of the water column) within the MEVA are likely to be contacted by entrained or emulsified hydrocarbons. Banks and shoals support a diverse and varied range of benthic communities, reef-building soft corals, hard corals and filter-feeders (Heyward *et al.*, 2012, 1997b). Lethal and sub-lethal effects to filter-feeders from hydrocarbons include mortality and changes in population recruitment, growth and reproduction, which may lead to changes in community composition and structure (Wei *et al.*, 2012). Filter feeders are particularly susceptible as they are likely to directly ingest hydrocarbons while feeding. This may cause mortality or sub-lethal impacts such as alteration in respiration rates, decreases in filter-feeding activity and reduced growth rates, and biochemical effects (Keesing & Edgar, 2016).

A number of shorelines may accumulate hydrocarbons, with the maximum accumulated volume predicted at the Indonesia-East – Timor Leste receptor (refer to Section 7.7.11.2.1). Shoreline locations include areas of benthic coral reefs and mangroves. Given the persistent nature of HFO and the worst-case volumes predicted to accumulate, a release may lead to a medium-term decrease in ecological values from toxicity impacts associated with persistent exposure. Local-scale loss of area and function of local habitat may occur and the quality of habitat may be reduced. Secondary impacts may occur to the fauna using the shoreline, as described in the next subsection.

The MEVA overlaps waters above the Shelf break and slope of the Arafura Shelf KEF and Carbonate bank and terrace system of the Van Diemen Rise KEF. Given the nature of the release (at surface), hydrocarbons are predicted to remain in the top 25 m of the water column. Therefore, extensive contact with the seabed of the KEFs is not anticipated.

Potential impacts to the physical environment and habitat are expected to be IV-Major, due to the persistent nature of HFO, and the worst-case volumes predicted to accumulate on a number of shorelines.

Threatened or Migratory fauna

Surface and entrained HFO in the sea surface layer could have the physical effect of coating fauna interacting within and under the surface, including plankton, pelagic invertebrates and fishes, marine reptiles, marine mammals and seabirds, and may also cause slight secondary effects through ingestion after preening for seabirds, or through ingestion of oiled fish.

In the event of a surface release of HFO, a reduction in water quality (described above) has the potential to impact marine fauna within the MEVA, as described in Table 7-18. Impacts would be greatest within several kilometres of the release location, where the hydrocarbon is at its thickest on the sea surface and where the toxic components of the HFO will be at their highest concentration. Upon release to the marine environment, the HFO will also lose toxicity with time and will spread thinner at the surface as evaporation and weathering processes continue.

Breeding and foraging BIAs for seabirds or migratory shorebirds are not predicted to be contacted by HFO within the MEVA. However, seabirds may contact floating hydrocarbons while foraging in offshore, open water locations and which may cause secondary effects through ingestion after preening or ingestion of oiled fish (as described in Table 7-18). Impact to overall population viability is not anticipated.

The MEVA overlaps the pygmy blue whale distribution and migration BIA and a number of marine mammal species may come into contact with HFO either on the sea surface or within the water column. Potential impacts are likely to be limited to individuals that may be transiting through the area, with potential for coating of baleen (in whales) and ingestion of oiled prey (plankton and fish), as described in Table 7-18. An unplanned release of HFO is not expected to interfere with the pygmy blue whale migration activity. There is the potential for behavioural disruption to the local population as individuals traverse the release.

The MEVA overlaps the whale shark foraging BIA. There is the potential for behavioural disruption to the local population as individuals traverse the release; impact to overall population viability or ecosystems is not anticipated.

The MEVA overlaps various marine turtle BIAs and internesting buffer HC close to the Tiwi Islands. Marine turtle species may come into contact with hydrocarbons either on the sea surface or within the water column; any potential impacts (as described in Table 7-18) are likely to be limited to individuals that may be transiting through the area or feeding at nearby

submerged shoals and banks. HFO is persistent on the sea surface and exposes surfacing marine turtles to hydrocarbons. The MEVA has the potential to extend to areas of known turtle foraging; therefore, there is a potential for behavioural disruption to local marine turtle population. However, given the wide distribution of turtle species in the region, impact to overall population viability or ecosystems is not anticipated. Potential impacts would be greatest during the internesting season for flatback and olive ridley turtles; between June and September for flatback turtles and April to August for olive ridley turtles. A number of shorelines may accumulate hydrocarbons (refer to Section 7.7.11.2.1), which could impact marine fauna that use these areas, such as shorebirds and turtles. Impacts to turtles could occur from hydrocarbons that accumulate on turtle nesting beaches, with the greater impact being during nesting seasons. Turtle nests are typically made above the high-water mark, which is typically the highest point along the shoreline that hydrocarbon will reach. As such, direct contact between turtle eggs and the hydrocarbons is very unlikely. Impacts may occur to nesting females as they move up and down beaches or to turtle hatchlings as they emerge from nests six to eight weeks after nesting. The persistent nature of HFO on shorelines means it can remain on the beach surface for a period, where it will weather, degrade and remobilise. Given the maximum volume of hydrocarbon accumulation (367 m³ at Indonesia-East – Timor Leste), the impact to nesting beaches (including nesting turtles, egg clutches and hatchlings) is anticipated to relate to a local disruption to populations using the nesting beach. Recovery of local populations would be expected over the medium term. Impact to overall population viability or ecosystems is not anticipated. The potential sensitive receptors in the surrounding areas of the hydrocarbon release include fish, marine mammals, marine reptiles and seabirds. Potential impacts (as described in Table 7-18) to Threatened or Migratory fauna are expected to be IV-Major and relate to a disruption to local populations including potential disruptions to the breeding cycle or area of occupancy of species. **Protected areas** The MEVA overlaps a number of marine parks (refer to Table 7-23). These marine parks support the habitats and faunal groups described above. Impacts to these receptors (as described in Table 7-18) may impact on the values of the marine parks. The potential impact is anticipated to be IV - Major, relating to a significant impact to marine fauna local populations e.g. long term decrease in species population contained within the protected area) as well as major long term effects on one or more of the marine park values, such as natural, cultural, heritage and socio-economic, as identified in Table 7-18. **Socio-economic and cultural features** There is the potential for hydrocarbons to temporarily disrupt fishing activities if the surface or entrained hydrocarbon moves through fishing areas. A major spill would result in the establishment of a safety exclusion zone around the affected area. A temporary prohibition on fishing activities for a period of time may be required, and subsequently there is a potential for economic impacts to those affected. Hydrocarbon may also foul fishing equipment, which will require cleaning or replacement. Fish exposure to hydrocarbon can result in 'tainting' of their tissues. Even very low levels of hydrocarbons can impart a taint or 'off' flavour or smell in seafood. Contamination of seafood can affect commercial and recreational fishing and can impact seafood markets long after any actual risk to seafood from a spill has subsided. There is potential for temporary disruption to fishing activities (traditional, recreational and commercial) due to surface, dissolved or entrained hydrocarbons resulting in a potential for major long-term loss of value of the local industry and threat to viability. Potential impacts to fishing activity are expected to relate to a medium-term loss of value to the local industry due to disruption to fishing activities and displacement of fishing ground. The EMBA overlaps cultural features (Section 3.7). Impacts to cultural features, including a disruption/displacement of cultural activities caused by the physical presence of the hydrocarbon, decline in traditional food sources and / or mortality of fauna with cultural significance and contact to sacred sites, may result in the event of a significant spill of hydrocarbons. Other energy operations in the region may also be disrupted in the event of a hydrocarbon release (such as Santos' Bayu-Undan operations) and defence and military exercises and commercial shipping may be excluded or displaced temporarily. Tourism could be affected by spilled HFO, either from reduced water quality and shoreline hydrocarbon accumulation preventing recreational activities or reducing aesthetic appeal or from impacts to habitats and marine fauna. Potential impacts (as described in Table 7-18) to socio-economic receptors are expected to be IV-Major and relate to a reduction of key natural features supporting socio-economic activities, as well as local disruption or displacement in activities.	
Likelihood	A – Remote
The likelihood of a hydrocarbon release occurring due to a vessel collision is remote, given the set of mitigation and management controls in place. External impacts to the FPSOs have not occurred within Santos and controls are in place that limit such events. The Barossa Ship Collision Study examines potential ship impact scenarios at the FPSO location and calculates the frequency of ship impacts with various outcomes. The potential to damage the FPSO is shown to be remote, particularly given the impact energies and the FPSO position away from areas of high concentrations of shipping movements. The likelihood of a vessel collision releasing hydrocarbons to the environment resulting in an IV - Major consequence is considered to be A – Remote.	
Residual risk	The residual risk is considered **Low**

7.7.11.5 Demonstration of as low as reasonably practicable

The use of vessels is integral to the Activity; therefore, vessels and associated risks of unplanned hydrocarbon releases cannot be completely eliminated.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. The proposed management controls are in accordance with the Santos risk management criteria and are considered appropriate to manage the risk to ALARP.

In terms of spill response activities, Santos will implement hydrocarbon spill response as specified within the Barossa Production Operations OPEP. A detailed ALARP assessment on the adequacy of arrangements available to support spill response strategies and control measures is presented in the Barossa Production Operations OPEP.

7.7.11.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – residual risk is ranked as Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ESD?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers principles of ESD: • The impacts from the spill scenario are inherently inconsistent with principles of ESD, given the nature and scale of impacts. Control measures are applied to ensure the impacts and risks from activities are managed to ALARP and an acceptable level.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice, wildlife conservation plans and Australian marine park zoning objectives)?	Yes – Control measures implemented will reduce the risk of an unplanned release of HFO to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009b) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b) • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b) • Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c) • Approved Conservation Advice for *Limnodromus semipalmatus* (Asian dowitcher) (DCCEEW, 2024f) • Approved Conservation Advice for *Limosa limosa* (black-tailed godwit) (DCCEEW, 2024e) • Approved Conservation Advice for *Calidris tenuirostris* (great knot) (DCCEEW, 2024d) • Approved Conservation Advice for *Charadrius leschenaultii* (greater sand plover) (DCCEEW, 2023f) • Approved Conservation Advice for *Pluvialis squatarola* (grey plover) (DCCEEW, 2024g) • Approved Conservation Advice for *Limosa lapponica baueri* (Alaskan bar-tailed godwit) (DCCEEW, 2024k) • Approved Conservation Advice for *Calidris canutus* (red knot) (DCCEEW, 2024m)

	• Approved Conservation Advice for *Phaethon rubricauda westralis* (Indian Ocean red-tailed tropicbird) (DCCEEW, 2023g) • Approved Conservation Advice for *Arenaria interpres* (ruddy turnstone) (DCCEEW, 2024m) • Approved Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW, 2024l) • Approved Conservation Advice for *Xenus cinereus* (terek sandpiper) (DCCEEW, 2024i) • Conservation Advice for the Abbott's Booby *Papasula abbotti* (TSSC, 2020a) • Approved Conservation Advice for *Rostratula australis* (DSEWPaC, 2013) • Conservation Advice for *Charadrius mongolus* (lesser sand plover) (DCCEW, 2024j) • Approved Conservation Advice for *Aipysurus fuscus* (dusky sea snake) (DCCEEW, 2024p) **Recovery plans:** • Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013) • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (CoA, 2014) • Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) • Wildlife Conservation Plan for Seabirds (CoA, 2020) • Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c) **Other management plans/guidelines**: • Marine bioregional plans for the NMR and NWMR (CoA, 2012a, 2012b). • Christmas Island Marine Park Management Plan (DNP, 2025) For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes in Section 7.7.7 and the control measures outlined in Section 7.7.11.3. Santos considers that the level of risk of an unplanned release of HFO is not inconsistent with these plans. The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the Shelf break and slope of the Arafura Shelf KEF. Significant impacts to this KEF are not predicted.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with the Safety Case, *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*, *Navigation Act 2012*, Marine Order 30: Prevention of Collisions, Marine Order 21: Safety of Navigation and Emergency Procedures, *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, MARPOL Annex I (Prevention of Pollution by Oil), Marine Order 91: Marine Pollution Prevention – Oil and National Plan for Maritime Environmental Emergencies (AMSA, 2020). Through acceptance of this EP, legislative and regulatory requirements will be met as per Appendix C.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP. The EP is also compliant with commitments stated within the NOPSEMA-accepted OPP.

Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – issues, objections / claims and measures discussed with Relevant Persons during consultation for this activity, including with AMSA, AAPA, the ECNT, the ACF and Ngoy Garmak Consultative Committee have been considered when evaluating performance outcomes, control measures and associated performance standards (refer to Section 4.7 for further information). No specific control measures were raised by relevant persons in relation to this risk. However, AMSAs marine safety division did advise Santos of the required maritime safety measures. Santos has confirmed that the required maritime safety measures identified by AMSA have been incorporated into this EP refer to (BAO-CM-6.1.2 and BAO-CM-6.6.1). Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have been adopted in this EP. Additional performance outcomes (EPO-19, EPO-20) have been adopted for an unplanned release of HFO based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

The residual risk is assessed as Low. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential risks are considered acceptable.

7.7.12 Contingency Spill Response Operations

7.7.12.1 Spill response strategies

The spill response strategies that may be adopted in the event of a hydrocarbon spill from this Activity have been identified in the Barossa Production Operations OPEP. These are generally strategies that have been implemented in the past or are considered good industry practice. The Barossa Production Operations OPEP contains an evaluation of hydrocarbon spill preparedness arrangements to demonstrate hydrocarbon spills will be mitigated to ALARP. An environmental assessment of these spill response strategies has been conducted as presented below.

An overview of the hydrocarbon spill scenarios considered for this Activity and relevant to spill response operations is provided in Section 7.7, with environmental assessments in Section 7.7.7 to 7.7.11.

7.7.12.2 Description of event

Event	In the event of a hydrocarbon spill, response strategies will be implemented to reduce environmental impacts to ALARP. Strategies will be selected through a NEBA. Spill response will be under the direction of the relevant control agency, as defined in the Barossa Production Operations OPEP, which may be Santos, another agency or both. In all instances, Santos will undertake a 'first-strike' spill response and will act as the Control Agency until the designated Control Agency assumes control. The response strategies considered to be appropriate for the worst-case hydrocarbon spill scenarios identified for the Activity are provided in the Barossa Production Operations OPEP and comprise: • source control (emergency shutdown, relief well) • monitor and evaluate • containment and recovery • mechanical dispersion • chemical dispersant application • shoreline protection and deflection • shoreline clean-up • oiled wildlife response • operational and scientific monitoring • waste management. Although a relief well is the primary method to stop a production well leak, secondary source control measures may be employed if the conditions are appropriate. While response strategies are intended to reduce the environmental consequences of a hydrocarbon spill, poorly planned and coordinated response activities can result in a lack of or inadequate information being available upon which poor decisions can be made, exacerbating or causing further environmental harm. An inadequate level of training and guidance when implementing spill response strategies can also result in environmental harm over and above that already caused by the spill.

Extent	Spill response could occur anywhere within the EMBA for the worst-case spill scenarios.
Duration	The spill response effort as a whole will exceed the duration of the worst-case spill, due to persistence of the hydrocarbon in the environment and the requirement to remove hydrocarbons and monitor impacts and recovery to sensitive receptors. The Barossa Production Operations OPEP provides further detail about the likely duration of specific response strategies.

7.7.12.3 Nature and scale of environmental impacts

Potential receptors: Physical environment and habitat, protected areas, threatened, migratory, or local fauna, socio-economic and cultural features.

Light emissions	
Spill response activities will involve the use of vessels and potentially a MODU for relief well drilling (within this section referred to as a 'vessel'), which are required, at a minimum, to display navigational lighting. Vessels may operate near shoreline areas during spill response activities. Spill response activities will also involve onshore operations, including the use of vehicles and temporary camps, which may require lighting.	
Potential receptors	Protected areas Threatened, migratory or local fauna Cultural Features
Lighting may cause behavioural changes to fish, mammals, birds and marine turtles that can have a heightened consequence during key lifecycle activities, such as turtle nesting and hatching. Turtles and birds, which include Threatened and Migratory fauna (Section 3.4.3, have been identified as key fauna susceptible to lighting impacts. Section 6.2 provides further detail about the nature and scale of light emission impacts. Spill response activities that require lighting may occur anywhere within the MEVA (refer to Section 7.7.12.1), including in protected areas and close to shoals. This could result in indirect impacts on the values of the protected areas. During nesting and hatching season (primarily over summer months), lighting may cause behavioural impacts to turtles, including aborted nesting attempts and disorientation of newly hatched turtles, which may increase the hatchling mortality rate. Spill response activities may also occur on shorelines used by nesting and feeding birds, including seabirds and shorebirds. Lighting can cause disorientation in flying birds, disrupt nesting and breeding behaviours, and impact on the ability of birds to forage. Disturbance to feeding migratory shorebirds may reduce their ability to replenish energy reserves and alter the timing and success of migratory flights. Lighting impacts to fauna are not considered to have the potential to impact supported industries such as tourism. Lighting from response activities may impact marine fauna of cultural significance.	
Noise emissions	
Spill response activities will involve the use of aircraft and vessels, which will generate noise both offshore and in nearshore locations within the EMBA. Spill response activities will also involve the use of equipment on coastal areas during clean-up of shorelines, such as pumps and vehicles, for accessing shoreline areas; and for supporting temporary camps, such as diesel generators.	
Potential receptors	Threatened, migratory or local fauna Protected areas Socio-economic receptors Cultural Features
Underwater noise from the use of vessels may impact marine fauna, such as fish (including commercial species), marine reptiles and marine mammals, in the worst instance causing physical injury to hearing organs but more likely causing short-term behavioural changes; for example, temporary avoidance of the area, which may impact key lifecycle processes such as spawning, breeding and calving. Underwater noise can also mask communication or echolocation used by cetaceans. Section 6.1 provides details about potential noise emission impacts. Cetaceans have been identified as the key concern for vessel noise within the MEVA, with the pygmy blue whale distribution BIA intersecting the MEVA. Vessels may also need to enter marine parks and other areas used for tourism, commercial and recreational fishing, and traditional purposes. Noise and vibration from terrestrial activities on shorelines has the potential to cause behavioural disturbance to coastal fauna, including protected seabirds and turtles. Shoreline activities involving the use of noise-generating equipment may occur in important nesting areas for turtles and roosting and feeding areas for shorebirds. As a consequence of impacts to fauna – including shorebirds, marine mammals, fish – noise has the potential to impact supported industries such as tourism and commercial fishing and recreational values of marine parks. Noise from response activities may impact marine fauna of cultural significance.	

Atmospheric emissions	
The use of fuels to power vessel engines, generators and mobile equipment used during spill response activities will result in emissions of GHG, such as CO_2, CH_4 and N_2O, along with non-GHGs such as SO_X and NO_X. Emissions will result in a localised decrease in air quality.	
Potential receptors	Physical environment and habitat Threatened, migratory or local fauna Socio-economic
Atmospheric emissions from spill response equipment will be localised, and the use of mobile equipment, vessels and vehicles is not considered to create emissions on a scale where noticeable impacts would be predicted. Emissions may occur in protected areas and areas where tourism is important; however, the scale of the impact relative to potential hydrocarbon spill impacts is not considered great. Sections 6.3 and 6.4 provide further details about the nature and scale of air emission impacts.	
Operational discharges and waste	
Operational discharges include those routine discharges from vessels used during spill response, which may include: • deck drainage • putrescible waste and sewage • cooling water from operation of engines • bilge water • ballast water • brine discharge. In addition, there are specific spill response discharges and waste creation that may occur, including: • cleaning of oily equipment, vessels and vehicles • decanting of water back into the marine environment from containment and recovery operations • flushing water for the cleaning of shoreline habitats • sewage and putrescible and municipal waste at offshore staging sites • creation, storage, transport and disposal of oily waste and contaminated organics.	
Potential receptors	Physical environment and habitat Protected areas Threatened, migratory or local fauna Socio-economic Cultural Features
Operational discharges from vessels may create a localised and temporary reduction in marine water quality. Effects include nutrient enrichment, toxicity, turbidity, and temperature and salinity increases, as detailed in Section 0. Discharge could potentially occur adjacent to marine habitats, such as corals, seagrass and macroalgae, and in protected areas, which support a more diverse faunal community; however, discharges are still expected to be localised and temporary. Cleaning of hydrocarbon-contaminated equipment, vehicles and vessels has the potential to spread hydrocarbon from contaminated areas to areas not impacted by a spill, potentially spreading the impact area and moving hydrocarbon into a more sensitive environment. The decanting of oily water back into the marine environment during containment and recovery activities has the potential to impact marine organisms from the toxic effects from hydrocarbons, however, given the marine environment is already contaminated with hydrocarbons there is limited potential for an increase in impact, unless the discharge spreads the contamination to a previously uncontaminated area. Flushing of hydrocarbon from shoreline habitats is a clean-up technique designed to remove hydrocarbon from the receptor that has been oiled and remobilise it back into the marine environment. It results in further dispersion of the hydrocarbon. The process of flushing has the potential to physically damage shoreline receptors such as mangroves and rocky shoreline communities, increase levels of erosion, and create an additional and potentially higher level of impact than if the habitat was left to bioremediate. Sewage and putrescible and municipal waste will be generated from offshore activities at temporary staging and mooring areas, and onshore activities at temporary camps, which may include toilet and washing facilities. These wastes have the potential to impact water quality, attract fauna, impact habitats, flora and fauna, and reduce the aesthetic value of the environment, which may be within protected areas. Disturbance may also impact cultural values of an area. The creation, storage, transport and disposal of oily waste and contaminated organics has the potential to spread impacts of hydrocarbon to areas, habitats and fauna not previously contaminated. Sewage and putrescible and municipal waste generated onshore will be stored and disposed of at approved locations. Operational discharges from response operations may impact marine fauna of cultural significance.	

Seabed and habitat disturbance, marine fauna interaction	
The movement and operation of vessels, vehicles, personnel and equipment, the undertaking of clean-up activities, and the setup of temporary camp areas during spill response activities have the potential to disturb the physical environment and marine and coastal habitats and fauna, which may occur within protected areas. Disturbance may also impact socio-economic values of an area. Vessel movement and transportation could potentially introduce to nearshore areas invasive marine species attached as biofouling, while vehicle and equipment movement could spread non-indigenous flora and fauna. Spill response operations can impact on wildlife via vessel strikes and behavioural changes due to physical presence of personnel and equipment. Oiled wildlife response activities may also involve deliberate disturbance (hazing), capture, handling, cleaning, rehabilitation, transportation, and release of wildlife, which could lead to additional impacts to wildlife.	
Potential receptors	Physical environment and habitat Protected areas Threatened, migratory and local fauna Socio-economic Cultural Features
The use of vessels may disturb benthic habitats in coastal waters, including corals, seagrass, mangroves and macroalgae. Impacts to habitats from vessels include damage through the deployment of anchors, nearshore booms, mooring lines and from grounding. Vessel use in shallow coastal waters also increases the chance of contact with or physical disturbance of marine megafauna such as turtles and dugongs. Booms create a physical barrier on the surface waters that has the potential to injure or entangle passing marine fauna that are either surface breathing or feeding. Vehicles, equipment, personnel and cleaning activities during shoreline response activities have the potential to damage coastal habitats, such as dune vegetation, mangroves and habitats important to threatened and migratory fauna, including nests of turtles and birds and bird roosting and feeding areas. Shoreline clean-up may involve the physical removal of substrates that could cause impact to habitats and coastal hydrodynamics and alter erosion or accretion rates. The presence of camp areas, although relatively short-term, may disrupt normal behaviour of coastal species, such as shorebirds and turtles, and could potentially interfere with nesting and feeding behaviours. Oiled wildlife response may include the hazing, capture, handling, cleaning, rehabilitation, transportation, cleaning and release of wildlife susceptible to oiling, such as birds and marine turtles. While oiled wildlife response is aimed at having a net benefit, poor responses can potentially create additional stress and exacerbate impacts from oiling, interfere with lifecycle processes, hamper recovery and, in the worst instance, increase levels of mortality. Impacts and risks from invasive marine species are described in Section 7.2 and are not described further in this section. Impacts from invasive terrestrial species are similar in that the invasive species, such as weeds, can outcompete local species and interfere with ecosystem processes. Non-native species may be transported attached to equipment, vehicles and clothing. Such an introduction would be especially detrimental to wilderness areas or protected terrestrial reserves, which may have a relatively undisturbed flora and fauna community. The disturbance to marine and coastal natural habitat, as well as the potential for disruption to culturally sensitive areas, may occur in specially protected areas such as marine parks, and may have flow-on impacts to socio-economic values and industry, such as tourism and fisheries.	
Interactions with other marine users	
Spill response activities may involve the use of vessels and equipment in areas used by the general public or industry in Australia and potentially Indonesia. The mobilisation of spill response personnel into Forward Operating Bases may also place increased demands on local accommodation and other businesses.	
Potential receptors	Socio-economic
The use of vessels in the offshore environment and the undertaking of spill response activities may exclude the general public and industry use of the affected environment. As well as impacting recreational activities (such as recreational fishing) of the general public, this may impact on revenue with respect to industries such as commercial fishing and interrupt military exercises. The mobilisation of personnel to regional communities has the potential to affect the local community through demands on local accommodation and business, reducing the availability of services to members of the public.	
Chemical dispersant application	
The application of chemical dispersants has the aim of enhancing oil dispersion and entrainment into the water column, thereby avoiding or reducing the volume of oil that could reach the shoreline.	
Potential receptors	Physical environment and habitat Protected areas Threatened, migratory or local fauna Socio-economic Cultural Features
While the aim of chemical dispersants is to provide a net benefit to the environment, the use of dispersants has the potential to increase impact to habitats under the sea surface, including coral, seagrass and macroalgae, and to marine fauna (particularly fish and invertebrates), by increasing entrained hydrocarbon and dissolved aromatic hydrocarbon concentration	

and exposure. These sensitive receptors are generally located in shallow coastal areas of the offshore islands and shoals and banks of the region, away from where surface dispersants would be applied.

Increased entrained and dissolved aromatic hydrocarbon concentration may also impact on marine fauna, either directly or through impacts to subsea habitats. Direct impacts are most likely to be encountered by plankton, benthic filterfeeding invertebrates, fish. Fish include Threatened and Migratory species, which may ingest hydrocarbons or uptake toxic compounds across gill structures. As a result of increased impact to marine fauna and subtidal habitats, including those that represent values of protected areas, socio-economic impacts may be felt through industries such as tourism and commercial fishing. Potential impacted marine fauna may also be of cultural significance.

The impacts from entrained hydrocarbon and aromatic hydrocarbons from a worst-case loss of hydrocarbons, without a specific consideration of dispersant addition, are described in Table 7-18.

7.7.12.4 Environmental performance outcomes and control measures

An assessment of the environmental benefits and the potential costs or issues associated with control measures relevant to response vessels and helicopters for this Activity are shown in Table 7-34 to demonstrate the potential impacts from this aspect are ALARP. EPOs and additional control measures that are more specific to spill response are presented in the Barossa Production Operations OPEP.

Control measures that are adopted have associated EPSs and measurement criteria which are presented in the relevant strategy sections of the Barossa Production Operations OPEP. Not adopted control measures have an ALARP evaluation provided to justify their rejection.

Table 7-34: Control measures evaluation for spill response operations

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
BAO-CM-6.1.1	Apply Santos' Protected Marine Fauna Interaction and Sighting Procedure to vessel and helicopter activities when in the vicinity of cetaceans and turtles (isolation control)	Refer to Table 7-4	Refer to Table 7-4	**Adopted** – refer to Table 7-4
BAO-CM-6.2.1	Lighting limited to that required for safe work conditions and navigational purposes (isolation control)	Refer to Table 6-13	Refer to Table 6-13	**Adopted** – refer to Table 6-13
BAO-CM-6.3.17	Pursuant to Marine Order 97, relevant vessels will have a current International Air Pollution Prevention (IAPP) Certificate or equivalent and Ship Energy Efficiency Management Plan (SEEMP) (administrative control)	Refer to Table 6-26	Refer to Table 6-26	Adopted - Refer to Table 6-26
BAO-CM-6.7.2	Routine discharges of treated sewage and grey water, in accordance with Marine Order 96 (Marine Pollution Prevention – Sewage) (administrative control)	Refer to Table 6-37	Refer to Table 6-37	**Adopted** – refer to Table 6-37

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
BAO-CM-6.7.6	Routine discharges of treated bilge and deck water from vessels and FPSO will comply with Marine Order 91. (administrative control)	Refer to Table 6-37	Refer to Table 6-37	**Adopted** – refer to Table 6-37

7.7.12.5 Environmental impact assessment

Key receptors	Consequence level
Spill response operations – light emissions	
Threatened, migratory or local fauna	The receptors considered most sensitive to lighting from vessel operations are seabirds, migratory shorebirds and marine turtles. After restricting nighttime operations of spill response vessels, which will demobilise to mooring areas offshore with safety lighting only (as specified by controls in the Barossa Production Operations OPEP), impacts from vessels are considered to be I – Negligible.
Physical environment and habitat	
Threatened ecological communities	
Protected areas	
Socio-economic	
Cultural Features	
Overall worst-case consequence	I – Negligible
Spill response operations – noise emissions	
Threatened, migratory or local fauna	The receptors considered most sensitive to vessel noise are cetaceans. However, after adopting control measures to limit close interaction with protected fauna (as in, Protected Marine Fauna Interaction and Sighting Procedure), a temporary behavioural disturbance is expected only with a consequence of I – Negligible.
Physical environment and habitat	
Threatened ecological communities	
Protected areas	
Socio-economic	
Cultural Features	
Overall worst-case consequence	II-Negligible
Spill response operations – atmospheric emissions	
Threatened, migratory or local fauna	Atmospheric emissions from spill response equipment will be localised, and impacts to even the most sensitive fauna, such as birds, are expected to be I – Negligible.
Physical environment and habitat	
Threatened ecological communities	
Protected areas	
Socio-economic	
Overall worst-case consequence	I – Negligible
Spill response operations – operational discharges and waste	
Threatened, migratory or local fauna	Operational discharges from vessels may create a localised and temporary reduction in marine water quality, which has the potential to impact shallow marine habitats in particular. However, after adopting regulatory requirements for vessel discharges, which prevent discharges close
Physical environment and habitat	

Key receptors	Consequence level
Threatened ecological communities Protected areas Socio-economic Cultural Features	to shorelines, discharges will have a negligible impact to habitats, fauna or protected area values. Decanting from containment and recovery operations would only occur if approval was provided by the relevant Jurisdictional Authority (as specified by controls in the Barossa Production Operations OPEP), otherwise all collected oil and water will remain in the collection tanks, and all will be treated as collected waste. Washing of vessels and equipment will occur only in defined offshore hot zones, preventing impacts to shallow habitats. Sewage, putrescible waste and municipal waste generated onshore will be stored and disposed of at approved locations. The storage, transport and disposal of hydrocarbon-contaminated waste arising from spill response operation actions will be managed by Santos' appointed waste management contractor, and dedicated waste containment areas will prevent the spreading or leaching of hydrocarbon contamination. Operational discharges from spill response operations are expected to be II – Minor.
Overall worst-case consequence	II – Minor
Spill response operations – seabed and benthic habitat disturbance, marine fauna interaction	
Threatened, migratory or local fauna Physical environment and habitat Threatened ecological communities Protected areas Socio-economic Cultural Features	The use of vessels has the potential to disturb benthic habitats, including sensitive shoal habitats such as corals and macroalgae. A review of shallow water habitats and of bathymetry and the establishment of demarcated areas for access and anchoring will reduce the level of impact to I – Negligible. These habitats or environments are likely to be values of the protected area they occur in, and the impact to the protected areas from physical disturbance is therefore also considered II – Minor. In the event of shoreline clean-up operations there is the potential for ground disturbance from removal of oiled habitat. Impact is considered II – Minor. The main direct disturbance to fauna would be the hazing, capture, handling, transportation, cleaning and release of wildlife susceptible to oiling impacts, such as birds and marine turtles. This would only be done if this intervention were to deliver a net benefit to the species, but it may result in a II – Minor consequence after complying with the Santos Oiled Wildlife Response Framework and Northern Territory Oiled Wildlife Response Plan.
Overall worst-case consequence	II – Minor
Spill response operations – disruption to other users of marine and coastal areas and townships	
Socio-economic	The use of vessels in the offshore environment and spill response activities may exclude general public and commercial industries (such as fishing). Note this is distinct from the socio-economic impact of a spill itself, as described in Sections 7.7.7 to 7.7.11. After applying control measures, it is considered the additional impact of spill response activities on affected industries would be II – Minor.
Overall worst-case consequence	II – Minor
Spill response operations – chemical dispersant application	
Socio-economic Cultural Features	The use of chemical dispersants has the potential to increase the distribution and concentration of entrained hydrocarbon and dissolved aromatic hydrocarbons within the water column. Entrained hydrocarbon and dissolved aromatic hydrocarbons concentrations are expected to be elevated adjacent to the release site, with the potential for increased impacts to nearby benthic and pelagic fishes, sharks and invertebrates. The generic impacts to receptors from entrained hydrocarbon and dissolved aromatic hydrocarbons described in Table 7-17 are considered to apply. The primary controls for reducing impacts to these receptors from dispersant use is in selecting approved or environmentally risk-assessed chemical dispersants and through carefully assessing application areas such that sensitive receptor impacts are reduced to ALARP. It is important to note dispersants will only be applied if the response is seen as having a net environmental benefit as per the overarching NEBA of spill response strategies. In the event dispersants are used, there is the potential for an II – Minor additional impact.
Overall worst-case consequence	II – Minor

7.7.12.6 Demonstration of as low as reasonably practicable

A NEBA is the primary tool used during spill response to evaluate response strategies and has the goal of selecting strategies that result in the least net impact to key environmental sensitivities. The NEBA process will identify and compare net environmental benefits of alternative spill response options, and will consider stakeholder input where relevant to inform the evaluation of impacts to socioeconomic sensitives. The NEBA will effectively determine whether an environmental benefit will be achieved through implementing a response strategy or by undertaking no response. The NEBA will be undertaken by the relevant Controlling Agency for the Activity. For those activities under the control of Santos, the Incident Management Team (IMT) Environment Unit Leader will be responsible for reviewing the priority receptors and selected response strategies identified in this EP and coordinating the NEBA for each operational period. This will demonstrate that, at the strategy level, the response operations reduce additional environmental impacts to ALARP.

Spill response activities will be conducted in offshore waters using vessels and aircraft, and potentially a MODU should a relief well be required. The greatest potential for additional impacts from implementing spill response is considered to be on wildlife in offshore waters from oiled wildlife response activities.

Santos, together with the Controlling Agency for spill response, will apply appropriate processes and standards to ensure spill response impacts are reduced to a level that is ALARP.

All reasonably practicable control measures have been reviewed and those adopted are considered appropriate to manage the impacts such that the residual consequence is assessed to be II – Minor. The proposed control measures are in accordance with the Santos risk management criteria and are considered appropriate to manage impacts to ALARP.

7.7.12.7 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence is II – Minor from contingency spill response operations.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ESD?	Yes – Activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline which considers principles of ecologically sustainable development.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans, conservation advice , wildlife conservation plans and Australian marine park zoning objectives)?	Yes – Control measures implemented will reduce the impact of contingency spill response operations to species identified in the following relevant species recovery plans, conservation advice, wildlife conservation plans and other management plans/guidelines, as also set out in Table 3-13. **Conservation advice:** • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009b) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014a) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014c) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014b) • Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) • Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b) • Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c) • Approved Conservation Advice for *Limnodromus semipalmatus* (Asian dowitcher) (DCCEEW, 2024f) • Approved Conservation Advice for *Limosa limosa* (black-tailed godwit) (DCCEEW, 2024e) • Approved Conservation Advice for *Calidris tenuirostris* (great knot) (DCCEEW, 2024d) • Approved Conservation Advice for Charadrius leschenaultii (greater sand plover) (DCCEEW, 2023f)

	• Approved Conservation Advice for Pluvialis squatarola (grey plover) (DCCEEW, 2024g) • Approved Conservation Advice for Limosa lapponica baueri (Alaskan bar-tailed godwit) (DCCEEW, 2024k) • Approved Conservation Advice for Calidris canutus (red knot) (DCCEEW, 2024m) • Approved Conservation Advice for Phaethon rubricauda westralis (Indian Ocean red-tailed tropicbird) (DCCEEW, 2023g) • Approved Conservation Advice for Arenaria interpres (ruddy turnstone) (DCCEEW, 2024m) • Approved Conservation Advice for Calidris acuminata (sharp-tailed sandpiper) (DCCEEW, 2024l) • Approved Conservation Advice for Xenus cinereus (terek sandpiper) (DCCEEW, 2024i) • Conservation Advice for the Abbott's Booby Papasula abbotti (TSSC, 2020a) • Approved Conservation Advice for Rostratula australis (DSEWPaC, 2013) • Conservation Advice for Charadrius mongolus (lesser sand plover) (DCCEW, 2024j) **Recovery plans:** • Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities (CoA, 2013) • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (CoA, 2014) • Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) • Wildlife Conservation Plan for Seabirds (CoA, 2020) • Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c) **Other management plans/guidelines**: • National Light Pollution Guidelines for Wildlife (DCCEEW, 2023h) • Marine bioregional plans for the NMR and NWMR (CoA, 2012a, 2012b). For the identified plans, the objectives of those plans are achieved through the adoption of performance outcomes and the control measures outlined in Section 7.7.12.4. Santos considers that the level of potential impact from contingency spill response operations is not inconsistent with these plans. Management is also consistent with the zoning of the Australian marine parks in that risks have been reduced to ALARP; for example, implementation of spill response activities will limit impacts, thereby conserving the marine park values as required by the North Marine Parks Network Management Plan (DNP, 2018a) and North-West Marine Parks Network Management Plan (DNP, 2018b).
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management consistent with and National Plan for Maritime Environmental Emergencies (AMSA, 2020), among other legislation identified in Appendix C. Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.7.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable Operations EPs accepted by NOPSEMA have been reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.

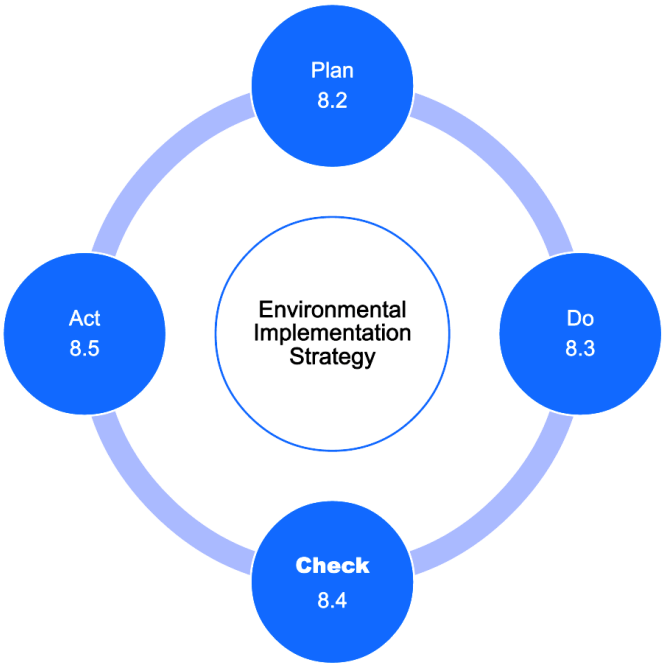
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – consultation with Relevant Persons for this activity has been considered when evaluating performance outcomes, control measures and associated performance standards. No specific issues, objections / claims or measures were raised by relevant persons in relation to this risk (aside from those already covered in relation to the spill risks identified in Sections 7.6 – 7.7.11) Where relevant, control measures implemented based on consultation with Relevant Persons for other Barossa EPs, have been adopted in this EP. Additional performance outcomes (EPO-19, EPO-20) have been adopted for contingency spill response operations based on consultation with Relevant Persons on other Barossa EPs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

The consequence of spill response operations on receptors is assessed as II – Minor. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential impacts are considered acceptable.

8. Implementation Strategy

Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)R 2023) requirements
Section 22 Implementation strategy for environment plan
22(1) The environment plan must contain an implementation strategy for the activity in accordance with this section. *Consultation and compliance* 22(16) The implementation strategy must comply with the Act, this instrument, any other regulations made under the Act, and any other environmental legislation applying to the activity.

This section describes the implementation strategy for this EP which follows a PLAN-DO-CHECK-ACT cycle and is structured accordingly. The implementation strategy is based on the assessment of impacts and risks and describes how the control measures (Table 8-2) will be implemented to achieve the environmental performance outcomes (Table 8-1) and performance standards (Table 8-2). It describes the systems, practices and procedures in place to plan, implement, monitor and manage the activities so environmental risks and impacts are continually being reduced to ALARP and are acceptable.



8.1 Environmental Performance Outcomes, Control Measures and Performance Standards

8.1.1 Environmental performance outcomes and standards

OPGGS(E)R 2023 Requirements
Section 21 Environmental assessment
Environmental performance outcomes and standards 21(7) The environment plan must: a) set environmental performance standards for the control measures identified under paragraph (5)(c); and b) set out the environmental performance outcomes for the activity against which the performance of the titleholder in protecting the environment is to be measured; and c) include measurement criteria that the titleholder will use to determine whether each environmental performance outcome and environmental performance standard is being met.

To ensure environmental risks and impacts will be reduced to ALARP and be of an acceptable level, environmental performance outcomes have been defined and are listed in Table 8-1, except those relating to hydrocarbon spill response, which are listed in the Barossa Production Operations OPEP. These outcomes will be achieved by implementing the identified control measures to the defined environmental performance standards (Table 8-2), noting some control measures are applicable to multiple environmental performance outcomes.

Table 8-1: Environmental performance outcomes

Reference	Environmental performance outcomes
EPO-01	No vessel collisions or adverse interactions with other marine users.
EPO-02	Vessel speeds in operational areas will not exceed applicable restrictions, to reduce the risk of physical interactions between cetaceans / marine reptiles and vessels.
EPO-03	Zero incidents of injury/mortality of cetaceans/marine reptiles from collision with vessels.
EPO-04	Seabed disturbance to be limited to planned activities and impacts described as part of the Activity and will not occur outside the Operational Areas.
EPO-05	No anchoring or mooring of the FPSO facility or vessels on shoals/banks.
EPO-06	No loss of equipment or cargo overboard from the FPSO facility or vessels.
EPO-07	No introduction, establishment or spread of IMS in the natural environment as a result of the Activity.
EPO-08	No injury of, or mortality to, EPBC Act 1999 listed marine fauna or marine fauna listed as threatened species under the *Territory Parks and Wildlife Conservation Act 1976* (NT) as a result of the Activity.
EPO-09	Atmospheric emissions associated with the Activity will me*et al*l regulatory source emission standards.
EPO-10	Manage indirect GHG emissions associated with the Activity consistent with the temperature objectives of the Paris Agreement, including by implementing company-wide targets and strategies for Scope 3 emissions reduction at Barossa as appropriate (having regard to joint venture arrangements and Barossa operations) and supporting customers and suppliers to reduce their GHG emissions.
EPO-11	Undertake the Activity in a manner that is compliant with the requirements of the Safeguard Mechanism.
EPO-12	No light emissions from the Activity except as required for safe operations and working requirements.
EPO-13	Produced water discharge will not exceed ANZG (2018) 99% Species Protection water quality guideline values and ANZG (2018) default sediment quality values beyond the PW Mixing Zone and will meet the level of dilution required for 99% Species Protection (based on ecotoxicity testing) within the PW Mixing Zone.
EPO-14	Planned discharges will meet relevant maritime obligations and Santos chemical assessment and approval process.
EPO-15	No displacement of marine turtles from habitat critical during nesting/breeding (including internesting periods for turtles) and ensure biologically important behaviour can continue in biologically important areas.
EPO-16	Zero unplanned discharge of hazardous and non-hazardous wastes into the marine environment from the Activity.
EPO-17	No release of controlled waste generated during the Activity, except through licensed onshore treatment and disposal facilities.
EPO-18	Zero unplanned discharge of hydrocarbons or chemicals to the marine environment from the Activity.
EPO-19	No significant[1] impact to cultural features from the Activity.
EPO-20	No impacts to underwater cultural heritage from the Activity.
EPO-21	Treated seawater discharge will not exceed the 99% species protection level beyond the validated mixing zone.
EPO-22	The outer boundary of the planned operational noise footprint (approximately 11.4km from source) will not impact the nearest shoals/ banks of Lynedoch Bank, Tassie Shoal or Evans Shoal (located >27km away).

Note 1: Significant is defined in the Santos Environment Consequence Descriptors (Appendix G).

8.1.2 Control measures and performance standards

Hazards and associated environmental risks and impacts for the proposed activities have been systematically identified and assessed in this EP in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline. The control measures that will be used to manage identified environmental impacts and risks and the associated statements of performance required of the control measure (Environmental Performance Standards) are listed in Table 8-2. Measurement criteria outlining how compliance with the control measure and the expected environmental performance could be evidenced are also listed.

All control measures and EPSs and associated measurement criteria relating to hydrocarbon spill preparedness and response operations are contained within the Barossa Production Operations OPEP.

Table 8-2: Environmental performance standards and measurement criteria

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-03 EPO-08 EPO-15 EPO-16 EPO-19	BAO-CM-6.1.1 Apply Santos' Protected Marine Fauna Interaction and Sighting Procedure to vessel and helicopter activities when in the vicinity of cetaceans and turtles	Vessel/s comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure, which ensures compliance with EPBC Regulations 2000- Part 8 which includes controls for minimising the risk of collision with marine fauna.	Conformance checked on receipt of marine fauna sighting datasheets. Completed vessel statement of conformance.
		Any vessel strikes with cetaceans will be reported in the National Ship Strike Database.	Conformance checked on Santos' receipt of incident report.
		Helicopter contractor procedures comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure, which ensures compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000, which includes controls for minimising interaction with marine fauna.	Helicopter contractor procedures align with Santos' Protected Marine Fauna Interaction and Sighting Procedure.
		The vessel master or crew will act as a wildlife observer and record sightings of cetaceans and turtles.	Recorded marine fauna observations demonstrate adherence to EPBC Regulations – Part 8 Division 8.1 Interacting with cetaceans (and applied for marine turtles), including initiation of management measures for when the vessel was operated within a caution zone.

EPO-01
EPO-08
EPO-09
EPO-12
EPO-15
EPO-16
EPO-19
EPO-20
	BAO-CM-6.1.2
	Vessels equipped and crewed in accordance with Australian maritime requirements, including Marine Order 30 (Prevention of Collisions) and Marine Order 21 (Safety and Emergency Arrangements)
		Vessels will be equipped and crewed in accordance with the Navigation Act 2012 (Cth) (as applicable for vessel size, type, and class), including implementing:
		• Marine Order 21 (Safety and emergency procedures), including safety measures such as manning and watchkeeping.
		• Marine Order 27 (Safety of navigation and radio equipment), including:
		  ○ radio equipment and communications
		  ○ navigation safety measures and equipment
		  ○ danger, urgency and distress signals and messages.
		• Marine Order 30 (Prevention of Collisions), including: lights and signals as applicable to vessel class per COLREGS requirements.
		• Marine Order 70 (Vessel marine crew are trained and competent to navigate vessels (Note, not applicable to FPSO due to stationary nature).
		• Marine Order 71 (master's and Deck Officers), including: all master, mate and watchkeeper officer duties undertaken by crew certified as applicable to vessel class per International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978 (STCW) requirements.
		• International Association of Marine Aids to Navigation and Lighthouse Authorities Recommendation O-139 on The Marking of Man-Made Offshore Structures (FPSO).
			A Minimum Safe Manning Certificate is in place and identifies minimum crew qualifications to meet the STCW requirements (as applicable for vessel size, type and class).
			Records of Santos marine vessel vetting process (as applicable for vessel size, type and class) to demonstrate the following:
			• Global Maritime Distress and Safety System (GMDSS) radio logbook maintained
			• radio equipment available, working and tested at regular intervals
			• electronic and/or paper-based charts are available.
			A Vessel Cargo Ship Safety Equipment Certificate demonstrates the vessel has lights, shapes, and means of making sound signals and distress signals in accordance with COLREGS requirements (as applicable for vessel size, type, and class).
			Records of vessel crew STCW qualifications align with the Minimum Safe Manning Certificate (as applicable for vessel size, type, and class)
			Non-compliance with relevant Marine Orders 21, 27, 30 70 71 and O-139 and corrective action undertaken documented (as applicable for vessel size, type and class).

EPO-19 EPO-20	BAO-CM-6.1.3 Cultural ceremony for FPSO arrival and inductions for all site-based workforce will include information on cultural heritage to raise awareness about the cultural and spiritual belief of First Nations people	Activity inductions contain information on cultural heritage and are completed by all site-based workforce prior to commencement of Activity.	Records demonstrate cultural heritage awareness inductions completed by site-based workforce
		A cultural ceremony will be held on the arrival of the FPSO prior to the commencement of the Activity.	DPR records (or equivalent) confirm occurrence of cultural ceremony on the arrival of the FPSO prior to commencement of the Activity.
EPO-12 EPO-19	BAO-CM-6.2.1 Lighting limited to that required for safe work conditions and navigational purposes	Vessel navigation lighting and equipment is compliant with COLREGS/Marine Orders 30: Prevention of Collisions, Marine Orders 21: Safety of Navigation and Emergency Procedures, Navigation Act 2012 (Cth). Work lighting will be the minimum required to maintain safe working conditions for all areas where the crew are operating on the deck.	Vessel certification confirms compliance with applicable regulations. Vessel crew induction outlines requirement to keep work lighting to a minimum to maintain safe working conditions Inspection verifies no excessive light being used beyond that required for safe work/navigation.
		HSE induction to crew includes minimising light emissions from vessel during night hours where possible.	Records demonstrate all project personnel have attended the Activity HSE Induction that includes minimising light emissions.

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-12 EPO-19	BAO-CM-6.2.2 Additional lighting management (as recommended in the National Light Pollution Guidelines for Wildlife (DCCEW, 2023h) implemented in OA2 when undertaking activities within 3.3 km of turtle BIA or HC, where it does not impact the ability of light to safely illuminate the work area	When undertaking activity within 3.3. km of known turtle BIA or habitat critical, additional measures implemented to minimise direct light spill on the ocean surface will include: • turning off lights not in use • closing curtains • adjusting orientation of lights • installing shielding where it does not impact the ability of light to safely illuminate the work area.	Completed vessel statement of conformance.
EPO-12 EPO-19	BAO-CM-6.2.3 Vessel searchlights will only be operated when retrieving AUVs at night or in the event of an emergency	Vessel searchlights shall only be operated when retrieving AUVs at night or in the event of an emergency to minimise light emissions.	Training and induction records for Vessel Masters detail that search lights are to be operated only in an emergency or when retrieving AUVs at night.
EPO-11	BAO-CM-6.3.1 Monitoring of vessel fuel consumption and vessel speed management to reduce fuel use	Daily vessel fuel use monitoring. Vessels instructed, prior to vessel sailing, to sail at 'economic' speed specific to each vessel to reduce fuel use, subject to operational requirements.	Fuel use monitoring recorded in daily vessel performance reports. Vessel speed instructions issued to vessel prior to vessel sailing and statement of compliance recorded in daily vessel performance reports.
EPO-11	BAO-CM-6.3.2 Initial start-up will be sequenced to ensure the maximum amount of alignment between the respective facilities whilst minimising fuel use and flaring.	Implementation of facilities alignment and fuel use requirements and flaring minimisation during initial start-up in accordance with the Fuel and Flare Target Setting process (Section 8.2.4.1).	Records demonstrate implementation of facilities alignment and fuel use requirements and flaring minimisation during initial start-up consistent with the Fuel and Flare Target Setting process (Section 8.2.4.1).
EPO-11	BAO-CM-6.3.3 Hook-up and Commissioning and Initial-Start-up fuel and flare performance target setting	Fuel and flare targets are set, tracked and managed during hook-up and cold-commissioning and initial start-up as described in Section 8.2.4.1	Records demonstrate fuel and flare performance targets set prior to commencement of activities, targets are tracked and managed to reduce emissions to ALARP.
EPO-11	BAO-CM-6.3.4 Energy efficient design of the FPSO power and heat supply system: Combined cycle gas turbine (CCGT) system, which incorporates high-efficiency gas turbine generators (GTGs) with waste heat recovery units (WHRUs), once-through steam generators (OTSGs) and a steam turbine generator (STG). Relevant Engineering Design Specifications and emissions reduction opportunities implemented as part of final facility construction.	Implementation of relevant Engineering Design Specification and facility emissions reduction opportunities (facility constructed consistent with items listed in the control measures ALARP evaluation table), will be verified prior to Facility Final Acceptance for operations.	Records demonstrate verification has been undertaken, to ensure implementation of emissions reduction opportunities in design and Engineering Design Specifications.
EPO-11	BAO-CM-6.3.5 Energy efficient design for FPSO process compression: Electric drive motors – fixed speed Relevant Engineering Design Specifications and emissions reduction opportunities implemented as part of final facility construction.	Implementation of relevant Engineering Design Specification and facility emissions reduction opportunities (facility constructed consistent with items listed in the control measures ALARP evaluation table), will be verified prior to Facility Final Acceptance for operations.	Records demonstrate verification has been undertaken, to ensure implementation of emissions reduction opportunities in design and Engineering Design Specifications.
EPO 11	BAO-CM-6.3.6 Energy efficient design of the FPSO reservoir CO_2 removal system: 2-stage membrane system for reservoir CO_2 removal	Implementation of relevant Engineering Design Specification and facility emissions reduction opportunities (facility constructed consistent with items listed in the control measures ALARP evaluation table), will be verified prior to Facility Final Acceptance for operations.	Records demonstrate verification has been undertaken, to ensure implementation of emissions reduction opportunities in design and Engineering Design Specifications.

EPO no	Control measure	Environmental performance standard	Measurement criteria
	Relevant Engineering Design Specifications and emissions reduction opportunities implemented as part of final facility construction.		
EPO-11	BAO-CM-6.3.7 Energy efficient design of the FPSO reservoir CO_2 disposal system: Thermal oxidiser destruction efficiency up to 99.9% methane destruction efficiency Relevant Engineering Design Specifications and emissions reduction opportunities implemented as part of final facility construction	Implementation of relevant Engineering Design Specification and facility emissions reduction opportunities (facility constructed consistent with items listed in the control measures ALARP evaluation table), will be verified prior to Facility Final Acceptance for operations.	Records demonstrate verification has been undertaken, to ensure implementation of emissions reduction opportunities in design and Engineering Design Specifications.
EPO-11	BAO-CM-6.3.8 Energy efficient design of the FPSO low pressure flare and acid gas flare – normally unlit (pilotless) Relevant Engineering Design Specifications and emissions reduction opportunities implemented as part of final facility construction	Implementation of relevant Engineering Design Specification and facility emissions reduction opportunities (facility constructed consistent with items listed in the control measures ALARP evaluation table), will be verified prior to Facility Final Acceptance for operations.	Records demonstrate verification has been undertaken, to ensure implementation of emissions reduction opportunities in design and Engineering Design Specifications.
EPO-11	BAO-CM-6.3.9 Reporting of GHG emissions as per the NGER Scheme	NGERS reporting is compliant with requirements set by Clean Energy Regulator and NGER report is lodged annually.	Records show that National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 has been used to measure, report, and manage the relevant Barossa facility emissions and they are compliant with the requirements set by the Clean Energy Regulator.
EPO-11	BAO-CM-6.3.10 Net-zero reservoir emissions through the purchase and/or surrender of Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs)	Manage net GHG emissions to within the baseline for the Barossa facility, through the purchase and/or surrender of Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs) under the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015.	Records demonstrate net GHG emissions managed within the applicable baseline under the Safeguard Mechanism.
EPO-11	BAO-CM-6.3.11 The purchase and/or surrender of Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs)required under the NGER (Safeguard Mechanism) Rule 2015 for any non-reservoir emissions from the Barossa facility above the annual baseline as determined by the Clean Energy Regulator.	If there are non-reservoir emissions from the Barossa facility above the annual baseline Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs)will be purchased or surrendered as required under the NGER (Safeguard Mechanism) Rule 2015.	Records demonstrate net GHG emissions managed within the applicable baseline under the Safeguard Mechanism.
EPO-11	BAO-CM-6.3.12 Implement an Operations GHG Emissions Management Plan (GHGEMP) as described in Section 8.3.2.13 to manage facility direct GHG emissions to ALARP over the life of the Activity, inclusive of: • Emissions Performance target setting (Section 8.2.4.1) • Critical Equipment Maintenance (Section 8.3.2.3.1) • Methane emissions management (Section 8.3.2.12) • Decarbonisation opportunity management (Section 8.5.7)	The GHGEMP will be implemented in accordance with Section 8.3.2.13. The GHGEMP will be reviewed annually.	Records demonstrate implementation of the GHGEMP against the performance standards listed for this control measure. Records demonstrate annual revision of the GHGEMP.
		Emissions performance targets are set and tracked as described in Section 8.2.4.2.	Records demonstrate both ongoing monthly reviews against emissions performance targets and annual review against emissions estimates.
		Emissions monitoring or emissions control equipment maintenance as described in 8.3.2.3.	Records demonstrate maintenance for emissions monitoring and emissions control equipment according to system/equipment criticality requirements.

EPO no	Control measure	Environmental performance standard	Measurement criteria
		• Conduct a process emissions baseline survey within 12 months of FPSO final acceptance test, to ensure key equipment/ including (Flare, Thermal Oxidiser and Power Generation) is operating as designed. • Implementation of bi-annual source-level fugitive detection and measurement survey supported by site-level drone methane measurements, to begin within 12 months of FPSO final acceptance test. • Confirm flare destruction efficiency achieved via review of records associated with BAO-CM-6.3.15. • Consider flare destruction efficiency technologies, processes and procedures as a means of continuous flare destruction efficiency improvement in line with the Decarbonisation Opportunity Management process for the Barossa facility as described in Section 8.5.7. • Rectification of identified leaks as soon as practicable	Records demonstrate baseline methane survey undertaken within 12 months of FPSO final acceptance testing. Records demonstrate implementation of a bi-annual source-level fugitive detection and measurement survey, within 12 months of FPSO final acceptance testing. Fuel, flare and vent reporting, lab records and/or CCTV footage will demonstrate flare ignition systems is operational, per BAO-CM-6.3.15. Records demonstrate implementation of the Decarbonisation Opportunity Management process as described in Section 8.5.7, and consideration of available flare destruction efficiency technologies, processes and procedures, including records of technologies, processes and procedures identified and adopted (and if not adopted, reasons as to why). Records demonstrate rectification of identified leaks, and timeframe for rectification following identification
		Implementation of the Decarbonisation Opportunity Management process for the Barossa facility as described in Section 8.5.7	Records demonstrate Decarbonisation Opportunity Management plan developed and reviewed annually in accordance with the process described in section 8.5.7. Records demonstrate progress in implementing Decarbonisation Opportunity Management plan.
EPO-11	BAO-CM-6.3.13 Fuel gas will be used preferentially for power generation instead of liquid fuel.	Diesel will be fuel source for GTG until such time as fuel gas is available, at which point fuel gas will be the preferred power generation fuel.	Fuel monitoring and reporting will demonstrate that fuel source was switched from Diesel to Fuel Gas when available.
		GTG are designed to run on liquid fuel and maintain a high level of efficiency with slightly reduced power output.	Fuel monitoring and reporting will detail usage of MGO/liquid fuel
		GTG will run on MGO intermittently to support Fuel Gas hot commissioning and to provide stability to the power supply with an intent to avoid blackout and delay to start-up.	Fuel monitoring and reporting will demonstrate use of diesel as required during hot commissioning.
		GTG will only run on liquid fuel during steady state operations as part of start-up/re-start process.	Fuel monitoring and reporting will demonstrate use of fuel gas during steady state operations and diesel use restricted to start/re-start.
EPO 11	BAO-CM-6.3.14 Measure/estimate emissions from all fuels combusted and gas disposal streams to meet NGER/NPI requirements	Fuel gas flow meters installed and calibration to vendor specifications performed.	Records demonstrate installation and calibration (initial and ongoing) performed to vendor specifications.
		Diesel fuel flow meters installed and calibration to vendor specifications performed.	Records demonstrate installation and calibration (initial and ongoing) performed to vendor specifications
		Thermal oxidiser, acid gas flare, LP and HP flare flow transmitters installed and calibration to vendor specifications performed.	Records demonstrate installation and calibration (initial and ongoing) performed to vendor specifications
		Gas chromatographs online and calibrated to vendor specifications	Gas chromatograph analyser records demonstrate chromatograph remains online (apart from unplanned outages) Records demonstrate installation and calibration (initial and ongoing) performed to vendor specifications
EPO-11	BAO-CM-6.3.15 Flare ignition system design to automatically reignite flare pilot on detection of loss of flame.	Pilot loss detected by ionisation rod and duplex thermocouple.	Fuel, flare and vent reporting, lab records and/or CCTV footage will demonstrate flare ignition systems is operational.
		High energy ignition system attempts auto-ignition for two minutes, alarm indicated if unsuccessful for manual intervention using high energy system.	
		Flame front generator provided as backup for ignition.	
		CCTV monitoring of flare provided in the CCR.	
		In event of flame-out there is no impairment of the FPSO topsides.	

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-09	BAO-CM-6.3.16 MARPOL-compliant (Marine Order 97) fuel oil will be used by vessels and MGO will be used on the FPSO to reduce atmospheric emissions.	Vessels contracted whose practices comply with Marine Order 97 (including use of fuel oil) as applicable to vessel size, type, and class to reduce atmospheric emissions.	Fuel supply specifications show fuel is MARPOL-compliant on vessels.
		FPSO power generation systems reduce CO_2 emissions to atmosphere by primarily using produced fuel gas (MGO will be main source during start-up).	FPSO fuel gas usage and diesel consumption records show power generation is primarily using produced fuel gas
EPO-09	BAO-CM-6.3.17 Pursuant to Marine Order 97, relevant vessels will have a current International Air Pollution Prevention (IAPP) Certificate or equivalent and Ship Energy Efficiency Management Plan (SEEMP)	Vessels contracted will maintain a current International Air Pollution Prevention (IAPP) Certificate and/or Engine IAPP Certificate and/or International Energy Efficiency Certificate (IEEC) (or equivalent)', which certifies that measures to prevent ozone-depleting substance emissions and reduce NOx, SOx and incineration emissions during the activity are in place.	Current IAPP Certificate or equivalent in place for relevant vessels
		Vessels contracted will have a (SEEMP) in place to reduce emissions during the activity	Current SEEMP in place for relevant vessels
EPO-09	BAO-CM-6.3.18 Santos' vessel vetting process to include evaluation of vessel emissions and the potential for use of alternative fuels.	Vessel vetting includes evaluation of vessel emissions and the potential for use of alternative fuels to reduce scope 3 emissions.	Completed documentation of evaluation
EPO-10	BAO-CM-6.3.19 Barossa products generated from the Activity will only be sold to customers from countries that are signatories to the Paris Agreement or have a mid-century net zero emissions commitment, as at the date of the relevant contract of sale.	Barossa sales contracts limited to customers from countries that are signatories to the Paris Agreement or have a mid-century net zero emissions commitment, as at the date of the relevant contract of sale.	Records as at date of relevant contract of sale demonstrate that customer countries are current signatories to the Paris Agreement or have a mid-century net-zero emissions commitment.
EPO-10	BAO-CM-6.3.20 Onshore Processing Services Agreements will only be made with Australian facilities that are subject to the Safeguard Mechanism.	Onshore processing of Barossa gas at DLNG facility - a facility covered under the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015.	Records demonstrate that DLNG facility is covered under the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015. Records demonstrate Barossa gas processed onshore at DLNG.
EPO-10	BAO-CM-6.3.21 GHG emissions reduction initiatives of suppliers will be evaluated in the tender evaluation process via development and implementation of a framework for identifying, assessing and implementing emissions reduction opportunities for all Barossa supplier contracts of $30m+ value. Through the data collection and tender evaluation process, opportunities to collaborate on emissions reduction initiatives and low carbon alternatives will be sought, including the potential to support suppliers in respect of: • investments in innovations in technology; • research programs; • education and training relating to the adoption of emissions reduction policies and processes; and/or • monitoring programs The tender evaluation framework will be reviewed and refined to ensure it is adaptive to advancements in technology, data collected and other opportunities to encourage reductions in GHG emissions.	Data will be collected and recorded via the tender process. GHG emissions reduction initiatives will be evaluated during the tender process via a tender evaluation framework. Collaborating with suppliers on initiatives may be adopted subject to a feasibility analysis, the willingness of suppliers to collaborate, and value to the environment. Annual review of the threshold spend will be conducted to ensure the most emissions intensive activities are captured. The tender evaluation framework will be reviewed and refined annually to ensure it is adaptive to advancements in technology, data collected and other opportunities to encourage reductions in GHG emissions.	Records demonstrate development and utilisation of tender evaluation framework, tender scope of work and evaluation forms. Records will evidence collaboration with suppliers including investment spend and the implementation of initiatives and programs, including explanation where this has not occurred. Records demonstrate that annual review of threshold spend has been conducted. Records demonstrate annual revisions of the tender evaluation framework to ensure it is adaptive to advancements in technology, data collected and other opportunities to encourage reductions in GHG emissions.

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-10	BAO-CM-6.3.22 Annual engagement with suppliers with Barossa supplier contracts of $30m+ value to request GHG emissions data for Barossa activities. Data sought would include: • quantitative and qualitative climate-related targets (including for scopes 1, 2 and 3 emissions); • information about the supplier's approach to setting, reviewing and monitoring progress against each target; • information about the supplier's performance against each climate-related target, including GHG emissions data and measurement approach, inputs and assumptions, over the past year; • the supplier's use over the past year, and planned use, of carbon credits to offset GHG emissions; • information regarding the supplier's climate-related risks and opportunities, including information regarding the supplier's emissions reduction initiatives (if any). Data will be used to verify GHG emissions estimates associated with our suppliers and track performance against Santos' Scope 3 equivalent targets and Climate Transition Action Plan.	Data will be collected annually and evaluated on an annual basis against Santos' scope 3 emissions estimations, Santos' scope 3 equivalent climate targets and Climate Transition Action Plan. Review to be undertaken annually of options for improvements in the management of or reduction of scope 3 emissions arising from this engagement.	Records will evidence annual supplier data requests, responses received and evaluation of responses. Records will evidence annual verification of GHG emissions estimates associated with our suppliers and evaluation against scope 3 equivalent climate targets and Climate Transition Action Plan to the extent practicable through the above engagement with suppliers. Records will demonstrate review of any options for improvements in the management of or reduction of scope 3 emissions arising from this engagement.
EPO-10	BAO-CM-6.3.23 Annual engagement with Barossa customers and the DLNG onshore processing facility via a survey regarding the use of Barossa product. Information sought would include: • GHG emissions data (scope 1 and 2 emissions) attributable to Barossa product; • information regarding use over the past year, and planned use, of carbon credits to offset GHG emissions attributable to Barossa product; • information regarding climate-related risks and opportunities, including information regarding the entity's emissions reduction initiatives (if any) Data will be used to verify GHG emissions estimates associated with our onshore processing facilities and customers and track performance against Santos' Scope 3 equivalent climate targets and Climate Transition Action Plan.	Data will be collected annually and evaluated on an annual basis against Santos' scope 3 emissions estimations, Santos' scope 3 equivalent climate targets and Climate Transition Action Plan. Review to be undertaken annually of options for improvements in the management of or reduction of scope 3 emissions arising from this engagement.	Records will evidence a data requests, responses received and evaluation of responses. Records will evidence annual verification of GHG emissions estimates associated with our customers and the DLNG onshore processing facility and evaluation against scope 3 equivalent climate targets and Climate Transition Action Plan to the extent practicable through the above engagement. Records will demonstrate review of any options for improvements in the management of or reduction of scope 3 emissions arising from this engagement.
EPO-10	BAO-CM-6.3.24 Supporting customers the DLNG onshore processing facility and suppliers to reduce GHG emissions by	Annual review of current or new industry forums, associations and initiatives warranting participation/involvement will be undertaken. Participation will take the form of attendance at events and actions arising, which may include ongoing collaboration and/or engagement with policy makers and other stakeholders, as relevant. Review to be undertaken annually of any options for improvement in GHG	Records will demonstrate annual review of current or new industry forums, associations and initiatives warranting participation/involvement.

EPO no	Control measure	Environmental performance standard	Measurement criteria
	• promoting global measurement and reporting standards by participating in relevant industry associations and collaboration initiatives; and • advocating for policy frameworks that enable a consistent approach to carbon emissions management.	emissions management or GHG emissions reductions arising from such engagement.	Records will demonstrate participation in relevant industry association and collaboration initiatives, and engagement with policy makers and other stakeholders, as relevant. Records will demonstrate consideration of any potential for improvements in GHG emissions management or emissions reductions arising from this engagement.
EPO-09	BAO-CM-6.4.1 Ozone depleting substance (ODS) and lower global warming potential (GWP) refrigerants use and handling procedures	To eliminate the use of ODS on the FPSO, heating, ventilation and air conditioning systems use non-ODS with lower global warming potential (GWP) refrigerants such as (R134a, R404a or R290).	FPSO refrigerant consumption records show heating, ventilation and air conditioning systems use non-ODS refrigerants with low GWP (such as R134a, R404a or R290).
		FPSO systems containing refrigerants are maintained in accordance with the maintenance system which aligns to manufacturer specifications (including frequency) to minimise fugitive emissions.	Maintenance records for FPSO systems containing refrigerants in accordance with manufacturer specification.
		ODS on vessels (excluding the FPSO) is managed in accordance with Marine Order 97 (vessels) and MARPOL Annex VI to reduce the risk of an accidental release of ODS to air.	Completed ODS Record Book or recording system is on vessel in accordance with Marine Order 97 (vessels) and MARPOL VI.
EPO-09	BAO-CM-6.4.2 Connection of process hydrocarbon vents to flare and vapour recovery system	Connection of process hydrocarbon vents to flare and vapour recovery system reduces flaring and associated atmospheric emissions.	As constructed records confirm connection of process hydrocarbon vents to LP/HP/Acid Gas flares and vapour recovery system.
EPO-09	BAO-CM-6.4.3 Vessel waste incineration management (note: no waste incinerator on board the FPSO)	Waste incineration on vessels is managed in accordance with Marine Order 97/MARPOL Annex V to minimise atmospheric emissions.	Completed vessel waste record book or recording system in accordance with Marine Order 97
EPO-09	BAO-CM-6.4.4 National Pollutant Inventory (NPI) Reporting	NPI reporting is lodged as per the NPI submission requirements.	Records show that NPI reports have been lodged as per NPI submission
All	BAO-CM-6.4.5 HSE inductions will include applicable environmental requirements	All project personnel will attend HSE inductions which will include environmental requirements as required by this EP to reduce environmental impacts and risks to ALARP and acceptable levels.	Records demonstrate all project personnel have attended the Activity HSE Induction and that HSE inductions include environmental requirements as required by this EP to reduce environmental impacts to ALARP and acceptable levels.
EPO-09	BAO-CM-6.4.6 Low-temperature Separator (LTS) operates within Integrity Operating Window	LTS stages are operating within their Integrity Operating Window.	Records show that LTS stages are operating within their Integrity Operating Window with exceedances tracked and reviewed in operations governance forums.
EPO-06 EPO-17 EPO-19 EPO-20	BAO-CM-6.4.7 Mercury collection pot gauge	Manual reading and recording of MCP magnetic level gauges is undertaken daily.	Records demonstrate daily readings of MCP magnetic level gauges has been recorded.
EPO-06 EPO-17 EPO-18 EPO-19 EPO-20 EPO-21	BAO-CM-6.4.8 Mercury Decanting Procedure	The Mercury Decanting Procedure outlines the following requirements: • Step by step instructions for decanting/handling of mercury • Site preparation, spill kit requirements and spill response actions • Mercury contaminated waste handling and disposal requirements • Role responsibilities for undertaking mercury decanting	Approved Mercury Decanting Procedure reflects content requirements.
		Mercury decanting is conducted in accordance with the Mercury Decanting Procedure.	Completed Mercury Decanting Procedure sign-off sheet.

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-09	BAO-CM-6.4.9 Emissions Performance target setting (Section 8.2.4.2)	Emissions performance targets are set and tracked as described in Section 8.2.4.2.	Records demonstrate both ongoing monthly reviews against emissions performance targets and annual review against emissions estimates.
EPO-08 EPO-09 EPO-13 EPO-14 EPO-15 EPO-16 EPO-17 EPO-19	BAO-CM-6.4.10 Barossa Facilities and vessels planned maintenance system to confirm equipment integrity is maintained in accordance with manufacturers guidelines.	Documented maintenance program is in place for cranes and lifting equipment on the FPSO and vessels to maintain & certify the equipment in accordance with manufacturer specification to reduce the likelihood of dropped objects associated with equipment failure. Inspection and load testing of all fixed and loose lifting appliances per applicable procedures ranging between 6 monthly to 5 yearly. Pedestal cranes and the aft service crane: • Function test of overload protection systems, motion/travel limits, constant tension system and emergency stop functions – Yearly. • Function test of winch, slewing and luffing brakes, and of hydraulic load control valves – Yearly. • Power failure simulated to test brake functions and emergency power operations - Yearly	Records confirm maintenance of cranes and lifting equipment on FPSO and vessels undertaken as scheduled and consistent with maintenance program and schedule provided in the EPS.
		Ensure offtake equipment (including the offtake floating hose) is maintained to reduce likelihood of loss of offtake integrity events during condensate transfers and offtakes, through routine: • visual inspections (6 monthly) • In-situ pressure test of hose string (2.5 yearly) • Function test ERC (Yearly)	Records show, maintenance of off take equipment on the FPSO occurs consistent with schedule provided in the EPS.
		Ensure bunkering equipment is maintained to reduce the likelihood of loss of integrity events during transfers: • visual inspection of the integrity of the prior to bunkering • test date/certification of the hose is checked prior to bunkering	Completed pre-bunkering checklist show bunkering equipment on the FPSO is checked and the test date/certification is valid
		Documented maintenance program is in place for discharge monitoring equipment to ensure they are operating within their design parameters and analysers are calibrated in accordance with manufacturer guidelines.	Records show maintenance of discharge monitoring equipment in accordance with manufacturer guidelines.
		Monitoring and support services provided in by third party (PW system) specialist to maintain the PW treatment system.	Records show maintenance of PW treatment system in accordance with manufacturer guidelines and specialist input.
		The flare sampling and conditioning system subject to 24M Preventative Maintenance inspection.	Records show maintenance of flare sampling and conditioning system in accordance with manufacturer guidelines.
EPO-04 EPO-05 EPO-20 EPO-21	BAO-CM-6.5.1 Vessel will not anchor within OA1 under routine operations	Vessels will not anchor under routine operations within OA1.	No reported or recorded incidents of anchoring occurring within OA1.
EPO-04	BAO-CM-6.5.2 Maintain a subsea infrastructure inventory	Maintain a comprehensive and accurate inventory of subsea infrastructure and locations, including tracking of subsea infrastructure brought into the OAs. An accurate inventory will reduce permanent seabed disturbance as it will enable Santos to fulfill future decommissioning/removal responsibilities.	Subsea infrastructure inventory records completed and maintained throughout the project.
EPO-04	BAO-CM-6.5.3 Span correction procedures to be developed, if required	If required, a span-correction procedure will be developed to provide clear direction on how spans shall be rectified and surveyed to minimise seabed disturbance.	A copy of a span rectification procedure (or similar) demonstrating alignment to requirements.

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-04 EPO-05 EPO-20 EPO-21	BAO-CM-6.5.4 Vessels will not anchor under routine operations within OA2 however may anchor during emergency conditions.	Vessels will not anchor under routine operations within OA2 however may anchor during emergency conditions	No reported or recorded incidents of anchoring occurring within OA2, unless in the event of emergency conditions.
EPO-01 EPO-04 EPO-19 EPO-20 EPO-21	BAO-CM-6.6.1 Notify AHS and AMSA MSI prior to relevant Activity	AHS Notice to Mariners and AMSA MSI will be notified prior to relevant Activity to reduce the likelihood of unplanned interactions with other vessels.	Consultation records demonstrate AHS and AMSA MSI provided sufficient information to generate Notice to Mariners prior to relevant activities.
EPO-01 EPO-19 EPO-20 EPO-21	BAO-CM-6.6.2 Petroleum safety zone administered by NOPSEMA in accordance with the OPGGS Act and cautionary area established	A 500 m radius PSZ will extend around the outer edge of the Barossa production wells, the subsea infrastructure and the dynamic portions of the mooring system to reduce the likelihood of unplanned interactions with other vessels.	AHS nautical charts show 500 m PSZ. Adverse interactions in PSZ with other marine users are recorded.
		A 2.5 nm cautionary zone is in place around the subsea infrastructure to reduce the likelihood of unplanned interactions with other vessels.	AHS nautical chart shows cautionary zone around the subsea infrastructure.
EPO-01 EPO-19 EPO-20 EPO-21	BAO-CM-6.6.3 Collision avoidance radar	FPSO is fitted with a collision avoidance radar, so it appears on the display of the triggering radars, providing range, bearing and identification information to reduce the likelihood of unplanned interactions with other vessels.	Collision avoidance radar is fitted on the FPSO.
EPO-01 EPO-07 EPO-09 EPO-17 EPO-18 EPO-19 EPO-20	BAO-CM-6.6.4 Activity undertaken in accordance with Santos HSE management and marine vessel vetting processes (Santos' Offshore Marine Assurance Procedure)	Vessels selected and onboarded in accordance with Santos' Offshore Marine Assurance Procedure to ensure contracted vessels equipment is maintained in accordance with Santos and industry standards, and regulatory requirements to ensure other marine users are aware of physical presence thus reducing the potential for interaction or collision.	Completed documentation in accordance with Santos' Offshore Marine Assurance Procedure.
		Vessels selected and onboarded in accordance with Santos' Offshore Marine Assurance Procedure are required to carry out a Biosecurity Risk Assessment prior to engagement to ensure the risk of introducing invasive marine species during activities undertaken by Santos in Australian marine waters in minimised	Biosecurity risk assessment completed by selected vessels
EPO-01	BAO-CM-6.6.5 Concurrent Barossa activities will be managed under relevant bridging documents/interface management plans	Bridging documents/interface management plans will be developed and implemented during concurrent activities Implementation of the plan will control and manage concurrent activities occurring within OAs. This will ensure that concurrent activities can be conducted safely and reduce the risk of unplanned vessel interactions/collisions and resulting MDO/MGO releases.	A copy of the bridging documents/interface management plans is available on the Barossa Management System.
			Records demonstrate no vessel incidents related to concurrent activities
EPO-02 EPO-19 EPO-20 EPO-21	BAO-CM-6.6.6 Vessel speed restrictions within 500m around the FPSO, IMMR vessels and campaign vessels	Restrict vessel operating speeds to 8 knots or less within 500m safety zone around FPSO, IMMR vessels and campaign vessels to reduce the likelihood of unplanned interactions with other vessels with the exception of FPSO Daughter Craft / other fast rescue craft undertaking drills and training or responding to an emergency situation"	Vessel speeds in exceedance of 8 knots are contained in incident reports documentation and corrective action undertaken documented. With the exception of FPSO Daughter Craft / other fast rescue craft undertaking drills and training or responding to an emergency situation".
		Project induction material includes an environmental requirements section that details speed limit requirements to reduce the likelihood of unplanned interactions with other vessels.	Induction records confirm all project personnel have completed the project induction, and that induction includes information specified in the EPS.
EPO-01	BAO-CM-6.6.7 Communications plan will be implemented for engagement prior to and during the Activity that may impact marine users, to raise awareness of the activity.	A communications plan will be developed by end of the first quarter of each year that identifies key Barossa activities that may impact other marine users and set out how we will communicate the location, timing, and nature of the identified Barossa activities to marine users that may be impacted. Communications will occur in accordance with Table 8-26	Consultation records demonstrate implementation and annual review of a communications plan, and any consultation feedback received.

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO- 01	BAO-CM-6.6.8 Charting of infrastructure on nautical charts	Activity infrastructure will be clearly marked on Australian nautical charts published by the AHO to reduce the likelihood of unplanned interactions with other vessels.	Evidence of confirmation that Australian nautical charts published by the AHO show infrastructure installed as part of the activities described in the EP.
EPO-14 EPO-17 EPO-20	BAO-CM-6.7.1 Routine discharges of putrescible waste, in accordance with MARPOL Annex V and Marine Order 95 (Marine Pollution Prevention – Garbage)	A Garbage Record Book is maintained onboard (as relevant to vessel class and type) to capture waste discharge locations (as relevant to vessel class and type) in accordance with the Barossa FPSO waste management plan.	Garbage Record Book outlining waste discharge locations (as relevant to vessel class and type) in accordance with the Barossa FPSO waste management plan.
		Putrescible waste and food scraps are disposed of in accordance with MARPOL Annex V (and Marine Order 95: Marine pollution prevention – garbage): If a macerator is in use, specifications confirm food scraps are passed through a screen with no opening wider than 25 mm. If a macerator is in use, the Garbage Record Book confirms food waste comminuted or ground is discharged more than 3 NM to nearest land. If food waste is not comminuted or ground, the Garbage Record Book confirms food waste discharge occurred more than 12 NM to nearest land or food waste is sent ashore for disposal.	Garbage Record Book confirms disposal of waste in accordance with EPS.
EPO-14 EPO-17 EPO-20	BAO-CM-6.7.2 Routine discharges of treated sewage and grey water, in accordance with Marine Order 96 (Marine Pollution Prevention – Sewage)	Valid International Sewage Pollution Prevention (ISPP) Certificate (as relevant to vessel class and type) that details the vessel has a: • MARPOL approved sewage treatment plant • sewage comminuting and disinfecting system • sewage holding tank sized appropriately to contain all generated waste (black and grey water).	A copy of valid International Sewage Pollution Prevention (ISPP) Certificate demonstrating the vessel has a MARPOL approved sewage treatment plant (as relevant to relevant to vessel class and type).
			Where the vessel does not have a MARPOL approved sewage treatment plant, records of sewage treated using an approved comminuted and disinfecting system are maintained in an Official Log Book (or similar) that records discharge locations and volumes and verifies that discharge occurred at a distance of more than 3 NM from the nearest land.
			Where the vessel does not have a MARPOL approved sewage treatment plant, records of sewage not comminuted or disinfected are maintained in an Official Log Book (or similar) that records discharge locations and volumes and verifies that discharge occurred at a distance of more than 12 NM from the nearest land.
EPO-14 EPO-19 EPO-20	BAO-CM-6.7.3 Deck cleaning product selection according to MARPOL Annex V (and Marine Order 93: Noxious liquid)	Deck cleaning products planned to be released to sea from the vessels and FPSO meet the criteria for not being harmful to the marine environment according to MARPOL Annex V.	Safety Data Sheet and product supplier supplementary data as required show deck cleaning products comply with MARPOL Annex V.
			Records demonstrate the chemical selection process has been implemented for all deck cleaning chemicals.
			Completed FPSO and vessel inspection checklists.
			FPSO Deck Cleaning products will be approved on ChemAlert.
EPO-14 EPO-19 EPO-20	BAO-CM-6.7.4 FPSO firefighting foam selection is confirmed PFAS and PFOS free (on FPSO) and is selected in accordance with the Santos chemical selection process (Section 8.3.2.10)	Firefighting foam on board FPSO are PFOS- and PFAS free and risk-assessed through the Santos chemical selection process (Section 8.3.2.10).	Firefighting foam approved on ChemAlert, hold a valid SDS and completed Santos Chemical risk assessment.
EPO-13 EPO-14 EPO-19 EPO-20	BAO-CM-6.7.5 Apply the Santos chemical selection process for chemicals planned to be discharged (Section 8.3.2.10).	Chemicals planned to be discharged to sea are Gold/Silver/D or E rated through OCNS, or PLONOR substances listed by OSPAR, or have a complete risk assessment as per Santos Offshore Division Operations Chemical Approval Procedure so that only environmentally acceptable products are discharged.	Records demonstrate the chemical selection process (Section 8.3.2.10) has been implemented for all chemicals planned to be discharged.
EPO-14 EPO-19	BAO-CM-6.7.6	Pursuant to Marine Order 91, support vessels larger than 400 t and the FPSO will have an International Oil Pollution Prevention Certificate, which certifies that required measures to reduce impacts of planned oil discharges are in place	A copy of a current International Oil Pollution Prevention (IOPP) certificate

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-20	Routine discharges of treated bilge and deck water from vessels and FPSO will comply with Marine Order 91.	Machinery space bilge/oily water for support vessels larger than 400 t and the FPSO shall have IMO approved oil filtering equipment (oil/water separator) with an on-line monitoring device to measure Oil in Water (OIW) content to be less than 15 ppm prior to discharge.	Supplement to the IOPP Certificate that indicates that the vessel / FPSO has an approved oil / water separator with online monitoring calibrated to discharge at less than 15 ppm OIW (as relevant to relevant to vessel class and type).
		Oily mixtures (bilge water) only discharged to sea in accordance with Marine Order 91.	Evidence of a current and maintained Oil Record Book.
EPO-14 EPO-19 EPO-20	BAO-CM-6.7.7 FPSO deck drain system and bunding to reduce risk of off specification OIW reaching the marine environment	Preventative maintenance on FPSO bunding and associated equipment is installed in accordance with certificate of class.	Certificate of class. Inspection records demonstrate FPSO bunding is functioning as required.
		Bunds drain through to slops tanks for treatment less than 15 ppm before discharge with OIW analyser. Off-specification storage allows for recirculation and re-treatment.	Records demonstrating the FPSO has an approved oil / water separator with online monitoring calibrated to discharge at less than 15 ppm OIW.
EPO-13 EPO-14 EPO-19 EPO-20	BAO-CM-6.7.8 Controlled feed water flow by individual flow transmitters, to limit sodium hypochlorite in seawater discharge to 3 mg/L and periodic manual verification sampling of chlorine concentrations by the FPSO laboratory to ensure residual chlorine discharged is within limit (excluding shock dosing).	Cooling water flow transmitters, sampling points and analysis maintained in accordance with the FPSO Maintenance system and where required adjusted in accordance with required tolerances to ensure residual chlorine discharged is within limit. This range in concentrations will be only applied under normal operations (excluding any periods of maintenance or shock dosing).	Maintenance Records including validation, lab readings and calibration records.
EPO-06 EPO-17 EPO-18 EPO-20 EPO-21	BAO-CM-6.7.10 Waste Management Plan for management of controlled waste	The FPSO Waste Management Plan will be reviewed every two years and outlines the following requirements: • Requirements for the containment, labelling, stowage and transport of mercury waste and other hazardous/harmful wastes • Requirements of MARPOL Annex III (Prevention of Pollution of Harmful Substances Carries by Sea in Package Form) and the International Maritime Dangerous Goods Code (IMDG Code). • Role responsibilities for the management of mercury waste and other hazardous/harmful wastes.	Records demonstrate FPSO Waste Management Plan is approved and is reviewed every two years.
EPO-22 EPO-14	BAO-CM-6.7.11 Contractor contingency pipeline preservation procedure and specification	Contractor contingency pipeline preservation procedure and specification will be implemented and will include: • treatment chemicals selected will be Gold (OCNS) or pseudo-CHARM rated Gold • calculate the chemical treatment dosage to result in the discharge concentration not exceeding 550ppm • metering of water and chemical injection volumes during flooding and dewatering activities.	A copy of the contractor contingency pipeline preservation procedure and specification are aligned with requirements listed in the EPS of BAO-CM-6.7.11
			Records demonstrate the chemical selection procedure was implemented for all relevant chemicals.
			Records demonstrate that the chemical treatment product selected is a Gold (OCNS) or pseudo-CHARM rated Gold.
EPO-22 EPO-20	BAO-CM-6.7.12 Contractor contingency pipeline major repair procedure to be developed in the event a major repair is required	The contractor will develop a major repair procedure, in the case that a major repair is required, and will include management of treated seawater to reduce the likelihood of an unplanned treated sea water release.	Records confirm a pipeline major repair procedure (or similar) is in place in the event of a major repair is required and includes management of treated seawater.
EPO-22	BAO-CM-6.7.13 In the unlikely event that the pipeline requires contingency filling and subsequent dewatering of treated seawater in response to a rupture or stuck ILI tool event and prolonged repair, pipeline dewatering of treated seawater will be discharged via an arrangement orientated to promote dispersion and direct discharge away from seabed as far as practicable	Pipeline dewatering of treated seawater, if required, will be through an arrangement orientated to promote dispersion and direct discharge away from seabed as far as practicable.	Evidence of discharge arrangement orientated to promote dispersion and direct discharge away from seabed as far as practicable.

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-22	BAO-CM-6.7.14 In the unlikely event that the pipeline requires contingency filling and subsequent dewatering of treated seawater in response to a rupture repair or stuck ILI tool event and prolonged repair, water quality monitoring at the discharge location will be conducted to confirm the concentration and dispersion of treatment chemicals	Water quality monitoring at the discharge location at the time of discharge will be conducted to validate the dispersion plume forecast modelling and confirm the concentration and dispersion of treatment chemicals.	Water quality monitoring records verify that the concentration at sampling sites are consistent with the concentration predicted by dispersion modelling.
EPO-13	BAO-CM-6.8.1 PW is treated via primary and tertiary treatment stages to reduce OIW and mercury concentrations.	Primary and tertiary treatment systems for OIW removal and Hg removal installed & operational on the FPSO.	Inspection and maintenance records demonstrate primary (hydrocyclone and IGF) and tertiary (MPPE) treatment equipment installed and operational on the FPSO.
		The PW treatment system achieves performance target of >80% mercury removal during steady state operations	PW monitoring records demonstrate PW treatment system achieves performance target of >80% mercury removal during steady state operations
		The PW treatment system achieves performance target of <15 mg/L OIW over rolling 72-hour period when PW flowrate is 3,000 to 10,000 bbl/d and <25 mg/L OIW over rolling 72-hour period when PW flowrate is 10,000 to 20,000 bbl/d.	PW monitoring records demonstrate PW treatment system achieves performance target of <15 mg/L OIW over rolling 72-hour period when PW flowrate is 3,000 to 10,000 bbl/d or <25 mg/L OIW over rolling 72-hour period when PW flowrate is 10,000 to 20,000 bbl/d.
EPO-13	BAO-CM-6.8.2 Following 12 months of steady state production and then annually thereafter, OIW and mercury performance targets and limits will be reviewed to determine if they can be reduced further.	A review of OIW and mercury discharge targets and limits is conducted annually following 12 months of steady state production, and will include: A 12-month review of OIW and mercury monitoring data against performance targets and limits An assessment detailing if OIW and mercury targets and limits can be reduced for the following 12 months.	Records demonstrate that the reviews have been conducted as described.
EPO-13	BAO-CM-6.8.3 Online monitoring and/ or procedural controls in place to monitor and control PW discharge volume and OIW concentrations	Online monitoring and/or procedural controls in place to monitor and control PW discharge volume, OIW concentration, and prevent discharge of PW with high OIW concentration	PW management system including Alarm and Trip Schedule confirms details regarding inboarding of off-spec produced water, diverse set points, alarms, delays, suppression, start-up override, discrepancy alarms and other settings.
			Records demonstrate controls and procedure in place to prevent discharge of PW with OIW exceeding relevant limits.
EPO-13	BAO-CM-6.8.4 PW will not be discharged during steady state operations to the marine environment with an OIW content above 25 mg/L over a rolling 24-hour period when the PW production rate is between 3,000 and 10,000 bbl/d or with an OIW content above 30 mg/L over a rolling 24-hour period when the PW production rate is between 10,000 and 20,000 bbl/d.	If during steady state operations PW production rate is within 3,000 to 10,000 bbl/d and the OIW concentration exceeds 25 mg/L average over a rolling 24-hour period (either from the online OIW analyser or manual sampling), the off-specification PW will be diverted into the off-spec storage tank for re-treatment such that the PW will only be routed overboard when OIW is <25 mg/L over a rolling 24-hour period. If during steady state operations PW production rate is within 10,000 to 20,000 bbl/d and the OIW concentration exceeds 30mg/L average over a rolling 24-hour period (either from the online OIW analyser or manual sampling), the off-specification PW will be diverted into the off-spec storage tank for re-treatment such that the PW will only be routed overboard when OIW is <30 mg/L over a rolling 24-hour period.	Records demonstrate that if PW OIW content during steady state operations is above 25 mg/L over a rolling 24-hour period and the PW production rate is between 3,000 and 10,000 bbl/d or if PW OIW content during steady state operations is above 30 mg/L over a rolling 24-hour period and the PW production rate is between 10,000 and 20,000 bbl/d, then PW is diverted inboard, root cause of exceedance is investigated and responded to and PW only disposed when OIW content is below these limits.
EPO-13	BAO-CM-6.8.5 PW will be inboarded if mercury >10 ppbw is detected during initial start-up period or >8 ppbw detected during steady-state operations to reduce the potential environmental impact of PW discharge on the marine environment.	During the start-up period, PW is diverted inboard if mercury is detected >10 ppbw and not discharged overboard until mercury content <10 ppbw.	Records demonstrate that when mercury in PW exceeds 10 ppbw it is diverted inboard, root cause is investigated and responded to and PW only disposed when mercury content is <10 ppbw.
		During steady state operations PW is diverted inboard if mercury is detected >8 ppbw and not discharged overboard until mercury content <8 ppbw.	Records demonstrate that when mercury in PW is 8 ppbw or greater it is diverted inboard, root cause is investigated and responded to and PW only disposed when mercury content is <8 ppbw.

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-13	BAO-CM-6.8.6 PW will not be discharged at a rate above the maximum PW treatment system design rate (20,000 bbl/d) to ensure PW impacts are within acceptable levels	PW is discharged at a rate ≤20,000 bbl/d.	PW flowrate records demonstrate that PW is discharged at a rate ≤20,000 bbl/d.
EPO-13	BAO-CM-6.8.7 Implementation of PW Adaptive Management Plan (Appendix I) to reduce the potential impact of PW discharge on the marine environment.	Through the implementation of the PW Adaptive Management Plan, deviations in OIW concentrations between OIW analyser and onboard manual sampling are rectified.	Records show that when OIW concentration between the OIW analyser and the onboard manual sampling are trending away from each other, cleaning and other manufacturers recommendations, as required, have been implemented to rectify the deviation and onboard manual sampling is increased to 6 hours in the interim.
		Through the implementation of the PW Adaptive Management Plan, deviations in PW OIW concentration between the OIW analyser and NATA-accredited onshore laboratory results are rectified.	Calibration records show the onboard OIW analyser has been recalibrated in accordance with manufacturer's recommendations so that OIW concentrations from the OIW analyser and onboard manual OIW analysis equipment align with NATA-accredited laboratory results.
		Through the implementation of the PW Adaptive Management Plan, predicted concentrations of PW contaminants do not exceed ANZG (2018) 99% species protection (SP) default guideline values (DGVs) for marine water quality outside of the PW Mixing Zone.	Records show that an assessment has been undertaken and root cause / adaptive management measures applied, if required, as per Section 1.2 of the PW Adaptive Management Plan (Appendix I) such that exceedance of contaminant/s beyond the mixing zone is no longer predicted.
		Through the implementation of the PW Adaptive Management Plan, PW 99% species protection safe dilution factors (based on ecotoxicity testing) do not exceed the PW Mixing Zone.	Records show that an assessment has been undertaken and root cause / adaptive management measures applied, if required, as per Section 1.2 of the PW Adaptive Management Plan (Appendix I) such that 99% species protection safe dilution is not predicted beyond the mixing zone.
		Through the implementation of the PW Adaptive Management Plan, field water and sediment quality sampling results do not exceed the ANZG (2018) SP DGV (water quality) beyond the PW Mixing Zone or ANZG (2018) sediment quality guidelines.	Records show that an assessment has been undertaken and root cause / adaptive management measures applied, if required, as per Section 1.2 of the PW Adaptive Management Plan (Appendix I) such that additional exceedance of contaminant/s beyond the mixing zone is not predicted.
		Through the implementation of the PW Adaptive Management Plan, PW flowrate is managed so it does not exceed 20,000 bbl/d.	Records show that when flowrate forecasting or flowrate data exceeds 16,000 bbl/d, PW production is managed so as not to exceed the limit of 20,000 bbl/d
		New production chemicals are found acceptable for use as per the Santos chemical selection process and have triggered PW chemical characterisation as per the PW Adaptive Management Plan.	Records show that new process chemicals are approved under the Santos chemical selection process and PW chemical characterisation testing has occurred.
		Through the implementation of the PW Adaptive Management Plan, the following performance targets are met: • OIW concentration averages <15 mg/L over a rolling 3-day (72 h) period during steady state operations when PW production rate is 3,000 to 10,000 bbl/d and • OIW concentration averages <25 mg/L over rolling 3-day (72 h) period during steady state operations when PW production rate is 10,000 to 20,000 bbl/d.	Records of root cause investigation and response measures applied to reduce OIW to less than the performance targets.
		Through the implementation of the PW Adaptive Management Plan, the removal of mercury from PW by the PW treatment system is >80%	Records of root cause investigation and response measures applied, where practicable, to increase mercury removal to above the performance targets.
EPO-13	BAO-CM-6.8.8 OIW analyser and mercury analysis equipment calibration and maintenance to prevent discharge of off spec OIW to the marine environment.	Calibration of the OIW analyser and mercury analysis equipment in accordance with manufacturer's recommendations is undertaken.	Calibration records demonstrate the OIW analyser has been calibrated in accordance with manufacturer's specifications.
		OIW analyser original equipment manufacturer vendor undertakes a maintenance service of the analyser every two years (supplier recommended) to demonstrate that the analyser is fit for service.	OIW analyser maintenance records demonstrate analyser is fit for service. OIW analyser spare parts list and interchangeability record.

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-13	BAO-CM-6.8.9 Onboard manual laboratory sampling of PW to provide assurance that the PW discharged to the environment is reliably measured by the OIW analyser and to confirm mercury content in PW.	Onboard manual laboratory sampling of PW is undertaken approximately every 24 hours to verify readings from the OIW analyser.	Sampling records confirm laboratory sampling of PW OIW has been undertaken every 24 hours during permanent and temporary discharge.
		Onboard laboratory sampling procedures ensure onboard laboratory sampling is performed in a manner that prevents contamination of PW OIW and mercury samples and ensures results are reliable. Onboard sampling is undertaken in accordance with a relevant procedure that provides the requirements for sampling, including: • responsibilities • equipment • sampling frequencies • OIW and mercury specifications • testing method • clean-up and disposal of wastes.	Records demonstrate sampling has been undertaken in accordance with a relevant procedure.
		Calibration of the onboard laboratory sampling equipment is in accordance with manufacturer's recommendations which detail the calibration frequency.	Records demonstrate calibration of onboard sampling equipment has been undertaken in accordance manufacturer's recommendations which detail the calibration frequency.
		Onboard manual laboratory sampling and analysis of PW mercury content at sampling points before and after treatment is undertaken at the following frequencies: • Approximately every 24 hours during start-up • Approximately every 24 hours during steady state operations until 12 months of data is collected. Following 12 months of steady data the frequency may be adjusted to a maximum interval of 28 days if supported by an assessment showing frequency is appropriate for expected mercury content rate of change.	Sampling and analysis records confirm laboratory sampling of PW mercury content has been undertaken at sampling points at required frequency.
EPO-13	BAO-CM-6.8.10 Onshore National Association of Testing Authorities (NATA) laboratory sampling for chemical characterisation and ecotoxicity testing of PW in accordance with ANZG (2018)	NATA laboratory chemical characterisation and ecotoxicity within one month of completion of Final Performance Test (commencement of steady state operations) and then every 12 months while discharging. Additional chemical characterisation may occur if a PW risk assessment is triggered as per Section 1.2 of the PW Adaptive Management Plan (Appendix I)	Records confirm a sample has been taken for NATA laboratory chemical characterisation within one month of completion of Final Performance Test and then every 12 months while discharging.
		PW characterisation will measure the parameters outlined in Table 1-2 of the PW Adaptive Management Plan (Appendix I).	NATA-accredited laboratory reports include PW characterisation parameters as defined in Table 1-2 of the PW Adaptive Management Plan (Appendix I).
		PW ecotoxicity testing, in accordance with ANZG (2018) guidelines, will constitute an annual surrogate test (indicatively 2 species) and a 3-yearly multi species test (indicatively 8 species) with the 3-yearly multi species test being the first test conducted. Additional ecotoxicity testing may occur if a PW risk assessment is triggered as per Section 1.2 of the PW Adaptive Management Plan (Appendix I)	Annual NATA-accredited laboratory surrogate test report and 3-yearly multi species report.
EPO-13	BAO-CM-6.8.11 Produced water discharge receiving environment impact monitoring program to verify that impacts are not outside PW mixing zone and verify PW modelling	Water and sediment quality field sampling is undertaken within six months of achieving steady state production then every five years thereafter to verify that impacts are not outside PW mixing zone and verify PW modelling	Water and sediment quality field sampling records that water and sediment quality sampling has been undertaken within six months of achieving steady state production and then every five years thereafter.
		ANZG (2018) 99% Species Protection Default Guideline Values for water quality and ANZG (2018) sediment guideline values are not exceeded beyond the PW mixing zone.	Sampling records demonstrate that ANZG (2018) water and sediment guideline values are not exceeded outside the mixing zone.
		Water and sediment quality field sampling and analysis is undertaken in accordance with the protocols set within the Water and Sediment Quality Monitoring and Sampling Plan (Appendix J).	Water quality field sampling records and analysis show the protocols set in Appendix J have been followed.

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-13	BAO-CM-6.8.12 PW discharge modelling will be undertaken when triggered under adaptive management to verify levels of impact are within acceptable limits	PW dispersion modelling assessments are conducted when triggered under the PW Adaptive Management Plan (Appendix I) and will be performed using the MUDMAP model.	Records show PW modelling has been undertaken using the MUDMAP model when triggered under the PW Adaptive Management Plan (Appendix I).
		PW dispersion modelling verifies that 99% species protection safe dilutions are within the approved PW Mixing Zone (acceptable limits).	Modelling report shows 99% species protection safe dilutions within the approved PW Mixing Zone.
EPO-06 EPO-17 EPO-19 EPO-20 EPO-21	BAO-CM-7.1.1 Implement standards and procedures for lifting equipment to reduced risk of dropped objects during lifting.	Crane operations on the FPSO comply with relevant aspects of an operations procedure, which requires: • cranes are inspected by an authorised third-party inspector • routine crane maintenance is performed in accordance with the manufacturer's specifications • lifting over pipe work or process equipment is only approved by the Offshore Installation Manager after a risk assessment is undertaken • non-routine lifts are only undertaken after a risk assessment is undertaken and a lifting plan is developed • a pre-start check is completed that includes visual inspection of the entire crane to ensure there is nothing obstructing the operation of the crane • all cranes shall be operated by competent crane driver (or during training is supervised by a competent operator).	FPSO maintenance records show cranes are maintained and inspected in accordance with the operations procedure. Training records show crane operator is competent in accordance with the procedure. Risk assessment documentation for lifting over pipe work or process equipment or non-routine lifts. Completed crane pre-start checklist.
		FPSO lifting operations comply with a lifting operations procedure that specifies the minimum standards to be implemented and includes requirements on: • roles and responsibilities • lift planning • engineered lifts • permits and risk assessments • operational procedural guidelines lifting equipment (inspection and certification) • lift communications • training and competency.	Records and Lifting Equipment Register shows lifting equipment is certified.
		A vessel undertaking lifting activities that needs a Safety Case will have in place to manage lifts and avoid dropped objects: • an activity-specific lifting operations plan • a safety management system bridging document to the Barossa Safety Case • SIMOPS to manage interface with Barossa production operations, which includes permit to work interfaces, heavy lift exclusion zones and matrix of permitted operations • lifting equipment certification and inspection • lifting crew competencies • heavy-lift procedures • preventative maintenance on cranes.	Activity-specific lifting operations plan is in place. Safety management system bridging document is in place. SIMOPS is in place.
		A vessel undertaking lifting activities that do not require a Safety Case will have an activity-specific procedure in place to manage lifts and avoid dropped objects.	Activity-specific procedure includes management of lifts and avoidance of dropped objects.
		When safe and practicable objects dropped overboard are recovered per BAO-CM-7.1.2.	Fate of dropped objects detailed in incident documents.
EPO-06 EPO-17 EPO-19 EPO-20	BAO-CM-7.1.2 Dropped objects (incident) management	For all dropped objects, dropped object (incident) management includes the following: • assessment of environmental risk • assessment of feasibility of object recovery, where safe and practicable to do so	Incident documentation details the dropped objects management assessment, considerations and outcomes.

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-21		• implementing outcomes of the assessment.	
EPO-06 EPO-17 EPO-18 EPO-19 EPO-20 EPO-21	BAO-CM-7.1.3 International Maritime Dangerous Goods Code	Dangerous goods managed in accordance with International Maritime Dangerous Goods Code to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction.	Records demonstrate that dangerous goods carried on Registered Australian Vessels (RAVs) and foreign vessels are shipped in accordance with Marine Order 41 (Division 4, Regulation 16), and appropriate records including a completed multimodal dangerous goods form are kept.
EPO 18 EPO 19	BAO-CM-7.1.4 Chemicals and hydrocarbons will be managed in accordance with SDS to reduce risk of release to the marine environment	Chemicals and hydrocarbons managed in accordance with SDS in relation to safe handling and storage, spill response and emergency procedures, and disposal considerations.	Records of contractor vessel audits and/or inspections demonstrate compliance with chemical and hydrocarbon storage and handling requirements.
		The chemicals and hydrocarbons used on the FPSO will also be managed in accordance with the Chemical Management Procedure.	Accidental loss of chemicals overboard contained in incident documents.
EPO-06 EPO-17 EPO-19 EPO-20	BAO-CM-7.1.5 Mercury collection transport container	Decanted mercury is collected and stored within IMDG Code compliant and certified mercury collection transport containers (i.e. QC80s).	Mercury collection transport container specification and up to date certification records.
EPO-06 EPO-18 EPO-19 EPO-20	BAO-CM-7.1.6 Barossa FPSO Facility Safety Case	The Barossa FPSO Facility Safety Case will be in place to identify hazards that have the potential to cause a loss of containment (including as a result from dropped objects), detail the risks and identify physical barriers and safety management systems required to reduces risks to ALARP. If a loss of containment from the FPSO, associated subsea system or activity vessel was to occur, it will be managed in accordance with the Barossa FPSO Facility Safety Case, which details alarms and required emergency response in the event of a loss of containment.	Acceptance letter from NOPSEMA demonstrates acceptance of the Barossa FPSO Facility Safety Case. Records demonstrate alarms are maintained and emergency response enacted in accordance with Barossa FPSO Facility Safety Case.
EPO-07 EPO-18 EPO-19	BAO-CM-7.2.1 Develop and implement a FPSO-specific biosecurity management plan in consultation with and approved by the Department of Agriculture Forestry and Fisheries (DAFF).	Vessels and FPSO on contract to Santos are managed to low risk in accordance with the biosecurity management plan and Santos Offshore Division Invasive Marine Species Management Plan before movement or transit into or within the invasive marine species management zone, which requires: • compliance with the Biosecurity Act 2015 • assessment of applicable vessels using the IMS Management Plan risk assessment • the management of immersible equipment to low risk • accurately reporting information in accordance with Section 193 of the Biosecurity Act 2015 • compliance with the Biosecurity Status Document conditions • maintain a Biofouling Management Plan and Ballast Water Management Plan as required • read and understand the Biosecurity Status Document directions and conditions and keep a copy of the current version on board the vessel, for the duration of the voyage in Australia.	Record of Biosecurity Status Document for applicable vessels. Records show the FPSO Biofouling Management Plan and Ballast Water Management Plan have been adopted. Completed Pre-Arrival forms.
		FPSO has a valid International Anti-Fouling Systems (IAFS) Certificate.	International Anti-Fouling Systems (IAFS) Certificate.
		Vessels mobilising from international locations will complete an IMS risk assessment, before first mobilisation to the OAs, as described in Santos Offshore Division Invasive Marine Species Management Plan. The IMS risk assessment assigns a final risk category of low, acceptable, uncertain or high to vessels based on a range of information including last port of call, age of	Records of IMS risk assessment.

EPO no	Control measure	Environmental performance standard	Measurement criteria
		antifouling coating, internal sea water systems and niche management. If a risk category of uncertain or high is assigned, management responses will include inspections, cleaning or treatment of internal seawater systems (or a combination of these actions).	
		Vessels and FPSO receive entry clearance from DAFF (Seaports) as necessary (or as applicable to their location and movements).	Records show a completed Questionnaire for Biosecurity Exemptions for Biosecurity Control Determination issued to Seaports at least one month in advance where practicable. Letter received from DAFF indicating that the FPSO and vessels (as necessary) achieve a low IMS risk status and entry clearance is granted.
		Pursuant to the Biosecurity Act 2015 and Australian Ballast Water Management Requirements 2017, vessels and FPSO carrying ballast water and engaged in international voyages shall manage ballast water so marine pest species are not introduced.	Records show ballast water management is implemented.
			Completed ballast water record book or log is maintained.
		ROV footage acquired during the two-yearly turret and mooring ROV inspections and the five yearly FPSO hull underwater inspection in lieu of dry-docking (UWILD) and will be reviewed by IMS expert and upon identification of IMS appropriate cleaning will be initiated.	Records of hull, turret and moorings underwater inspections reviewed by IMS expert and upon identification of IMS appropriate biosecurity measures will be initiated.
EPO-07 EPO-18 EPO-19	BAO-CM-7.2.2 Vessels undertake ballast water management or treatment to achieve low risk ballast water.	Ballast water discharges will comply with the Australian Ballast Water Management Requirements (DAWE, 2020a), which implements the requirements of the Biosecurity Act 2015 (Cth) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (as appropriate for vessel class) The FPSO meets the D-2 discharge standard exemption requirements.	Records demonstrating a ballast water record system (electronic or in hard copy) is maintained.
			If the vessel cannot demonstrate it meets D-2 standards, records of ballast water discharge logs confirm no discharge within 12 nautical miles of coastlines including any ports. Note: FPSO has an approved exemption in place from DAFF not to comply with Regulation D2.
			An International Ballast Water Management Certificate is in place for vessels and demonstrates the principal ballast water management method is in accordance with D-2 standards.
			A Biosecurity Status Document showing an approved ballast status (for vessels arriving from international locations) or a low-risk exemption through a domestic ballast water risk assessment (for domestic vessels).
			Ballast water exchange has been conducted as per the FPSO Ballast Water Management Plan.
EPO-07 EPO-18 EPO-19	BAO-CM-7.2.3 Vessels equipped with effective anti-fouling coatings.	Vessels will have a suitable anti-fouling coating in accordance with the Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 (Cth) (as applicable for vessel class and type), including: • Marine Order 98 (Marine Pollution – Anti-fouling Systems) including (as required by vessel class): • a valid international anti-fouling system certificate. • Vessel and FPSO anti-foulant system maintained in compliance with International Convention on the Control of Harmful Anti Fouling Systems on Ships where applicable.	A copy of an approved international anti-fouling system certificate, as relevant to each vessel class and type.
EPO-07 EPO-18 EPO-19	BAO-CM-7.2.4 Vessels equipped with Marine Growth Prevention System (MGPS)	FPSO and vessels will have a marine growth prevention system or appropriate manual treatment systems.	Biosecurity management records demonstrate FPSO and vessels have a marine growth prevention system or appropriate manual treatment systems.
EPO-07 EPO-19	BAO-CM-7.2.5	FPSO hull will be cleaned prior to entering Australian waters, and a Biofouling Risk Assessment shall be completed. The completed Vessel Check must meet an Overall	Marine Biologist report stating FPSO hull has been cleaned and an 'in-date' Vessel Check Report indicating a 'Low' overall risk status.

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-20	Inspection and cleaning of FPSO hull prior to entering Australian waters under the direction of appropriately qualified marine biologist.	Risk Status of Low prior to entering Australian waters, thus reducing any potential risk of introducing IMS to the Operational Area.	
EPO-07 EPO-19 EPO-20	BAO-CM-7.2.6 Biosecurity inspection of FPSO topside prior to departure from last international port	Pre-departure topside biosecurity inspection will be completed to provide recommendations to assist with FPSO mobilisation and confirmed low biosecurity risk status reduces any potential risk of introducing IMS to the Operational Area.	Records show a topside biosecurity inspection report prior to FPSO departure confirming a 'Low' overall risk status.
		Ship Sanitation Control Exemption Certificates issued in accordance with Article 39 of the International Health Regulations (2005).	Records show a Ship Sanitation Certificate confirming a 'Low' overall risk status and that no eradication programme is required.
EPO-07 EPO-19 EPO-20	BAO-CM-7.2.7 Pest monitoring program of FPSO topsides commencing prior to mobilisation to the OA and through to Operations	Pest monitoring program of FPSO topside commencing prior to mobilisation to the OA and through to Operations will be undertaken to conduct surveillance, identify if any eradication program is necessary and confirmed low biosecurity risk status. This aims to reduce any potential risk of introducing IMS to the Operational Area.	Records show a pest monitoring and eradication program of FPSO topsides is implemented from prior to mobilisation
		Ship Sanitation Control Exemption Certificates issued in accordance with Article 39 of the International Health Regulations (2005).	Records show a Ship Sanitation Certificate confirming a 'Low' overall risk status and that no eradication programme is required.
EPO-07 EPO-19 EPO-01	BAO-CM-7.2.8 Removal of loose timber that is not treated to ISPM 15 international standard	The Biosecurity (Exposed Conveyances – Exceptions from Biosecurity Control) Determination 2016 is DAFF's policy approach to offshore installations. The Determination is a legislative instrument made under section 196(2) of the Biosecurity Act 2015 (Act). To assist with low risk determination of the FPSO; • International Standards for Phytosanitary Measures No. 15—Regulation of wood packaging material in international trade complied with.	Biosecurity Consultant Inspection Report confirming internationally recognised certification mark that is applied to wood packaging verifies that it has been treated and is compliant with the ISPM 15 standard.
EPO-07 EPO-19 EPO-01	BAO-CM-7.2.9 Deep clean of FPSO galley to remove any potential biosecurity risk material during the voyage from the last port to the OA and on arrival at the OA	The Biosecurity (Exposed Conveyances – Exceptions from Biosecurity Control) Determination 2016 is DAFF's policy approach to offshore installations. The Determination is a legislative instrument made under section 196(2) of the Biosecurity Act 2015 (Act). To assist with low-risk determination of the FPSO; • Deep clean of FPSO galley to remove any potential biosecurity risk material will be undertaken during the voyage from last port to the OA and on arrival at the OA.	Biosecurity Consultant Inspection Report or cleaning report demonstrates 'low-risk' nature of the FPSO during the voyage from the last port to the OA and on arrival at the OA.
		Ship Sanitation Control Exemption Certificates issued in accordance with Article 39 of the International Health Regulations (2005).	Records show a Ship Sanitation Certificate confirming a 'Low' overall risk status and that no eradication programme is required.
EPO-19	BAO-CM-7.3.1 Seawater extraction (engineering control)	Seawater is extracted at a depth of 70m, through flexible hoses with 15mm mesh screens to eliminate the potential for marine fauna to become entrained within the Seawater extraction system.	Seawater intakes are installed as per design and records demonstrate that marine fauna have not entered the system.
EPO 18 EPO 19	BAO-CM-7.4.1 ROV operations undertaken in accordance with good industry practice.	Scheduled preventive maintenance on ROV completed as per manufacturer specifications to reduce the risk of hydraulic fluid releases to sea.	Vessel contractor written verification demonstrates compliance with manufacturer specifications.
		ROV pre-mobilisation audit completed to reduce the risk of hydraulic fluid releases to sea.	Records show a pre-mobilisation audit completed for all ROV operations.
EPO-17 EPO-18 EPO-19	BAO-CM-7.4.2 Bulk liquid transfer procedure	Bunkering operation procedure is in place and includes key requirements to prevent spills to the environment such as: • when bunkering activities can occur (hose connection restricted to daylight hours) • roles and responsibilities for bunkering operations • hoses have dry break couplings • bunkering activity communication requirements • hose integrity inspection • requirement to be DP Class 2 vessels.	Records show a completed bunkering checklist prior to any bunkering is undertaken.

EPO no	Control measure	Environmental performance standard	Measurement criteria
EPO-19 EPO-20	BAO-CM-7.4.3 FPSO and vessel spill response plans (SOPEP/SMPEP)	FPSO and vessels have and implement checklists and a SOPEP or SMPEP pursuant to MARPOL Annex I. These measures reduce the likelihood of a spill entering the marine environment is reduced.	Approved SOPEP or SMPEP in place.
			Spill details contained in incident documentation.
		Spill response exercises conducted in accordance with SOPEP/SMPEP to ensure personnel are prepared.	Spill exercise records or evidence of a spill exercise aligned with the vessel SOPEP/SMPEP requirements.
		Mercury spill kits are provided on board the FPSO and included in BWO SMPEP.	FPSO maintenance records show mercury spill kits available and maintained in accordance with manufacturers guidance.
EPO-17 EPO-18 EPO-19	BAO-CM-7.4.4 Spill clean-up kits available in high-risk areas	Selection of vessel contractor is subject to Santos marine vessel vetting processes, specifically spill kits stocked and ready for use by trained personnel in the event of a spill to the marine environment.	FPSO and vessel audit process confirm spill kits stocked and ready for use in accordance with the manufacturer's guidance.
		Mercury spill kits are provided and maintained on board the FPSO and included in BWO SMPEP.	FPSO maintenance records show mercury spill kits available and maintained in accordance with the manufacturer's guidance.
EPO-18 EPO-19	BAO-CM-7.4.5 Helicopter refuelling procedure	Helicopter refuelling procedures will be in place and will include: • completed permit to work and/or job safety analysis for the activity • continual visual monitoring of gauges, hoses, fittings and the sea surface during the activity • hose and fitting checks before starting the activity • weather conditions to be assessed before the activity.	Records demonstrate refuelling procedure in place, inclusive of the matters specified, and all criteria within the Refuelling procedure has been followed.
EPO-06 EPO-17 EPO-19 EPO-20	BAO-CM-7.4.6 Mercury Management Plan	The Mercury Management Plan will be implemented and includes controls for reducing risk of mercury exposure/contamination during working on dry gas, wet gas or liquid systems and outlines the following requirements: • Guidelines and instrumentation for conducting monitoring mercury in the atmosphere, on surfaces and in solids/liquids. • Mercury contamination controls for any tasks involving potential mercury contact • Spill kit, spill response and mercury waste disposal requirements • Mercury training requirements • Mercury management roles and responsibilities.	Approved Mercury Management Plan meeting content requirements
			Records demonstrate that controls for reducing risk of mercury exposure/contamination, as per the Mercury Management Plan, are implemented when working on dry gas, wet gas and liquid systems.
EPO-06 EPO-17 EPO-19 EPO-20	BAO-CM-7.4.7 Mercury monitoring/ sampling equipment	Mercury monitoring/ sampling equipment for atmospheric, surface and soil/liquid monitoring/sampling as per the Mercury Management Plan is available on the FPSO.	Register of Mercury monitoring/ sampling equipment confirms availability.
EPO-06 EPO-17 EPO-19 EPO-20	BAO-CM-7.4.8 Mercury hazard awareness training	Mercury hazard awareness training package will include: • Hazards associated with mercury in the process • Controls to prevent exposure or contamination/spillage of mercury • Mercury testing requirements and emergency response procedures	Mercury hazard awareness training package meets content requirements
		Training on mercury hazard awareness provided every 3 years to all personnel that may encounter mercury or who plan or supervise work potentially involving mercury.	Mercury hazard awareness training completion records
EPO-06 EPO-17 EPO-19 EPO-20	BAO-CM-7.4.9 Mercury Register/ Mercury Map	A mercury register/map covering all areas of equipment or areas of pipe-work where mercury has been detected shall be maintained for the facility. The mercury register shall contain the following information, as a minimum: • Process equipment identification details (pipe-section, valve, vessel etc) • Process area details	Up to date mercury register/map meeting content requirement

EPO no	Control measure	Environmental performance standard	Measurement criteria
		• Date of testing / detection (including occupational exposure monitoring results) • Work activity • Details of products found i.e. vapour/ liquid / sludge / crystal • Details of analysis conducted, results (in vapour, liquid or solid, species) and Reference specific reports • Details of purging / preparation techniques employed prior to testing (i.e. steam vent, water washed, diesel flushed)	
EPO-18 EPO-19 EPO-20	BAO-CM-7.5.1 FPSO hull integrity	The FPSO hull integrity will be confirmed prior to mobilisation via: • being double-sided and -bottomed design, providing multiple physical barriers between hydrocarbon containing tanks and the marine environment, and • maintain a class certification.	FPSO class certification is current and in force, confirming the hulls stress and vessel stability within integrity limits. Class certification will be maintained throughout the life of the Activity.
EPO-09 EPO-18 EPO-19 EPO-20	BAO-CM-7.6.1 Emergency response plan (ERP)	ERP details the requirements for preparedness and response to emergencies and crises to protect people and the environment. ERP is initiated to activate isolation of the flowline, pipeline and wells in the event the integrity of a pipeline and valve is compromised or there is an unplanned hydrocarbon release.	Completed incident documentation shows ERP implemented as applicable if triggered by a release of hydrocarbons.
EPO-09 EPO-18 EPO-19 EPO-20	BAO-CM-7.6.2 Pipeline operating procedures	The Pipeline is operated within design envelope and maintained consistent with the Pipeline operating procedures reducing the potential of a pipeline rupture/subsea leak and hydrocarbon release.	Record logs show pipeline operation has been in accordance with the relevant procedure. Inspection, review and maintenance records.
EPO-09 EPO-18 EPO-19 EPO-20	BAO-CM-7.6.3 Pipeline Integrity Management Plan	The integrity of the pipeline is maintained consistent with the Pipeline Integrity Management Plan reducing the potential of a pipeline rupture/subsea leak and hydrocarbon release.	Pipeline maintenance and inspection records.
EPO-09 EPO-18 EPO-19 EPO-20	BAO-CM-7.6.4 Gas Export Pipeline Safety Case	Gas Export Pipeline Safety Case will be in place to identify hazards that have the potential to cause a loss of containment, detail the risks and identify physical barriers and safety management systems required to reduces risks to ALARP. If a loss of containment from the Pipeline was to occur, it will be managed in accordance with the Gas Export Pipeline Safety Case, which details alarms and required emergency response in the event of a loss of containment.	Acceptance letter from NOPSEMA demonstrates acceptance of the Safety Case. Records demonstrate alarms are maintained and emergency response enacted in accordance with Gas Export Pipeline Safety Case.
EPO-09 EPO-18 EPO-19 EPO-20	BAO-CM-7.6.5 Repairs to the Pipeline carried out to design specification	Pipeline repairs are carried out consistent with design specifications, including Pipeline Integrity Management Plan and Offshore Standard for Submarine Pipeline Systems, ensuring that infrastructure integrity remains in line with standards and specifications. The above reduced the possibility of a release of hydrocarbons resulting from a loss in infrastructure integrity.	Records demonstrate repairs to the Pipeline carried out in accordance with the Pipeline Integrity Management Plan and DNV Offshore Standard for Submarine Pipeline Systems.
EPO-04 EPO-18 EPO-19 EPO-20	BAO-CM-7.6.6 MODU station keeping system during concurrent activities	For concurrent activities under accepted Drilling and Completions EP the MODU station keeping system maintains the MODU at the desired location.	No station keeping incidence recorded.
		Anchors positioned and maintained at locations defined in the MODU mooring analysis to reduce risks to seabed habitat and petroleum infrastructure	Completed Mooring Report (supplied by the MODU/vessel contractor) demonstrates that intended positions were maintained.
		All parts of the MODU mooring system deployed to sea are recovered within three months of MODU departure to mitigate consequences from objects remaining in the marine environment.	Mooring recovery recorded in daily vessel report. supplied by the MODU/vessel contractor

EPO no	Control measure	Environmental performance standard	Measurement criteria
		Positioning of the MODU will be undertaken in accordance with the mooring design and analysis and the drilling contractors' rig move procedure, which includes procedures for the deployment and retrieval of anchors using support vessels to minimise seabed disturbance.	Procedures for the deployment and retrieval of anchors are Implemented by the MODU/vessel contractor.
EPO-18 EPO-19 EPO-20	BAO-CM-7.6.7 MODU identification systems during concurrent activities	For concurrent activities under accepted Drilling and Completions EP with a MODU, an AIS to aid in its detection at sea, reducing the potential of vessel interaction/collisions.	Noted in inspection report or statement of conformance supplied by MODU/vessel contractor.
EPO-18 EPO-19 EPO-20	BAO-CM-7.6.8 MODU move procedure during concurrent activities	For concurrent activities under accepted Drilling and Completions EP with a MODU, the move procedure contains a passage plan. No accidental contact with the seabed and subsea infrastructure during the MODU move.	MODU move procedure supplied by MODU/vessel contractor. Details contained in incident documents. Supplied by MODU/vessel contractor.
EPO-18 EPO-19 EPO-20	BAO-CM-7.7.8.1 FPSO Hull tank inspection and maintenance regime	The FPSO hull tank inspection and maintenance regime as outlined in the Hull structure integrity management plan, supported by the Hull Risk Based Inspection (RBI) study assures FPSO hull integrity and reduces potential for the release of condensate/MDO/MGO in the event of collision or loss of hull integrity.	FPSO maintenance records indicate FPSO tank testing and inspection schedules and status.
EPO-18 EPO-19 EPO-20	BAO-CM-7.7.8.2 Emergency Shutdown and blowdown systems	Emergency shutdown and blowdown systems are maintained and confirmed to be functioning through function testing and inspection. • Maintenance system provide details about: • performance criteria • equipment to be tested • nominal testing frequencies and intervals • pass/fail criteria • work instructions. The above, aim to assure equipment can initiate blowdown and shutdown on hydrocarbon containing equipment to prevent and minimise release volumes to the environment.	FPSO maintenance records detail testing and inspection schedules along with current status as per the most recent inspection.
EPO-18 EPO-19 EPO-20	BAO-CM-7.7.8.3 FPSO unplanned gas release escalation prevention controls – blowdown system functionality	Blowdown system is maintained and confirmed to be functioning through function testing and inspection criteria, to prevent unplanned gas release escalation by rapid depressurisation of process inventories. • Blowdown equipment includes: • blowdown valves • flare tip integrity • nitrogen flare purge valves.	FPSO function testing and inspection schedules.
EPO-18 EPO-19 EPO-20	BAO-CM-7.7.8.4 Barossa Terminal Handbook, including pilotage procedure	Offtakes are undertaken within defined safe weather limits, as specified in the Barossa Terminal Handbook, which details limitations to swell height and wind speed, ultimately reducing risk of collision due to adverse weather. Note the final berthing decision will be made by the Pilots and the FPSO. Offtake berthing requirements that are defined include: • completion of a pre-berthing toolbox talk before each offtake, which includes a check of the key controls, functioning equipment and communication which mitigate against vessel to vessel interaction and loss during condensate transfers.	Weather records demonstrate safe operating conditions offtake period meeting requirements of the Terminal Handbook Offtake vessel will produce daily reports detailing compliance with Terminal Handbook requirements.
	BAO-CM-7.7.8.5 Barossa Terminal Handbook, including offtake operations	Offtakes will be undertaken in line with Barossa Terminal Handbook requirements, including: • requirement that the floating hose is of double-carcass structure and fitted with a butterfly valve (emergency release coupling) on the connection between the floating hose and the hose reel	Floating hose inspection records confirm hose design requirements are met. Offtake vessel will produce daily reports detailing compliance with Terminal Handbook requirements.

EPO no	Control measure	Environmental performance standard	Measurement criteria
		• completion of the Offtake Operations Checklist, which includes a check that the key equipment and communications mitigating a release to the environment are in place.	
EPO-18 EPO-19 EPO-20	BAO-CM-7.7.8.6 Inspection of hydrocarbon containing equipment	The Barossa Project Integrity Management Plan – Subsea is implemented to ensure subsea infrastructure integrity is maintained, reducing likelihood of release to the marine environment and to ensure Santos can meet obligations under s.572 of the OPGGS Act. The plan includes: • inspection frequencies aligned with Risk-Based Inspection (RBI) plan, including 3-to 5-yearly general visual inspections (GVI), at a minimum, of hydrocarbon-containing elements of the subsea production system and associated pipelines where applicable • inspections methodologies (including close visual inspection [CVI], cathodic protection [CP] survey, ILI) are applied based on component type and integrity risk • post-cyclone survey requirements, after a significant cyclonic event.	Campaign-specific inspection records demonstrate ongoing inspection and maintenance with the Barossa Project Integrity Management Plan – Subsea. FPSO maintenance records detail testing and inspection schedules along with current status as per the most recent inspection. Integrity records detailing CP surveys and inspection campaigns, including inspection schedules and the current status of the CP, as recorded during the most recent inspection. Any finding, maintenance or future monitoring will also be recorded and presented within the Maintenance records.
EPO-19 EPO-20	BAO-CM-7.7.8.7 NOPSEMA-accepted Barossa Production Operations Oil Pollution Emergency Plan (OPEP)	In the event of an oil spill to sea, the Barossa Production Operations OPEP requirements are implemented to mitigate environmental impacts.	Completed incident documentation shows the Barossa Production Operations OPEP implemented as applicable.
EPO-18 EPO-19 EPO-20	BAO-CM-7.7.8.8 Inspection and integrity monitoring of risers	Inspection and monitoring of risers undertaken 3 yearly (as per the Subsea and Pipelines Performance Standard). Inspection results confirm risers intact with no seawater ingress and riser buoyancy modules remain in position with no observed or recorded slippage.	Inspection reports confirm riser integrity and that inspection is completed in accordance with schedule.
EPO-18 EPO-19 EPO-20	BAO-CM-7.7.8.9 Mooring equipment integrity verified and maintained in accordance with the Mooring Line Monitoring System (MLMS), preventing interaction with risers and subsequent release of hydrocarbons	The vessel excursion system monitors the FPSO position and heading relative to its safe operating envelope. The MLMS detects failure of a mooring line attached to the STP buoy. Mooring lines and connectors are installed with designed dimension and service life limits. Mooring equipment is inspected at an appropriate frequency (or after significant weather event) to monitor condition and availability of the system. These monitoring systems and activities ensure the FPSO mooring system meets its designed integrity requirements and prevents interaction with the risers.	Vessel excursion or mooring line failure is alarmed in the Central Control Room (CCR). Historical trends reviewed as part of integrity management. Records confirm and demonstrate FPSO class certification.
EPO-18 EPO-19 EPO-20	BAO-CM-7.7.8.10 FPSO position monitoring to identify loss of FPSO position	Vessel excursion system monitors the FPSO position and heading using a combination of Global Navigation Satellite System (GNSS) and Motion Reference Unit (MRU) data. The system displays real-time vessel position against subsea infrastructures and pre-set excursion envelopes and raises an alarm in the Central Control Room (CCR) when the vessel moves outside these envelopes. - Vessel excursion system function test – 3-monthly - Inspection of GNSS antennas/receivers, MRU, panel and workstation by competent person – Yearly	FPSO maintenance records indicate function testing and inspection performed as required.
		All mooring lines links have inclinometers installed which transmit inclination value every 5 minutes using hydroacoustic communication link. The Mooring Line Monitoring System (MLMS) raises an alarm in the CCR when an inclination indicating line failure is detected. - Recent data collection reviewed, and system integrity checks completed on system – 3-monthly	FPSO maintenance records indicate data review and integrity checks.
		On vessel excursion system alarm activation, the following actions are taken: OIM informed and initiation of BW Opal Emergency Response Plan Emergency shutdown system (ESD) and blowdown activated to minimise hydrocarbon inventory onboard FPSO and isolation from subsea and wells FPSO position monitoring for further drift.	Asset reporting and incident reporting indicates actions were taken in response to vessel excursion system alarm activation.

EPO no	Control measure	Environmental performance standard	Measurement criteria
		IMMR vessels mobilised for inspection of moorings and risers and rectification work as required • NOTE: As installed, the mooring system can maintain position of the FPSO during 100-year storm conditions with a single line failure. With the failure of two mooring lines, the system can maintain FPSO in position during 10-year storm conditions	
EPO-18 EPO-19 EPO-20	BAO-CM-7.7.8.11 SIMOPS Plans, Procedure and Safe Operating Envelope	Vessels undertaking a project or campaign activity will comply with a SIMOPS plan and activity-specific work procedures to reduce potential for interactions between FPSO operation and project or campaign activities.	Records show SIMOPS plans implemented for vessels undertaking a project or campaign activity as required.
EPO-18 EPO-19 EPO-20	BAO-CM-7.7.8.12 Production flowline monitoring	A low-pressure trip will occur if the measured value reaches the trip set point, which will stop the gas export compressors, close the SSIV and alert the CCR technicians to the upset condition.	FPSO control system historian show flowline pressure remains within pre-determined operational range.
EPO-18 EPO-19 EPO-20	BAO-CM-7.7.8.13 NOPSEMA accepted WOMP	The Well Operating Management Plan manages well integrity, and all wells will be in compliance with the NOPSEMA-accepted WOMP at all times. The WOMP includes control measures to manage well integrity risks to ALARP, including: • barriers in place to isolate hydrocarbons from the marine environment • inspection, monitoring and testing of barriers over the life of the well • response to increases in well integrity risk • notification and reporting requirements. The accepted WOMP is implemented, and well integrity notification and reporting are undertaken in accordance with the Regulations (as applicable).	Regulator-accepted (NOPSEMA) WOMP includes control measures for well integrity. Records demonstrate applicable NOPSEMA notification and reporting. Incident records confirm no breach of containment. Computerised maintenance management system records demonstrate inspection and maintenance activities are compliant with the WOMP.
EPO-18 EPO-19 EPO-20	BAO-CM-7.7.8.14 Source Control Plan during concurrent activities with MODU	Prior to drilling with a MODU (under the accepted Drilling and Completions EP) there will be a source control plan in place to ensure source control arrangements are effectively and efficiently implemented in order to reduce the volume of hydrocarbons released to the environment.	Records demonstrate that a Source Control Plan is supplied by Drilling & Completions prior to MODU activities and where, required, implemented as in accordance with the plan.
EPO-18 EPO-19 EPO-20	BAO-CM-7.7.10.1 Radio communication prior to entering PSZ	Communications between the FPSO and vessels entering the petroleum safety zone is established prior to vessels entering reducing the possibility of vessel collisions. Vessels requesting entry to the 500m safety zone are required to complete a pre-entry checklist.	Record logs will show communications between the FPSO and vessels entering the PSZ have been established, and completion of a pre-entry checklist.

8.2 Plan

The activities covered under 'Plan' describe an established and defined environmental management system, leadership commitments, and specific measures in the EMS that demonstrate how the activity will be managed and monitored to ensure that the EPOs and EPSs are met, within an ALARP performance target setting framework.

8.2.1 Environmental Management System

OPGGS(E)R 2023 Requirements
Section 22 Implementation strategy for environment plan
Environmental management system 22(2) The implementation strategy must contain a description of the environmental management system for the activity, including specific measures to be used to ensure that, for the duration of the activity: (a) the environmental impacts and risks of the activity continue to be identified and reduced to a level that is as low as reasonably practicable; and (b) control measures detailed in the environment plan are effective in reducing the environmental impacts and risks of the activity to as low as reasonably practicable and an acceptable level; and (c) environmental performance outcomes and environmental performance standards in the environment plan are being met.

Santos as a titleholder and Operator of the Barossa facilities, inclusive of the FPSO and subsea infrastructure (including the GEP) is accountable for implementation and compliance with this Environment Plan. BW Offshore (BWO) is the owner of the BW Opal FPSO and provides crewing for its day-to-day operation and maintenance under a service contract with Santos.

Santos operates the Barossa facilities in accordance with an asset-specific management system: the Barossa Management System (BMS). The BMS is the environmental management system for the Activity. The BMS provides the framework and sets the mandatory requirements to manage and operate the Barossa facilities, including complying with the requirements of this EP.

8.2.1.1 Barossa Management System

The Barossa Management System integrates the relevant parts of the Santos and BWO management systems into a cohesive framework through the alignment of policies, standards and procedures.

Given the FPSO is provided under a service contract from BWO, the Barossa Management System was developed to leverage the BWO management system for the FPSO. The Barossa Management System comprises:

- BWO documents, procedures, and applications from the BWO management system that apply to Barossa FPSO work activities; and
- Santos documents from the Santos Management System that apply to operation of the Barossa subsea infrastructure and supporting activities.

The BMS supports implementation of EP requirements. The BMS also meets the minimum requirements of the Santos Policies and Operating Standards related to environment, health, and safety (EHS), and security. Santos as the operator of the Barossa facilities is accountable for the health and safety of all personnel, and the environmental performance of the Barossa facilities.

To ensure that all users and stakeholders of the BMS can identify and access applicable management system documentation for respective Barossa infrastructure and activities, the Barossa Management System Interface Plan serves to clearly explain the system hierarchy, scope boundaries and content of the BMS. The BMS is jointly managed by BWO and Santos and is hosted in an online location accessible to all persons engaged in Barossa related activities.

Future changes to BMS documentation and tools are managed via a change management process (Section 8.5.5). If the change under consideration results in an EP requirement no longer being met, or if a conflicting requirement is proposed for implementation, such changes are required to be assessed via the EP MoC process (Section 8.5.2) to determine if an EP revision or resubmission is required.

All field work, including subsea operations, is controlled by the FPSO Permit Process (Section 8.3.2.4), and all environmental incidents are recorded in Santos' incident management database.

The Santos Risk Matrix is the foundation for all risk assessments and management of change activities. BWO risk assessment and management of change applications are used for the FPSO, with Santos' systems applied to subsea infrastructure and the GEP. Where a risk assessment or management of change is required to span both topsides and subsea, the Santos application governs the overall process. BWO risk assessment and management

of change processes align with the Santos Risk Matrix. Risk management processes are further described in Section 8.3.2.1.

The BMS implements the requirements of this EP at the Barossa facilities through the relevant, standards, procedures, processes, and tools. This includes:

- The standards, procedures, and tools for FPSO operations. These standards, procedures and tools satisfy the minimum EHS requirements of Santos' Policies and Operating Standards and key procedures, and the requirements of this EP.
- The Santos standards, procedures, and tools for operating the subsea infrastructure.
- The Santos standards, procedures, and tools for business and supporting activities, including logistics / helicopter operations, drilling and completions activities, project management, etc.

Specific standards, procedures, processes and tools relevant to implementation of this EP, are described in the subsequent sections of the implementation strategy.

The BMS is continually improved and updated over the life of the Activity, responding to learnings from internal or industry wide incidents, changes in technology, regulations, processes, plant, and systems.

The Santos General Manager – Darwin is accountable for implementation of the BMS.

Figure 1-1 presents the key aspects of the BMS.

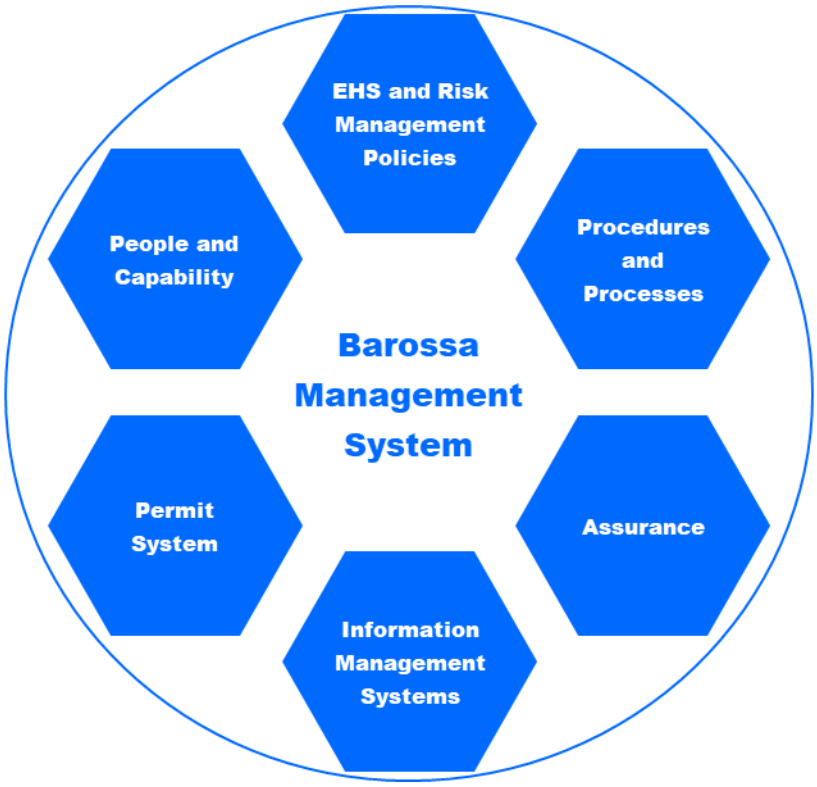


Figure 8-1: Key elements of the Barossa Management System

8.2.1.2 Environment, health and safety policy

Santos' Environment, Health and Safety Policy (Appendix A) clearly sets out Santos' strategic environmental objectives and the commitment of the management team to continuously improving environmental performance. This EP has been prepared in accordance with this policy.

8.2.1.3 Standards, procedures and tools

The standards, processes, procedures, and tools contained within the BMS, support the implementation of control measures to achieve environmental performance outcomes and standards identified in this EP. EP requirements have been mapped to relevant standards, processes, procedures and tools within the BMS, and those relevant to EP implementation are described in the subsequent sections of the implementation strategy. For example, processes for equipment maintenance and mercury management to manage related impacts/risks of the Activity.

8.2.2 Leadership, Accountability and Responsibility

OPGGS(E)R 2023 Requirements
Section 22 Implementation strategy for environment plan
Responsibilities of employees and contractors 22(3) The implementation strategy must establish a clear chain of command, setting out the roles and responsibilities of employees and contractors in relation to the implementation, management and review of the environment plan, including during emergencies or potential emergencies.

8.2.2.1 Organisation

Figure 8-2 presents the indicative Barossa offshore organisation structure in place throughout all activities conducted under this EP.

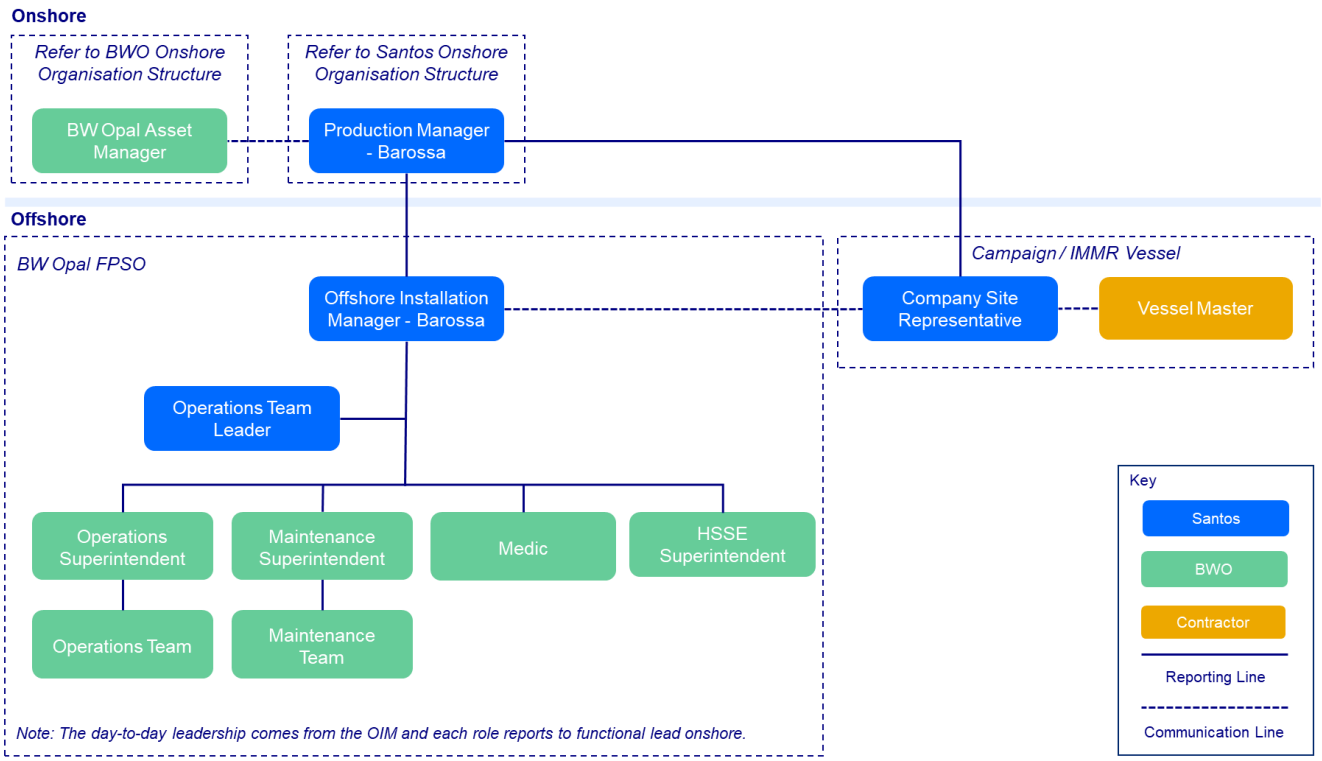


Figure 8-2: Barossa Offshore Organisation Structure[55]

In OA1 the primary interface between the Santos and BWO onshore support teams is between the Production Manager – Barossa and the BWO Asset Manager.

In OA2 the primary interface between the Santos and Campaign/ IMMR vessel is between the Santos IMMR Project Manager and the Santos Company Site Representative.

Figure 8-3 and **Figure 8-4** present the indicative Barossa onshore organisation structures for the operations phase.

[55] *All organisation charts used in this EP are accurate at the time of submission.*

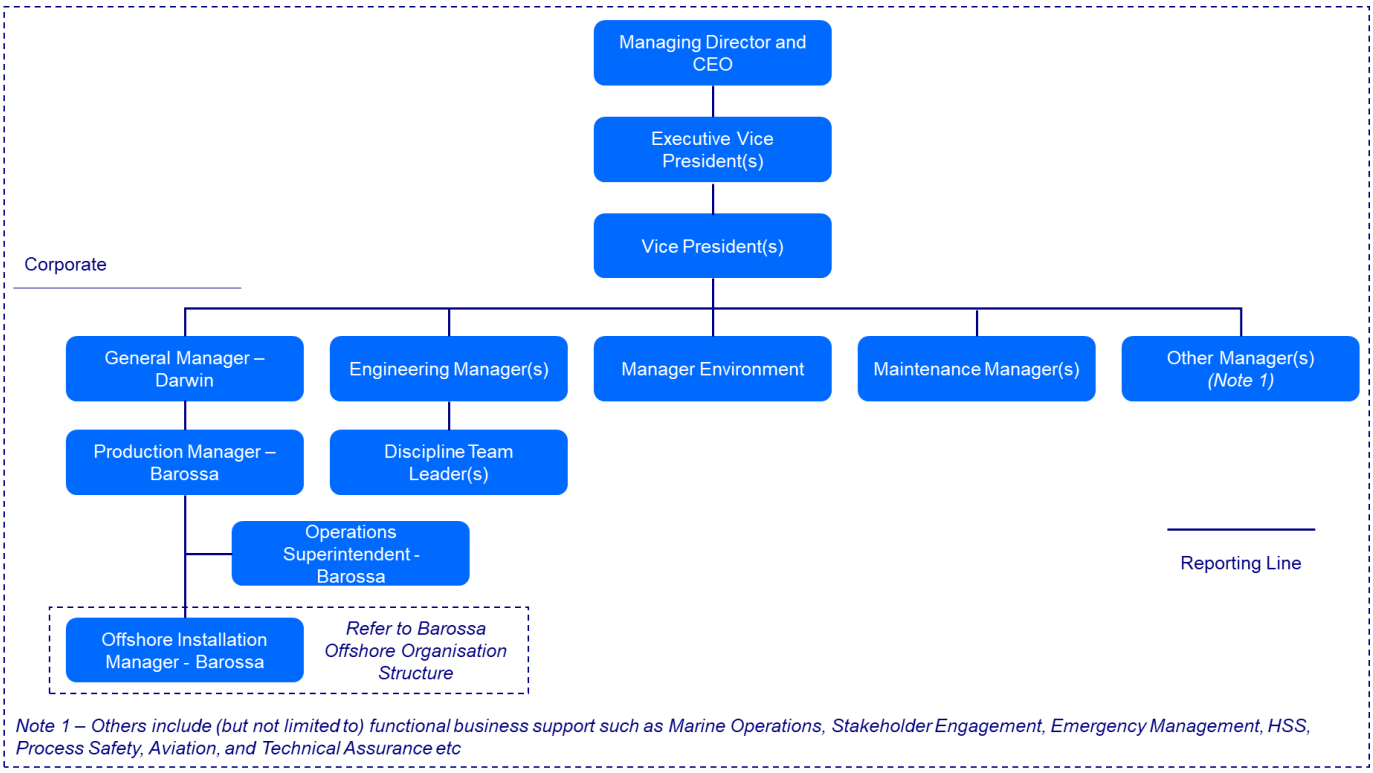


Figure 8-3: Santos Onshore Organisation Structure

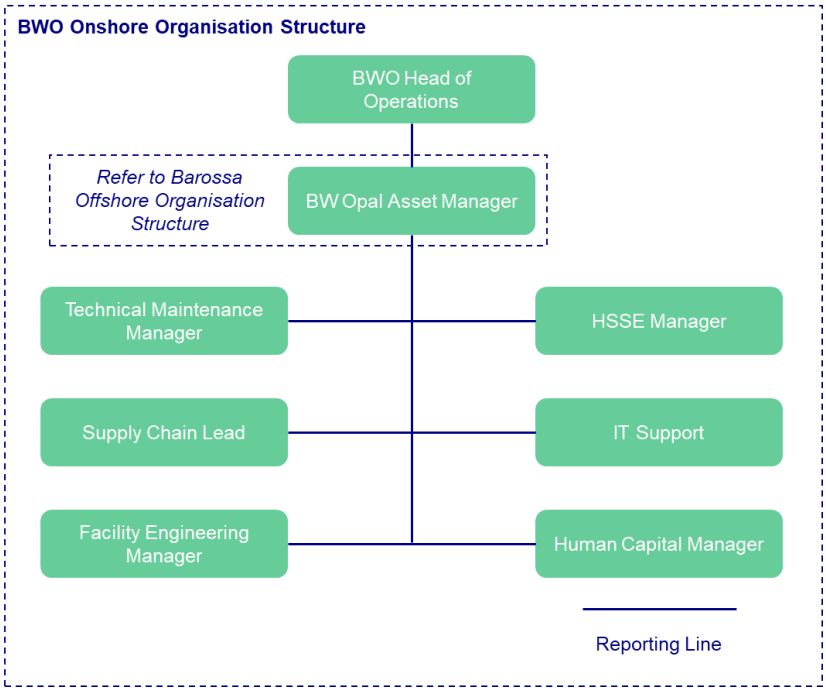


Figure 8-4: BWO Onshore Organisation Structure

8.2.2.2 Roles and responsibilities

The Santos General Manager - Darwin is the owner of the BMS and has accountability for implementation.

The Santos' Barossa Production Manager reporting to the Santos General Manager - Darwin, is responsible for all aspects of the Barossa facilities' performance, and is accountable for ensuring compliance with all internal and external regulatory requirements, including the implementation, management and review of this EP.

The Santos' Offshore Installation Manager (OIM) is the individual (the 'Operator's representative' at the facility) who has day-to-day management and control on board of the facility, and absolute authority for the safety of the facility and all personnel on board, following connection of the FPSO to the STP Buoy. The OIM is responsible for operating the Barossa facilities in compliance with the EP, regulations and procedures.

The effective implementation of this EP requires collaboration and cooperation among Santos and its contractors. The chain of command and accountabilities of personnel in relation to implementation, management and review of the EP is outlined in Table 8-3. It is also outlined in the Barossa Production Operations OPEP for spill response. The roles and responsibilities described in Table 8-3, will take effect from commencement of the Activity upon arrival of the FPSO in OA1, and will remain in place for all stages of the Activity. All commitments in this EP will be tracked and monitored against the performance standards and the responsible role.

Table 8-3: Chain of command, key leadership roles and responsibilities

Role	Accountabilities/Responsibilities
All Personnel	
Office-based roles and offshore roles	• Understand the relevant standards and procedures that apply to their area of work. • Understand the environmental risks and control measures that apply to their area of work. • Carry out assigned activities in accordance with approved procedures and the EP. • Follow instructions from relevant supervisor with respect to environmental protection. • Cease operations which are deemed to present an unacceptable risk to the environment. • Participate in environmental assurance activities and inspections as required. • Prompt reporting of environmental hazards/incidents to their supervisor and assist in event investigation.
Office-based roles	
Executive Vice President Western Australia (WA), Northern Australia (NA) & Timor Leste (TL)	• Accountable for HSE at Santos operated WA, NA, and TL facilities. • Approval of any changes with a risk level of 'High', if acceptable and ALARP.
General Manager – Darwin	• Accountable for implementation of the Barossa Management System. • Approval of any changes with a risk level of 'High'. • Enforces compliance with local laws and ensure that regulatory requirements are maintained. • Drives development of strategy to deliver continuous improvement in all aspects of Santos Operations. • Ensures that positive relationships are developed and maintained with internal and external stakeholders.
Production Manager – Barossa (Santos)	• Accountable for compliance with all internal and external regulatory requirements, including the overall management and implementation of the Barossa Management System. • Accountable for FPSO and subsea processes, procedures that support EP implementation • Responsible for leading annual EP performance reviews to review effectiveness of control measures in reducing environmental impacts and risks of the activity to ALARP and acceptable levels and identifying opportunities for continuous improvement. • Responsible for communication of any changes to the Activity that may affect the risk and impact assessment, EPOs, control measures, EPSs and MC detailed in this EP to the Santos HSE team. • Responsible for all aspects of the asset's performance. • Responsible for driving continuous improvement. Develops, monitors, and improves strategies to ensure KPIs are met or exceeded. • Accountable for managing marine vessel vetting as per the Marine Assurance Standard for field vessels as per Section 8.3.2.5 and 8.4.8. • Provides visible leadership and demonstrable commitment to the development and sustainability of Santos HSE culture. • Accountable for implementation of the Operations management processes and plans such as the GHG Emissions Management Plan and as described in Section 8.3.2.13. • Provides resources for HSE management. • Accountable for training and competency program for Santos Barossa personnel. • Responsible for the management and implementation of the SIMOPS plan. • Responsible Santos person for managing operations interface with BWO

Role	Accountabilities/Responsibilities
	• Responsible for the implementation of risk management as per Section 8.3.2.1.
Manager – Environment (Santos)	• Provides leadership and guidance in all matters relating to environmental performance. • Drives the application of consistent environment culture and behaviours to ensure alignment with the overall Santos values and objectives. • Responsible for obtaining environment-related regulatory approvals. • Accountable for EP compliance assurance program and activities. • Accountable for environmental performance monitoring activities • Responsible for analysis of environmental performance data and communication of findings to the Santos production manager • Provides implementation oversight of the environment components of the Barossa Management System. • Provides oversight and leadership in security and emergency management to ensure that adequate capability and structure is in place to respond to an oil pollution emergency as per the Barossa Production Operations OPEP. • Leads environmental incident investigations as per Section 8.4.6. • Responsible for the development and implementation of a Biosecurity management plan as per Section 8.3.2.9.
Environmental Advisor (Santos)	• Responsible for the management and review of this EP. • Responsible for EP compliance assurance program and activities. • Prepares, maintains and distributes the EP assurance register. • Completes EP inspections and audits. • Completes EP inductions and promotes general awareness. • Responsible for EP performance monitoring, collation of associated data and records for analysis. • Contributes to environmental incident management and investigations. • Provides operational HSE oversight and advice. • Facilitates the development and implementation of MoC documents. • Provides incident reports, compliance reports and notifications to NOPSEMA. • Responsible for fulfilment of Relevant Person consultation and communication requirements. • Responsible for communicating EP requirements to subcontractors.
Stakeholder Coordinator (Santos)	• Responsible for implementation of the steps described in Section 8.4.11 relating to post acceptance consultation throughout the duration of the Activity • Maintains a Relevant Persons contact and information database • Maintains a Relevant Persons Notification Log specific to the EP • Maintains records of all Relevant Persons correspondence specific to the EP • Before the Activity begins and on advice of the Santos Barossa Environmental Adviser, notifies the Relevant Persons listed, or as revised, in Table 8-7: Training Standard, Procedures and Plans • Is available before, during and after the Activity to ensure opportunities are available for Relevant Persons to provide feedback • Prepares quarterly updates
Emergency Response Advisor (Santos)	• Providing overarching incident and crisis management responsibility • Manages the Crisis Management Team and IMT personnel training program • Reviews and assesses competencies for Crisis Management Team, IMT, and field based Incident Response Team members • Manages the duty roster system for Crisis Management Team and IMT personnel • Manages the maintenance and readiness of incident response resources and equipment
Oil Spill Response Advisor (Santos)	• Provides ongoing guidance, framework and direction on preparing the Barossa Production Operations OPEP relevant to this Activity

Role	Accountabilities/Responsibilities
	• Develops and maintains arrangements and contracts for incident response support from third parties • Develops and defines objectives, strategies and tactical plans for response preparedness defined in the Barossa Production Operations OPEP and IRP • Undertakes assurance activities on arrangements outlined within the Barossa Production Operations OPEP
Manager – Engineering WA (Santos)	• Responsible for Santos Engineering Change Management Process as per Section 8.5.5 • Responsible for the implementation of the subsea maintenance and integrity management plan • Provides engineering support and technical assurance resources to FPSO and subsea, through MoC processes and risk assessments as required. • Responsible for mercury mapping processes
BW Opal (BWO) Asset Manager	• Responsible BWO person for managing operations interface with Santos • Accountable for FPSO processes, procedures that support EP implementation • Accountable for FPSO asset integrity management as per Section 8.3.2.2.1 • Accountable for the maintenance management strategy as per Section 8.3.2.3 • Responsible for BWO Engineering MoC Process as per Section 8.5.5 • Accountable for communicating any changes to the Activity that may affect the risk and impacts assessment, EPOs, EPSs and MC detailed in this EP to the Santos HSE team • Accountable for the Control of Work process and procedures onboard the FPSO as per Section 8.3.2.4 • Responsible for overall management of resources and personnel engaged in supporting operations and maintenance of the FPSO. • Accountable for training and competency program for BWO personnel • Responsible for the management and implementation of the FPSO components of the Barossa Management System • Provides visible leadership and a demonstrable commitment to develop the HSSE culture in the BW Opal Support organisation • Responsible for the allocation of sufficient resources onshore and offshore, to allow for safe operations of the FPSO. • Emergency response support team member.
BW Opal (BWO) HSSE Manager	• Responsible for FPSO processes, procedures that support EP implementation • Responsible for mercury monitoring as per Section 8.3.2.11.
Construction and Fixed Assets Programme Lead – WA, NA & TL	• Responsible for assigning a suitable IMMR Project Manager to complete the activities in accordance with this EP • Accountable for ensuring the IMMR Project has sufficient resources to execute the activities in accordance with this EP • Responsible for coordination of Subsea IMMR Project Managers across Santos Assets • Responsible ensuring compliance with the systems and processes used by Santos to execute the activities in accordance with this EP • Responsible for collating and reviewing the reporting and KPIs associated with the execution of IMMR activities across Santos Assets (including environmental incidents) • Responsible for collating the IMMR budget and delivering the scope across the Santos subsea assets in conjunction with the subsea integrity engineering team
Santos Manager Maintenance – WA, NA & TL	• Accountable for ensuring that there are sufficient IMMR Project Manager resources to execute subsea IMMR activities across Santos Assets • Accountable to Santos Production Manager for the reporting and KPIs associated with the execution of IMMR activities across Santos Assets (including environmental incidents) • Accountable for delivering the IMMR budget across the Santos subsea assets to each Asset Production Manager (budget owner) in conjunction with the subsea integrity engineering team lead. • Accountable to Santos Production Manager for timely execution of Critical Equipment Maintenance as per Section 8.3.2.3.1.

Role	Accountabilities/Responsibilities
BWO Technical Maintenance Manager	• Accountable for ensuring that there are sufficient technical resources to execute and assure maintenance activities onboard the FPSO activities across Santos Assets • Accountable to Santos Production Manager for the reporting and KPIs associated with the execution of maintenance activities (including environmental incidents). Accountable to Santos Production Manager for timely execution of Critical Equipment Maintenance as per Section 8.3.2.2.1
Santos IMMR Project Manager	• Responsible for the Subsea infrastructure asset integrity management as per Section 8.3.2.2.2. • Accountable for managing marine vessel vetting for vessel required for GEP IMMR as per hierarchy of procedures in Section 8.3.2.5 • Accountable for inclusion of the HSE exhibit in contract tender documents, and evaluation of tenders against EP requirements • Accountable for implementation of IMMR activities in accordance with this EP • Accountable for communicating any changes to the Activity that may affect the risk and impacts assessment, EPOs, EPSs and MC detailed in this EP to the Santos HSE team • Responsible for providing the resources required to enable the commitments in this EP to be maintained • Accountable for confirming the reporting of environmental incidents meets both external and Santos incident reporting requirements • Responsible for liaising with Santos Environmental Advisor on environmental incidents and what constitutes a reportable incident • Accountable for tracking and closing out of any corrective actions raised from environmental audits as required by this EP • Accountable for the Control of Work process and procedures onboard IMMR vessels as per Section 8.3.2.4
IMMR Contractor Project Manager	• Responsible for implementing the IMMR activity in accordance with this EP • Responsible for providing the resources required to enable the IMMR commitments as relevant to this EP to be implemented • Responsible for biosecurity assurance for all activity vessels mobilised to the OAs (Section 8.3.2.9). • Responsible for all crew attending HSE inductions and saving attendance records • Responsible for reporting and investigating incidents, as required
Santos Aviation Specialist	• Responsible for approving aircraft operators and aircraft types in accordance with Aviation Procedure as per Section 8.3.2.6
Offshore roles	
Barossa Offshore Installation Manager (OIM)	• Person in charge on board the FPSO. • Person in charge for any matter which may affect the safety of people, cause damage to the Barossa facilities or the environment. • Responsible for compliance with control measures identified in this EP to achieve EPOs and EPSs. • Responsible for implementation of supporting processes described in the EP implementation strategy e.g. Santos chemical management, mercury management, greenhouse gas emissions management • Acts as Emergency Commander during emergency response situations. • Responsible for all works meeting the requirements of the Permit To Work (PTW) system (Section 8.3.2.4). • Responsible for ensuring the Barossa facilities are maintained as per the Maintenance Management System. • Responsible for operating the Barossa facilities in compliance with the EP, regulations and procedures. • Responsible for ensuring personnel on the facility are suitably trained and competent for their roles and duties. • Promotes an HSE culture amongst offshore crew. • Responsible for investigating and reporting all incidents in a timely manner.

Role	Accountabilities/Responsibilities
Company Site representative (IMMR and Vessel activities)	• Confirms contractors undertake the Activity in a manner consistent with this EP • Confirms the management measures detailed in this EP are implemented • Confirms that the Vessel Master and all crew adhere to the requirements of this EP • Advises the Project Manager of any activity changes that may lead to a non-conformance with the requirements with this EP • Reports environmental incidents to the IMMR Project Manager • Management of offshore greenhouse gas emission sources.
BWO Operations Superintendent	• Responsible for implementing control measures identified in this EP to achieve EPOs and EPSs. • Takes action with the OIM, OTL and Maintenance Superintendent during emergency situations to ensure the safety of personnel, the facility, and the environment in line with guidance from the Emergency Response Plan. • Responsible for ensuring the operations team are suitably trained and competent for their roles and duties. • Promotes an HSE safety culture amongst the Offshore Team. • Responsible for delegating HSE responsibility and informs these personnel of their responsibilities under the EP • Empowers personnel to 'stop the job' due to HSE concerns • Responsible for compliance with processes HSE incident reporting, investigation, correction and communication • Responsible for the FPSO meeting quarantine requirements to operate in Australian waters • Responsible for compliance with processes for HSE inspections and audits and implementation of corrective actions • Reviews MoC documents • Responsible for compliance with requirements for personnel on the FPSO to have the necessary qualifications, training and/or supervision • Responsible for produced water management as per Section 8.5.6 • Responsible for the day-to-day implementation of the FPSO mercury management plans and procedures as per Section 8.3.2.11.
BWO Maintenance Superintendent	• Responsible for Organising, administering, and implementing the planned maintenance systems for all the various equipment and machinery on the FPSO. • Responsible for the maintenance management system offshore. • Responsible for planned maintenance requirements that are to be undertaken in accordance with manufacturer's recommendations and operating experience. • Takes action with the OIM, OTL and Operations Superintendent during emergency situations to ensure the safety of personnel, the facility, and the environment in line with guidance from the Emergency Response Plan. • Responsible for ensuring the maintenance team are suitably trained and competent for their roles and duties.
Vessel Masters (IMMR and Vessels)	• Responsible for compliance with all HSE laws, conventions and approvals (such as safety case) • Responsible for conformance with the EP as relevant to vessel activities • Reports any new, or increase in, HSE risk or impact • Responsible for compliance with MoC procedures • Empowers personnel to 'stop the job' due to HSE concerns • Responsible for compliance with reporting requirements for all HSE incidents, hazards and non-conformances • Facilitates HSE investigations and is responsible for the implementation of corrective actions • Responsible for compliance with requirements for crew to be competent and prepared to respond to HSE incidents

Role	Accountabilities/Responsibilities
HSE Advisers (Santos and/or contractor)	• Responsible for supporting the Santos OIM and/or Senior Client Site Representative to implement the requirements within this EP and assisting to collect and record environmental assurance evidence • Responsible for supporting the Santos OIM and/or Senior Client Site Representative to report environmental incidents or breaches of outcomes or standards outlined in this EP and develop, track and close out corrective actions for incidents and breaches are in a timely manner • Responsible for completing periodic environmental inspections/reviews, including waste audits, and developing, tracking and closing out corrective actions from inspections are in a timely manner • Responsible for reviewing contractors' procedures and providing input into toolbox talks and job safety analyses • Responsible for providing day-to-day environmental support for activities in consultation with the Santos Barossa Environmental Adviser

8.2.3 Adverse Weather Preparedness

The FPSO Adverse Weather Plan describes how the safety of personnel, equipment and the environment is ensured with respect to managing adverse weather conditions. The plan describes the precautions to be taken, and limitations to the operation of the FPSO during periods of adverse weather. The plan describes:

- Responsibilities for managing adverse weather. The OIM is responsible for ensuring the FPSO remains in a seaworthy state and is prepared to safely meet adverse weather.
- Guidance for weather monitoring.
- Operational precautions during non-cyclone adverse weather conditions. This includes providing guidance including when activities should be limited/stopped, or precautions should be taken. This guidance is summarised in an adverse weather matrix.
- Operational precautions leading up to and during a cyclone, including:
    - Critical path evaluation of developing weather systems to support operational planning.
    - Use of cyclone alert status to ensure the facility is well prepared for possible impact by a cyclone.
- Action checklists which outline actions to be taken based on the cyclone alert status.
- Evaluating whether production operations require suspension.
- Requirements for resuming operations post adverse weather events.

8.2.4 Emissions Management

8.2.4.1 Fuel and Flare Target Setting – HUC & Initial Start-Up

Fuel and flare targets are developed for flaring during both HUC & initial start-up in line with the planned activities, start-up sequence and plan. The intent of the targets is to prioritise reduction of flaring to ALARP by identifying and implementing GHG emissions reduction opportunities. The below will be considered as part of the target setting process:

- Well test requirements
- Onshore (DLNG) gas demand
- Gas Export Pipeline management
- Fuel Gas Demand and Optimisation
- Start-Up Sequence and Commissioning requirements
- Minimum turn-down of FPSO equipment
- Minimisation of liquid fuel

Targets will be actively monitored throughout the initial start-up with oversight from operations and start-up teams. Management of the initial start-up fuel use and flaring is a key factor in the establishment of the start-up sequence.

If exceedances are foreseen, based on daily tracking or changes to the start-up sequence then measures will be proactively implemented to minimise the risk of exceedance.

Requirements of daily tracking shall include monitoring actual vs planned flaring/fuel use for previous 24 hours and forward forecasting of potential future exceedance. Where measures are required to manage potential exceedances, the following will be considered:

- Minimising flare volume
- Net benefit of using diesel vs fuel gas
- Turndown of flow from wells (below minimum)
- Maintaining stability of systems from well head to onshore facility
- Timeframes

Targets are set in alignment with the estimates risk assessed in Sections 6.3 and 6.4 and deemed to be ALARP. Targets are set based on planned activities and will be tied to environmental decision making to remain within estimates.

Fuel and flare targets will be established and monitored as shown in Figure 8-5. Where exceedance is predicted based on progress or where changes to strategy are required, procedural change management will be used to implement controls with agreement of relevant Start-Up and Environment Managers. Should exceedance of EP limits be predicted these will be managed in line with the Environmental Plan Management of Change Process described in Section 8.5.2.

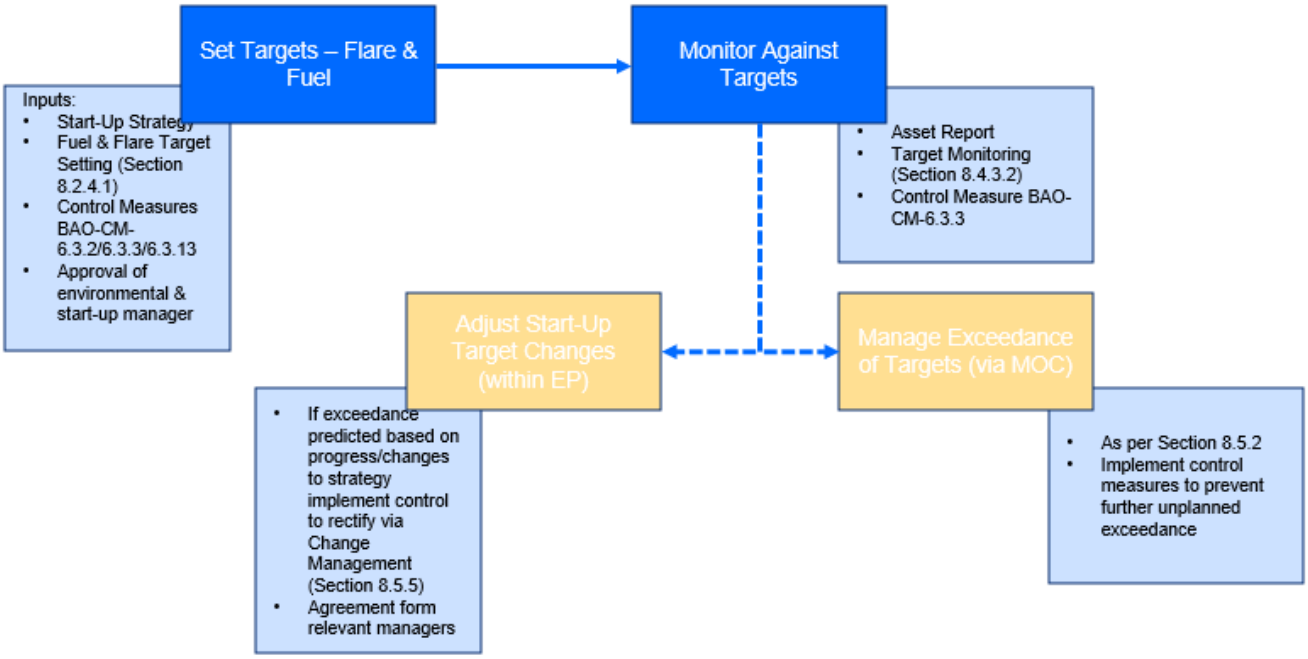


Figure 8-5: HUC and Initial Start-up Fuel and Flare Target Setting

8.2.4.2 Emissions performance target setting – Steady State

The GHG and atmospheric emissions estimates contained in this EP are the basis for evaluation of impacts and risks from the Activity and represent a threshold that if exceeded would trigger an EP MoC assessment (Section 8.5.2). In demonstrating that risks and impacts relating to Activity emissions, both GHG and atmospheric, are reduced to ALARP over the life of the Activity, fuel, flare vent and energy efficiency performance targets for the facility are set annually and progress tracked monthly and annually, before new annual targets are set. In support of reducing emissions to ALARP, emissions performance targets are also designed to drive continuous improvement in emissions performance. Figure 8-6 shows the emissions target setting cycle for steady state operations.

In developing this EP, performance targets are set with a view to reducing emission to ALARP. Inputs to setting the performance targets consider:

- EP emissions estimate inputs and assumptions
- Operating experience
- Forecast activities – planned and contingency

Annual performance targets require approval of both the relevant Santos Environment Manager for the Barossa asset, and the Barossa Production Manager.

Performance targets will be tracked on a monthly frequency as part of Operations Government Forums (Section 8.5.3.1), which include separate forums with representatives from both Asset leadership and Regional Business Unit leadership. Operations Governance Forums will track both leading and lagging indicators of relevance to performance targets e.g. emissions control equipment performance and reliability and will consider both year to date performance and forecast performance against targets. In reviewing monthly performance, emissions improvement initiatives are considered. Where improvement opportunities are identified and endorsed for further evaluation, they are managed per the decarbonisation opportunity management process (Section 8.5.7). Operations governance KPI dashboards are shared with the workforce for awareness, and to solicit feedback about improvement opportunities (Section 8.3.1.1.2).

If deviations against annual performance targets are forecast to occur, an internal performance target deviation is developed, which requires an ALARP justification and approval from both the relevant Environment Manager and Barossa Production Manager. If EP emissions estimates are likely to be exceeded, an EP management of change assessment (Section 8.5.2) is undertaken to determine if a revision and resubmission is required.

A baseline facility "energy efficiency" target will be established after the first year of steady state operations to inform monthly tracking of energy efficiency performance, and potential improvement opportunities. Efficiency improvement opportunities will be managed via the Barossa decarbonisation opportunity management process (Section 8.5.7).

At the end of the 12-month cycle, performance against targets and emissions estimates is reviewed, continuous improvement opportunities and adaptive management measures considered, and assumptions and targets are reviewed and re-set for the next 12-month cycle.

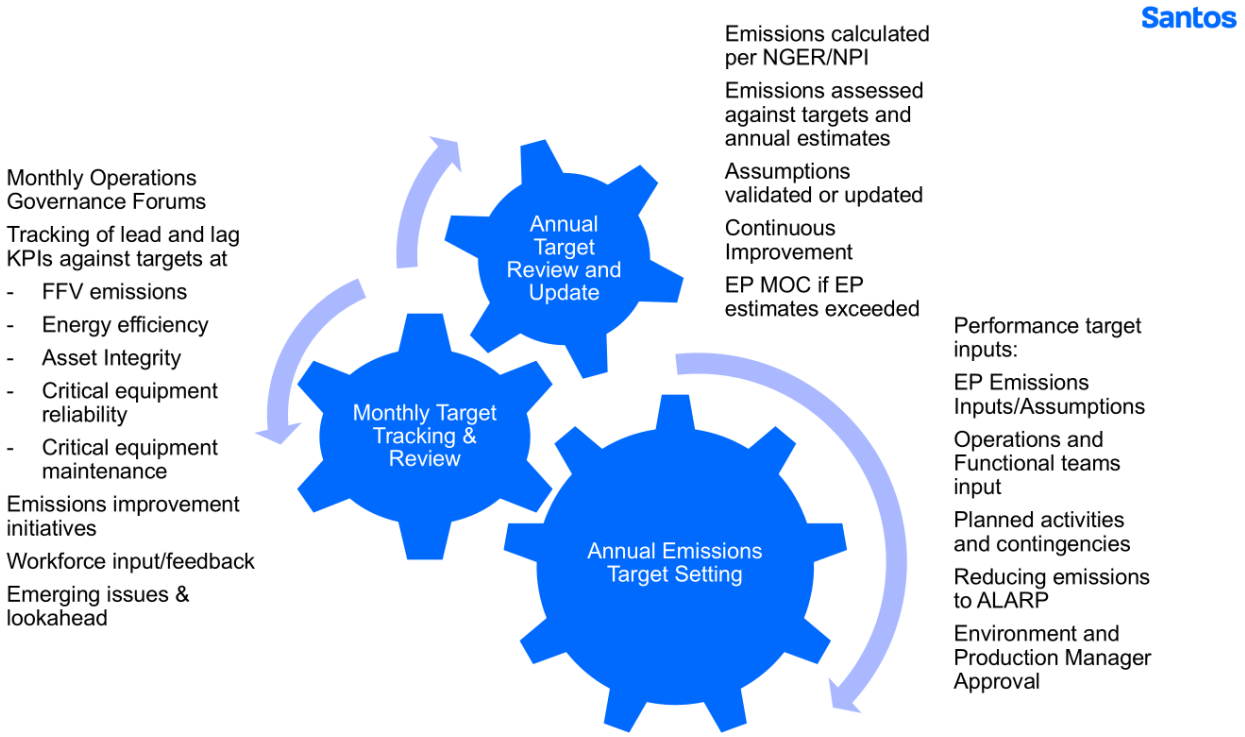


Figure 8-6: Emissions Target Setting Cycle

The following is provided as an example of application of the emissions performance target setting process and how it is applied to manage emissions to ALARP.

GHG emissions against acid gas flaring targets – deviation management

- Input/Basis: Acid gas flaring is only operational when thermal oxidiser is offline and the CO_2-rich permeate stream needs to be diverted to the acid gas flare for disposal
- Annual Target: acid gas flaring 20 days annually (less than assumed 30 days per EP emissions estimate assumptions)
- Monthly tracking: Acid gas flare has been operational for 10 days in the preceding 6 months YTD, trending towards an exceedance of the annual performance target.
- Performance Review/Adjust: Investigation to identify root cause of TOx impaired reliability/availability and implementation of corrective actions. Ongoing monitoring of TOx performance following implementation of corrective actions, and emissions performance against target.

The following is provided as an example of application of the target setting process.

Mercury (Hg) emissions against fuel and flare performance targets – continuous improvement

- Input/Basis: mercury content of fuel gas based on reservoir Hg composition assumptions (500 ppbw) and Hg content (20 ppbw) in treated (dry) fuel gas which is used preferentially to run FPSO GTGs
- Annual Target: <0.004 tonnes fuel gas mercury emissions.
- Monitor Tracking: Monthly Hg emissions tracking well below the annual fuel gas mercury emissions target due to lower than expected reservoir fluid mercury composition, as a result fuel gas mercury limit not ALARP
- Performance Review/Adjust: Review/adjust underpinning assumptions for reservoir fluid mercury composition and revise annual fuel gas mercury emissions target to ALARP.

8.2.5 Produced Water Management

8.2.5.1 Produced water performance target setting cycle

In demonstrating that risks and impacts relating to Activity produced water (PW) discharges are reduced to ALARP over the life of the Activity, performance targets and limits have been set (refer Section 0) and will be reviewed annually. Monitoring of produced water parameters relevant to performance targets and limits, including key contaminants of oil in water (OIW) and mercury, is conducted routinely as per the PW Adaptive Management Plan (Section 8.2.5; Appendix I) and adaptive management responses are required when parameter levels are triggered.

Key produced water parameters (including PW flowrate, mercury, OIW) will be summarised and reported monthly as part of Operations Government Forums (Section 8.5.3.1), which include separate forums with representatives from both Asset leadership and Regional Business Unit leadership. Monthly reporting will track leading and lagging indicators, displaying past performance (year to date) in relation to targets and limits and providing a forecast based on observed trends and any expected changes to operating conditions or equipment performance relevant to PW management. Operations governance KPI dashboards are shared with the workforce for awareness, and to solicit feedback about improvement opportunities (Section 8.3.1.1.2).

In developing this EP, performance targets and limits for PW have been set with a view to reducing PW impacts to ALARP and acceptable levels and rely on a number of predictions. Inputs to setting PW performance targets and limits consider:

- Reservoir modelling and predicted PW flowrate
- Expected gas composition and mercury feed concentration
- Predicted OIW and mercury removal through PW treatment system
- Predicted PW toxicity and scale of acceptable impacts (PW Mixing Zone)

The first annual target review following one year of steady state operations, and subsequent annual target setting cycles, will allow for assumptions and predictions to be validated and revised targets to be set in line with the principle of reducing PW impacts to ALARP and within acceptable levels. Annual target setting will consider the following aspects with input from Operations and Functional teams:

- 12-month review of PW discharge against performance targets and limits
- Updated information on PW chemical characterisation and toxicity
- Validated predictions on PW treatment system efficacy
- Reservoir forecast modelling and PW (condensed and formation water) volume estimates
- Forecast equipment maintenance requirements and performance expectations
- Forecast monthly PW flowrate, OIW and mercury content for the next 12 months.

If during the target setting cycle, review and forecasting indicates that ongoing compliance with discharge limits within the accepted EP cannot be maintained (or acceptable levels of impact cannot be maintained), an EP management of change assessment (Section 8.5.2) is undertaken to determine if a revision and resubmission is required.

Figure 8-7 summarises the key elements of the target setting cycle for PW.

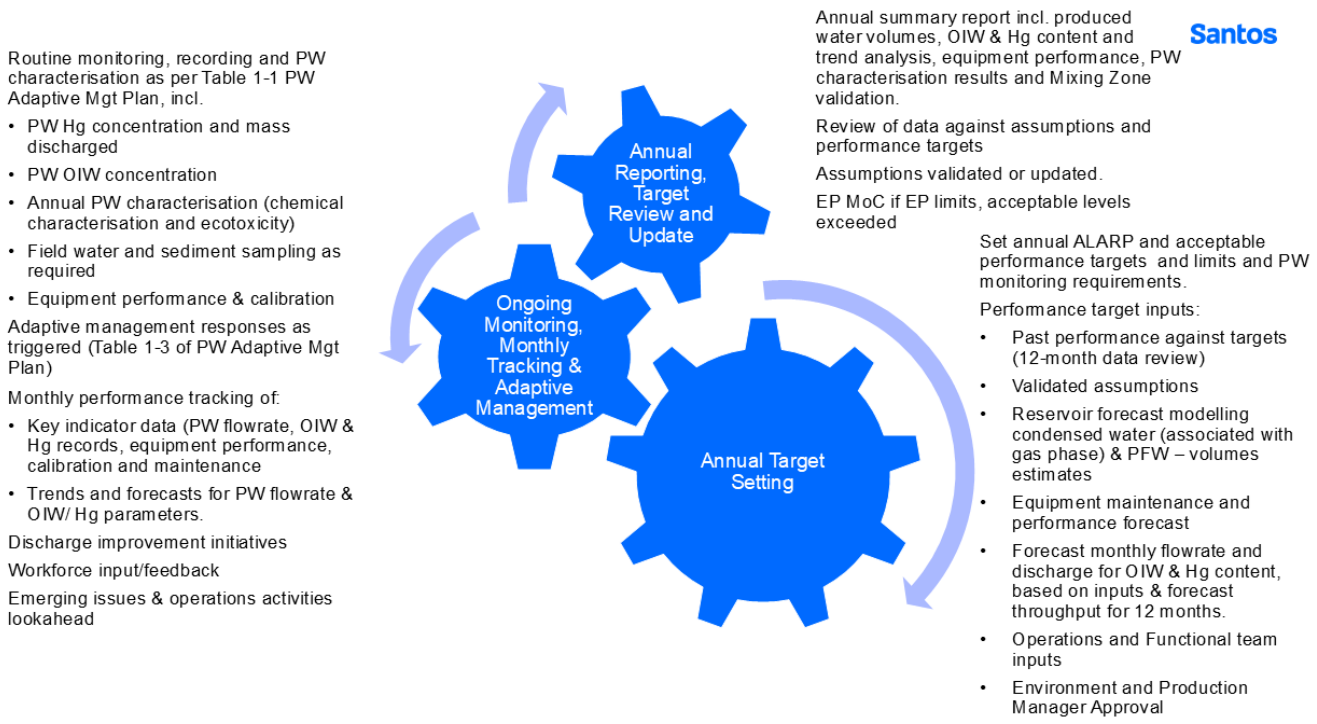


Figure 8-7: Produced water target setting cycle

8.2.6 Santos Decommissioning Strategy

Decommissioning lifecycle planning covers:

- Decommissioning considerations for new facilities or modifications to existing facilities (Appraise, Select and Define).
- Decommissioning and maintenance considerations during facility Operate phase facility management.
- Managing decommissioning opportunities when preparing for End of Field Life (EOFL) and surrender of production license/lease.
- Development and maintenance of restoration cost estimates for use in financial provisioning.

Implementation of the above supports compliance with section 572(3) of the OPGGS Act, under which, a titleholder must remove from the title area all structures that are, and all equipment and other property that is, neither used nor to be used in connection with the operations. Under section 572(7) of the OPGGS Act, the property removal requirements under section 572(3) of the OPGGS Act have effect subject to any other provision of the OPGGS Act, the regulations, directions given by NOPSEMA or the responsible Commonwealth Minister, and any other law. Under section 270(3) of the OPGGS Act, before title surrender, all property brought into the surrender area must be removed to the satisfaction of NOPSEMA, or arrangements that are satisfactory to NOPSEMA must be made in relation to the property.

Sections 572(7) and 270(3) of the OPGGS Act provide scope for in-situ decommissioning and other 'alternative' arrangements to be made where it can be demonstrated that the risks and impacts are ALARP and acceptable as well as compliant with all other Acts and regulation, this is further reflected within NOPSEMA Policy PL1903 'Maintenance and removal of property'.

8.2.6.1 Decommissioning in operations

Decommissioning planning forms part of the strategic planning for how an operational asset is effectively and efficiently managed throughout the Operate phase in accordance with the Asset Long Term Plan (LTP) and Asset Reference Plan (ARP) for each Santos operated asset.

8.2.6.2 Facility decommissioning planning

Decommissioning planning and costing start early during field development to ensure development decisions account for decommissioning strategy and costs. In accordance with the Santos Opportunity Development Process, decommissioning philosophies must be identified, and for high risk/complexity and high opportunity cost assets, considered during selection of a preferred concept.

During Field Development Planning for any opportunity, consideration must be given to the means of decommissioning and how this may impact on the design, key decisions, and economics. The regulatory environment may change during the life of an asset; therefore, all equipment must be designed for the base case of full removal and (in the case for offshore developments) onshore disposal. Further guidance on typical expectations for offshore developments can be found in the Australian Government's offshore petroleum decommissioning guideline and NOPSEMA's information paper on Planning for proactive decommissioning.

Santos Decommissioning Project Delivery Process can be seen presented within Figure 8-8.

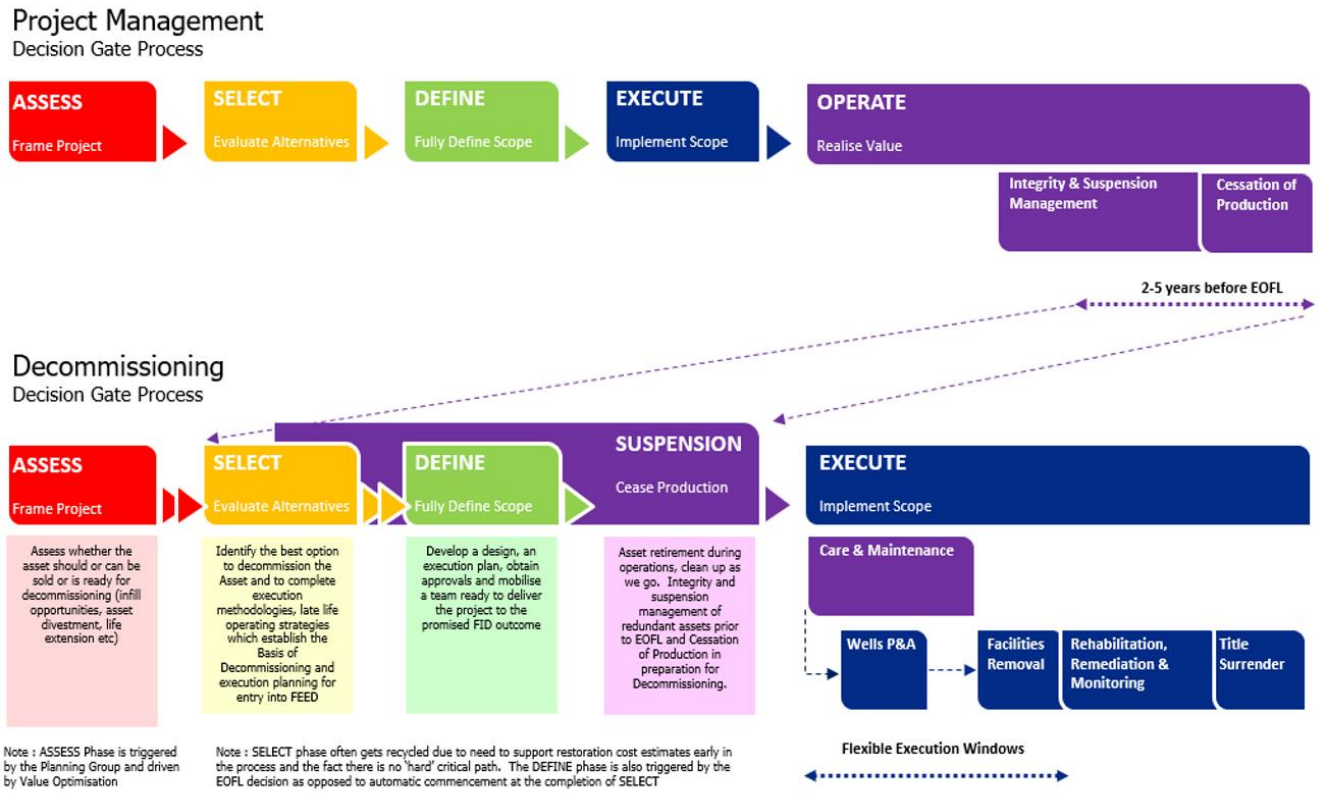


Figure 8-8: Santos Project Delivery Process for Decommissioning

8.2.6.3 Barossa decommissioning planning

Barossa will have a documented decommissioning strategy or plan that considers all obligations, including regulatory requirements, Joint Venture agreements, timing constraints and credible cost estimates, at all stages of it's lifecycle:

- Decommissioning planning will be aligned with Project Delivery Process requirements (Figure 8-8)
- Financial provisioning for decommissioning will be underpinned by reasonable cost estimates and comply with the relevant Accounting Practice. The basis of the cost estimate will be in compliance with the regulatory requirements of the relevant jurisdiction governing the project. Timing assumptions for the realisation of decommissioning liabilities shall be in accordance with the governing regulatory requirements
- Regulator engagement and notification will be maintained at a level of detail and frequency suitable to the life cycle stage and regulations applying to the asset. Santos holds regular decommissioning update meetings with NOPSEMA to update them on planning progress across all assets.

The asset systems identified as key for decommissioning are designed to facilitate infrastructure flushing, cleaning, and decommissioning processes, and will be maintained as required. These systems will continue to operate in compliance with standard IMMR protocols until the conclusion of the operational lifespan. To ensure that the systems used in conjunction with operations are adequately maintained throughout their operational life, these requirements will be incorporated into the relevant operational documentation.

8.2.6.3.1 Floating production storage and offloading decommissioning

To meet the defined decommissioning obligations, the following functional requirements are provisioned:

- Inspection, Maintenance and Repair requirements (including the maintenance of Classification) shall be maintained until Demobilisation and Decommissioning
- Required marine systems for tow shall be maintained and available for the demobilisation

- A demobilisation and decommissioning plan shall be prepared in advance of the cessation of production
- On the nominated date, production shall cease and the flowlines, risers and processing facilities shall be made as hydrocarbon free as is reasonably practical
- Sludge, slops or waste on board (including liquid mercury or Naturally Occurring Radioactive Material (NORM)) shall be disposed of in accordance with applicable laws and statutory requirements
- The demobilisation of the FPSO shall be complete when the FPSO has been removed from OA1
- The ethical scrapping, legal disposal or lay-up and refurbishment of the FPSO (or other treatment of the FPSO) shall be agreed via the Demobilisation and Decommissioning Plan
- Decommissioning shall be completed when the Mooring System has been removed from OA1.

8.2.6.3.2 Subsea infrastructure decommissioning

To satisfy future decommissioning obligations, including the requirements of the OPGGS Act, all subsea infrastructure has been designed to be feasible to remove. Detailed decommissioning documents, plans and procedures will be produced as detailed within Figure 8-8., while prioritising optimal environmental outcomes and the latest technological advancements available at that time.

All subsea infrastructure has been designed and will be installed and operated so that it can be removed when it is neither used, nor to be used in connection with the operations, as per Section 572 of the OPGGS Act. Design features and maintenance plans for major subsea infrastructure, which allow removal to occur at the end of field life, are detailed in Table 8-4.

Table 8-4: Design features and maintenance plans to enable removal of infrastructure at decommissioning

Infrastructure	Key elements to facilitate maintenance & removal
3 x Production manifold module + foundation 1 x Riser Base Manifold + foundation	**Design**: Cathodic protection system provides design life (25yr) protection for lift points. No planned maintenance is required. **Maintenance**: Risk-based inspection regime to monitor system integrity. **Removal**: Reverse installation method. Attachment to existing lift points, and removal by crane. Awareness of embedment over life of field and preparation for dredging / jetting prior to lifting to be a consideration.
Spools / rigid jumpers: • 6 x 8" XT-manifold jumpers • 3 x 14" flowline-manifold spool (Production) • 3 x 6" flowline-manifold spool (Service) • 2 x 26" export spool	**Design:** Cathodic protection system provides design life (25yr) protection. No planned maintenance is required. **Maintenance:** Risk-based inspection regime to monitor system integrity. **Removal:** Disconnect and recover or cut in sections subsea and recover to surface.
Flying leads: • 11 x Steel-tube flying lead • 27 x Electrical flying lead • 6 x 2" annulus jumper (flexible) • 6 x Optical flying lead • 1 x hydraulic flying lead (HFL) • Stabilisation sand/grout bags	**Design**: Cathodic protection system provides design life (25yr) protection. No planned maintenance is required. **Maintenance:** Risk-based inspection regime to monitor system integrity. **Removal:** Lines flushed in preparation, where appropriate. Disconnected and retrieved by ROV and appropriate tooling into baskets or direct to surface.
3 x 14" Production flowline 3 x 6" Service flowline	**Design:** Cathodic protection system provides design life (25yr) protection. No planned maintenance is required. **Maintenance:** Risk-based inspection regime to monitor system integrity. **Removal:** All lines flushed back in preparation. Three options considered: reverse S-lay, reverse reel lay and pipeline cutting and recovery.
6 x Production FLET + foundation 6 x Service FLET + foundation	**Design**: Cathodic protection system provides design life (25yr) protection for lift points. No planned maintenance is required. **Maintenance:** Risk-based inspection regime to monitor system integrity. **Removal:** May be recovered as part of pipeline recovery or first cut from pipeline and retrieved separately. Attachment to existing lift points, and removal by crane.
3 x Umbilicals – static	**Design**: Cathodic protection system provides design life (25yr) protection. No planned maintenance is required. **Maintenance:** Risk-based inspection regime to monitor system integrity.

Infrastructure	Key elements to facilitate maintenance & removal
	Removal: Lines flushed in preparation, where appropriate. Reverse installation method for recovery. To be disconnected and spooled onto reels.
2 x Umbilicals – dynamic incl tether bases	**Design**: Cathodic protection system provides design life (25yr) protection. No planned maintenance is required. **Maintenance:** Risk-based inspection regime to monitor system integrity. **Removal:** Lines flushed in preparation, where appropriate. Reverse installation method for recovery. To be disconnected and spooled onto reels. Buoyancy and ancillaries recovered in sequence. Tether bases recovered by lift points via vessel crane.
6 x Umbilical termination assembly + foundation	**Design**: Cathodic protection system provides design life (25yr) protection for lift points. No planned maintenance is required. **Maintenance:** Risk-based inspection regime to monitor system integrity. **Removal:** Reverse installation method. Attachment to existing lift points, and removal by crane.
8 x Risers incl tether bases	**Design**: Cathodic protection system provides design life (25yr) protection. No planned maintenance is required. **Maintenance:** Risk-based inspection regime to monitor system integrity. **Removal:** Lines flushed, disconnected and pull head fitted in preparation. Reverse installation method for recovery. To be disconnected and spooled onto reels. Buoyancy and ancillaries recovered in sequence. Tether bases recovered by lift points via vessel crane.
1 x STP Buoy	**Design:** Cathodic protection system provides design life (25yr) protection. No planned maintenance is required. **Maintenance:** Risk-based inspection regime to monitor system integrity. **Removal:** Lower turret buoy ~40-50m below water surface. Move FPSO off-site. Disconnect all risers and umbilicals. Turret buoy to be de-ballasted, disconnected from moorings and towed from site.
15 x Mooring lines: • 2 x wires • Midline buoyancy • 2 x chains • Assoc. Connectors	**Design:** Designed to maintain integrity for design life (25 year). **Maintenance:** Risk-based inspection regime to monitor system integrity. **Removal:** Reverse installation method. Wires recovered to reels, chains recovered to lockers or similar. Cut chain at pile location and retrieve.
15 x Mooring piles (suction piles)	**Design:** Designed to maintain integrity for design life (25 year). **Maintenance**: Risk-based inspection regime to monitor system integrity. **Removal:** Reverse installation method applied using existing ports and deployed pump. Recovery by vessel crane to deck or barge.
Infield Flowline Mattresses • 46 x Free span support (DI locations) • 46 x webbed scour mattresses for flowline • 300 x walking mitigation • 138 x structure scour protection • 26 x spool support	**Design:** Mattress block connections and material are designed to be suitable for lifting service and recovery after subsea service. **Maintenance**: Risk-based inspection regime to monitor system integrity. **Removal:** Recovery into baskets subsea via existing lift loops or bespoke lifting tool if loop integrity not sufficient. Recovery basket or tool to deck.
10 x Production Displacement Initiators **13** x Service Displacement Initiators	**Design**: Cathodic protection system provides design life (25yr) protection for lift points. No planned maintenance is required. **Maintenance:** Risk-based inspection regime to monitor system integrity. **Removal:** Attachment to existing lift points, and recovery by crane.

8.2.6.3.3 Gas export pipeline decommissioning

The Barossa infrastructure has been designed and will be installed and operated so that it is feasible to remove, this includes the GEP. Design features and maintenance plans for the GEP, which allow removal to occur at the end of field life, are detailed in Table 8-5.

Table 8-5: Design features and maintenance plans to enable removal of the gas export pipeline and ancillary infrastructure at decommissioning

Infrastructure	Key elements to facilitate maintenance & removal
Gas Export Pipeline[1] • 26" x 262km Offshore GEP • 26" x 61.8km Nearshore GEP • 34" x 60.7km Nearshore GEP	**Design:** Cathodic protection system provides design life (25yr) protection. **Maintenance**: Risk-based inspection regime to monitor system integrity. **Removal:** Two options considered: reverse S-lay and pipeline cutting and lifting for retrievals

Infrastructure	Key elements to facilitate maintenance & removal
Export Pipeline Mattresses • 66 x pre-lay • 45 x post-lay scour • 12 x buckle initiator • 44 x PLET scour • 6 x PLET span support • 8 x crossing support and scour • 2 x spool supports • 16 x ILT scour mitigation • 18 x crossing supports	**Design:** Mattress block connections and material are designed to be suitable for lifting service and recovery after subsea service. **Maintenance**: Risk-based inspection regime to monitor system integrity. **Removal:** Recovery into baskets subsea via existing lift loops or bespoke lifting tool if loop integrity not sufficient. Recovery basket or tool to deck.
3 x GEP PLET + foundation	**Design**: Cathodic protection system provides design life (25yr) protection for lift points. No planned maintenance is required. **Maintenance:** Risk-based inspection regime to monitor system integrity. **Removal:** Pipeline flushed in preparation. May be recovered as part of pipeline recovery or first cut from pipeline and retrieved separately. Attachment to existing lift points, and removal by crane.
1 x 34" x 14" In-Line Tee c/w integrated foundation	**Design**: Cathodic protection system provides design life (25yr) protection for lift points. No planned maintenance is required. **Maintenance:** Risk-based inspection regime to monitor system integrity. **Removal:** Pipeline flushed in preparation. May be recovered as part of pipeline recovery or first cut from pipeline and retrieved separately. Attachment to existing lift points, and removal by crane.
Grout bags	**Design:** Designed to maintain integrity for design life (25 year). **Maintenance**: Risk-based inspection regime to monitor system integrity. **Removal:** Retrieval by ROV and ROV basket.

[1] The portion of the GEP in NT waters is outside the scope of this EP.

8.2.7 Emergency Preparedness and Response

OPGGS(E)R 2023 Requirements
Section 22 Implementation strategy for environment plan
Oil pollution emergency response 22(8) The implementation strategy must contain an oil pollution emergency plan and provide for the updating of the plan. 22(9) The oil pollution emergency plan must include adequate arrangements for responding to and monitoring oil pollution, including the following: • the control measures necessary for timely response to an emergency that results or may result in oil pollution; • the arrangements and capability that will be in place, for the duration of the activity, to ensure timely implementation of the control measures, including arrangements for ongoing maintenance of response capability; • the arrangements and capability that will be in place for monitoring the effectiveness of the control measures and ensuring that the environmental performance standards for the control measures are met; • the arrangements and capability in place for monitoring oil pollution to inform response activities. 22(10) The implementation strategy must provide for monitoring of impacts to the environment from oil pollution and response activities that: • is appropriate to the nature and scale of the risk of environmental impacts for the activity; and • is sufficient to inform any remediation activities. 22(11) The implementation strategy must include information demonstrating that the response arrangements in the oil pollution emergency plan are consistent with the national system for oil pollution preparedness and response. *Testing oil pollution emergency response arrangements* 22(12) The implementation strategy must include arrangements for testing the response arrangements in the oil pollution emergency plan. The testing arrangements must be appropriate to the response arrangements and to the nature and scale of the risk of oil pollution for the activity. 22(13) The testing arrangements must include: • a statement of the objectives of testing; and • a proposed schedule of tests; and • mechanisms to examine the effectiveness of response arrangements against the objectives of testing; and • mechanisms to address any recommendations arising from tests. (14) For the purposes of paragraph (13)(b), the proposed schedule of tests must provide for the following:

- testing the response arrangements when they are introduced;
- testing the response arrangements when they are significantly amended;
- testing the response arrangements not later than 12 months after the most recent test;
- if a new location for the activity is added to the environment plan after the response arrangements have been tested, and before the next test is conducted–testing the response arrangements in relation to the new location as soon as practicable after it is added to the plan;
- if a facility becomes operational after the response arrangements have been tested and before the next test is scheduled to be conducted–testing the response arrangements in relation to the facility when it becomes operational.

The FPSO and vessels are required to have and implement incident response plans, such as an emergency response plan and SMPEP or SOPEP. Regular incident response drills and exercises – for example, as defined in an emergency response plan, SMPEP or SOPEP – are performed to refresh the crew in using equipment and implementing incident response procedures.

Santos will implement the Barossa Production Operations OPEP in the event of a hydrocarbon spill. The Barossa Production Operations OPEP details how Santos will prepare and respond to a spill event and meet the requirements of the OPGGS(E)R 2023.

8.2.7.1 Emergency response overview

The Santos Crisis, Incident and Emergency investigation, defines the requirements for emergency response preparedness for all facilities, including:

- Emergency Response Plans (ERPs) are in place for credible operational risks and scenarios with trained Emergency Response Team (ERT) personnel and equipment / resources in place to execute the plans.
- An Incident Management Plan (IMP) and trained Incident Management Team (IMT) are in place to provide operational support for escalating emergencies.
- A Crisis Management Plan (CMP) and trained CMT are in place to manage incidents or issues with significant, strategic implications for the organisation.
- An annual schedule of exercises is developed and executed to test effectiveness of the plans and to build and maintain response capability.

Emergency management for the Barossa facilities follows a three level response framework as presented in Table 8-6.

An ERP, IMP and CMP are in place which define the requirements for emergency response preparedness. These plans apply for the FPSO during both the HUC and production operations phases, and for the GEP.

A trained ERT, IMT and CMT are in place to execute these response plans and provide support during emergencies.

Table 8-6: Emergency response levels

Response Level	Description
Level 1 Emergency Response	Incidents that can be controlled by using resources normally available at the facility concerned, without the need to mobilise the IMT or other external assistance. This level would include sending personnel ashore for medical examination of a non-emergency nature. Generally, a Level 1 event is managed by the ERT. A Level 1 event is escalated to Level 2 at any time support is required from a Business Division IMT or external response agencies.
Level 2 Incident Management	Incidents that cannot be controlled by the facilities resources alone and require external support and resources to address the situation. PERTH IMT and/or Santos Support Teams / Oil Spill Response Team will be activated to provide operational and technical resources management and liaise with authorities and mutual aid organisations. Generally, a Level 2 event is managed by the IMT.
Level 3 Crisis Management	Incidents which have a wide-ranging impact on the company's strategic and enterprise interests and/or crisis status, warranting establishment of the Santos CMT. A large scale, sustained response requires the engagement of significant external resources and response vendors. A level 3 event may not have resulted from, or result in, ERT or IMT activation and can be a standalone event. Generally, a Level 3 event is managed by the CMT.

8.2.7.2 Emergency response

The ERP addresses the credible operational emergency risks and scenarios for the FPSO and GEP. The ERP has been developed in accordance with NOPSEMA's Emergency Planning Guidance Note, and Safe Work Australia's Guidelines for Emergency Plans. The plan includes incident management guides for the identified emergency scenarios, including emergency scenarios with potential significant environmental consequences (such as hydrocarbon loss of containment from the FPSO or subsea infrastructure, and potential vessel collision, etc). These guides assist the facility emergency response team by describing the actions to be undertaken during emergency scenarios, including initial response to an incident, and follow on actions.

A trained ERT are the designated FPSO based emergency responders who respond to tactically manage an emergency event / incident. The ERT are directed by the Emergency Commander and coordinated locally by the ERT Leader (On-Scene Commander). The Emergency Commander is supported by the Emergency Command Team who operate at the Emergency Command Centre / CCR. In the event of an emergency the OIM assumes the role of the Emergency Commander and is responsible for the implementation and supervision of procedures in the event of an incident.

The ERT roles and responsibilities are outlined in the ERP. Incumbent and back up personnel are also identified for each ERT role. Facility crewing is commensurate with the ERP / ERT requirements.

8.2.7.3 Incident management

Level 2 incident management is enacted for incidents / emergencies that cannot be controlled by the facilities resources alone and require external support and resources to address the situation (i.e. Level 2 incidents / emergencies). A trained IMT are in place to provide operational support for escalating incidents / emergencies with a focus on:

- Managing / supporting the incident / emergency overall.
- People, environment, assets and recovery.
- Operational continuity and recovery.
- Divisional stakeholder management.

The WANATL IMP establishes Santos' incident management arrangements to:

- Guide the IMT in emergency preparedness, emergency response and operational recovery.
- Support site / facility ERTs during emergencies.
- Undertake incident action planning to manage the consequences of an emergency event.
- Ensure WANATL incident management preparedness.

The IMP interfaces with the ERP and the Barossa Development OPEPs.

The IMP also provides incident scenario guides which provide guidance on potential IMT tasks associated with various potential emergency scenarios, including loss of containment, fire/explosion, vessel incidents and severe weather / natural disasters.

The IMT manages the operational consequences and impacts of an emergency event. The IMT are led by the IMT Lead, who provides leadership to:

- Ensure support is provided to the affected site / facility / field operations during actual / potential emergencies.
- Ensure the safety and protection of the company's people, environment, assets and reputation.
- Minimise operation production and business interruption.
- Determine and mitigate the operational risks arising from the emergency.
- Lead operational and business recovery.

The Incident Management Manual incudes duty cards which define each IMT role including their role, responsibility and specific actions to be performed during an incident.

8.2.7.4 Crisis management

The CMP and trained CMT are in place to manage incidents or issues with significant, strategic implications for the organisation. The CMP defines:

- Criteria and procedure for activating the plan (both incident and issue triggers), including CEO consultation.

- Roles and responsibilities of the CMT.
- CMT selection and training requirements.
- Crisis Management Process and the CMT response objectives, actions, processes, and tools.
- Internal and external stakeholder communication plans and protocols.
- Strategies for managing a long term crisis.
- Criteria and procedure for calling an end to the crisis and standing down the CMT.

The CMT is convened for the purpose of managing crisis events (Level 3 emergencies / incidents / events) The CMT is comprised of executive leadership, governed by the Crisis Management Chair (CEO or delegate). The Crisis Management Lead (appointed by the Crisis Management Chair) leads the CMT. The CMT:

- conducts crisis management operations, including assessing the crisis event and setting clear objectives to manage and recover from the crisis;
- directs the enterprise level strategic response; and
- addresses strategic implications and outcomes.

Support Teams support the CMT, when warranted, as business function subject matter experts. The Support Team functions will focus on strategies and actions set by the CMT.

8.2.7.5 IMMR campaign emergency response

Contracted IMMR vessels shall have a vessel specific ERP covering vessel emergencies. This typically includes major emergencies such as vessel collision, loss of vessel stability, etc. The plan shall comply with the regulatory requirements including AMSA, Flag State and NOPSEMA (for IMMR activities where the vessel operates under its own vessel Safety Case) when working in Australia waters.

Bridging documentation shall also be prepared providing campaign-specific guidance, including explaining the emergency response interfaces between Santos and the IMMR vessel contractor, and the process for providing a coordinated response for emergencies at the Barossa facilities.

8.3 Do

The activities under ‘Do’ describe competency and training processes relevant to implementation of the EP, and specific measures relevant to implementation of the requirements of the environmental plan. Awareness, training and competency (Do)

8.3.1 Workforce EP Awareness and Training

OPGGS(E)R 2023 Requirements
Section 22 Implementation strategy for environment plan
Responsibilities of employees and contractors 22(4) The implementation strategy must include measures to ensure that each employee or contractor working on, or in connection with, the activity is aware of the employee’s or contractor’s responsibilities in relation to the environment plan, including during emergencies or potential emergencies, and has the appropriate competencies and training.

This section describes the mechanisms that will be in place so each employee and contractor is aware of his or her responsibilities in relation to the EP and has appropriate training and competencies.

8.3.1.1 Workforce EP Awareness

8.3.1.1.1 Inductions

The induction process is in place to ensure that all personnel associated with, working on or visiting the Barossa facilities are provided the necessary awareness, knowledge and competence appropriate for their role, to ensure that personnel are aware of the environmental impacts and risks associated with the facilities and the environmental management requirements arrangements described in this EP.

All new personnel to the Barossa facilities must complete several inductions prior to commencement of work duties, including company, facility and activity specific awareness induction packages (depending on role). The induction will include an Environment Plan awareness component, which covers environmental management commitments and requirements to be implemented as described in this EP, tailored to the environmental impacts/risks of each activity phase:

- hook-up and cold-commissioning
- hot-commissioning and initial start-up
- steady-state operations
- short duration campaigns e.g. planned shutdowns, IMMR

During steady state operations, induction refreshers will be implemented every 3 years. There will be separate environmental awareness induction packages for the general workforce, one for leadership roles, and one specific for vessel based activities.

The Environment Plan awareness induction for the general workforce includes:

- Overview of Santos' Environment, Health and Safety Policy (Appendix A) and the Barossa Management System
- the applicable environment legislative requirements, including EP commitments and requirements relevant to the activity phase
- environmental values and sensitivities relevant to the Barossa facilities and Operational Areas (such as protected marine areas, sensitive environmental periods)
- maritime underwater cultural heritage and First Nations cultural heritage awareness
- key environmental hazards and control measures as relevant to the activity phase (including but not limited to GHG emissions, atmospheric emissions, produced water management, mercury management, waste management, spill prevention, chemical storage, fauna interactions);
- hazard and incident reporting and notifications
- regulatory compliance reporting (including fauna interactions)
- oil pollution emergency response requirements (such as the Barossa Production Operations OPEP)
- where to locate copies (paper and digital) of the EP and OPEP.

The Environment Plan awareness training for key shore-based and offshore leadership roles (refer Table 8-3) also includes training for:

- EP commitments (Table 8-1 and Table 8-2)
- OPEP commitments
- GHG emissions management plan requirements
- Produced Water Adaptive Management Plan requirements
- Mercury Management
- Processes and expectations for managing and maintaining emissions/discharges critical equipment.
- EP recordable and reportable incident reporting
- EP Assurance Processes
- EP non-conformance management
- EP management of change process
- Performance review process and continuous improvement expectations

All personnel that may encounter mercury or who plan or supervise work potentially involving mercury will participate in a Mercury Hazard Awareness Training Program (refer Section 8.3.2.11), to ensure a high awareness of the hazards associated with mercury in the process. All personnel who plan or supervise work associated with discharge and management of PW will be briefed in PW Adaptive Management awareness to facilitate the implementation of and adherence to the plan.

The Environment Plan awareness training for vessel based activities includes training for:

- Overview of Santos' Environment, Health and Safety Policy (Appendix A) and the Barossa Management System
- the applicable environment legislative requirements
- environmental values and sensitivities relevant to the Barossa facilities and Operational Areas (such as protected marine areas, sensitive environmental periods)

- maritime underwater cultural heritage and First Nations cultural heritage awareness
- key environmental hazards and control measures as relevant (including but not limited to GHG emissions, atmospheric emissions, waste management, spill prevention, chemical storage, fauna interactions and vessel speeds and interactions with other marine users)
- hazard and incident reporting and notifications
- regulatory compliance reporting (including fauna interactions)
- oil pollution emergency response requirements (such as the Barossa Production Operations OPEP).
- where to locate copies (paper and digital) of the EP and OPEP
- records of induction attendance will be maintained.

8.3.1.1.2 Workforce involvement and communication

Daily operational meetings will include environmental management as a standing agenda item. It is a requirement that supervisors attend daily operational meetings and all personnel attend daily toolbox or pre-shift meetings. Toolbox or pre-shift meetings will be held to plan jobs and discuss work tasks, including environmental risks and their control measures. Further to this, HSE Information Feedback meetings will be held for the Barossa facilities workforce on a bi-weekly or 3 weekly frequency and will cover environmental themes and specific issues such as details of recent environmental incidents, inspection/ audits findings, and any key outcomes from annual EP performance reviews.

Environmental performance will be monitored and reported during the Activity by the Environment Manager, and performance metrics (such as the number of environmental incidents) will be regularly communicated to the workforce via the daily operational meetings. The Operations Governance Forum (Section 8.5.3.1) KPI dashboard (inclusive of environmental performance KPIs) will be shared with the workforce via the HSE Information Feedback meetings (see above), with members of the workforce encouraged to contribute opportunities for improvement to be considered/evaluated at monthly Operations Governance Forums (Section 8.3.1.1.2).

Workforce involvement and environmental awareness will also be promoted by reminding offshore personnel about obligations communicated during environmental awareness inductions (Section 8.3.1.1.2) to report marine fauna sightings and marine pollution; for example, oil sheens on water, dropped objects.

8.3.1.1.3 Environment Plan Compliance Registers

The key mechanism for ensuring all personnel involved in the operation of the Barossa facilities across all petroleum activity phases are aware of the environmental control measures and performance standards adopted in this EP is via the provision of EP compliance registers. Each register is tailored to the requirements of each activity phase. Responsibilities are assigned for each EP compliance requirement, consistent with the roles and responsibilities in Section 8.2.2.2, as relevant to each activity phase. The Environment Advisor is responsible for preparing, maintaining and distributing the EP Compliance registers. The registers will be updated as required following EP revisions.

Santos is responsible for ensuring all personnel are aware of the environmental control measures and performance standards as adopted in the EP. For infield subsea infrastructure and the gas export pipeline, these EP assurance compliance registers will be incorporated into Santos systems.

For FPSO based activities, these EP compliance registers will be incorporated in the BMS system for use by the BWO Asset Manager.

For vessel-based activities, these EP compliance registers as relevant to vessel based activities will be used by the Vessel Master for ensuring the environmental control measures and performance standards relevant to the activity are implemented.

8.3.1.1.4 Contractor health, safety and environment requirements

The minimum requirements and expectations for HSE management of contractors and subcontractors is described in the HSE Contractor Management Procedure, including a specific contractual HSE exhibit for project specific scopes of work. The HSE exhibit has a detailed environmental requirements section for:

- review of EP requirements applicable to the contract scope
- the contractor to comply with the control measures specific to the contract scope, and identify any new environmental risks and propose additional control measures to reduce the risk to ALARP. The Santos EP MoC assessment (refer Section 8.5.2) is triggered if there are changes to the Activity and associated environment risk, as assessed in the accepted EP.
- understanding and compliance with applicable environmental legislation
- key activities to support continuous environmental improvement

- chemical selection and approvals
- prohibited materials and chemicals (if/as applicable)
- vessel requirements (if relevant to the scope) to comply with the EP.

8.3.1.2 Workforce Training and Competency

All members of the Barossa facilities workforce will complete relevant training and hold qualifications and certificates for their role. Santos and its contractors (including BWO) are individually responsible for ensuring their personnel are qualified and trained. The systems, procedures and responsible persons will vary and will be managed through the use of online databases, staff onboarding process, training departments and other means.

Personnel qualification and training records will be sampled before and during an activity. Such checks will be performed during the procurement process, facility acceptance testing, inductions, crew change, and operational inspections and audits. Ongoing checks will be undertaken to check and verify training needs are being identified and training undertaken to maintain a competent workforce.

Table 8-7 describes the standard, procedures and plans that manage the training and competence of personnel at the Barossa facilities to ensure they can effectively and safely perform their work in order to ensure compliance and regulatory obligations are met.

The training may be provided through learning modules, with vendor training programs and accredited training provided by external training providers as required, as well as on the job training / job shadowing and coaching. The BWO Training and Competency Manager is responsible for the training and competence process on the FPSO and ensuring compliance with the Competency Assurance Plan. The Offshore Installation Manager is responsible for ensuring that minimum competency requirements are met on the FPSO at any time.

As per the Competency Assurance Plan for BW Opal all FPSO Training and Competency records are maintained.

The Santos Manager of Training and Competency Assurance (Operations and Maintenance) is responsible for the training and competency of the Santos workforce undertaking IMMR activities associated with subsea infrastructure in OA1 and OA2.

As per the Santos Competency and Training Technical Standard, records of competency requirements and the employee's assessment in relation to those requirements will be retained in the Learning Management System (LMS) enabling tracking, monitoring and reporting.

Table 8-7: Training Standard, Procedures and Plans

Title	Description
Competency and Training Technical Standard	Ensures appropriate and relevant training is provided to personnel so they are able to effectively perform their work; and compliance and regulatory obligations are met. The Technical Standard requires the assessment of organisational and individual capability via competency frameworks, training needs analysis and training delivery (including frequency of training/ competency checks) through the core curriculum programme or individual / group training.
Competency Framework Procedure	The framework delivers standardised competency-based training and an assessment curriculum that provides fit-for-purpose training and assessment to confirm personnel are competent to perform work against established and pre-defined performance. The process includes competency-based assessment undertaken by assessors with nationally accredited qualification and includes assessment by a combination of: • Attendance at a formal training course. • Observation during work activities. • Questioning (oral, written or online). • Collection of historical evidence.
Competency Assurance Plan	This plan ensures that all contract personnel are trained and assessed as competent to carry out their assigned tasks in line with environmental performance requirements in this EP, including the required training and certification standards which apply for core crew on the Barossa facilities, to ensure personnel have the necessary level of competence to conduct the work in the operation, design, maintenance, and emergency response for the Barossa facilities. Training records for all crew are maintained and available to the OIM and key Santos operations personnel onshore. To meet the requirements of Australian legislation / regulations, the Santos Competency Framework Procedure and BWO internal requirements, a matrix has been developed that defines the training and competency requirements considered either mandatory or beneficial for each role. For example roles that are responsible for emissions or discharges critical equipment will identify the required competencies in operating, inspecting, maintaining or using equipment that is critical to achieve environmental performance outcomes and standards as defined in this EP. Personnel mobilised on vessels involved in HUC activities, and vessel based activities will be subject to competency testing criteria, including site-specific competency assessment, verification of

	certificates and work experience (as required), as per the contractor management and marine assurance processes.
Competency Verification	The process for verifying competence. Competence is assessed by questioning and observation during work activities, collecting historical evidence of competence (including evidence of accredited / recognised prior learning, applicable licences, records of performance, etc), and attendance at formal training courses.

For IMMR campaigns, the training and competency requirements are typically documented in the HSE Management Plan developed for each specific IMMR campaign. All personnel mobilised on an IMMR vessel are subject to competency testing criteria, including site-specific competency assessment, verification of certificates and work experience.

Emergency preparedness and response (including for oil spill response) training requirements are addressed in Section 8.3.1.3.

Members of the workforce that have been allocated roles within the PTW system are required to complete the training module relevant to their role. The PTW system training requirements for the various roles on the Barossa facilities are defined in the training and competency matrix, and includes delivering training on the PTW system structure, permit planning and preparation, permit coordination, authorisation and arrangement, permit execution, revalidation and closing, risk assessments, mechanical (process) isolations.

8.3.1.3 Emergency response training, drills and exercises

All personnel appointed to emergency response roles undergo suitable training and participate in preparedness activities and exercises to enable them to effectively perform their roles. All positions that are required to have specific emergency response training are identified. The minimum training requirements for key roles are presented in Table 8-8.

Other members of the Emergency Management Team shall undertake PMAOMIR322 'Manage Incident Response Information' (or an equivalent training course), with members of the ERT also trained as appropriate for their role.

The Drills and Exercises Procedure, describes the facility emergency response drills and exercises. The drills and exercises are based on the identified emergency scenarios, and include liaison with, and involvement of, external response organisations and other operators where appropriate.

The minimum emergency exercise requirements are:

- Annual IMT exercise with facility participation.
- Annual Level 3 oil spill exercise involving external parties—the Santos facility involved in this exercise is dependent on the worst case scenario defined in the Santos operated facilities OPEPs.

Reviews are conducted after each exercise or activation to identify any opportunities for improvement or sharing of learnings (including good practices).

Additional training and competency requirements for relevant personnel specific to spill response are provided in the Barossa Production Operations OPEP.

- An overview of Santos hydrocarbon spill response training and competency requirements are provided in dashboards for key responder roles. The roles are consistent with Santos' crisis and emergency management incident control structure.
- Santos' Oil Spill Response Advisor(s) are responsible for maintaining hydrocarbon spill preparedness competency. This includes the identification and development of approved competency and non-competency-based courses, identification of relevant personnel required to undertake training, and ensuring training records are maintained. Minimum Santos capabilities will continue to be identified and documented.

Table 8-8: Emergency response training

Role	Minimum training requirements
Emergency Commander (EC)	• PMAWHS511 Manage Emergency Incidents • PMAOMIR322 Manage incident response information • Oil Spill Familiarisation (AMOSC)
IMT Leader	• PMAOMIR418 'Coordinate Incident Response'

8.3.2 Supporting Management Processes and Procedures

This section describes the 'specific measures' of the Barossa Management System that define how the activity will be managed and monitored to ensure that the EPOs and EPSs are met.

8.3.2.1 Risk Management

Santos operates under an overarching Risk Management Policy that applies to this Activity. The company Risk Management, Investigation and Assurance operating standard underpins the Risk Management Policy and is consistent with the requirements of AS/NZS ISO 31000:2018, Risk Management – Guidelines (ISO, 2018). Risk management processes are implemented on an ongoing basis during the Activity to manage risks to personnel, the Barossa facilities and the environment. The key steps to risk management are illustrated in Figure 5-1.

The forum used to undertake environment risk assessment is the environmental hazard workshop, referred to as an ENVID, which is described in Section 4 of Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline, and summarised in Section 8.5.4.

8.3.2.2 Asset Integrity Management

8.3.2.2.1 FPSO Asset Integrity Management

The Asset Integrity Management Philosophy describes the philosophy and framework for asset integrity management of the BW Opal and provides guidance on its implementation. The purpose of the philosophy is to present a clear framework for FPSO asset integrity management to:

- Ensure asset integrity management is implemented in a consistent manner.
- Define the deliverable for implementing the asset integrity management strategy.
- Control the effectiveness of asset integrity management activities.
- Allow sharing of experience and lessons learned.
- Asset integrity management is implemented across the facility lifecycle. Proper implementation of asset integrity management during operations by all stakeholders is a key contributor to:
    - Minimising the risk of a major accident or its consequences.
    - Maximising production performance.
    - Improving facility reliability and availability.
    - Increasing the robustness of operational processes.

Asset integrity management is implemented through a Plan-Do-Check-Act approach to provide continuous improvement.

Continuous improvement is driven by ongoing review and assessment of the performance of SCEs, augmented by independent verification body verification activities. Santos Technical Authorities are involvement in the integrity management process includes:

- Review of integrity management strategy and philosophies.
- Review / audit of Risk Based Inspection RBI programs.
- Review of identified anomalies on a severity basis / work order assessment recommendation type.

Risk Based Inspection (RBI) programs are developed for the topsides static equipment and hull. These programs include:

- Topsides static equipment.
- Topsides and marine structures
- Hull (including hull tanks and condensate offloading equipment)

The plan for managing integrity of the turret and moorings system has been developed based on guidance from the APL-NOV (who designed system).

8.3.2.2.2 Subsea Infrastructure Asset Integrity Management

The Subsea Integrity Management Procedure sets out the requirements for managing the integrity of the Barossa subsea equipment. The procedure requires that Integrity Management Plans are developed which review and verify credible damage and failure mechanisms identified in the design phase and as part of ongoing operational and integrity reviews.

RBI programs are developed to ensure that maintenance of the subsea equipment is appropriately prioritised, ensuring risks are managed proactively. The RBI programs are based on the findings of several workshops held to risk assess the identified threats to the Barossa subsea infrastructure and develop inspection requirements and associated cycles to maintain the integrity of each component.

The Corrosion Monitoring Procedure defines the philosophy, procedure, and reporting requirements for internal corrosion monitoring of pipelines / risers and subsea pressure piping.

The Subsea Inspection Procedure and Underwater Inspection Manual, describe the inspection philosophy, inspection types and reporting requirements for subsea assets, including marine growth and post cyclone surveys, offshore cathodic protection, and includes offshore structures, pipelines, and risers. No in line inspection of the flowlines is conducted.

8.3.2.3 Maintenance Management System

Systems and equipment are maintained to achieve a required level of functionality. The FPSO maintenance management system holds a register of all maintainable systems and equipment onboard. A risk-based approach is used to develop the inspection, maintenance and testing requirements. The likelihood of equipment degradation leading to failure is considered when setting up planned maintenance tasks and intervals. Maintenance activities shall be planned, as far as possible with consideration for frequency, criticality, resource optimisation and shutdown alignment. The maintenance program is prepared by systematic analysis of function criticality and application of maintenance strategies and is required to be adaptive to change in criticality or emerging maintenance technologies. The main maintenance strategy is condition based, non-intrusive maintenance which includes watch keeping, vibration analyses, lube oil sampling and other condition-based techniques where potential failure conditions can be monitored.

Discharges and emissions reduction equipment such as the steam turbine generator, CO_2 removal membranes, Thermal Oxidiser, Vapour Recovery Unit, PW treatment system and flares have target availability criteria set, which influence the criticality assigned relative to system/equipment reliability/availability targets (refer Section 8.2.4 and 8.2.5). Discharges and emissions monitoring equipment such as flare and fuel flow meters and analysers are assessed as individual pieces of equipment.

The subsea infrastructure, risers, flowlines and gas export pipeline are designed to avoid the requirement for preventative maintenance (i.e. regular maintenance activities necessary to maintain integrity/operability. The subsea equipment condition will be regularly assessed to monitor its condition and detect if corrective maintenance is required.

Inspection findings and any resultant maintenance requirements are manages through the Santos MMS.

8.3.2.3.1 Critical Equipment Maintenance

Each maintainable item is assigned a criticality level in the MMS based on the safety or environmental consequence of failure. Production downtime is also considered in this determination The criticality then determines the priority that preventative or corrective maintenance work orders are assigned in the scheduling of maintenance work, to achieve desired performance functionality/reliability/availability of systems/equipment. Equipment that has a function that is necessary to achieve or verify environmental performance standards and that may impact compliance with an environmental performance outcome, as described in Section 8.1, are assigned a criticality rating reflective of the importance of the performance of this equipment. Breakdown of systems or equipment with a criticality level of 1 receive the highest priority for corrective maintenance and the frequency of planned maintenance is appropriate to meet the required availability of the equipment. Changes to the maintenance regime for criticality 1 equipment is subject to a risk assessment and approval process. The Santos management requirements of the maintenance system include adherence to specific performance criteria for critical equipment, mandating that planned maintenance does not go overdue without a deferral risk assessment, and that corrective maintenance is completed in the required timeframe.

A deferral process is in place to initiate a risk assessment well before any critical equipment maintenance becomes overdue. In raising deferrals, consideration is given to the likelihood of failure of that element during the deferral period. The deferral risk assessment process shall establish the potential for increased environmental impact or risk, or non-compliance with an associated EPS. In such cases the Santos Environment Manager will be included in the risk assessment process. The deferral for equipment that has a critical function in reducing environmental risks and impacts to ALARP and acceptable levels, or maintaining compliance with the EP requires approval from the Santos Production Manager, who is accountable for compliance with all internal and external regulatory requirements, including compliance with the Environment Plan.

The criticality of subsea equipment is determined and managed through the same process in the Santos MMS and with the same criteria as described for the FPSO.

8.3.2.4 Control of Work

The Control of Work process and procedures are applied onboard the BW Opal and vessel-based activities in the Barossa field and along the GEP (IMMR) so that work activities are executed in a safe manner. The Control of Work process and procedures include:

- Stop Work Authority. All personnel have the permission and responsibility to stop a work / task or to decline to perform a task where they believe there is a threat to the health or safety of people or the environment. Individuals calling to stop work should inform their supervisor / person in charge of the work immediately. When a safety concern is raised and work is stopped, the work shall also be reassessed. The Stop Work Authority and the workforce's responsibility to stop unsafe work, forms part of the induction program for all personnel arriving on board and forms part of facility toolbox talks.
- Safety Observation System. A safety observation system is in place to identify, record, report and track safety, environment or integrity hazards observed on the facility. Submitted observations are reviewed by the facility management team. Corrective actions which result from such identified hazards shall be documented, assigned to a person for close-out and tracked. Regular feedback back is provided to facility personnel on close-out of corrective actions. The facility induction covers use of the safety observation system.
- Performing task planning, including for PTW, SIMOPS, daily reporting, short, medium, and long term planning, and managing unplanned tasks.
- Task Risk Assessments for hazard identification and risk control for high-risk, complex, and multitask offshore operations and maintenance activities, and special operations. Task Risk Assessments are an integrated part of the PTW process.
- The PTW Procedure describes the management of risks to health and safety arising from the interaction between work activities and process hazards at the Barossa facilities. The PTW Procedure is implemented for work activities carried out by all personnel on the Barossa facilities and whose work activities are under the influence and control of Barossa operations. The procedure documents hazard controls so that work can be carried out in an environment where risks are eliminated or minimised to ALARP. Members of the workforce that have been allocated roles within the PTW system are required to complete the training module relevant to their role (refer to Section 8.3.1.2). Vessels requesting entry to the 500m safety zone are required to complete a pre-entry checklist. A PTW and/or risk assessments may also be required depending on the types of activities a vessel is undertaking within the 500m safety zone. IMMR vessels shall operate under their own PTW system (refer to Section 8.3.2.4).
- Process safety, including override management and inhibit management.
- Isolations and purging procedures covering mechanical (process) isolations and purging, electrical isolations and instrument and safety control system isolations.
- Ensuring activities meet the minimum risk control requirements identified in the relevant technical procedures (e.g. isolations, confined space entry, etc). These procedures define personnel roles and responsibilities, isolation requirements (including approved isolation techniques, authorisations, testing and lock-out and tag-out).
- The Operational Risk Assessment process, which is used to assess if it is safe to operate plant and equipment outside of operating limits.
- Defining the requirement for suitable bridging arrangements to be developed between the Barossa Control of Work and contractor control of work procedures and processes.
- Developing a SIMOPS Matrix to assess work to be performed and avoid potential conflicts.
- Conducting Toolbox Talks to discuss the hazards, risks and associated controls and procedures for work activities.
- Managing hazardous operations, including vessel operations, lifting operations. Management of these hazardous operations is described in Sections 8.3.2.5 and 8.3.2.7.
- Temporary equipment use. The Temporary Equipment Procedure defines the requirements and process for assessing, transporting, registering, operating, and demobilising temporary equipment on the facility.

8.3.2.5 Vessel operations

Santos manages marine vessel operations using a hierarchy of procedures, outlined below. These requirements for vessel acceptance criteria include technical, personnel (e.g. crew competencies) and operational requirements for marine vessels engaged by Santos.

Vessel Type	Vessel Acceptance Criteria
Supply Vessels	Vessels visiting the FPSO are required to complete a pre-entry checklist prior to approval to enter the FPSO safety zone. The checklist includes requirements to confirm that weather / sea state conditions are acceptable, communications are established, suitable vessel systems tests have been performed and conflicting activities have been reviewed. Bunkering Operations Procedure for BW Opal which describes the bunkering procedures for Marine Gas oil (MGO), methanol, Monoethylene Glycol (MEG) and freshwater. The procedure defines: • The roles and responsibilities during bunkering operations. • Safety and environmental requirements, including the requirement to hold a toolbox talk, raise a cold work permit, maintain watch at bunkering stations, SIMOPS restrictions, and when operations shall cease. • The requirements for completing various plans and checklists for bunker operations, including bunker plans, pre-bunkering checklists, bunker specific checklists (i.e. MGO, MEG, methanol, freshwater) and post bunkering checklists. Pre-bunker activities include visual inspection of bunker hoses and establishing communications between personnel involved in the bunkering operation on the FPSO, and the supply vessel. Lifting operations between the FPSO and supply vessels are conducted in accordance with the Operation Manual – System 73 Material Handling (refer to Section 8.3.2.7).
Offtake Tankers	The FPSO BW Opal – Barossa Terminal Handbook describes the management of offtake tanker operations, including: • Roles and responsibilities during offtake operations, including personnel on the FPSO, offtake tanker, hold back vessel, assist vessels and the pilot. • Directing of the approach of the tanker towards the FPSO by the Santos appointed pilot. • Defining the environmental limitations for offtake tanker approach, mooring, offloading, unmooring and departure operations. • Operational restrictions, including sectors and limits, offloading distances, mooring hawser tension requirements and SIMOPS restrictions / considerations. • Defining the communications protocols, including establishing contact, routine and emergency communications and offtake tanker arrival notices and notifications. • Guidelines for offloading operations, including preparation activities, offtake tanker approach and mooring operations, offloading hose connection, cargo transfer operations, termination of operations, and offtake tanker unmooring and departure operations. • Defining emergency response actions, including emergencies on the FPSO, offtake tanker or hold back tug, mooring hawser failures, black-out and pollution events. Vetting of offtake tankers is also performed in accordance with the Marine Assurance Standard (refer to Section 8.4.8). Development of the Terminal Handbook was informed by the guidance provided in the International Safety Guide for Tankers and Terminals (OCIMF). The Terminal Handbook also requires that Offtake Tankers shall at all times observe, perform and comply with the berthing terms within the handbook, and all relevant OCIMF standards. The Santos Marine Superintendent is the Santos Authority for offtake operations and provides technical support and oversight for offtake operations.
Hook-up and commissioning support vessels	The Barossa assurance process for selection and management of the vessel and the tug vessels, is in accordance with the Santos Marine Assurance Standard (refer to Section 8.4.8), and the relevant international marine standards, and includes: • Vessel suitability and condition survey; • Offshore Vessel Inspection Database review; and • Planned Maintenance System review
IMMR Vessels	The specific requirements for managing vessels performing Inspection Monitoring Maintenance and Repair (IMMR) or installation support vessels activities in the field are defined in campaign specific interface management plans. Such plans will typically define the vessels planned activities, communications protocols, PTW requirements, roles and responsibilities, interface management procedures and controls, emergency response protocols and incident reporting and notification requirements. A Santos CSR is present on IMMR and installation vessels in the field to provide oversight of the day to day activities on board the vessel.

8.3.2.5.1 Marine operations manual

The Marine Operations Manual describes the standards of marine operations to achieve safe and efficient outcomes. The Marine Operations Manual details:

- standard operating procedures for all vessels under contract with Santos
- compliance requirements for relevant maritime legislation and relevant guidelines, standards and codes
- compliance requirements for international conventions and agreements, including:
  - International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004
  - SOLAS 1974 and its Protocol of 1988
  - International Convention for the Prevention of Pollution from Ships 1973/1978 (MARPOL 73/78)
  - Convention on the International Regulations for Preventing Collisions at Sea 1972 (COLREGS)
  - International Convention on Standards of Training, Certification and Watchkeeping (STCW) for Seafarers, 1978.
- compliance requirements for industry standards as set up by:
  - OCIMF
  - IMCA
  - Guidelines for Offshore Marine Operations
  - Nautical Institute.
- Marine assurance
  - vessel vetting criteria
  - marine personnel competency
- Santos and contractor standards, procedures and best practice management to comply with the control measures and performance standards (as set out in Table 8-2) in this EP as relevant to vessels, including:
  - vessels' safety of navigation
  - vessels using DP systems
  - vessels' bunkering procedures
  - crew competency and training records
  - biosecurity management
  - chemical storage and handling procedures
  - discharge management procedures
  - waste management procedures
  - anchoring procedures
  - vessel and equipment maintenance procedures as per the vessel-specific safety management system.

8.3.2.6 Aviation operations

The Aviation Procedure which sets out the requirements for the safe, effective, and efficient management of all aviation operations and activities.

Operations must meet CASA's regular public transport (RPT) standards and published aircraft performance criteria, and independent evaluations or audits will take place at no less than 12 month intervals.

8.3.2.7 Lifting operations

Operation Manual – System 73 Material Handling describes how lifting operations are performed on the FPSO and between the FPSO and supply vessels. It includes the requirements that:

- Lifts are planned and conducted by competent personnel.

- The maximum weight and dimensions of a load is known and is within the rated capacity of the lifting and rigging equipment.
    - A documented lift plan is prepared for complex lifts.
    - Certified lifting equipment is used.
    - Lifting equipment is checked and is within inspection date and is in good condition prior use.
- Clear communication is established and maintained between everyone involved in the lift.
- Separation distances from live hydrocarbon and electrical services are maintained.

Lifting operations on an IMMR vessel are managed under the IMMR vessel contractor's procedures. Contracted IMMR vessels are vetted under the Santos Marine Assurance process described in Section 8.4.8.

8.3.2.8 Waste management

Waste management will be undertaken in a manner consistent with Santos' waste management processes, including application of the waste management hierarchy, classification and segregation of waste streams, appropriate storage, transportation requirements, record management (e.g. waste inventories and tracking), use of licenced contractors/facilities and auditing.

All FPSO wastes are disposed of in accordance with the FPSO Waste Management Plan. which includes for the cradle to grave management of FPSO waste generated during FPSO transit, hook-up, commissioning and operations and identifies:

- Relevant legislative and regulatory requirements
- Responsibilities and obligations
- Waste Hierarchy
- Waste classification/categorization
- Types of waste generated.
- Waste management processes and procedures
- Waste storage requirements
- Waste transport and tracking requirements.
- General waste monitoring requirements
- Audit and inspection requirements
- Record keeping and reporting requirements, and
- Revision process for the continuous improvement.

The BWO HSE Supervisor will conduct Internal audit once every year to assess the effectiveness of, and conformance to the FPSO Waste Management Plan. The specialist waste handling contractors will also be audited every two years.

As certain controlled wastes (such as mercury-contaminated wastes) will need to be sent outside of the NT for treatment and disposal, such transfers will need to comply with the requirements of the National Environment Protection (Movement of Controlled Waste between States and Territories) Measure, 1998, specifically Schedule B), which requires that the waste producer for each transfer supplies:

- description of the waste(s), using the proper shipping name/technical name if applicable for dangerous goods
- the physical nature of the waste
- waste code(s)
- UN Number(s)
- UN Code(s)
- Dangerous Goods Class(es) (UN Class(es)) and subsidiary risk if applicable for dangerous goods
- Packaging Group number
- quantity of waste(s)
- type of package (such as bulk) and number of packages of each type if applicable for dangerous goods

- facility name and address
- facility licence number
- State/Territory of destination
- name of waste producer
- address of waste source
- producer's telephone number
- emergency contact number in the event of accident or spillage
- consignment authorisation number
- producer identification number
- date of dispatch.

Wastes from vessels are sent to shore and are maintained as per vessel class in accordance with relevant Marine Orders. This includes recording waste volumes in a Garbage Record Book.

Further detail of the management of mercury waste on the FPSO is included within Section 8.3.2.11.3.

8.3.2.9 Biosecurity management

Barossa Biosecurity Management Plan has been developed in consultation with the Department of Agriculture Forestry and Fisheries (DAFF) and submitted for approval prior to FPSO sailaway. Given that the FPSO will remain on location once hooked-up, there is no ongoing risk in relation to the topsides vector. The biosecurity management plan will provide methodology and biosecurity arrangements once the FPSO is on location in OA1 and how it will interact with vessels, whilst maintaining a low risk status. Detail on third party IMS review, survey or inspections during the ongoing operations is provided Section 8.3.2.9.2.5.

8.3.2.9.1 Ballast water management

8.3.2.9.1.1 Summary of requirements

The Australian ballast water management requirements set out the obligations on vessel operators regarding managing ballast water and ballast tank sediment when operating within Australian seas. These requirements include legislative obligations under the Biosecurity Act 2015 (Cth) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments. The requirements provide guidance for vessel operators on best practice policies and apply to all vessels operating internationally and domestically in Australia. All vessels designed to carry ballast water (as applicable to vessel class) are required to carry the following:

- a valid ballast water management plan
- a valid international ballast water management certificate
- a type approval certificate specific to the type of ballast water management system installed (if installed)
- maintenance of a complete and accurate record of all ballast water movements, including those conducted in Australian waters.

Ballast water exchange should be conducted in areas at least 12 Nm from the nearest land and in water at least 50 m deep (having regard to the D-2 standard exemptions in the Australian Ballast Water Management Requirements [DAWE, 2020a]). Volumetric exchange must be at least 95% of the relevant tank.

Records on ballast water exchange must include the start and finish times and geographic coordinates of the operation.

All ballast water management equipment, such as pumps, will be maintained per the vessel's preventive maintenance system and regularly tested to ascertain accurate calculations for ballast water exchange operations.

8.3.2.9.1.2 Australian pre-arrival report

All international vessels (intending to ballast) must submit a pre-arrival report (through the Maritime Arrival Reporting System [MARS]) at least 12 hours prior to arrival. The Ballast Water Report will be assessed by the DAFF through MARS, and a response will be issued through the Biosecurity Status Document. Domestic vessels can request a low-risk exemption through a domestic risk assessment through MARS.

MARS is the online portal used by commercial vessel masters and shipping agents to submit the reports required of all international vessels seeking Australian biosecurity clearance and to request services such as coastal strip, waste removal, ship sanitation certification and crew change.

DAFF will request evidence from vessels with a ballast water management system of:

- a valid ballast water management plan specific to the vessel (consistent with the Ballast Water Management Convention)
- a valid ballast water management certificate, or certificate of compliance, that is approved by a port state administration, or a recognised survey authority (consistent with the Convention)
- ballast water management records clearly demonstrate the ballast water management system has been operated consistently with the ballast water management plan.

A DAFF biosecurity officer may board the vessel to verify the pre-arrival report and personnel proficiency in the operation and maintenance of the ballast water management system.

8.3.2.9.2 Biofouling management

IMS may be present as biofouling on the vessel hull or within piping, sea chests, etc. Biofouling, which may be found on and in a vessel, reflects the vessel's design, construction, maintenance and operations. Each of these aspects introduces particular biofouling vulnerabilities but also offers opportunities to limit the extent and development of biofouling, with commensurate reduction in biosecurity risks.

The FPSO will implement a Biofouling Management Plan (BFMP) and maintain a Biofouling Record Book (BFRB) outlining the FPSO specific biofouling management measures reducing the likelihood of translocating IMS via the FPSO to the Barossa field to ALARP and acceptable levels. Sections below are applicable to all Activity vessels.

8.3.2.9.2.1 Summary of requirements

Biofouling management for international vessels will comply the Australian biofouling management requirements (DAFF, 2023), which implements the requirements of the *Biosecurity Act 2015* (Cth) and the IMO 2023 Guidelines for the Control and Management of Ships' biofouling to Minimize the Transfer of Invasive Aquatic Species.

Under the *Biosecurity Regulation 2016* (Cth), all operators of vessels intending to enter Australian territorial waters must provide information relating to biofouling management through the mandatory pre-arrival report 12–96 hours prior to arrival. In addition, the vessel operator must demonstrate proactive management of biofouling by implementing one of the 3 accepted proactive biofouling management options:

- implementation of an effective biofouling management plan and record book
- cleaned all biofouling within 30 days prior to arriving in Australian territory
- implementation of an alternative biofouling management method pre-approved by the department.

Vessels mobilised to the OAs from international or domestic waters must also comply with the National biofouling management guidelines for the petroleum production and exploration industry (Marine Pest Sectoral Committee, 2009).

8.3.2.9.2.2 Vessel risk assessment

This includes:

- completing a biofouling risk assessment
- implementing mitigation measures commensurate with the level of risk.

Figure 8-9 illustrates the biofouling risk assessment process. Factors that will inform risk include:

- timing of marine pest risk assessment relative to the Activity vessel mobilisation to provide sufficient time to implement control measures in cases where management is warranted
- Activity vessel location history since last dry dock and clean to inform whether the Activity vessel may have been exposed to high-risk ports/locations
- level of biofouling and the presence of species of concern (particularly the presence of marine pests) within biofouling communities on the vessels associated with the Activity (often informed by biofouling record books and/or maintenance/cleaning or inspection programs)
- operational profile relevant to biosecurity risk such as operating speed, time alongside a facility and the need for ballast exchanges within the title area
- receiving environment including the presence of shallow-water sensitivities near the Activity and the presence and area of non-biocidal surfaces on facilities that could harbour marine pests
- presence and effectiveness of external and internal marine growth prevention systems including effectiveness and integrity of anti-fouling coatings and functionality of internal treatment systems

- qualifications and competency of those conducting and reviewing the risk assessment and making management decisions.

8.3.2.9.2.3 Vessel risk status

Vessels must achieve a 'low' risk status to demonstrate to the government that Santos has taken all reasonable measures to minimise the risk of IMS. The risk assessment categorises the vessel's risk status as:

- low – low risk of introducing IMS; no additional management measures required
- uncertain – risk of introducing IMS is not apparent; precautionary approach adopted, additional management measures required to achieve low status
- high – high risk of introducing IMS; additional management measures will be required.

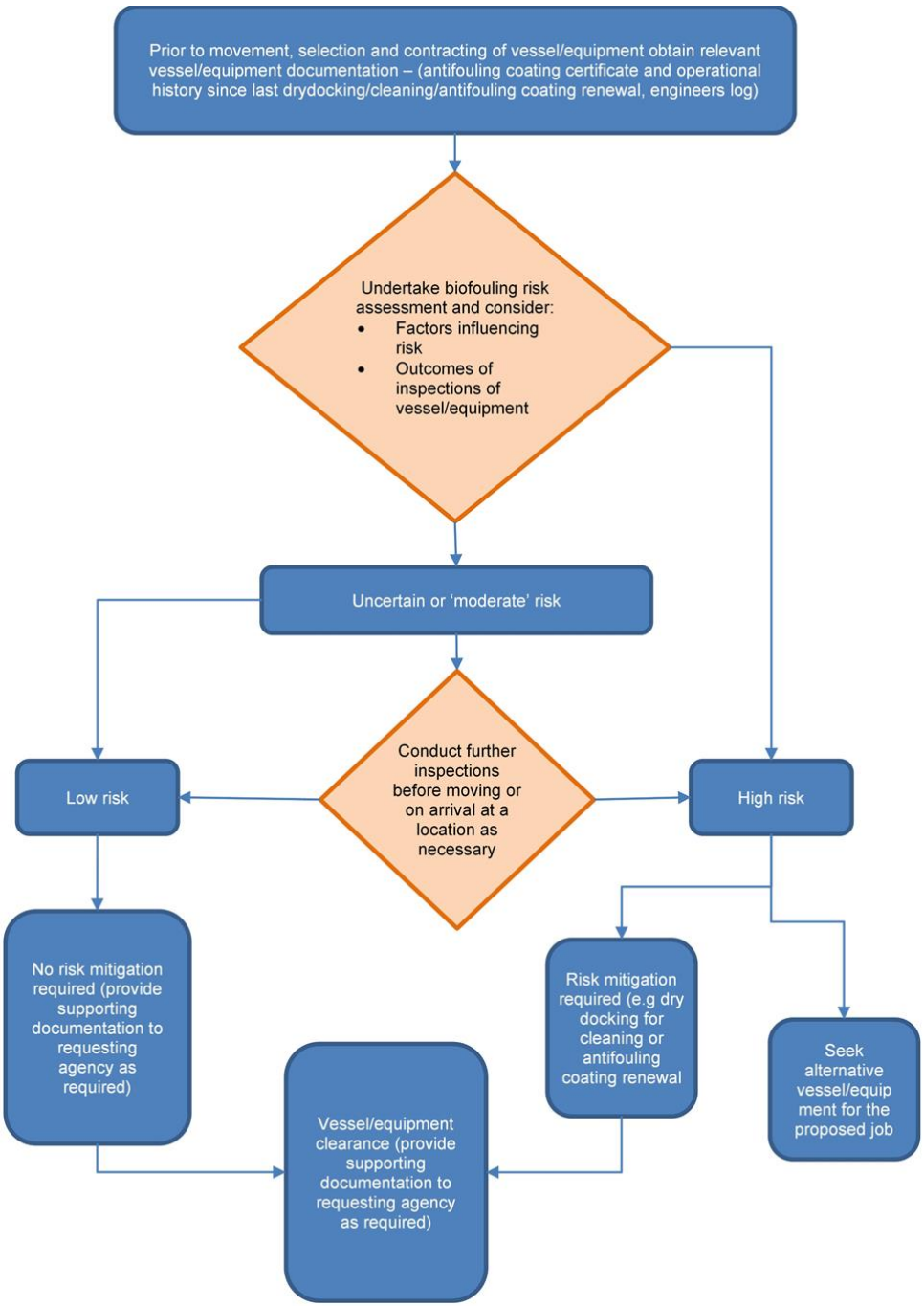
8.3.2.9.2.4 Potential management measures to achieve low risk status

The outcome of the risk assessment will determine the management measures required. If the vessel is deemed as 'low' risk status, no other measures are required (providing the vessel does not exceed the 7-day threshold at stationary or slow speed, in waters outside Australia).

For vessels that are assessed as having an 'uncertain' or 'high' risk, contractors will engage a qualified IMS inspector to conduct inspections and/or provide advice on obtaining 'low' status. Table 8-9 lists mitigation measures that can be applied to achieve 'low' risk status.

Table 8-9: Biofouling mitigation measures

Mitigation measure	Overview
IMS inspection	Visual inspection (reviewing of ROV footage obtained during FPSO hull integrity inspections) of submerged surfaces and niche areas by a qualified biosecurity inspector to better understand the actual biosecurity risk.
In-water cleaning	The appropriateness of in-water cleaning operations must be a decision made closely with an IMS inspector on a case-by-case basis. Many factors will be considered, including: • degree and type of biofouling • location of biofouling on the vessel. Before undertaking in-water cleaning within Australia, approval from the relevant state/territory authority must be granted and conditions may be imposed. Application must be made to the administering authority (harbour master, local government or state/territory environmental protection agency) at least 5 working days before the proposed start of work.
Dry docking cleaning	Dry docking and removing/cleaning biofouling will include hull surfaces, niche areas such as sea chests, all retractable equipment such as thrusters, intakes and outlets, anodes and voids.
Temporal or spatial controls	Temporal or spatial controls to limit vessel exposure to sources of risk.
Applying anti fouling coating	Depending on its age, the vessel may require a new anti-fouling coating to be applied by professional operators. The anti-fouling coating type will be based on technical advice. All vessels more than 400 gross tonnage require a valid anti-fouling system certificate.
Treating internal seawater systems	In the absence of a marine growth prevention system, internal seawater systems may need to be cleaned. Cleaning actions may include: • dehydration • heat • physical removal • chemical treatment. Ideally, treating internal seawater systems will be undertaken before the vessel is mobilised to Australia. If chemical treatments are to be undertaken within Australian waters, advice must be sought from the Australian Pesticides and Veterinary Medical Authority (https://apvma.gov.au/) in relation to permit and reporting requirements—it is prohibited to clean internal systems in Australian waters without a permit.



Source: Marine Pest Sectoral Committee (2009)

Figure 8-9: Generic biofouling risk assessment process

8.3.2.9.2.5 FPSO inspection strategies

ROV footage acquired during FPSO hull, turret and mooring integrity inspections will be reviewed by IMS expert and upon identification of IMS appropriate biosecurity measures will be initiated.

FPSO inspection strategies take into account that it remains on station for the life of the asset in the Barossa field without the need for disconnection. The risk based inspection (RBI) programs provide the basis for the inspection reporting, corrective maintenance actions undertaken and informs future inspection planning.

The hull structure integrity management plan is based on DNV Class Rules and includes a 5 yearly underwater inspection in lieu of dry-docking (UWILD). UWILD includes underwater inspection, repair, and maintenance using ROVs and divers if required. To enable diverless inspection of the hull, the FPSO has 'ODIN' access ports installed on shipside valves.

The turret and mooring integrity management plan provides for two yearly ROV inspections the turret and mooring structure and the STP subsea system.

8.3.2.10 Chemical management

Chemicals will be selected in accordance with the Santos chemical selection process (refer Section 2.7.3.8.4) and managed at the FPSO in accordance with the facility chemical management procedure.

The facility chemical management procedure defines the process for managing chemicals at the FPSO, including:

- the roles and responsibilities for requesting, reviewing, approving and administration of chemicals
- use of the electronic chemical management system for registering chemicals the process for requesting new chemicals and maintaining the Chemical Inventory Register
- chemical inventory and storage requirements, including the requirement for developing a Chemical Storage Plan
- handling and use of chemicals is required to be in accordance with the SDS and chemical risk assessments (as applicable), which define the PPE requirements and emergency actions on chemical spills, fires, exposure, etc.
- that all chemical waste is disposed of in accordance with the Facility Waste Management Procedure.

A Safety Data Sheet (SDS) is provided for each for each hazardous substance. The SDS describes its physical and chemical properties, health and physical hazards, safe handling and storage, emergency procedures and disposal considerations.

8.3.2.11 Mercury management

Santos has overall accountability for compliance with the mercury management commitments within this EP and associated processes and procedures. BWO, in particular the BWO Operations Superintendent (refer Figure 8-2, Table 8-3), and its third-party contractors are directly responsible for the day-to-day implementation of the FPSO mercury management plans and procedures from detection, collection, transport of mercury waste to final disposal (i.e. cradle to grave).

The Barossa FPSO Mercury Management Strategy describes the requirements for establishing a Mercury Management Framework which describes how the mercury exposures risk posed to operations and maintenance personnel and to the environment will be identified, assessed, controlled, and managed.

The Barossa Mercury Management Strategy and Mercury Management Framework are implemented via the BWO Mercury Management Plan and associated procedures:

- The Mercury Management Plan and Mercury Mapping Procedure cover the requirements for controlling exposure and contamination risks from mercury, the maintenance of a mercury register and the ongoing mercury mapping of contaminated process areas to aid in the planning of maintenance.
- The Occupational Health Management Plan which define the health procedures used to manage mercury exposure.
- The Breaking Containment Procedure which includes the requirements for managing mercury when breaking containment, including testing and set-up of temporary decontamination zones.
- The Mercury Decanting Procedure which enables mercury decanting operations to be conducted in a safe, responsible manner, minimising both exposure of personnel to mercury vapour, and minimising the potential for spillage or contamination of mercury.
- The FPSO Waste Management Plan which includes the requirements for managing, transporting and disposing of elemental mercury and mercury contaminated waste which will reflect the requirements of the International Maritime Dangerous Goods (IMDG) Code / MARPOL Annex III with respect to containment, labelling, stowage and transportation of hazardous/harmful goods.
- The BWO SMPEP which includes requirements for the provision and management of Mercury spill kits on the FPSO.
- The Mercury Hazard Awareness Training Program which will be carried out as part of the overall operations training package (refer Section 8.3.1.2). The Mercury Hazard Awareness Training Program will be provided to all personnel that may encounter mercury or who plan or supervise work potentially involving mercury to ensure a high awareness of the hazards associated with mercury in the process, and the importance of preventing exposure or spillage / contamination from mercury, as well as details on mercury testing requirements and emergency response procedure.

Additional to the above, there are also requirements for the adaptive management of mercury within produced water (PW) as per the PW Adaptive Management Plan (Appendix J).

Further detail on key FPSO mercury management plans, procedures and processes is provided below.

8.3.2.11.1 Mercury Management Plan

The Mercury Management Plan provides precautions and procedures to be adhered to for maintenance activities where mercury may pose a hazard to personnel and the environment. This includes key aspects of the processes and procedures with some presented below:

- Mercury exposure and contamination controls for any tasks involving potential mercury contact
- Guidelines and instrumentation for conducting monitoring of mercury in the atmosphere, on surfaces and in solids/liquids when working on dry gas, wet gas or liquid systems where there is the potential for mercury exposure or contamination (refer Table 8-25). For noting, all process areas will initially be considered to be mercury contaminated until monitoring confirms mercury free.
- Requirements and procedures for a mercury mapping tool and mercury register to support operations maintenance activities planning where there will be a need to select appropriate controls for performing maintenance tasks, or sampling, when breaking of containment into the piping/equipment is required.
- Where the presence/absence of mercury in the process has not been validated through monitoring maintenance planning will be based on principle that the process could be contaminated.
- Arrangements for detection and exposure monitoring for airborne mercury by direct reading/real time instrument to alert operations personnel of airborne concentrations.
- Procedures for workplace health and safety, including specific requirements and procedures for exposure and workplace exposure standards management.
- Mercury risk management including health monitoring and training.
- Breaking containment during invasive maintenance activities involving mercury contaminated equipment only conducted in accordance with operations standards and procedures for hazardous process contaminants.
- Guidance and precautions for mercury decontamination for piping and contaminated equipment.
- Precautions such as barricading, bunding and the provision of mercury spill kits where there is potential for a mercury spill.
- Requirements that in the event of small mercury spills, these will be collected and contained dedicated Hazmat drum with sealable lid. The effected area will be decontaminated and contaminated materials will be safely shipped back to shore by the specialist mercury removal contractor for further treatment or disposal.
- Mercury waste disposal will be compliant to the FPSO Waste Management Plan and in conjunction with the specialist mercury removal contractor.

8.3.2.11.2 Mercury Decanting Procedure

Operating guidance for the drainage operation from the Mercury Collection Pots by a specialist mercury removal contractor is included in the Mercury Decanting Procedure.

The Mercury Decanting Procedure contains:

- Step by step instructions for decanting/handling of mercury
- Site preparation, spill kit requirements and spill response actions
- Mercury contaminated waste handling and disposal requirements
- Role responsibilities for undertaking mercury decanting

Mercury decanting steps include:

- Recording the mercury level in the Mercury Collection Pot (MCP) using the magnetic level gauge.
- Isolation of the LTS vessel and the MCP.
- Connection of IMDG Code-approved mercury collection transport container (MCTC) (i.e. QC80s) to the MCP.
- Opening and monitoring of MCP drain valve and depressurisation of the MCP to the MCTC.
- Pushing mercury from the MCP into the MCTC with nitrogen.
- Isolating the nitrogen supply and completing all rechecks and levels of the MCP to the MCTC to confirm unchanged values and close all valves and drains.
- Closing the isolation valves connecting to the MCTC.
- Sealing and confirming MCTC is safe for transportation to the designated temporary storage area on the FPSO prior to offload and transportation to shore.
- Removing temporary drain hose from the MCP and decontaminating hose in Sodium Hypochlorite solution (5%).
- Decontaminating any other tooling that could have been contaminated.

- Cleaning the area and collecting any free mercury found using mercury spill kit / appropriate supplies and disposing to safe container.

Monitoring of the magnetic level gauge on MCPs will be undertaken manually as part of Operations Daily Checks Module M63. During the first year of Barossa operations, mercury collection and decanting is anticipated to be more frequent than the forecasted steady state production average of 5-7 months for the MCP to fill up. This more frequent removal will allow for the initial assessment of the mercury production level from the reservoir to validate the design assumptions. Management of mercury decanting will be revisited as the level of mercury collection changes over the field life.

8.3.2.11.3 Mercury waste management

Besides decanted and collected elemental mercury, mercury may be co-produced with other hazardous waste including sludge removed from process vessels, contaminated equipment or PPE. All mercury or suspected mercury waste with be disposed of in accordance with the FPSO Waste Management Plan.

Mercury contaminated waste in both solid and liquid form will be stored at designated starboard aft Lay Down Area before transferring to the approved shore-based contractor for disposal. Mercury contaminated waste will be placed into a HDPE plastic bag and placed within a clearly labelled Hazmat container with a sealable lid. A specialist 3rd party contractor will be engaged for the handling of mercury recovery and onshore processing.

Mercury waste management procedures include:

- Before any waste with mercury leaves the facility, at least one sample should be taken to the laboratory for background analysis measurements on total mercury.
- Solid mercury contaminated waste (e.g. sand) will be stored in sandbags inside impermeable heavy duty plastic cases.
- Liquid/slurry mercury contaminated waste will be stored in drums and overpack drums with bunding. A copy of the mercury safety datasheet will be included with mercury waste being sent offsite.
- International Maritime Dangerous Goods Code requirements will be followed for marine transportation of mercury- contaminated waste.
- Records will be kept of the total volumes of mercury-contaminated wastes sent to shore for disposal.

Process system deposits contaminated with mercury may take the form of sludge's, sands, scales, waxes, filter media, mercury bed catalyst or elemental mercury. Management of mercury contaminated process system deposits includes:

- Adequate containment of process deposits will be provided to prevent mercury being discharged into the sea.
- Mercury contaminated process deposits will be stored in a cool / shaded location, and securely covered to ensure vapour releases do not pose a hazard to workers (atmospheric levels should be verified to confirm)
- If contaminated process system deposits are to be disposed of offsite, then the mercury content of the deposits will be quantified with at least two samples and consultation carried out with waste management contractors
- Materials Controller on potential disposal routes for the material.
- Adequate PPE will be worn when transferring process deposits contaminated with mercury from storage to shipping containers and the potential for contamination of other surfaces will be considered.

Prior to leaving a mercury control zone mercury-contaminated PPE, consumables and other materials will be placed in HAZMAT drums and clearly labelled as mercury contaminated waste. This includes any potentially contaminated cleaning and absorbent materials used for decontamination and tools or materials which cannot be decontaminated (e.g. wooden materials)

8.3.2.12 Methane Emissions Management

Santos' approach to methane, as outlined in the 2024 Annual Report, focuses on three key areas:

- **Detect, measure and validate**: Activities that detect and accurately measure methane emissions using a combination of evidence-based theoretical techniques and real-time technologies. The utilisation of various methods and technologies permits validation of results and comparison against reported emissions. Our most material emissions are assessed and prioritised accordingly.
- **Monitor and mitigate**: Asset-led programs that incorporate surveillance of emissions using different techniques and technologies. These programs permit prioritisation of our most material emissions, associated reparation feasibility assessment and value impact to the business.

- **Engagement and leadership**: Interaction with stakeholders across the methane value chain to collaborate on solutions. This includes engagement and collaboration with our peers on approaches for methane measurement and reduction.

Actions implemented under each of these pillars may change year-on-year as our approach evolves, but in 2024 included, at the corporate level:

- Becoming a signatory of the OGCI Aiming for Zero Initiative, committing to 'near zero' methane emissions from operated assets by 2030[56]
- Became a signatory to the World Bank's Zero Routine Flaring Initiative, committing to avoid routine flaring in new oil field developments and end routine flaring at existing oil facilities by 2030, where economically viable.
- Participation in a satellite monitoring campaign to validate knowledge of methane emissions within the areas we operate
- Completed a methane emissions materiality assessment across our operated assets
- Participated in the Australian Energy Producers methane working group and Climate Leaders Coalition methane workstream

Methane emissions from Santos portfolio operations, equated to approximately 10 per cent of total gross operated Scope 1 emissions in 2024. Santos also achieved a methane emissions intensity of 0.16%, which is below the Oil and Gas Climate Initiative's (OGCI) 2025 target of 0.20%.

As described in Section 6.3, Santos has adopted methane emissions preventative measures in Barossa FPSO's design, such as adoption of a two-stage CO_2 removal membrane technology to minimise losses of methane in the acid-gas disposal stream and adoption of high methane destruction efficiency gas turbine generators and thermal oxidiser. Whilst methane emissions management is shaped by corporate targets and RBU management objectives, it is operationalised at the asset level taking into consideration factors including NGERs legislative reporting requirements, integrity and safety risk, materiality of emission sources, applicability of methane detection, measurement and reduction technologies and stage of asset-life.

As the operator of the Barossa facilities, Santos will operationalise the three methane emissions reduction pillars to Barossa operations having regard to its joint venture arrangements. Operationalisation of these pillars will be in the form of specific control measures and environmental performance standards (refer to BAO-CM-6.3.12) which aims to complement FPSO design emissions reduction measures and ensure that methane, along with other GHG emissions, are reduced to ALARP throughout the life of the Activity.

Methane emissions reduction opportunities are also considered as part of Santos' ongoing decarbonisation opportunity management process as described in Section 8.5.7.

8.3.2.13 Greenhouse gas emissions management plan

Management of facility scope 1 GHG emissions over the life of the Activity will be governed under the Operations Greenhouse Gas Emissions Management Plan (GHGEMP) to ensure a coordinated approach across all aspects of GHG emissions management described in the implementation strategy. The purpose of the Operations GHGEMP is to reduce scope 1 emissions from facility operations to ALARP over the life of the Activity. The Barossa Production Manager will be accountable for the Operations GHGEMP. The GHGEMP will take effect from the commencement of steady-state operations.

The scope of the Operations GHGEMP includes all FPSO and subsea (including GEP) emissions sources, upstream of the DLNG facility custody transfer point at the DLNG facility beach valve. That is, the scope of the Operations GHGEMP covers emissions from Operations under this EP but also emissions from operation of the GEP in NT waters outside the scope of this EP (noting that GHG emissions from operation of the GEP will be limited to fugitive emissions from transport of gas through the pipeline and vessel emissions from infrequent IMMR vessel activity).

To ensure ongoing GHG emissions management in line with evolving best practice standards, and because the GHGEMP captures activities outside the scope of this EP, the GHGEMP will be a living document within the Barossa Management System (Section 8.2.1.1) and not annexed to this EP.

The following protocols, procedures, systems and measures, as detailed further within the implementation strategy at the sections cross-referenced below, will be incorporated in, and form part of, the GHGEMP:

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[56] *Page 90 of Santos 2024 Annual Report* https://www.santos.com/wp-content/uploads/2025/02/FINAL-Appendix-4E-and-2024-Annual-Report.pdf

- Adaptive management, to address areas of uncertainty, are integral to emissions performance target setting (Section 8.2.4.2), methane emissions management (Section 8.3.2.12) and decarbonisation opportunity management (Section 8.5.7).
- Emissions Performance Target Setting (Section 8.2.4.2)
- Critical Equipment Maintenance (Section 8.3.2.3.1)
- Methane Emissions Management (Section 8.3.2.12)
- Decarbonisation Opportunity Management (Section 8.5.7)

Due to its importance as a governing document, the GHGEMP has been adopted as a specific control measure (BAO-CM-6.3.12) with corresponding environmental performance standards (Table 8-2).

In addition to any updates to the GHGEMP triggered as a result of annual performance reviews (Section 8.5.3.2) and the annual emissions performance target setting cycle (Section 8.2.4.2), this GHGEMP will be reviewed and updated every five years at a minimum.

8.3.3 Other Measures

During the preparation of this EP, including as a result of consultation with Relevant Persons, Santos has identified additional measures which it considers are appropriate to implement. These measures are not control measures, as defined in the OPGGS(E)R, because they are not intended to be used by Santos as a basis for managing environmental impacts and risks. Some measures are not properly characterized as 'control measures' in respect of the Activity because they relate to operations outside of the operational area, which are not regulated under this EP. Notwithstanding this, Santos considers it appropriate to adopt the following measures as part of its implementation strategy:

- Given AIMS, BOM and UWA may have equipment deployed, outside of the OA but within proximity, in addition to the quarterly updates and notice to mariner notifications Santos will confirm annually with AIMS/ BOM and UWA their activity proposed for the year, along with locations of any equipment that may be deployed.
- Santos to provide a report to DCCEEW on outcomes of IMMR activities in the Oceanic Shoals Marine Park multiple use zone (for 30km) and the habitat protection zone (for 31km).
- To build community confidence and capacity, Santos will offer training to Tiwi Islands Ranger Groups, other Tiwi people nominated by Tiwi Land Council Trustees and Croker Island Ranger Groups for rapid assessment for hydrocarbon spill incidents. Training will be provided subject to the interest, availability and the participation of the Ranger Groups.
- BWO will develop a Ship Security Plan for transit to the OA, and Santos will develop an Offshore Facility Security Plan for the operational phase in accordance with the *Maritime Transport and Offshore Facilities Security Act 2003* and the accompanying *Maritime Transport and Offshore Facilities Security Regulations 2003*.
- Santos to provide biosecurity risk assessment information to the Tiwi people, once the final work has been completed in 2025, prior to the FPSO leaving for Australian waters.
- Santos to advise relevant Tiwi clan member if any bones are identified during the term of this EP.

8.4 Check

The ‘Check’ section describes surveillance and assurance activities to check effectiveness of the implementation strategy and associated control measures to achieve environmental performance outcomes (Table 8-1) and performance standards (Table 8-2) in this EP.

OPGGS(E)R 2023 Requirements
Section 22 Implementation strategy for environment plan
Monitoring and reporting (22(5) The implementation strategy must provide for sufficient monitoring, recording, audit, management of non-conformance and review of the titleholder’s environmental performance and the implementation strategy to ensure that the environmental performance outcomes and environmental performance standards in the environment plan are being met.

8.4.1 Assurance Framework

Santos Assurance Procedure defines the framework and requirements for the planning and application of assurance activities for Santos Operations.

Level 1 assurance (such as the inspections described in Section 8.4.4) is the day-to-day assessment and management of risk undertaken by frontline leadership (a focus on hazards), which includes:

- Ensuring that controls are in place and operating effectively for the management of risk.
- Monitoring and maintaining compliance with relevant controls.
- Escalating identified material or systemic control failures or weaknesses and ensuring that any ongoing risk exposure is managed in line with the relevant risk management procedure.

Level 2 assurance (such as the audits described in Section 8.4.5) is management oversight through an annual assurance plan, based on key risks and controls (typically as described in relevant approvals such as the EP), and the underpinning systems. Typically, this level of assurance is conducted by management and senior management. Findings of Level 2 assurance activities resulting in necessary control improvement actions to effectively manage risk exposure are recorded, monitored and when completed, closed. Emerging trends and material or systemic control failures or weaknesses identified through these assurance activities must be promptly escalated to the relevant managers and any ongoing risk exposure must be managed in line with the relevant risk management procedure.

Level 3 assurance is independent auditing, undertaken by independent internal or external auditors and is independent of Operations. The integrated assurance plan is governed by the Executive Functional Governance Committee of Santos, with a focus on audit of Technical and Operating Standards and "selection of risk-based audits". Findings from this assurance activity resulting in improvement actions are recorded, monitored and closed out in an approved system within agreed timeframes and the internal audit team notified upon completion. Key findings from these audits are required to be shared with the Santos leadership team.

Inspections and audits are undertaken to confirm compliance with the performance outcomes, controls measures and environment performance standards in the EP and confirm that the control measures are effective at reducing the environment impacts and risks. They will also identify potential new or changes to existing environmental impacts and risk, and methods for reducing these to ALARP.

Santos will retain accountability for assurance of all aspects of the Barossa Management System for all stages of the Activity including undertaking assurance activities in a manner consistent with the Barossa Project Environmental Compliance and Assurance Plan (ECAP). The ECAP outlines a process that enables the planning, collection and verification of environmental assurance evidence across the life of the Activity to measure compliance against the EPOs, EPSs, and measurement criteria for this EP. The ECAP is centred around the Barossa Environment Plan (EP) Compliance Register, which is the primary compliance tool that has a touchpoint at all stages of the environmental assurance process and directly shapes environmental assurance requirements, tools, schedules, verification and reporting. The Barossa EP Compliance Register identifies all applicable environmental requirements within the EP (EPOs, EPSs, measurement criteria, notifications), assigns responsibilities and applies verification controls, timing and tasks to each environmental compliance requirement. It will be first developed following acceptance of this EP and prior to commencement of the activities. It will be reviewed and revalidated following 12 months of steady state operations, and then again follow the 5 year revision of the EP. Planned inspections and audits against the Barossa EP Compliance Register are described in Section 8.4.4 and 8.4.5.

8.4.2 Initial Start-Up Performance Testing

As described in Section 2.6.1, all equipment is subject to performance trials as part of the final performance test. This test is designed to demonstrate the equipment as installed is performing in line with assumptions, should equipment performance not be met rectification works may be required. The EP Change Management Process (Section 8.5.2) will be followed to manage environmental impacts.

8.4.3 Monitoring, Recording of Emissions and Discharges

OPGGS(E)R 2023 Requirements
Section 34 Criteria for acceptance of an environmental plan
For the purposes of section 33, the criteria for acceptance of an environment plan (the ***environment plan acceptance criteria***) for an activity are that the plan: includes an appropriate implementation strategy and monitoring, recording and reporting arrangements.
Section 22 Implementation strategy for environment plan
Monitoring and reporting

22(6) The implementation strategy must provide for sufficient monitoring of, and maintaining a quantitative record of, emissions and discharges (whether occurring during normal operations or otherwise), such that the record can be used to assess whether the environmental performance outcomes and environmental performance standards in the environment plan are being met.

The following sections describe monitoring and recording of emissions and discharges for each stage of the Activity.

The purpose of emissions and discharges monitoring is to assess compliance with EP requirements and to reduce environmental impacts and risks to ALARP. Monitoring data may also inform identification of improvement opportunities as part of continuous improvement over the life of the Activity.

There may be contingency activities, such as extended duration of equipment hot-commissioning resulting in extended diesel use for power generation or flaring, as described in Section 2.6.3. Monitoring and recording of emissions and discharges for each stage of the Activity, as described in the sections that follow, will also apply to contingency activities depending on which stage of the Activity they occur.

Evaluating of monitoring results for the produced water treatment system is addresses per requirements of the PW Adaptive management Plan (Appendix I).

8.4.3.1 Hook-up and cold commissioning

8.4.3.1.1 Vessel emissions and discharge monitoring

Discharges to the marine environment associated with this Activity will be recorded and controlled in accordance with requirements under relevant Marine Orders and MARPOL requirements.

Santos and vessel contractors will maintain records so emissions and discharges can be determined or estimated. Such records will be maintained for a period of five years. Contractors are required to make these records available upon request.

For vessel activities Santos will maintain records of discharges or emissions to the environment as described in Table 8-10.

Table 8-10: Monitoring of vessel emissions and discharges

Vessel Discharge/emission	Parameter	Quantitative record	Frequency
Air emissions	Fuel volume	GHG emissions calculations based on measured fuel use in accordance with NGER/NPI reporting scheme requirements (if applicable)	Fuel use tracked daily, emissions calculated at end of campaign
Oily water	Volume and location	Oil Record Book* or equivalent report	As required
Ballast water	Volume and location	Ballast water log or Marine Daily Log Sheet	As required
Garbage (including food scraps)	Volume and location	Volumes recorded in Garbage Record Book*	As required
Sewage	Volume and location	Estimated based on POB and days on location	Once per campaign
Unplanned discharge of: • solid objects • hazardous liquids	Volume	NOPSEMA recordable or reportable incident reports	As required
Unplanned hydrocarbon release	Volume	NOPSEMA recordable or reportable incident reports as per Table 8-26	As required

* Maintained as per vessel class in accordance with relevant Marine Orders.

8.4.3.1.2 FPSO discharge monitoring

Discharges from the Activity have been identified throughout Section 2. Those monitored on the FPSO have been identified in Table 8-11.

Table 8-11: FPSO discharge monitoring

Discharge source	Monitoring	Frequency
FPSO Topsides cooling water	**Discharge volumes** Discharge volumes will be measured based on flowmeter records. **Discharge temperature** Cooling water discharge temperature will be measured before overboard discharge via the online temperature indicator transmitter. **Discharge chlorination** Manual sampling points are included both immediately after seawater chlorination to verify maximum dosing levels as well before the discharge point. Chlorine concentrations can be measured from samples at the Barossa FPSO laboratory.	Daily Daily Intermittent/as required
Subsea preservation chemicals i.e. MEG with PW overboard	**Discharge volumes** Discharge volumes will be measured based on injection flowmeter records.	As required

Discharges from the FPSO and vessels are also monitored as per vessel class in accordance with relevant Marine Orders and MARPOL requirements.

8.4.3.1.3 FPSO emissions monitoring

Emissions from the Barossa FPSO have been identified in Sections 6.3. Those monitored have been identified in Table 8-12. Emissions data will be recorded in line with NGERS and NPI reporting scheme requirements.

Table 8-12: FPSO emissions monitoring

Emissions source	Monitoring	Frequency
Gas turbine – liquid fuelled operations	**Primary** All diesel received at the Barossa FPSO will be supplied through commercial transactions with invoices for record-keeping. The turbines are supplied from the MGO service tanks each of which have level transmitters. Additionally, the diesel fuel flowrate to each turbine is monitored by individual diesel flow meters.	Daily
Diesel consumers	All diesel received at the FPSO will be supplied through commercial transactions with invoices for record-keeping. Essential Generators – diesel fuel flow meters are provided to, and from, each generator. Emergency Generator – the emergency generator is supplied from a dedicated day tank with a level transmitter. Firewater pumps – each of the four firewater pumps are supplied from separate day tanks with level transmitters. Inert Gas Generator – the inert gas generator is supplied from the MGO service tanks, each of which have level transmitters.	Daily

8.4.3.1.4 FPSO waste monitoring

Wastes generated by the Barossa FPSO are summarised in Table 8-13.

Table 8-13: Production Operations waste

Waste source	Approximate disposal frequency	Category
Mercury decanted from first and second stage low-temperature separators (refer Section 2.7.2.2)	Between quarterly and annually	Hazardous waste
MPPE media for columns	2 to 4 years	Recyclables (returned to supplier for recycling)
Filters	Infrequent	Hazardous waste
General wastes	Fortnightly	Non-hazardous waste
Plastics	Fortnightly	Recyclables
Paper and cardboard	Fortnightly	Recyclables
Metal	Fortnightly	Recyclables

Waste source	Approximate disposal frequency	Category
Oily rags and filters	Fortnightly	Hazardous waste
Bulk liquid wastes (oil, chemicals, cooking oil)	As required	Hazardous waste
Other recyclables (glass, broken crockery, aerosol cans, batteries, etc)	Fortnightly	Recyclables
Other hazardous waste (E-waste, solvents, chemicals, hydraulic fluids, oily waste, etc)	Fortnightly	Hazardous waste
Mixed bed resin	Every 4 months	Hazardous waste
Unused helideck fuel	As required	Hazardous waste

All wastes sent onshore for disposal will be monitored, recorded and reported based on the waste manifests that will be prepared for each shipment of wastes.

A waste tracking system will be developed and implemented at the Barossa FPSO and the supply base.

8.4.3.2 Initial Start-up to steady state

During Initial Start-Up emissions and discharge monitoring will inform the target setting process as described in Section 8.2.4.1.

8.4.3.2.1 Vessel emission and discharge monitoring

Discharges to the marine environment associated with this Activity will be recorded and controlled in accordance with requirements under relevant Marine Orders and MARPOL requirements.

Santos and vessel contractors will maintain records so emissions and discharges can be determined or estimated. Such records will be maintained for a period of five years. Contractors are required to make these records available upon request.

The Emissions and Produced Water Reporting Procedure describes the FPSO reporting requirements and process.

For vessel activities Santos will maintain records of discharges or emissions, to the environment as described in Table 8-14.

Table 8-14: Monitoring of vessel emissions and discharges

Vessel Discharge/emission	Parameter	Quantitative record	Frequency
Air emissions	Fuel volume	GHG emissions calculations based on measured fuel use in accordance with NGER reporting scheme requirements	Fuel use tracked daily, emissions calculated at end of campaign
Oily water	Volume and location	Oil Record Book* or equivalent report	As required
Ballast water	Volume and location	Ballast water log	As required
Garbage (including food scraps)	Volume and location	Volumes recorded in Garbage Record Book*	As required
Sewage	Volume and location	Estimated based on POB and days on location	Once per campaign
Unplanned discharge of: • solid objects • hazardous liquids	Volume	NOPSEMA recordable or reportable incident reports	As required
Unplanned hydrocarbon release	Volume	NOPSEMA recordable or reportable incident reports	As required

* Maintained as per vessel class in accordance with relevant Marine Orders.

8.4.3.2.2 FPSO discharge monitoring

Discharges from the Activity have been identified throughout Section 2. Those monitored on the FPSO have been identified in Table 8-15

Table 8-15: FPSO discharge monitoring

Discharge source	Monitoring	Frequency
FPSO cooling water	**Discharge volumes** Discharge volumes will be measured based on flowmeter records. **Discharge temperature** Cooling water discharge temperature will be measured before overboard discharge via the online temperature indicator transmitter. **Discharge chlorination** Manual sampling points are included both immediately after seawater chlorination to verify maximum dosing levels as well before the discharge point. Chlorine concentrations can be measured from samples at the Barossa FPSO laboratory.	Daily Daily Intermittent/as required
Subsea preservation chemicals i.e. MEG with PW overboard	**Discharge volumes** Discharge volumes will be measured based on injection flowmeter records.	As required
Production chemicals i.e. Methanol & MEG	**Discharge volumes** Discharge volumes will be measured based on injection flowmeter records.	As required

PW monitoring is in accordance with the PW Adaptive Management Plan (Appendix I).

Discharges from the FPSO and vessels are also monitored as per vessel class in accordance with relevant Marine Orders and MARPOL requirements.

8.4.3.2.3 FPSO emissions monitoring

Emissions from the Barossa FPSO have been identified throughout Section 2. Those monitored have been identified in Table 8-16. Emissions data will be recorded in line with NGERS and NPI reporting scheme requirements.

Table 8-16: FPSO emissions monitoring

Emissions source	Monitoring	Frequency
Gas turbine – gas fuelled operations	**Primary monitoring** Individual fuel gas flow meters are provided for each turbine to monitor fuel gas consumption. Gas Chromatographs are provided to measure fuel gas composition for the normal fuel gas supply and all backup supplies.	Daily (when in use)
Gas turbine – liquid fuelled operations	**Primary** All diesel received at the Barossa FPSO will be supplied through commercial transactions with invoices for record-keeping. The turbines are supplied from the MGO service tanks each of which have level transmitters. Additionally, the diesel fuel flowrate to each turbine is monitored by individual diesel flow meters.	Daily (when in use)
CO_2 disposal – thermal oxidiser	Fuel gas and CO_2 permeate gas sent to the thermal oxidiser is monitored through: • fuel gas line to thermal oxidiser flow transmitter (primary fuel gas, only normally required for start-up) • first-stage permeate gas flow transmitter (supplementary source of fuel gas) • second-stage permeate gas and permeate gas absorber streams calculated through mass balance approach between flow transmitters on the incoming stream and the residue stream.	Daily (when in use)

Emissions source	Monitoring	Frequency
	Gas chromatographs are provided to measure gas composition for the primary fuel gas supply and the CO_2 removal system streams.	
CO_2 disposal – acid gas flare tip backup	Streams sent to the acid gas flare tip when thermal oxidiser is offline are monitored by a flow transmitter. Enrichment gas sent to the acid gas flare tip is measured by a flow transmitter. Nitrogen purge gas sent to the acid gas flare tip is measured by a flow transmitter.	Daily (when in use)
HP and LP Flares	Pilot fuel gas consumed in the LP, acid gas and HP flares is measured by a totalising flow indicator. LP flaring quantities are measured at the totalising flow meter on the outlet of the LP flare knock-out drum. Nitrogen purge gas sent to the LP flare tip is measured by a flow transmitter. HP flaring quantities are measured at the totalising flow meter on the outlet of the HP flare knock-out drum.	Daily (when in use)
Diesel consumers	All diesel received at the FPSO will be supplied through commercial transactions with invoices for record-keeping. Essential Generators – diesel fuel flow meters are provided to, and from, each generator. Emergency Generator – the emergency generator is supplied from a dedicated day tank with a level transmitter. Firewater pumps – each of the four firewater pumps are supplied from separate day tanks with level transmitters. Inert Gas Generator – the inert gas generator is supplied from the MGO service tanks, each of which have level transmitters.	Daily (when in use)

8.4.3.2.4 FPSO waste monitoring

Wastes generated by the Barossa FPSO are summarised in Table 8-17.

Table 8-17: Production Operations waste

Waste source	Approximate disposal frequency	Category
Mercury decanted from first- and second stage low-temperature separators (refer Section 2.7.2.2)	Between quarterly and annually	Hazardous waste
MPPE media for columns	2 to 4 years	Recyclables (returned to supplier for recycling)
CO_2 removal membranes	4 years (then every 6 months partial change)	Hazardous waste
Filters	Infrequent	Hazardous waste
Produced sand	Annual	Hazardous waste
General wastes	Fortnightly	Non-hazardous waste
Plastics	Fortnightly	Recyclables
Paper and cardboard	Fortnightly	Recyclables
Metal	Fortnightly	Recyclables
Oily rags and filters	Fortnightly	Hazardous waste
Bulk liquid wastes (oil, chemicals, cooking oil)	As required	Hazardous waste
Other recyclables (glass, broken crockery, aerosol cans, batteries, etc)	Fortnightly	Recyclables
Other hazardous waste (E-waste, solvents, chemicals, hydraulic fluids, oily waste, etc)	Fortnightly	Hazardous waste
Mixed bed resin	Every 4 months	Hazardous waste
Unused helideck fuel	As required	Hazardous waste

All wastes sent onshore for disposal will be monitored and reported based on the waste manifests that will be prepared for each shipment of wastes.

A waste tracking system will be developed and implemented at the Barossa FPSO and the supply base.

8.4.3.3 Steady state operations

8.4.3.3.1 Vessel emission and discharge monitoring

Discharges to the marine environment associated with this Activity will be recorded and controlled in accordance with requirements under relevant Marine Orders and MARPOL requirements.

Santos and vessel contractors will maintain records so emissions and discharges can be determined or estimated. Such records will be maintained for a period of five years. Contractors are required to make these records available upon request.

PW Adaptive Management Plan (Appendix I) and the BWO Emissions and Produced Water Reporting Procedure describes the FPSO reporting requirements and process.

For vessel activities Santos will maintain records of discharges or emissions, to the environment as described in Table 8-18.

Table 8-18: Monitoring of vessel emissions and discharges

Vessel Discharge/emission	Parameter	Quantitative record	Frequency
GHG emissions	Fuel volume	GHG emissions calculations based on measured fuel use in accordance with NGER reporting scheme requirements	Fuel use tracked daily, emissions calculated at end of campaign
Oily water	Volume and location	Oil Record Book* or equivalent report	As required
Ballast water	Volume and location	Ballast water log	As required
Garbage (including food scraps)	Volume and location	Volumes recorded in Garbage Record Book*	As required
Sewage	Volume and location	Estimated based on POB and days on location	Once per campaign
Unplanned discharge of: • solid objects • hazardous liquids	Volume	NOPSEMA recordable or reportable incident reports	As required
Unplanned hydrocarbon release	Volume	NOPSEMA recordable or reportable incident reports	As required

* Maintained as per vessel class in accordance with relevant Marine Orders.

8.4.3.3.2 FPSO discharge monitoring

Discharges from the Activity have been identified throughout Section 2. Those monitored on the FPSO have been identified in Table 8-19.

Table 8-19: FPSO discharge monitoring

Discharge source	Monitoring	Frequency
FPSO cooling water	**Discharge volumes** Discharge volumes will be measured based on flowmeter records. **Discharge temperature** Cooling water discharge temperature will be measured before overboard discharge via the online temperature indicator transmitter. **Discharge chlorination** Manual sampling points are included both immediately after seawater chlorination to verify maximum dosing levels as well before the discharge point. Chlorine concentrations can be measured from samples at the Barossa FPSO laboratory.	Daily Daily Intermittent/as required
Production chemicals i.e. Methanol & MEG	**Discharge volumes** Discharge volumes will be measured based on injection flowmeter records.	As required

PW monitoring is in accordance with the PW Adaptive Management Plan (Appendix I).

Discharges from the FPSO and vessels are also monitored as per vessel class in accordance with relevant Marine Orders and MARPOL requirements.

8.4.3.3.3 FPSO and GEP emissions monitoring

Emissions from the Barossa FPSO have been identified throughout Sections 6.3 and 6.4. Those monitored have been identified in Table 8-20 Emissions data will be recorded in line with NGERS and NPI reporting scheme requirements.

The overall philosophy for monitoring and reporting emissions at the Barossa FPSO is based on measurement of the fuels consumed and gas streams disposed of, followed by calculation and estimation of subsequent emissions, either through adjustment using specific compositions such as those measured by gas chromatographs (GCs), or through the use of standard factors in line with NGERMD and NPI methodologies. Measurement data used for emissions calculations is recorded and stored in a production historian database.

Table 8-20: FPSO emissions monitoring

Emissions source	Monitoring	Frequency
Gas turbine – gas fuelled operations	**Primary monitoring** Individual fuel gas flow meters are provided for each turbine to monitor fuel gas consumption. Gas Chromatographs are provided to measure fuel gas composition for the normal fuel gas supply and all backup supplies.	Daily (when in use)
Gas turbine – liquid fuelled operations	**Primary** All diesel received at the Barossa FPSO will be supplied through commercial transactions with invoices for record-keeping. The turbines are supplied from the MGO service tanks each of which have level transmitters. Additionally, the diesel fuel flowrate to each turbine is monitored by individual diesel flow meters.	Daily (when in use)
CO_2 disposal – thermal oxidiser	Fuel gas and CO_2 permeate gas sent to the thermal oxidiser is monitored through: • fuel gas line to thermal oxidiser flow transmitter (primary fuel gas, only normally required for start-up) • first-stage permeate gas flow transmitter (supplementary source of fuel gas) • second-stage permeate gas and permeate gas absorber streams calculated through mass balance approach between flow transmitters on the incoming stream and the residue stream. Gas chromatographs are provided to measure gas composition for the primary fuel gas supply and the CO_2 removal system streams.	Daily (when in use)
CO_2 disposal – acid gas flare tip backup	Streams sent to the acid gas flare tip when thermal oxidiser is offline are monitored by a flow transmitter. Enrichment gas sent to the acid gas flare tip is measured by a flow transmitter. Nitrogen purge gas sent to the acid gas flare tip is measured by a flow transmitter.	Daily (when in use)
LP And HP Flares	Pilot fuel gas consumed in the LP, acid gas and HP flares is measured by a totalising flow indicator. LP flaring quantities are measured at the totalising flow meter on the outlet of the LP flare knock-out drum. Nitrogen purge gas sent to the LP flare tip is measured by a flow transmitter. HP flaring quantities are measured at the totalising flow meter on the outlet of the HP flare knock-out drum. CCTV is available to monitor flare and flare pilots as required.	Daily (when in use)
Diesel consumers	All diesel received at the FPSO will be supplied through commercial transactions with invoices for record-keeping. Essential Generators – diesel fuel flow meters are provided to, and from, each generator. Emergency Generator – the emergency generator is supplied from a dedicated day tank with a level transmitter. Firewater pumps – each of the four firewater pumps are supplied from separate day tanks with level transmitters.	Daily (when in use)

Emissions source	Monitoring	Frequency
	Inert Gas Generator – the inert gas generator is supplied from the MGO service tanks, each of which have level transmitters.	
Fugitive emissions	Fugitive emissions are not actively metered; they will be estimated based on default NGER factors based on design parameters of the FPSO (including storage tank sizes, refrigerant capacities, produced water rates, flowline/pipeline lengths etc.).	Annual

8.4.3.3.4 FPSO waste monitoring

Wastes generated by the Barossa FPSO are summarised in Table 8-21

Table 8-21: Production Operations waste

Waste source	Approximate disposal frequency	Category
Mercury decanted from first- and second stage- low-temperature separators (refer Section 2.7.2.2)	Between quarterly and annually	Hazardous waste
MPPE media for columns	2 to 4 years	Recyclables (returned to supplier for recycling)
CO_2 removal membranes	4 years (then every 6 months partial change)	Hazardous waste
Filters	Infrequent	Hazardous waste
Produced sand	Annual	Hazardous waste
General wastes	Fortnightly	Non-hazardous waste
Plastics	Fortnightly	Recyclables
Paper and cardboard	Fortnightly	Recyclables
Metal	Fortnightly	Recyclables
Oily rags and filters	Fortnightly	Hazardous waste
Bulk liquid wastes (oil, chemicals, cooking oil)	As required	Hazardous waste
Other recyclables (glass, broken crockery, aerosol cans, batteries, etc)	Fortnightly	Recyclables
Other hazardous waste (E-waste, solvents, chemicals, hydraulic fluids, oily waste, etc)	Fortnightly	Hazardous waste
Mixed bed resin	Every 4 months	Hazardous waste
Unused helideck fuel	As required	Hazardous waste

All wastes sent onshore for disposal will be monitored and reported based on the waste manifests that will be prepared for each shipment of wastes.

A waste tracking system will be developed and implemented at the Barossa FPSO and the supply base.

8.4.4 Inspections

Inspections are the primary tool to check compliance with the relevant commitments (including CMs and EPSs) in the EP. Inspections can be desktop or field based. Inspections will be undertaken throughout all phases of the Activity and will utilise the Barossa EP Compliance Register (refer Section 8.4.1) as the basis to inform their scope.

FPSO

During the Activity, a number of inspection types will be undertaken during each activity phase. These would include desktop and field based inspections to check compliance against the Barossa EP Compliance Register as well as inspections to identify hazards or risks. The inspection program will utilise both planned and unplanned inspections with the scope and frequency of inspections undertaken using a risk based approach. For example, control measures directly relating to emissions or discharges will be inspected at a higher frequency, reflecting the importance of ensuring performance of these in achieving compliance with EPOs (Table 8-1). The Barossa EP Compliance Register outlines the required inspection frequency for all commitments in the EP. Table 8-22 outlines the inspection schedule and scope for the FPSO. Any in-field opportunities for improvement or corrective actions from these inspections will be discussed during the inspection with the work area supervisor and/or crew Barossa Offshore Installation Manager. If the actions cannot be completed immediately they will be tracked to ensure actions are closed out.

Table 8-22: EP Inspection Schedule and Scope for FPSO

Activity Phase	Inspection	Frequency	Scope
Pre sail-away	Pre-mobilisation inspection	Once prior to entering the Operational Area	Environmental pre-mobilisation inspection will examine the level of mobilisation readiness of the FPSO prior to entering the Operational Area, undertaken by a suitably experienced Santos or Contractor HSE Advisor. The inspections include a review of readiness against EP commitments.
Hook-up and cold-commissioning; hot-commissioning and initial start-up	Commissioning Inspections	Monthly	Targeted inspections against systems and processes being commissioned. General ongoing environment inspections against EP commitments.
Steady state operations	Operation Inspections	Monthly	General ongoing environment inspections against EP commitments and as relevant plans/ procedures/ other requirement using a risk based approach.

Vessels

An environmental inspection program will be implemented for all vessels carrying out activities under this EP. Inspections are used to assess the vessels' performance and demonstrate compliance against requirements outlined in this EP, and at the end of all vessel campaigns, records will be collected from the vessel contractor to demonstrate compliance with the EP for performance reporting. Table 8-23 outlines the inspection schedule and scope for vessel. Inspection reports will be distributed for review to Santos relevant personnel (for e.g., Operations Superintendent, Santos on-board representatives), and HSE Department representatives.

Table 8-23: EP Inspection Schedule and Scope for Vessels

Activity Phase	Inspection	Frequency	Scope
Pre mobilisation	Pre-mobilisation inspection	Once prior to entering the Operational Area	Environmental pre-mobilisation inspection will examine the level of mobilisation readiness of the vessel prior to entering the Operational Area, undertaken by a suitably experienced Santos or Contractor HSE Advisor. The inspections include a review of readiness against EP commitments.
Activity	Execution Inspections	Monthly - the first inspection will be undertaken within 2 weeks of entering the field. If Activity duration is <1 month then an inspection will be undertaken during the Activity	General ongoing environment inspections against all EP commitments and as relevant plans/ procedures/ other requirement using a risk based approach.

Any opportunities for improvement that cannot be addressed as part of inspection close out, will be considered as part of annual performance reviews and identification of continuous improvement opportunities (Section 8.5.3).

8.4.5 Audits

Santos maintains Activity audit plans and schedules that are frequently reviewed and updated. Audits will typically include for assessing compliance with relevant EP commitments as well as the supporting management processes and procedures described in the Implementation section of the EP. For Contractors the audit will review their processes and procedures that support implementation of and compliance with the commitments in the EP. Table 8-24 outlines the EP audit schedule. Further information on assurance activities for vessels is described in Section 8.4.8.

Audits will be undertaken in a manner consistent with the Santos' Assurance Procedure and the Barossa Project Environmental Compliance Assurance Plan (ECAP). Audits focus on Santos will retain accountability for assurance of all aspects of the Barossa Management System, for all stages of the Activity.

Table 8-24: EP Audit Schedule

Activity Phase	Audit Type	Frequency	Scope
Pre sail-away	Field Audit of EP	Once (minimum), in conjunction with the pre-mobilisation inspection (refer Table 8-23)	Aspects of the EP implementation strategy relevant to the activity phase, with a focus on operational readiness and compliance with the EP ahead of entering the Operational Area.
Hook-up and cold-commissioning; hot-commissioning and initial start-up	Desktop or Field Audit of EP	Once (minimum), in conjunction with the pre-mobilisation inspection (refer Table 8-23)	Aspects of the EP implementation strategy relevant to the activity phase, with a focus on operational readiness and compliance with the EP ahead of steady state operations
Steady state operations	Desktop or Field Audit of EP	Once per calendar year	All control measures and aspects of the EP implementation strategy relevant to the selected risk area/ activity. All risk sources specific to the FPSO will be reviewed over a three year rolling period.
Vessel campaigns (for vessels contracted for >3 mths duration)	Desktop or Field Audit of EP	Once per campaign	Aspects of the EP implementation strategy as relevant to the Activity.
All phases	Desktop or Field Audit of EP	As required – in the event that assurance data (inspection reports, monitoring data) is trending toward non-compliance a proactive audit will be undertaken.	Risk specific, with a focus on implementation aspects.

Santos' audit plans and schedules are reviewed and updated at the beginning of each activity phase or calendar year (following commencement of steady state operations) and cover all Santos facilities and activities.

During steady state operations, selected risk areas/activities are selected to review environmental performance against the EPOs and EPSs and verify that control measures are effective in reducing the environmental risks and impacts of the activity to an ALARP and acceptable level. The audit also includes review of conformance with selected aspects of the EP implementation strategy. All risk sources/activities applicable to the FPSO will be reviewed over a three-year rolling period.

Vessel HSE audits by the Santos HSE department are performed in accordance with the applicable requirements of any Environment Plan, Safety Case or campaign specific HSE Management Plans. The Barossa EP compliance register (refer Section 8.4.1) will capture all EP requirements related to marine vessels (EPOs, EPSs, measurement criteria, notifications).

OPEP assurance activities, including testing arrangements and audits, are described in the OPEP (Section 5.5 of the OPEP).

Audit findings may include opportunities for improvement and non-conformances. Audit nonconformances are managed as described in Section 8.4.1. Any opportunities for improvement that can't be closed out as part of audit close out, will be considered as part of annual performance reviews and identification of continuous improvement opportunities (Section 8.4.3).

Audit findings and conformance with the Audit Schedule in Table 8-25 will be provided to the FPSO OIM or Vessel Master at the completion of the audit, with recommendations and actions to be tracked to close out. The audit findings will also be reported in the Annual Performance Report.

8.4.6 Incident Investigations

The Event Reporting & Investigation Technical Standard describes the requirements for reporting and investigating events that can cause harm to people, the environment and/or assets. These requirements ensure:

- Learning from events.
- Preventative and corrective actions are identified.
- Actions are tracked to closure.

The scope of the standard includes hazards, near misses, incidents, occupational injuries and illness, non-conformances and events requiring technical investigations.

Incident investigations will demonstrate consideration of the following:

- the availability and feasibility of adopting new or improved technology that would minimise the risk of incident recurrence
- the incorporation, where relevant, of lessons learned from the incident into the EP, as part of the continuous improvement cycle
- assessment of existing EPOs, EPSs and CMs to determine if they can continue to be achieved

Where changes are required to the EP, based on the outcomes of the above considerations, the EP MoC process outlined in Section 8.4.2 will be followed.

8.4.7 Mercury Validation

8.4.7.1 Mercury Mapping

The development of a process mercury map (and its ongoing refinement once production begins) will allow facility operators to better manage the risks associated with maintenance activities performed on contaminated process systems. Furthermore, it will provide data to validate mercury content in atmospheric emissions and produced water discharges. The mercury map presents the process facilities with the expected level of mercury content of the process piping and equipment across the process systems and differentiates areas which have low, moderate and high levels of mercury.

To assess how mercury partitions between the gas, hydrocarbon condensate and aqueous phases, throughout the process a Mercury Partitioning Study performed in the design phase. The simulation models run in this study established a mercury map based on a maximum inlet mercury concentration of 500 ppb(wt). This mercury map will be used to validate it against actual process sampling after offshore start-up and introduction of hydrocarbons to the FPSO.

During operations, all process areas will initially be considered to be mercury contaminated, as a conservative approach. Mercury mapping will be carried out during steady state operations and continuously updated, in line with the operations mercury mapping procedure detailed in the Mercury Management Plan. This will enable up-to-date mapping of confirmed mercury contaminated process areas (and areas confirmed to be free of mercury) which will aid in the maintenance planning activities.

8.4.7.2 Mercury monitoring

Mercury content within production streams and discharges and within process equipment as deposited mercury (waste) is monitored to meet a number of objectives, including ongoing mercury mapping, to verify the performance of process equipment in removing mercury, to meet regulatory and commercial requirements and to determine if limits of discharges are being met to reduce environmental impacts to ALARP and acceptable levels. A summary of mercury monitoring on the FPSO is provided in Table 8-25, giving detail on the type of monitoring, monitoring locations, frequencies and scope/ objectives.

Table 8-25: Mercury monitoring summary

Type of mercury monitoring	Location	Frequency	Scope and objective
Inlet gas composition sampling and analysis	At production inlet before separation and gas cooling (Figure 8-10)	Minimum every 12 months	Full gas composition including mercury content. Confirms the composition and changes to the composition of gas from the Barossa field and production wells.
Monitoring of atmosphere, surfaces and/or solid/liquid waste for mercury	Location dependent upon maintenance	As required when working on dry gas, wet gas or liquid systems where there is the potential for mercury exposure or contamination	Onsite monitoring and/or external sample analysis as defined in the Mercury Management Plan. Verifies mercury mapping and informs work planning.
	Contaminated waste storage locations	As required where waste could include mercury contamination	Onsite monitoring and/or external sample analysis as defined in the FPSO Waste Management Plan. Verifies waste handling, transport and disposal requirements.

Monitoring of mercury levels in Mercury Collection Pots	Mercury Collection Pot level gauges (Figure 8-10)	Daily	Manual reading and recording of MCP magnetic level gauges as per Operations Daily Checks Module M63. Tracks fill rate of mercury into MCPs and informs collection frequency.
Monitoring of mercury in PW	Sampling point at locations before and after produced water treatment system (Figure 8-10).	Sample is collected and analysed every ~24 hours during the start-up period and then up to a maximum interval of 28 days during steady state operations (refer PW Adaptive Management Plan)	Sampling of mercury in produced water at sample points before and after PW treatment. Determines treatment efficacy and discharge concentration to inform adaptive management as per PW Adaptive Management Plan
Monitoring of mercury content in export gas	Mercury Analyser at gas export outlet (Figure 8-10)	Daily	Online instrumentation (Hg Analyzer) as detailed in the Static Equipment Integrity Management Plan. Determines if export gas meets commercial requirements. Informs mercury mapping

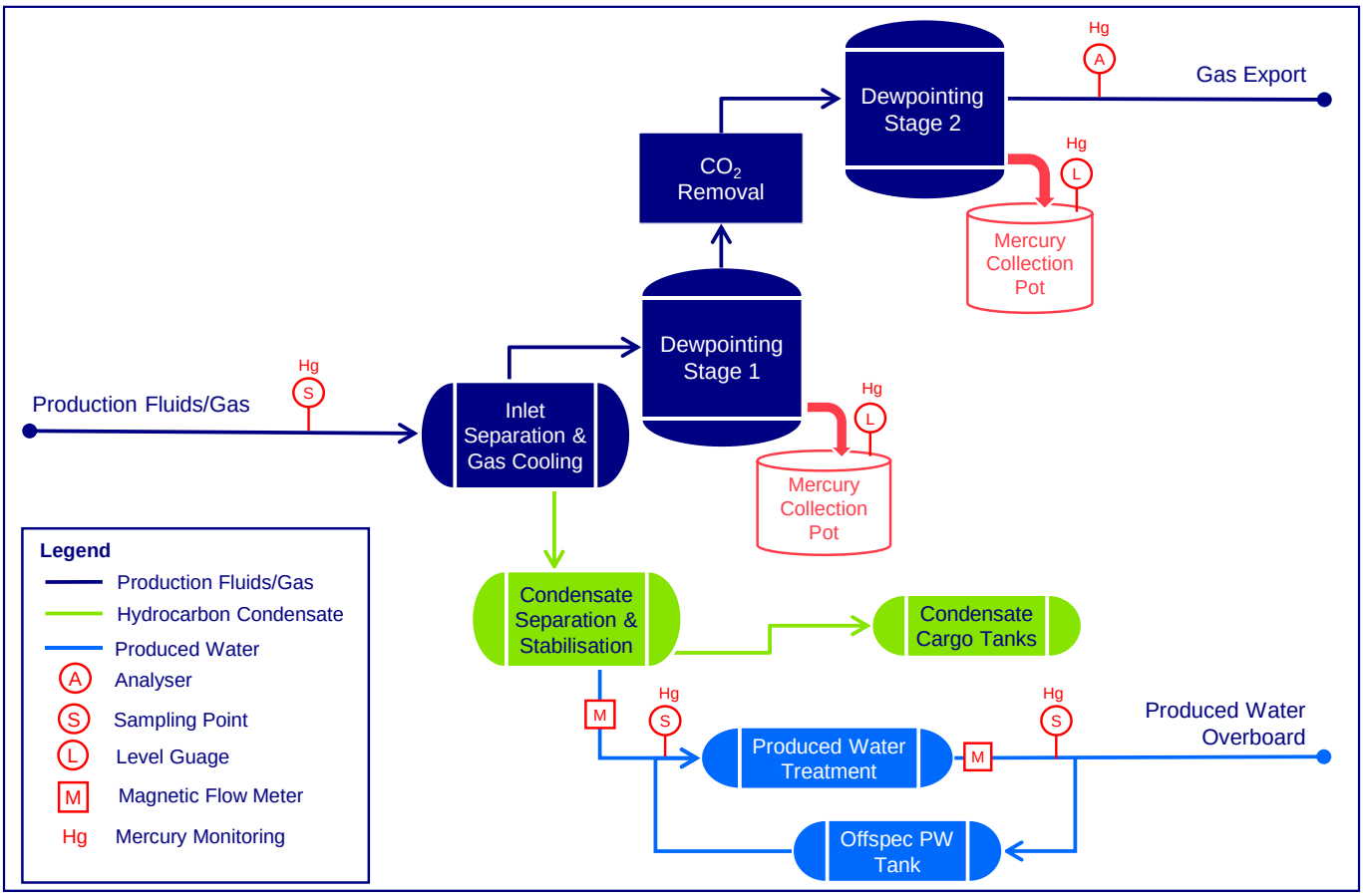

Figure 8-10: Process flow diagram schematic with mercury monitoring locations

8.4.8 Marine Assurance

The Marine Assurance Standard requires that all vessels engaged for the Activity are to be vetted, and applies to activities described in the EP. The vetting process is based on industry standards and best practices, along with considerations of guidelines and recommendations from recognised industry organisations such as Oil Companies International Marine Forum (OCIMF) and International Maritime Contractors Association (IMCA), and international regulatory agencies like the IMO and vessel classification societies.

The Marine Assurance Standard provides the framework to define the minimum controls, expectations and guidance for the selection and engagement of contractors and their vessels to minimise the risk of harm to people, environment, or assets. This includes requirements relating to:

- contractor assurance;
- vessel assurance and suitability;
- operational capability;
- ongoing vessel assurance; and
- change management.

All contracted vessel operators are audited against their respective Management Systems to ensure they have policies and procedures that define the safe operation of their vessels, verify their compliance with these and their continual improvement process.

Vessels are audited annually by an OCIMF or IMCA accredited inspectors against the respective Offshore Vessel Inspection Database (OVID) report or a Common Marine Inspection Document (CMID). For vessels where the OVID and/or CMID are not valid or available, a Santos approved inspection report is required.

The Marine Assurance Standard includes the following requirements relating to the ongoing assurance of vessels:

- Vessel visits are performed as required by the Santos Marine Superintendent or other Santos representative (or nominated Contractor representatives) throughout the charter period. The purpose of such visits is to ensure Santos' expectations are being upheld, there is compliance and conformity with operational procedures and a safety culture is being fostered.
- Reviews of the vessel Contactor's Management System are performed every three years, or whenever there is considered a requirement, such as following a major incident, repeated incidents, incidents which may impact the vessel State, Class or Flag status or if a vessel operator has been detained by a regulatory authority.
- Reviews of crew experience are undertaken whenever key personnel crew members change.
- Control measures relevant to crewed vessels (such as BAO-CM-6.1.1 and BAO-CM-6.1.2) apply equally to crewed support vessels, noting that the Santos marine assurance process will be tailored to measures specific to USVs to achieve an equivalent level of environmental performance. For example, a 360 degree camera will be required to comply with Part 8 of the compliance with Part 8 of Environment Protection and Biodiversity Conservation Regulations 2000 (BAO-CM-6.1.1) and the Vessel Master (person responsible for remotely operating the USV) will be subject to equivalent vessel crew Australian maritime requirements.

8.4.9 Reporting and Notifications

OPGGS(E)R 2023 Requirements
Section 22 Implementation strategy for environment plan
22(7) The implementation strategy must state when the titleholder will report to NOPSEMA in relation to the titleholder's environmental performance for the activity. The interval between reports must not be more than 12 months. Note: Section 51 requires a titleholder to report on environmental performance at the times or intervals set out in the environment plan.

Regulatory and other notification and compliance reporting requirements are summarised in Table 8-26 and Table 8-27.

Table 8-26: Activity notification and reporting requirements

Initiation	Required Information	Timing	Type	Recipient
Before the Activity				
Director of National Parks (DNP) notifications, as per Condition 4 of Gas Export Pipeline Commercial Activity Licence	Notify DNP of the acceptance or refusal of an EP by NOPSEMA.	Within 24 hours of its acceptance or refusal.	Written	DNP marineparksauthorisations@dcceew.gov.au
	Following acceptance of an EP by NOPSEMA, provide DNP with a copy of that EP.	Within ten business days of acceptance		
Australian Hydrographic Office (AHO)	Notification of proposed start and end dates and any other relevant information for the Notice to Mariners to be issued.	No less than four working weeks before operations.	Written	AHO datacentre@hydro.gov.au
Australian Maritime Safety Authority (AMSA)	AMSA's Joint Rescue Coordination Centre (JRCC) requires the: • vessel and FPSO details (including name, callsign and Maritime Mobile Service Identity) • satellite communications details (including International Maritime Satellite C (INMARSAT-C) and satellite telephone numbers) • area of operation • requested clearance from other vessels • any other information that may contribute to safety at sea • when operations start and end.	At least 48 hours before operations begin.	Written	AMSA's JRCC rccaus@amsa.gov.au
Other Marine Users identified in Table 8-27 (as may be updated from time to time).	In addition to being able to access Notice to Mariners, other marine users active in the Operational Area will be advised by Santos prior to the start of IMMR activities.	At least 48 hours before IMMR activities begin.	Written	Other Marine Users active in the Operational Area.
DAFF – Biosecurity (international vessels, aircraft and personnel) (refer Section 4)	In accordance with control measure BAO-CM-7.2.1, Santos will: • pursuant to the *Biosecurity Act 2015* and the *Biosecurity (Exposed Conveyances – Exceptions from Biosecurity Control) Determination 2016*, undertake a vessel biosecurity risk and be assessed as 'low' by the Commonwealth Department of Agriculture, Fisheries and Forestry before interacting with domestic vessels and aircraft • undertake pre-arrival approval for the vessels (where applicable) using the Maritime Arrivals Reporting System to meet the DAFF biosecurity reporting obligations.	At least one month before Activity begins. Maritime Arrivals Reporting System reporting at least 12 hours before arrival.	Written	DAFF Biosecurity (vessels, aircraft and personnel)

Initiation	Required Information	Timing	Type	Recipient
OPGGS(E)R Section 54– Notifications NOPSEMA must be notified that the activity is to begin	Complete NOPSEMA's Section 54 of the OPGGS(E)R Start or End of Activity Notification form before the activity.	At least ten days before the Activity begins.	Written	NOPSEMA
During the Activity				
OPGGS(E)R Section 50 – Recordable Incidents NOPSEMA must be notified of a breach of an EPO or EPS, in the environment plan that applies to the activity, that is not a reportable incident	Complete NOPSEMA's Recordable Environmental Incident Monthly Report Form.	The report must be submitted as soon as practicable after the end of the calendar month, and in any case, not later than 15 days after the end of the calendar month.	Written	NOPSEMA
	The oral notification must contain: • all material facts and circumstances concerning the reportable incident known or that by reasonable search or enquiry could be found out • any action taken to avoid or mitigate adverse environmental impacts of the reportable incident • the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident.	As soon as practicable, and in any case not later than two hours after the first occurrence of a reportable incident, or if the incident was not detected at the time of the first occurrence, at the time of becoming aware of the reportable incident.	Verbal	NOPSEMA
	A written record of the oral notification must be submitted. The written record is not required to include anything that was not included in the oral notification.	As soon as practicable after the oral notification.	Written	NOPSEMA NOPTA Department of the responsible state or NT Minister

Initiation	Required Information	Timing	Type	Recipient
OPGGS(E)R section 24(c), 47 and 48 – Reportable Incident NOPSEMA, NOPTA and Department of the responsible State Minister or NT Minister must be notified of any reportable incidents For the purposes of the OPGGSS(E)R, a reportable incident is defined as: • For an activity, means an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage	A written report must contain: • all material facts and circumstances concerning the reportable incident known or that by reasonable search or enquiry could be found out • any action taken to avoid or mitigate any adverse environmental impacts of the reportable incident • the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident • the action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in the future • Report using NOPSEMA's Report of an Accident, Dangerous Occurrence or Environmental Incident Form.	Must be submitted as soon as practicable, and in any case not later than three days after the first occurrence of the reportable incident unless NOPSEMA specifies otherwise. Same report to be submitted to National Offshore Petroleum Titles Administrator (NOPTA) and Department of the responsible State Minister or NT Minister within seven days after giving the written report to NOPSEMA.	Written	NOPSEMA NOPTA Department of the responsible state or NT Minister
AMSA Reporting	Titleholder agrees to notify AMSA of any marine pollution incident[57].	Notification within two hours of incident.	Verbal	AMSA JRCC
	Harmful Substances Report and Situation Report available online (refer to Barossa Production Operations OPEP).	Harmful Substances Report as requested by AMSA after verbal notification.	Written	AMSA JRCC

[57] *For clarity and consistency across Santos' regulatory reporting requirements, Santos will meet the requirement of reporting marine oil pollution by reporting oil spills assessed to have an environmental consequence of Moderate or higher in accordance with Santos' environmental impact and risk assessment process outlined in* ***Section 4.***

Initiation	Required Information	Timing	Type	Recipient
Director of National Parks Reporting Notification of the event of oil pollution within a marine park or where an oil spill response action must be taken within a marine park (requested through consultation)	The DNP should be made aware of oil and gas pollution incidences that occur within a marine park or are likely to impact on a marine park as soon as possible. Notification should be provided to the 24hour Marine Compliance Duty Officer on 0419 293 465. The notification should include: • titleholder details • time and location of the incident, including name of marine park likely to be affected • proposed response arrangements as per the Barossa Production Operations OPEP, such as dispersant, containment • confirmation of providing access to relevant monitoring and evaluation reports when available • contact details for the response coordinator. *Note:* the DNP may request daily or weekly Situation Reports, depending on the scale and severity of the pollution incident.	Verbal notification as soon as reasonably practicable.	Verbal	DNP
DCCEEW Reporting Any harm or mortality to EPBC-listed Threatened marine fauna Marine fauna sighting data	Notification of any harm or mortality to an EPBC-listed species of marine fauna, whether attributable to the Activity or not.	Within seven days to EPBC.permits@environment.gov.au.	Written	DCCEEW
	If matters of national environmental significance are considered at risk from a spill or response strategy, or where there is death or injury to a protected species.	Email notification as soon as practicable.	Written	DCCEEW (Director of monitoring and audit section)
	Marine fauna sighting data recorded in the marine fauna sighting database.	As soon as practicable.	Written	DCCEEW
	Underwater cultural heritage details recorded in online database if discovered during Activity.	As soon as practicable; in any case, no later than three months after the end of the Activity.	Written	DCCEEW
	Reports to be provided to DCCEEW outlining findings from IMMR activities conducted in the Oceanic Shoals Marine Park	Following IMMR survey Activity (every 3 years)	Written	DCCEEW
Australian Marine Mammal Centre Reporting Any ship strike incident with cetaceans will also be reported to the National Ship Strike Database	Ship strike report provided to the Australian Marine Mammal Centre: https://data.marinemammals.gov.au/report/shipstrike.	As soon as practicable.	Written	DCCEEW

Initiation	Required Information	Timing	Type	Recipient
NT Department of Environment, Parks and Water Security Marine pollution incidents	Verbal reporting will consist of transfer of information to conduct a coordinated emergency response. All reporting will be performed by the vessel master as per the vessel specific SOPEP/SMPEP.	As soon as practicable.	Verbal	DEPWS (Pollution Response Hotline; Environmental Operations)
	Written reports will contain all material facts and circumstances concerning the reportable incident, actions taken to avoid or mitigate any adverse impacts, and corrective action taken.	Written report as soon as practicable.	Written	DEPWS (Pollution Response Hotline; Environmental Operations)
AFMA	Verbal notification if any spill may affect Commonwealth fisheries within the EMBA.	Verbal notification within eight hours.	Verbal	AFMA
Department of Foreign Affairs and Trade (DFAT)	Any oil spill that has entered or is likely to enter international waters.	Verbal phone call notification within eight hours if the spill is likely to extend into international waters.	Verbal	DFAT (24-hour consular emergency centre)
		Follow up with email outlining details of incident.	Written	DFAT (24-hour consular emergency centre)
Autoridade Nacional do Petróleo (ANP)	Any oil spill that has entered or is likely to enter Timor-Leste waters.	Verbal phone call notification within 8 hours if the spill is likely to extent into Timor-Leste waters	Verbal	Harbour Master of Dili Port, Deputy Harbour Master of Tibar Port and ANP safety phone centre
		Follow up with email outlining details of incident	Written	Harbour Master of Dili Port, Deputy Harbour Master of Tibar Port and ANP safety phone centre
AHO, AMSA	Notification of updates to both AHO and AMSA (JRCC) on progress and, importantly, any changes to the intended operations.	As soon as possible.	Written	AMSA's JRCC AHO
Greenhouse gas emissions	Reporting of greenhouse gas emissions, energy production and consumption under the NGER Reporting Scheme.	Annually.	Written	Clean Energy Regulator
Pollutant emissions	National Pollution Inventory reporting is lodged as per the National Pollution Inventory submission requirements.	Annually.	Written	National Pollution Inventory
OPGGS(E)R Section 51 –Environmental Performance NOPSEMA must be notified of the environmental performance at the intervals provided for in the EP	Report must contain sufficient information to determine whether or not EPOs and EPSs in the EP have been met.	An environmental performance report will be submitted to NOPSEMA annually from the date of acceptance of this EP.	Written	NOPSEMA

Initiation	Required Information	Timing	Type	Recipient
Tiwi Resources (Ranger Coordinator), Tiwi Land Council and the delegated Clan Trustees	Notification of all spills heading towards the Tiwi Islands.	Within eight hours of incident being identified.	Verbal phone call notification	Tiwi Resources (Ranger Coordinator), Tiwi Land Council and the delegated Clan Trustees
	Follow up with email outlining details of incident.	After oral notification.	Written	Tiwi Resources (Ranger Coordinator), Tiwi Land Council and the delegated Clan Trustees (per the Barossa Production Operations OPEP), subject to obtaining relevant email addresses
First Nation Consultative Committees	Notification of all spills heading towards the relevant parties interests	Within eight hours of incident being identified.	Verbal phone call notification	First Nation Consultative Committees via Committee Chairs
	Follow up with email outlining details of incident.	After oral notification.	Written	First Nation Consultative Committees, via Committee Chairs (per the Barossa Production Operations OPEP), subject to obtaining relevant email addresses
Other First Nations groups	Notification of all spills heading towards the relevant parties interests.	Within eight hours of incident being identified.	Verbal phone call notification	Other First Nation Groups, as agreed through the post acceptance consultation implementation process and through the NLC.
	Follow up with email outlining details of incident.	After oral notification.	Written	Other First Nation Groups, as agreed through the post acceptance consultation implementation process and through the NLC.
Vocus	Notification in the event of a spill requiring clean-up activities that may impact its infrastructure	As soon as possible	Written	Vocus

Initiation	Required Information	Timing	Type	Recipient
Environmental Approval (EPBC 2022/09372) for Darwin Pipeline Duplication Project **Compliance Records and annual data reporting**	Condition 14 The approval holder must maintain accurate and complete compliance records. Condition 16 The approval holder must ensure that any monitoring data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under the conditions of this approval are prepared in accordance with the Guidelines for biological survey and mapped data, Commonwealth of Australia 2018, or as otherwise specified by the Minister in writing. Condition 17 The approval holder must ensure that any monitoring data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under the conditions of this approval are prepared in accordance with the Guide to providing maps and boundary data for EPBC Act projects, Commonwealth of Australia 2021, or as otherwise specified by the Minister in writing.	Condition 18 The approval holder must submit all monitoring data (including sensitive ecological data), surveys, maps, other spatial and metadata and all species occurrence record data (sightings and evidence of presence) electronically to the department within 20 business days of each anniversary of the date of this approval decision. Condition 15 If the department makes a request in writing, the approval holder must provide electronic copies of compliance records to the department within the timeframe specified in the request.	Written	DCCEW

Initiation	Required Information	Timing	Type	Recipient
Environmental Approval (EPBC 2022/09372) for Darwin Pipeline Duplication Project **Annual Compliance Reporting**	Condition 19 The approval holder must prepare a compliance report for each 12-month period following the date of this approval decision (or as otherwise agreed to in writing by the Minister). Condition 20 Each compliance report must be consistent with the Annual Compliance Report Guidelines, Commonwealth of Australia 2023. Condition 21 Each compliance report must include: Condition 21, b) Accurate and complete details of compliance and any non-compliance with the conditions and the plans, and any incidents. Condition 21, c) One or more shapefile showing all clearing of protected matters, and/or their habitat, undertaken within the 12-month period at the end of which that compliance report is prepared. Condition 21, d) A schedule of all plans in existence in relation to these conditions and accurate and complete details of how each plan is being implemented.	Condition 22 The approval holder must: Condition 22, a) Publish each compliance report on the website within 60 business days following the end of the 12-month period for which that compliance report is required. Condition 22, b) Notify the department electronically, within 5 business days of the date of publication that a compliance report has been published on the website. Condition 22, c) Provide the weblink for the compliance report in the notification to the department. Condition 22, d) Keep all published compliance reports required by these conditions on the website until the expiry date of this approval. Condition 22, e) Exclude or redact sensitive ecological data from compliance reports published on the website or otherwise provided to a member of the public. Condition 22, f) If sensitive ecological data is excluded or redacted from the published version, submit the full compliance report to the department within 5 business days of its publication on the website and notify the department in writing what exclusions and redactions have been made in the version published on the website.	Written	DCCEEW

Initiation	Required Information	Timing	Type	Recipient
Environmental Approval (EPBC 2022/09372) for Darwin Pipeline Duplication Project **Independent Audit**	Condition 27 For each independent audit, the approval holder must: Condition 27, a) Provide the name and qualifications of the nominated independent auditor, the draft audit criteria, and proposed timeframe for submitting the audit report to the department prior to commencing the independent audit. Condition 27, b) Only commence the independent audit once the nominated independent auditor, audit criteria and timeframe for submitting the audit report have been approved in writing by the department. Condition 27, c) Submit the audit report to the department for approval within the timeframe specified and approved in writing by the department. Condition 28 Each audit report must report for the period preceding that audit report. Condition 29 Each audit report must be completed to the satisfaction of the Minister and be consistent with the 'Environment Protection and Biodiversity Conservation Act 1999 Independent Audit and Audit Report Guidelines, Commonwealth of Australia 2019'.	Condition 26 The approval holder must ensure that an independent audit of compliance with the conditions is conducted at three (3) years after the commencement of the Action, and at any time upon the direction of the Minister. Condition 27 For each independent audit, the approval holder must: Condition 27, d) Publish the audit report on the website within 15 business days of the date of the department's approval of the audit report. Condition 27, e) Keep the audit report published on the website until this approval expires.	Written	DCCEEW

Initiation	Required Information	Timing	Type	Recipient
Environmental Approval (EPBC 2022/09372) for Darwin Pipeline Duplication Project **Reporting Non-Compliance**	Condition 24 The approval holder must specify in the notification: Condition 24, a) Any condition or commitment made in a plan which has been or may have been breached. Condition 24, b) A short description of the incident and/or potential non-compliance and/or actual non-compliance. Condition 24, c) The location (including co-ordinates), date and time of the incident and/or potential non-compliance and/or actual non-compliance. Condition 25 The approval holder must provide to the department in writing, within 12 business days of becoming aware of any incident and/or potential non-compliance and/or actual non-compliance, the details of that incident and/or potential non-compliance and/or actual non-compliance with the conditions or commitments made in a plan. The approval holder must specify: Condition 25, d) Any corrective action or investigation which the approval holder has already taken. Condition 25, e) The potential impacts of the incident and/or non-compliance. Condition 25, f) The method and timing of any corrective action that will be undertaken by the approval holder.	Condition 23 The approval holder must notify the department electronically, within 2 business days of becoming aware of any incident and/or potential non-compliance and/or actual non-compliance with the conditions or commitments made in a plan. Condition 25 The approval holder must provide to the department in writing, within 12 business days of becoming aware of any incident and/or potential non-compliance and/or actual non-compliance, the details of that incident and/or potential non-compliance and/or actual non-compliance with the conditions or commitments made in a plan.	Written	DCCEEW
End of the Activity				
OPGGS(E)R Section 54 – Notifications NOPSEMA must be notified that the activity has ended	Complete NOPSEMA's Section 54 Start or End of Activity Notification Form.	Within ten days after the Activity ends.	Written	NOPSEMA

Initiation	Required Information	Timing	Type	Recipient
OPGGS(E)R Section 46 EP ends when titleholder notifies completion and the regulator accepts the notification NOPSEMA must be notified that the activity has ended and all EP obligations have been completed	Complete NOPSEMA's Section 46 – End of Operation of Environment Plan form[58]	At the completion of the Activity and all EP obligations.	Written	NOPSEMA
AMSA (JRCC) Consultation	Notification that Activity has completed.	Within ten days of completion.	Written	JRCC
AHO	Notification that Activity has completed.	Within ten days of completion.	Written	AHO
	Final positions of any permanent features for charting action.	Within	Written	AHO
Other Marine Users identified in (as may be updated from time to time).	Notification that IMMR activities have been completed.	Within ten days of completion.	Written	Other Marine Users active in the Operational Area.
Environmental Approval (EPBC 2022/09372) for Darwin Pipeline Duplication Project **Completion of the Action**	Condition 30 The approval holder must notify the department electronically 60 business days prior to the expiry date of this approval, that the approval is due to expire.	60 business days prior to the expiry date of this approval	Written	DCCEEW
Environmental Approval (EPBC 2022/09372) for Darwin Pipeline Duplication Project **Completion of the action**	Condition 31 Within 20 business days after the completion of the Action, and, in any event, before this approval expires, the approval holder must notify the department electronically of the date of completion of the Action and provide completion data. The approval holder must submit any spatial data that comprises completion data as a shapefile.	Within 20 business days after the completion of the Action	Written	DCCEEW

[58] *https://www.nopsema.gov.au/sites/default/files/documents/Regulation%2046%20-%20End%20of%20Operation%20of%20Environment%20Plan%20%28A346625%29%20form.docx*

Other Marine Users Communications plan will be implemented by the end of the first quarter of each year, for engagement prior to and during the Activity that may impact marine users, to raise awareness of the activity. The plan will:

- Identify key Barossa activities that may impact other marine users.
- Leverage the regional engagement model and the database of relevant authorities' person and organisations (refer section 8.4.11), to identify other marine users whose activities may be impacted.
- Set out the method/s and frequency/timing of communications (inclusive of activity notifications contained in Table 8-26).
- Communicate the location, timing, and nature of the identified Barossa activities
- Set out person/s accountability to undertake the communications activities set out in the plan.
- Contain mechanism for stakeholders to contact Santos with any queries or complaints.
- Require that records of engagement and complaints be maintained.
- Where practical communications will occur at least two weeks before the activities take place

Table 8-27: Marine user notification recipients

Person to be issued marine user notifications	Notification Recipient
Aquarium Fishery licence-holders (NT)	NTSC and NT DAF
Australian Border Force (ABF)	ABF
Australian Fisheries Management Authority (AFMA)	AFMA
Australian Institute of Marine Science (AIMS)	AIMS
Demersal Fishery licence-holders (NT)	NTSC and NT DAF
Department of Defence – Navy (DoD – Navy)	DoD – Navy
Eni Australia Ltd	Eni Australia Ltd
INPEX Ichthys Pty Ltd	INPEX Ichthys Pty Ltd
Mackerel Managed Fishery	WA Fishing Industry Council
Northern Demersal Scalefish Managed Fishery	WA Fishing Industry Council
Northern Prawn Fishery commercial licence-holders	NPFI and AFMA
Northern Prawn Fishing Industry Pty Ltd (NPFI)	NPFI
NT Department of Agriculture and Fisheries (NT DAF)	NT DAF

Person to be issued marine user notifications	Notification Recipient
NT Seafood Council (NTSC)	NTSC
Timor Reef Fishery commercial licence holders	NTSC and NT DAF
Spanish Mackerel Fishery licence-holders	NTSC and NT DAF

8.4.9.1 Incident reporting

OPGGS(E)R 2023 Requirements
Section 24 Other information in the environment plan
24(c) details of all reportable incidents in relation to the proposed activity.
Section 47 Notifying reportable incidents
47(1) A titleholder commits an offence of strict liability if: • the titleholder undertakes an activity under the title; and • there is a reportable incident for the activity; and • the titleholder does not notify NOPSEMA of the reportable incident in accordance with subsection (2). Penalty: 40 penalty units. 47(2) For the purposes of paragraph (1)(c), the notification: • must be given as soon as practicable, and in any case not later than 2 hours, after: 1. the first occurrence of the reportable incident; or 2. if the reportable incident was not detected by the titleholder at the time of the first occurrence—the time the titleholder becomes aware of the reportable incident; and • must be oral; and • must include: 3. all material facts and circumstances concerning the reportable incident that the titleholder knows or is able, by reasonable search or enquiry, to find out; and 4. any action taken to avoid or mitigate any adverse environmental impacts of the reportable incident; and 5. the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident. 47(3) As soon as practicable after the titleholder notifies a reportable incident, the titleholder must give a written record of the notification to: • NOPSEMA; and • the Titles Administrator; and • if the incident occurred in the offshore area of a State—the Department of the responsible State Minister; and • if the incident occurred in the Principal Northern Territory offshore area—the Department of the responsible Northern Territory Minister. 47(4) The titleholder is not required to include in the record anything that was not included in the notification.

The requirements for reporting, investigating, and learning from unplanned or uncontrolled events that have or could have resulted in harm to people, the environment or company assets are defined in the Incident Reporting, Procedure.

All personnel will be informed, through inductions and daily operational meetings, of their duty to report HSE incidents and hazards. Reported HSE incidents and hazards will be shared during daily operational meetings and will be documented in Santos' incident management system. HSE incidents will be investigated using root cause analysis.

Environmental recordable and reportable incidents will be reported to NOPSEMA as required, in accordance with Table 8-26. The incident reporting requirements will be provided to all crew on board the facilities and vessels, with special attention to the reporting timeframes to provide for accurate and timely reporting.

For the purposes of this Activity, in accordance with Section 5 of the OPGGS(E)R:

- A recordable incident for an activity means a breach of an EPO or EPS, in the EP that applies to the Activity, that is not a reportable incident.
- A reportable incident for an activity means an incident relating to the Activity that has caused, or has the potential to cause, moderate to significant environmental damage.

For the purposes of this EP, a reportable incident is one that is assessed to have an environmental consequence of moderate or higher in accordance with the Santos environmental impact and risk assessment process outlined in Section 5. Of the planned and unplanned events assessed within this EP, the items identified to have a potential consequence level of moderate or higher if the event were to occur and would therefore be a reportable incident were:

- introduction of invasive marine species (III – Moderate in OA1 and IV – Major in OA2)

- surface release of condensate from the FPSO as a result of an external impact (vessel collision) (III – Moderate)
- surface release of marine gas oil from the FPSO as a result of an external impact (vessel collision) that ruptures a marine gas oil tank (III – Moderate)
- surface release of marine diesel oil from a vessel (III – Moderate)
- surface release of HFO hydrocarbon release from the offtake tanker as a result of external impact (vessel collision) that ruptures an HFO tank (IV – Major)
- subsea release of gaseous hydrocarbons (III – Moderate in OA2)

8.4.10 Document Management

OPGGS(E)R 2023 Requirements
Section 52 Storage of records
Environment plan 52(1) A titleholder must store an environment plan for an activity under the title, in a way that makes retrieval of the environment plan reasonably practicable, during the following periods: (a) when the environment plan is in force for the activity; (b) for 5 years beginning on the day that the environment plan ceases to be in force for the activity. 52(2) A titleholder commits an offence of strict liability if the titleholder does not comply with subsection (1). Penalty: 30 penalty units. *Records and reports required under provisions of this instrument* 52(3) A titleholder must store the following documents, in a way that makes retrieval of the document reasonably practicable, for a period of 5 years beginning on the day the document is given or submitted to NOPSEMA: (a) a written record of a notification by the titleholder under section 47; (b) a written report given or submitted by the titleholder under section 48, 49, 50 or 51. 52(4) A titleholder commits an offence of strict liability if the titleholder does not comply with subsection (3). Penalty: 30 penalty units. *Other records and reports* 52(5) A titleholder commits an offence of strict liability if the titleholder: (a) creates a record or report mentioned in subsection (7); and (b) either: (i) does not store the record or report; or (ii) stores the record or report in a way that does not make retrieval of the record or report reasonably practicable. Penalty: 30 penalty units. 52(6) Subsection (5) does not apply if the failure to store the record or report, or failure to store it in a way that makes retrieval reasonably practicable, occurs more than 5 years after the day that the record or report was created. Note: A defendant bears an evidential burden in relation to the matter in subsection (6) (see subsection 13.3(3) of the Criminal Code). 52(7) For the purposes of paragraph (5)(a), the records and reports are the following: (a) records relating to environmental performance, or the implementation strategy, under the environment plan in force for an activity under the title; (b) records of emissions and discharges into the environment made in accordance with the environment plan in force for an activity under the title; (c) records of calibration and maintenance of monitoring devices used in accordance with the environment plan in force for an activity under the title; (d) written reports (including monitoring, audit and review reports) about environmental performance, or about the implementation strategy, under the environment plan in force for an activity under the title.

This EP and OPEP, as well as approved MoC documents, are controlled documents; current versions will be available on Santos' intranet. Santos' contractors are also required to maintain current versions of these documents.

Environmental performance outcomes and standards will be measured based on the measurement criteria listed in Table 8-2. Such records will be maintained for a period of five years. Contractors are required to make these records available upon request.

8.4.10.1 Information management and document control

The Barossa Information Management System is comprised of a suite of applications, configured to support operations and accessible by relevant BWO and Santos personnel. Key aspects of relevance to the EP include:

- Engineering Information Management Systems (EIMS)
- Operating manuals and procedures, Operating Procedure Guides and Work Instructions (standards, processes,
- Computerised Maintenance Management Systems (CMMS').
- Process surveillance and analysis.
- Condition monitoring for rotating equipment and electrical systems.
- Asset integrity management systems for topsides and hull.
- Santos IRR for operational risk assessment of the subsea infrastructure.
- MoC management systems.
- Incident reporting systems (including HSSE and technical).
- Productions and emissions reporting.

A library of controlled documents specific to the Barossa facility operations, including this EP and the Barossa Production Operations OPEP, is accessible by personnel on the FPSO via a dedicated homepage. Each document has an 'Approver' and an 'Owner' who are responsible for the effectiveness of the requirements in that document. All documents will be updated as necessary in response to:

- Requirements for revision in accordance with the relevant Regulations.
- Changes in legislation, standards and/or codes.
- Findings / lessons learned from hazards reported and incident investigations.
- Audit actions.
- Changes to plant, equipment, and operating parameters.
- Changes in operating practices.
- Significant increase in the level of risk associated with a work activity or operation.
- Introduction of new technology, materials, or services.

The current approved version of controlled documents can always be readily located and accessed by the workforce through the information management system. Santos' contractors are also required to maintain current versions of these documents.

8.4.10.2 Environment Plan Review

Outside of any EP reviews and revisions triggered by the EP MoC process (Section 8.5.2), the EP will be reviewed as part of the 5-year major revision and resubmission in line with Regulation 41.

8.4.11 Post Acceptance Consultation Implementation Strategy

OPGGS(E)R 2023 Requirements
Section 22 Implementation strategy for environment plan
Consultation and compliance 22(15) The implementation strategy must provide for appropriate consultation with: a) relevant authorities of the Commonwealth, a State or a Territory; and b) other relevant interested persons or organisations.

Post-acceptance consultation activities for this EP will be principally supported by Santos' existing relationships with those relevant interested persons and organisations whose functions, interests and activities may be affected by the Activity.

Santos recognises and respects the preference of relevant government authorities and other relevant interested persons and organisations to determine the frequency and method of updates, in addition to the written quarterly updates outlined in this strategy below.

8.4.11.1 First Nations people and groups

Santos will undertake post acceptance consultation over the life of the Activity with First Nations representative organisations.

Santos will provide quarterly written Activity updates via land councils and Aboriginal Corporations, specifically to:

- GDA
- KLC
- LDC
- LNAC
- NLC
- TLC
- Wickham Point Deed liaison committee
- Quarterly written Activity updates will also be provided to:
    - Tiwi Clan Trustees for each Clan via TLC
    - First Nations Consultative Committees via Committee Chairs.

Having regard to Santos' experience consulting with First Nations groups, and feedback from First Nations relevant persons, Santos considers that consultation through representative bodies provides an appropriate mechanism for ongoing consultation with First Nations relevant interested persons.

Representative bodies provide for regular, culturally appropriate engagement, including processes for dissemination of information to First Nations Elders, cultural leaders and communities in a manner that is readily accessible and culturally appropriate.

8.4.11.2 Local governments, communities and industry

As part of Santos' community engagement efforts, Santos will provide quarterly written Activity updates to regional local government and associated communities.

Santos will also provide quarterly written Activity updates to the commercial fishing industry, which is the industry most likely to be affected by proposed offshore activities. Santos will provide quarterly written Activity updates to those representative organisations whose membership are most likely to be affected, specifically to NPFI and NTSC.

8.4.11.3 Post-acceptance consultation implementation strategy – approach

Santos will provide to those organisations identified above quarterly written Activity updates. The updates will also be posted on Santos' website, with notifications to registered/subscribed interested parties.

Activity notifications and reports will be made in accordance with Table 8-26 and Table 8-27. The notifications and reports are based on legislative requirements, standing arrangements with particular Relevant Persons, Relevant Persons' requests for notification made during Section 25 of the OPGGS(E)R 2023 consultation or as otherwise deemed appropriate by Santos.

Santos will apply the regional engagement model to consider the preferences of relevant government authorities and other relevant interested persons and organisations when determining the frequency and method of additional updates.

A community lead for each region (e.g. NT Community Affairs Manager) oversees the development and implementation of engagement related plans, such as community investment plan and provision of information updates on Santos' activities. A core aim is to build long term relationships with key local stakeholders through regular engagement.

The regional engagement model is bespoke for each area so it can incorporate the preferences of local stakeholders and updated from time to time to reflect those preferences. For example, the NT model currently

includes the use of a Darwin shopfront which is open to the public and a NT based First Nations Engagement Adviser. These plans also consider the community commitments (e.g. post EP engagement) for each region. For example, the NT model currently includes quarterly meetings with Larrakia people through the Wickham Point Deed liaison committee.

Santos will continue to accept, assess and respond to post acceptance consultation feedback during the life of the Activity under this EP. Records of any post acceptance consultation will be maintained in an appropriate Santos consultation database.

During the EP validity period, Santos will also:

- Review information sources that may give rise to additional or new relevant interested persons or organisations, as part of planned consultation activities to support future approvals.
- Request recipients of Santos' Quarterly Update to advise Santos of other organisations who may be relevant interested persons or organisations or who may be relevant Commonwealth, State or Territory authorities with respect to particular regional activities. The Quarterly Update is sent to a diverse range of organisations and provides information about Santos' proposed, existing and completed activities.

Additional new potentially relevant interested persons or organisations will be engaged and provided information about the accepted activity, as well as information about the post-acceptance consultation process and opportunities to provide input or receive activity updates.

Additional new relevant interested persons or organisations will also be added to the distribution list for its Quarterly Update, unless they request that they not be added.

If, during the course of post acceptance consultation, Santos receives information demonstrating a new or increased environmental impact or risk that is not provided for in this EP, as in force at the time, Santos will apply its MoC process outlined in Section 8.5.2.

Santos will maintain a database of relevant authorities, and other relevant interested persons and organisations for the Activity under this EP. This includes updating its database in light of post acceptance consultation, including identification of new relevant interested persons or organisations.

8.5 Act

Within 'Act' are described the processes for ongoing environmental impacts and risks to ensure they remain at ALARP and acceptable levels for the life of the Activity.

8.5.1 Non-conformance Management

EP non-conformances will be addressed and resolved by a systematic corrective action process, as outlined in Santos' Assurance Operating Standard and the Assurance Procedure. Non-conformances arising from audits and inspections will be entered into Santos' incident and action tracking management system (as in, HSE Toolbox). Once entered, corrective actions, timeframes and responsible persons (including action owners and event validators) will be assigned. Corrective action 'close out' will be monitored using a management escalation process. Any non-conformances that trigger recordable or reportable incident reporting to NOPSEMA will be managed per Section 8.4.6.

8.5.2 Environment Plan Management of Change

The EP MoC process provides a systematic approach to initiate, assess, approve, implement and close out actions associated with a change in the Activity. Implementation of the EP MoC process is designed so that all activities undertaken by Santos is in full compliance with regulatory approvals and conditions and that changes have been properly considered, risk assessed, approved and communicated to all appropriate stakeholders accompanied by a detailed record of the change in Activity.

For any change with identified environmental impacts or risks, an impact / risk assessment will be undertaken to ensure that impacts and risks from the change can be managed to meet relevant EPOs and be ALARP and acceptable. For a change to proceed, the associated environmental impacts and risks must be demonstrated to be acceptable and ALARP.

The MoC process considers sections 18, 19, 38 and 39 of the OPGGS(E)R 2023 and determines if:

- in respect of existing activities for the purposes of ss 18, 19 and 39, a proposed change can proceed and the manner in which it can proceed; and
- whether a proposed change or activity constitutes a 'new activity' for the purposes of s 38.

The MoC process applies to:

- new activities, assets, equipment, processes or procedures proposed to be undertaken or implemented that have the potential to impact on the environment and have not been assessed or authorised previously
- changes arising from any aspect of the approved activity including proposed changes to activities, assets, equipment, processes or procedures that have the potential to impact on the environment
- changes to the existing environment as relevant to the Activity
- changes to performance standards
- receipt of information form stakeholders about the impacts or risks of the activity
- new information that becomes available after EP acceptance
- changes, updates or environmental performance improvements identified from incident investigations, emergency response activities or annual audits
- an assurance check for a specific activity (e.g. PFW management, methane emissions management, annual audits)
- for GHG emissions, changes or updates following changes to Santos' corporate targets and policies regarding scope 3 equivalent emissions, or following the collection of data from suppliers, the DLNG onshore processing facility and customer and evaluation of opportunities to collaborate on emissions reductions initiatives (see BAO-CM-6.3.21, 6.3.22, 6.3.23 and 6.3.24)

The MoC procedure also allows for the assessment of information that may become available after EP acceptance.

Some of the above circumstances where the MoC process applies are expanded on below as follows:

- When further feedback is received from external stakeholders after EP acceptance, consideration will be given as to whether it includes information concerning the environmental impacts or risks of Santos' activities, and if so, whether these impacts or risks are provided for in the relevant approval documentation (e.g. in this EP).
- Santos will also have regard to the guidance in *Munkara* that a 'new' significant environmental impact or risk means objective facts and circumstances arising after the approval of the EP.[59] If the impact or risk is not provided for in the EP and is new, the MoC process will be initiated in a timely manner in order for the significance of the new information, and any new or increased impacts or risks to be assessed.
- Separately, if seminal reports are published, or there are material advances in technology, related to matters such as climate and GHG emissions, these will be regularly monitored by Santos and the Barossa JV staff, including through implementation of the GHGEMP (see Sections 8.3.2.13). Such developments may engage the MoC procedure. In any event, updated publications and technological advances will be assessed and addressed in each five-yearly revision to this EP.

The MoC procedure also includes an assurance check process.

- Where there is an identified change from the accepted EP content, a check is done to test the 'significance' of the change, to determine whether it can be accommodated which may then result in an MoC as described above.

Once the MoC process is complete:

- Accepted changes become part of the in-force EP or the Barossa Production Operations OPEP, are tracked on a register and are made available on Santos' intranet. Where appropriate, the EP compliance register will be updated so that CM or EPS changes are communicated to the workforce and implemented. Any MoC will be distributed to the relevant roles identified in Table 8-38.2.4.1, and the most relevant management position is responsible for communication and implementation of the MoC. This may include crew meetings, briefings or communications as appropriate for the change.
- The MoC procedure will determine whether a revision of the EP is required and whether that revision must be submitted to NOPSEMA. Additional consultation with Relevant Persons may be appropriate in order to complete the MoC process, depending on the nature and scale of the change.
- If re-submission of the EP to the Regulator is triggered as a result of the MoC assessment, standard practice of document revision will apply. If re-submission of the EP to the Regulator is not triggered, but an update to the latest version of the EP is required to reflect the changes from the MoC assessment, then this type of revision is called a "minor" revision.

[59] *Munkara* at [232].

8.5.3 Performance Review and Continuous Improvement

Review of environmental performance and the implementation strategy will occur at regular intervals over the life of the Activity as part of existing business processes, or stand-alone reviews specific to the EP. These processes are described below for steady state operations.

For hook-up and cold commissioning, and initial start-up, target setting and ongoing review of environmental performance will be conducted as outlined in 8.2.4.1, 8.4.3.1 and 8.4.3.2. For these periods, target setting is prospective based on planned activities. Due to the shorter duration of these activity phases, performance will be monitored, reviewed and adjusted daily. After action review and activity close out processes will also review environmental performance at the end of each of these activity phases.

8.5.3.1 Monthly Operations Governance Forums

Santos Operations Governance requires that the governance process:

- Assess and evaluate adequacy of existing performance indicators and supplement with new performance indicators (as required).
- Track and monitor health of performance indicators against targets.
- Identify gaps and focus areas for improvement, with performance below threshold requiring a plan to improve, endorsed by Leaders in the Business Unit and Function.
- Report and communicate performance in governance forums to facilitate and enable discussion for improvement initiatives.

Operations Governance Forums are held monthly to review operations and maintenance performance and KPIs, and will include KPIs relevant to evaluating the effectiveness of this EP implementation strategy.

8.5.3.2 Annual Environmental Performance Reviews

Review of environmental performance with Operations leadership against the requirements of the EP will occur annually in the lead up to the preparation of the annual performance report (Section 8.5.3.2). The review will be informed primarily by the results of EP monitoring and assurance activities, including inspections and audits. These are described in Section 8.4 The purpose of the annual performance review is to review effectiveness of the implementation strategy, test the adequacy of resources to implement the requirements of the EP, assess effectiveness of the Environment Management System (EMS), refer Section 8.2.1 and to assess if there are any necessary changes to the management of environmental impacts and risks for the activity.

8.5.3.3 Continuous Improvement

The scope of the annual performance review process is to also identify opportunities to improve environmental performance over the life of the Activity. Inputs to improvement opportunity identification will include the following:

- improvements identified from quarterly review of HSE key performance indicators (leading and lagging), where KPIs are relevant to management of Activity impacts and risks in this EP.
- opportunities for improvement identified from EP assurance processes including emissions/discharges monitoring, audits, inspections, environmental incident investigations and after action reviews
- emissions and energy management activities (Section 8.2.4.2)
- opportunities for improvement identified during EP MoC reviews (Section 8.5.2)
- emergence of new knowledge or technologies relevant to management of environmental impacts and risks of the Activity
- any changes to Commonwealth or Northern Territory legislation, regulation or policy of relevance to management of impacts and risks from the Activity.
- issues raised during the ongoing consultation process (Section 8.4.11).

To ensure Santos maintains up-to-date knowledge of external sources of information that may be relevant to identification of continuous improvement opportunities, the following is undertaken:

1. maintain membership of Australian Energy Producers (formerly Australian Petroleum Production and Exploration Association), which provides a mechanism for communicating potential changes in legislation, industry practice and other issues that may affect EP implementation;
2. undertake annual spill response exercises, involving relevant external response organisations, to check spill response arrangements and capability are adequate;
3. subscribe to various regulator updates; and

4. have regular liaison meetings with regulators.

8.5.4 Environmental Impact/Risk Review

A review of environmental impacts and risks via an ENVID workshop will be conducted 12 months after commencement of steady state operations, and then once every five years to inform the 5-yearly revision of the EP in line with Regulation 41.

8.5.5 Engineering Change Management

Engineering change management processes will be used to scope and guide engineering and operations changes and determine reviews required to appropriately manage risks. Change management is critical to ensure all changes, no matter how minor or small, are effectively captured, assessed, approved, and managed with due rigour by competent people to ensure that any change will not compromise integrity, safe operations, the safety of personnel or protection of the environment. The change management process applies to all technical substitutions, modifications, additions, or deletions of: plant or equipment; systems and procedures; critical positions or personnel.

Each change has an owner responsible for managing the change through its lifecycle, from inception through to ultimate close-out. Change requests evaluations shall include operations and technical disciplines as appropriate to the requested change. Appropriate communication and consultation with the parties affected by the change will also be conducted. Close-out will confirm that any lessons learned from implementation are captured and communicated appropriately.

There will be two complementary change management of processes in place:

- Santos Engineering Change Management Process
  - Utilised for STO change impacting field wide operations (including regulatory etc)
  - Covers multiple scopes (Subsea, GEP etc) and their interactions with the FPSO
  - References supporting BWO process where required
- BWO Engineering Change Management Process
  - Used for BWO identified or introduced change or as required via Santos Engineering Change Management Process
  - Focused on single scope (FPSO) change
  - Links to Santos process when change is a result of field wide change or when FPSO identified change impacts other scopes

Any change that spans both the FPSO and subsea (including GEP), or that is relevant to requirements of the EP, will be governed under the Santos change management process.

Both change management processes include an HSE review at initiation, which will determine whether potential changes impact achievement or verification of environmental performance standards or compliance with an environmental performance outcome. Any change that results in an outcome that may affect management of impacts and risks of the Activity will trigger the EP MoC process (Section 8.5.2).

Each change has an owner responsible for managing the change through its lifecycle, from inception through to ultimate close-out. Change requests evaluations shall include operations and technical disciplines as appropriate to the requested change. Appropriate communication and consultation with the parties affected by the change will also be conducted.

8.5.6 Produced Water Adaptive Management

Produced water (PW) will be managed over the life of Barossa field operations to reduce impacts associated with PW discharge to the marine environment to ALARP and acceptable levels. Produced water (comprising condensed water and formation water) is managed through the produced water treatment system prior to discharge, including primary treatment through a hydrocyclone and induced gas flotation (IGF) unit and tertiary treatment through a macro-porous polymer extraction (MPPE) unit, considered to provide a high degree of oil in water (OIW) and mercury removal from the PW stream. The MPPE system has been designed for PW flowrates of up to 20,000 bbl/d. Given the modelled peak flowrate for the life of the field is 20% lower than this (16,000 bbl/d) and flowrates for the majority of field life (including the life of this EP) are expected to be less than 10,000 bbl/d, the system is expected to deliver higher levels of performance, in terms of oil in water (OIW) and mercury removal, than the design specification guarantee (OIW<30 mg/L and mercury <10 ppbw) based on accepted limits within the Barossa OPP.

Santos has set performance targets and upper limits for OIW and mercury content in discharged PW at lower levels than the design specification and will respond to exceedances through an adaptive management process, as outlined within the PW Adaptive Management Plan (Appendix I) to ensure impacts are ALARP. The PW Adaptive Management Plan also details how the PW stream will be monitored and characterised over time to ensure that predictions made on the level of impact of a PW discharge (as detailed in Section 6.8) are continually validated and remain compliant with environmental performance outcomes. Performance targets and limits, PW monitoring and adaptive management requirements are included within control measures and associated environmental performance standards as outlined within Section 6.8.3 and Table 8-2.

The PW Adaptive Management Plan (Appendix I) provides detail on the following areas of PW monitoring and management:

- PW (OIW and mercury content) sample and analysis requirements (scope and frequency)
- OIW monitoring equipment calibration requirements
- PW chemical characterisation requirements (scope and frequency)
- PW ecotoxicity testing requirements (scope and frequency)
- PW discharge modelling requirements
- Water and sediment quality monitoring frequency
- PW OIW and mercury performance targets and upper limits
- Adaptive management triggers and associated investigation/ response requirements for:
    - Exceedances of PW OIW and mercury above performance targets
    - PW flowrate exceedance
    - New production chemicals
    - PW chemical characterisation results
    - PW ecotoxicity results
    - Water and sediment quality results

The Water and Sediment Quality Monitoring and Sampling Plan (Appendix J) provides detail on the requirements for monitoring water quality, sediment quality and benthic infauna to provide data that will be used to validate the predicted effects of PW to the marine environment and to determine compliance with PW environmental performance outcomes. The Water and Sediment Quality Monitoring and Sampling Plan includes for:

- Sample design, indicative locations and methodology
- Laboratory test parameters (water and sediment quality) and infauna identification requirements
- Data analysis

Levels of performance and limits for PW discharge have been set based on expected performance of the Barossa FPSO PW treatment system but carry with them a level of uncertainty since the system has yet to be run in the field. Assumptions underpinning the levels of performance set in this EP for PW treatment will be validated through the approach outlined in Section 8.2.5.1. This will entail annual review of PW performance data (including OIW and mercury removal efficiency) commencing once a year of steady state performance data is collected.

8.5.7 Decarbonisation Opportunity Management

Each Santos Regional Business Unit (RBU) is required to submit a decarbonisation plan for each regional asset as part of the annual corporate Long Term Planning Process. These plans contain an articulation of asset specific carbon emissions forecasts, material carbon sources and decarbonisation strategy; and outline opportunities to meet regulatory requirements and corporate targets. The plans outline identified projects to achieve regulatory compliance, such as Australia's Safeguard Mechanism, and Santos' path to net-zero Scope 1 and 2 emissions (avoid & reduce emissions). Any remaining gap to net-zero Scope 1 and 2 emissions is evaluated for offset solutions.

Each RBU's decarbonisation opportunities will vary depending upon their business. RBUs will first look to avoid emissions and then to reduce by implementing energy efficiency and lower emission technologies such as CCS (carbon capture and storage). Operating efficiency projects can include reducing fuel, flare and vent, electrification, improving fuel efficiency and other projects which improve energy efficiency in operations. Opportunities are added to an asset-specific decarbonisation plan, where they are evaluated and prioritised within the constraints of technical feasibility, cost, resource availability and other factors. Asset managers are responsible for identifying asset specific decarbonisation opportunities for all assets, including Barossa, for inclusion in RBU decarbonisation

plans. RBU long-term plans, including the decarbonisation opportunities, are consolidated by the Corporate planning group and then reviewed and discussed with executive leadership to determine the best way to achieve required and targeted emissions reductions.

Based upon this discussion, guidance is provided to the RBUs on projects to include in their budget noting that only sanctioned major projects are considered committed (sanctioned major projects have progressed through the corporate project development process and have an approved final investment decision). The corporate group also considers new technology and other initiatives that may be outside the business unit remit to decarbonise. Sanctioned projects must meet minimum investment criteria set by the corporation based upon several metrics including net present value, internal rate of return, pay back, capital efficiency and marginal abatement cost (for decarbonisation projects). The marginal abatement cost is used to create a cost curve comparing the relative costs of individual projects to understand cost-effectiveness of options.

Projects that do not meet the capital threshold can be approved through the regional business unit's annual budget.

Project opportunity lists are maintained by each RBU and a compilation of current/ongoing opportunities are included in the annual decarbonisation plan. Following delivery, opportunities are validated prior to closeout.

As an individual asset, Barossa will form part of the RBU decarbonisation plan. For Barossa, opportunities identified during the Design/Execute phases, which remain applicable during the Operations phase, will be captured in the applicable RBU decarbonisation plan. Additionally, and as a new facility, a post-start-up workshop will be held within the first 18 months of Barossa steady-state operations for opportunity identification, once the facility is well understood and areas for long-term emissions intensity improvement become evident.

During steady-state operations, opportunities will be added to a formal tracking register where they are evaluated and prioritised, having regard to technical feasibility, cost, resource availability and other factors such as synergistic benefits e.g. opportunities that provide a GHG emissions and atmospheric emissions benefit. Improvement opportunities identified from the performance target setting process (Section 8.2.4.2) will assist with identification of decarbonisation opportunities over the life of the Activity.

Santos reviews and revises its internal planning processes and incorporates changes in requirements and timing as needed to meet changing environmental and internal requirements and to continuously improve internal processes. RBUs are accountable for their asset decarbonisation plans and corporate teams are accountable for validation of these plans and estimated emission reductions. These processes are subject to external audit.

Santos reports annually on its Climate initiatives. The most recent Santos Climate Report can be found on page 68 of the 2024 Annual report: https://www.santos.com/wp-content/uploads/2025/02/FINAL-Appendix-4E-and-2024-Annual-Report.pdf.

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Appendix A Santos' Environment, Health and Safety Policy

Environment, Health & Safety

Policy

Our Commitment

Santos is committed to being the safest gas company wherever we have a presence and preventing harm to people and the environment

Our Actions

We will:

1. Integrate environment, health and safety management requirements into the way we work
2. Comply with all relevant environmental, health and safety laws and continuously improve our management systems
3. Include environmental, health and safety considerations in business planning, decision making and asset management processes
4. Identify, control and monitor risks that have the potential for harm to people and the environment, so far as is reasonably practicable
5. Report, investigate and learn from our incidents
6. Consult and communicate with, and promote the participation of all workers to maintain a strong environment, health and safety culture
7. Empower our people, regardless of position, to "Stop the Job" when they feel it necessary to prevent harm to themselves, others or the environment
8. Work proactively and collaboratively with our stakeholders and the communities in which we operate
9. Set, measure, review and monitor objectives and targets to demonstrate proactive processes are in place to reduce the risk of harm to people and the environment
10. Report publicly on our environmental, health and safety performance

Governance

The Environment Health Safety and Sustainability Committee is responsible for reviewing the effectiveness of this policy.

This policy will be reviewed at appropriate intervals and revised when necessary to keep it current.

Kevin Gallagher

Managing Director & CEO

Status: APPROVED

Document Owner:	David Banks, Chief Operating Officer		
Approved by:	The Board	Version:	3

Appendix B Santos' Climate Policy

Climate

Santos

Policy

Our Commitment

Santos believes that access to reliable and affordable energy is critical to meeting sustainable development goals and improving living standards and economic prosperity in developed and developing nations. Santos recognises the scientific consensus of climate change assessed by the Intergovernmental Panel on Climate Change. We support the objective of the Paris Agreement to limit global temperature rise to less than 2 degrees Celsius and pursue efforts to limit the temperature rise to 1.5 degrees Celsius.

To achieve the goals of the Paris Agreement, we work with governments, customers and suppliers to minimise emissions from our operations and products whilst ensuring continued access to reliable and affordable energy to meet demand.

At Santos, we commit to continuing to take action to minimise the environmental impacts of our operations wherever practicable, including:

- Reducing our greenhouse gas emissions intensity whilst continuing to deliver critical, reliable and affordable fuels to meet demand.
- As a producer of energy, we are committed to achieving net-zero Scope 1 greenhouse gas emissions by 2040 and net-zero Scope 2 greenhouse gas emissions by 2050.
- Utilising carbon capture and storage, developing and trialling new emissions technologies and low carbon fuels as domestic and global markets evolve.
- Working with our customers to reduce their greenhouse gas emissions and sell the products we generate only to customers from countries that have a net-zero commitment or are signatories to the Paris Agreement.
- Providing our shareholders with an advisory vote, known as a 'Say on Climate', at regular intervals.

Our Actions

The actions to achieve Our Commitment are detailed in our annual Sustainability and Climate Report and Climate Transition Action Plan, which details our decarbonisation projects and pathway to net-zero.

Governance

The Safety and Sustainability Committee is responsible for reviewing the effectiveness of this policy.

This policy will be reviewed at appropriate intervals and revised when necessary to keep it current.

Kevin Gallagher

Managing Director and CEO

Date Approved:	12 February 2025	Version:	3.1

Appendix C Requirements (including Legislative Requirements) Applicable to the Activity

Table C-1: Summary of Relevant Commonwealth Legislation

Table C-2: Summary of Relevant Northern Territory Legislation

Table C-3: Summary of Relevant Western Australian legislation

Table C-4: Summary of Relevant International Agreements and Conventions

Table C-5: Conditions from the Class Approval – Mining Operations and Greenhouse Gas Activities for the North Marine Parks Network Management Plan 2018 relevant to the activities in this Environment Plan

Table C-6: Conditions from the Commercial Activity Licence relevant to the environmental management of the activities in this Environment Plan

Table C-7: EPBC Act Approval (EPBC 2022/09372) Compliance Table

Table C-1: Summary of Relevant Commonwealth Legislation

Requirement for Environmental Management	Administering Authority	Summary of requirement and how it will be met	EP section
Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth) (ATSIHP Act)	Commonwealth – Attorney-General's Department DCCEEW	The ATSHIP Act provides for the preservation and protection from injury or desecration areas and objects in Australia and Australian waters that are of significance to Aboriginal people in accordance with Aboriginal tradition. The Minister for the Environment and Water may make a declaration to protect such areas and objects. The Act also requires the discovery of Aboriginal remains to be reported to the Minister. The ATSIHP Act is not directly relevant to the Activity as there are no areas or objects within the OAs or the EMBA the subject of a 'significant Aboriginal areas' or a 'significant Aboriginal object' declaration under the ATSIHP Act. Further, there are no requirements arising under the ATSIHP Act that apply to the environmental management of the Activity. However, in the event that such areas or objects are declared in the future, this Act could potentially become relevant to the activities. Accordingly, this Act has been identified for completeness. Santos notes that on 23 October 2023 it was informed by the DCCEEW that applications had been received under the ATSIHP Act in relation to certain areas of the sea. Santos understands that these areas overlap parts of OA2 and the EMBA. Santos understands that no decisions have been made by the Minister in relation to the applications at the time of writing.	Section 3.6.9 – Underwater cultural heritage Section 3.7 – Cultural features
Aboriginal Land Rights (Northern Territory) Act 1976 (Cth) (ALR Act)	Commonwealth – Attorney-General's Department Department of the Prime Minister and Cabinet	The main purpose of this Act is to provide for the granting of traditional Aboriginal land in fee simple to be held by Aboriginal Land Trusts for the benefit of Aboriginals entitled by Aboriginal tradition to the use or occupy the land. The ALR Act is not directly relevant to the environmental management of the Activity. There is no Aboriginal land either claimed or granted under the ALR Act, or sea closures put into effect in accordance with that Act, that overlap with the OAs. However, there are extensive coastal areas that intersect the EMBA that are formally recognised as Aboriginal land under the Act. As such, this Act has been included to give context to Santos' consultation with relevant Land Councils established under the Act.	Section 3.7 – Cultural features Table 4-18 – Consultation Summary Table
Australian Heritage Council Act 2003 (Cth)	Commonwealth - Australian Heritage Council	This Act identifies areas of heritage value, including those listed on the National Heritage List and the Commonwealth Heritage List and establishes the Australian Heritage Council. The functions of the Australian Heritage Council include advising the Minister on conserving and protecting places included, or being considered for inclusion, in the National Heritage List or Commonwealth Heritage List. There are no National heritage places or Commonwealth heritage places within the OAs. However, the EMBA intersects the Ashmore Reef Marine Park, a Commonwealth heritage place. In addition, Scott Reef, a Commonwealth heritage place, is approximately 37km from the EMBA. This Act is not directly relevant to the environmental management of the Activity, however, these National heritage places and Commonwealth heritage places are relevant to the Activity insofar as they comprise the values and sensitivities of the EMBA.	Section 3.6.9 – Underwater cultural heritage Section 3.5.3 – Commonwealth heritage places Sections 7.6 to 7.7.11 – Hydrocarbon spills

Requirement for Environmental Management	Administering Authority	Summary of requirement and how it will be met	EP section
Australian Maritime Safety Authority Act 1990 (Cth) (AMSA Act)	AMSA	This Act establishes the Australian Maritime Safety Authority which manages the National Plan for Maritime Environmental Emergencies in coordination with industry. AMSA is also responsible for administering Marine Orders in Commonwealth waters. The Act aims to promote maritime safety, protect the marine environment from pollution and environmental damage from ships, provide for a national search and rescue service and promote the efficient provision of service by AMSA. AMSA is the lead agency for responding to oil spills in the marine environment and is responsible for the Australian National Plan for Maritime Environmental Emergencies. While the Act does not contain any explicit requirements relevant to the Activity, it establishes and sets out the functions of AMSA, which relate to environmental management including in respect of response to spill events and administration of Marine Orders. The Act applies to the use of any vessel associated with operations and is relevant to the activity in respect of any unplanned pollution from ships. AMSA has also been consulted as a Relevant Person and will be notified throughout activities in accordance with Table 8-7. AMSA's relevant functions are described in Table 4-9.	Table 4-11 – Consultation Summary Table (AMSA) Sections 7.6 to 7.7.11 – Hydrocarbon spills Section 7.7.12 – Contingency spill response operations
Biosecurity Act 2015 (Cth) *Biosecurity Regulations* 2016 (Cth) *Biosecurity Amendment (Biofouling Management) Regulations* 2021 (Cth) Australian Ballast Water Management Requirements, Version 8 Australian Biofouling Management Requirements (DAWE 2022)	Commonwealth – Department of Agriculture, Fisheries and Forestry	This Act and its supporting regulations are the primary legislative means for managing diseases and pests that may cause harm to human, animal or plant health, or the environment. This Act includes provisions for ballast water management plans and certificates, record keeping obligations and powers to ensure compliance. This Act includes mandatory controls on the use of seawater as ballast in ships and the declaration of sea vessels voyaging out of and into Commonwealth waters. The Regulations stipulate that all information regarding the voyage of the vessel and the ballast water is declared correctly to the quarantine officers. The Australian Ballast Water Management Requirements outline the mandatory ballast water management requirements to reduce the risk of introducing harmful aquatic organisms into Australia's marine environment through ballast water from international vessels. These requirements are enforceable under the *Biosecurity Act 2015* (Cth) and include obligations under the International Convention for the Control and Management of Ships' Ballast Water and Sediments. This Act and Regulations apply to all foreign vessels operating in Australian waters and these vessels are required to comply with the requirements of this Act, the Regulations, the Australian Ballast Water Management Requirements, and the Australian Biofouling Management Requirements.	Section 7.2 – Introduction of invasive marine species
Climate Change Act 2022 (Cth) (Climate Act)	Commonwealth – Climate Change Authority	The Climate Act commenced in September 2022. The Climate Act sets out Australia's net-zero commitments and codifies Australia's net 2030 and 2050 GHG emissions reductions targets under the Paris Agreement. While the oil and gas sector is not subject to direct obligations under this Act, the Act legislates Australia's net zero emissions targets.	Section 6.3 - Greenhouse gas emissions

Requirement for Environmental Management	Administering Authority	Summary of requirement and how it will be met	EP section
Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) *Environment Protection and Biodiversity Conservation Regulations* 2000 (Cth) (EPBC Regulations)	Commonwealth – DCCEEW DNP	While the OPGGS (E) Regulations under the OPGGS Act (see below) regulate day to day petroleum activities and apply to any activity that may have an impact on the environment, the EPBC Act regulates the assessment and approval of proposed actions that are likely to have a significant impact on a matter of National Environmental Significance (MNES). Actions that are likely to have a significant impact on a MNES typically require referral under the EPBC Act, and the assessment process is administered by the DCCEEW. To protect, maintain and enhance recovery of certain threatened species and ecological communities listed under the EPBC Act, DCCEEW may prepare conservation management plans in the form of conservation advice or recovery plans. Australian Marine Parks (AMP) are established under the EPBC Act, and each AMP zone is based on the principles of the Australian International Union for Conservation of Nature (IUCN). Each of the AMPs have a management plan to give effect to management principles and objectives. Schedule 8 of the EPBC Regulations outlines the IUCN Reserve Management Principles. In addition, the EPBC Regulations provide for the protection and conservation of cetaceans, and create various offences for actions that may endanger them. This Act is relevant to the environmental management of the Activity and applies to all aspects of the Activity that have the potential to impact MNES. In addition to the operation of the OPGGS (E) Regulations under the OPGGS Act, part of the Barossa Development, being the Darwin Duplication Pipeline Project (DPD Project) is authorised pursuant to EPBC 2022/09372. This approval constitutes the Commonwealth Government's primary approval for the DPD Project and authorises the installation, pre-commissioning, operation and decommissioning of part of the Barossa GEP addressed in this EP. The DPD Project was deemed a 'controlled action' on 6 December 2022 and following assessment, was approved on 15 March 2024. The Barossa Development, including the Activity, will be undertaken in accordance with the 'class approval',[1] and, for those aspects of the Activity authorised under EPBC 2022/09372, in accordance with EPBC 2022/09372.	Section 3 – Description of the environment Section 6 – Planned activities impact assessment Section 7 – Unplanned events risk and impact assessment

[1] Being the final approval decision made under section 146B of the EPBC Act on 27 February 2014 by the (then) Minister for Environment, and available here.

Requirement for Environmental Management	Administering Authority	Summary of requirement and how it will be met	EP section
Fisheries Management Act 1991 (Cth) (FM Act)	Commonwealth - Department of Agriculture, Fisheries and Forestry Commonwealth – Australian Fisheries Management Authority	Management plans for fisheries are established under the FM Act, and the FM Act also sets out the legislative basis for Statutory Fishing Rights (SFRs), licences and permits. The Act defines the Australian Fishing Zone (AFZ) and provides for the majority of Commonwealth fisheries offences. The Act also establishes the functions of the Australian Fisheries Management Authority (AMFA), including in relation to the pursuit of ecologically sustainable development. The FM Act is not directly relevant to the environmental management of the Activity. However, in the event of a spill, the Act provides the regulatory framework for any necessary fisheries management decisions in Commonwealth waters. Further, the AFMA is responsible for managing Commonwealth fisheries and is a relevant agency where the Activity has the potential to impact on fisheries resources in AFMA managed fisheries. The OAs overlap four Commonwealth commercial fisheries managed by the AFMA, with the EMBA overlapping two additional Commonwealth fisheries. Accordingly, this Act has been identified for completeness (and to provide context for the consultation undertaken by Santos with the AFMA in the course of preparing this environment plan).	Section 3.6.1 – Commercial Fisheries Table 4-11 – Consultation Summary Table (AFMA)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 (Cth)	Commonwealth – DCCEEW	This Act regulates the import, export and transport of hazardous waste. The Act aims to ensure that exported, imported or transited waste is managed in an environmentally sound manner so that human beings and the environment, both within and outside Australia, are protected from the harmful effects of the waste. The Act gives effect to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1972 (commonly referred to as the Basel Convention). This Act applies to the import, export and transport of hazardous wastes required for the Activity, which will comply with the requirements of the Act.	Section 6.7 – Operational discharges Section 6.8 - Produced water discharges Section 8.4.3 – Monitoring and recording emissions and discharges
Marine Orders	Commonwealth - AMSA	Marine Orders are subordinate rules made pursuant to the *Navigation Act 2012* (Cth), the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth) and the *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) affecting the maritime industry. They are a means of implementing Australia's international maritime obligations by giving effect to international conventions in Australian law. There are two series of marine orders, being those made to give effect to international obligations and standards and apply to regulated Australian vessels, foreign vessels and some domestic commercial vessels (Marine Orders 1-98). In addition, Marine Orders 500-507 are made under the *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth). Various Marine Orders apply to the Activity, including in relation to discharges and emissions. The Marine Orders relevant to this EP include: • Marine Order 21: Safety and emergency arrangements • Marine Order 27: Safety of navigation and radio equipment • Marine Order 30: Prevention of collisions • Marine Order 58: Safe management of vessels • Marine Order 70: Seafarer certification. • Marine Order 71: Masters and deck officers	Section 2.8 – Support and campaign vessel operations Section 6 – Planned activities impact assessment Section 7 – Unplanned events risk and impact assessment Section 8.4.3 – Monitoring and recording emissions and discharges

Requirement for Environmental Management	Administering Authority	Summary of requirement and how it will be met	EP section
		• Marine Order 91: Marine pollution prevention – oil. • Marine Order 93: Marine pollution prevention – noxious liquid substances • Marine Order 94: Marine pollution prevention – packaged harmful substances • Marine Order 95: Marine pollution prevention – garbage • Marine Order 96: Marine pollution prevention – sewage • Marine Order 97: Marine pollution prevention – air pollution • Marine Order 98: Marine Pollution - anti-fouling systems Discharges to the marine environment caused by the Activity will be recorded and controlled in accordance with relevant Marine Orders.	
Marine Safety (Domestic Commercial Vessel) National Law Act 2012 (Cth)	Commonwealth – AMSA	This Act is a single regulatory framework for the certification, construction, equipment, design and operation of domestic commercial vessels inside Australia's exclusive economic zone. The Act names AMSA as the National Marine Safety Regulator and confers functions on AMSA in relation to marine safety, including that AMSA may make and maintain Marine Orders. The Regulations under the Act set out the definition of a vessel and details and requirements of the accredited marine surveyor scheme. The Act also sets requirements in relation to the survey of marine vessels which any Australian Activity vessels must comply with. All vessel movements associated with the Activity will be governed by AMSA marine safety regulations provided for under this Act. This Act also imposes duties on owners, masters and crew of domestic commercial vessels in relation to the safety of the vessel, relevant to owners, masters and crew of any Australian Activity vessels under this EP.	Section 6.6. – Interaction with other marine users Section 7.5 – Surface release of MEG or methanol from the FPSO Section 7.6 – 7.7.11 – Hydrocarbon spills Section 7.7.12 – Contingency spill response operations
National Biofouling Management Guidance for the Petroleum Production and Exploration Industry 2009	Commonwealth – Department of Agriculture, Fisheries and Forestry	The guidance document provides recommendations for the management of biofouling hazards by the petroleum industry. The recommendations and biofouling controls set out within this document will be applied to the Activity in order to reduce the risk of the introduction of an IMS.	Section 7.2 – Introduction of invasive marine species
National Environmental Protection Council Act 1994 (Cth)	Commonwealth - DCCEEW	This Act establishes the National Environmental Protection Council (NEPC) that sets National Environmental Protection Measures (NEPMs). NEPMs are a set of national objectives designed to assist in protecting or managing particular aspects of the environment, to ensure that Australians have equivalent protection from air, water, soil and noise pollution. This Act is mirrored in all States and Territories. The Activity will be undertaken in line with the principles of ecologically sustainable development, and impacts and risks resulting from these activities relevant to National Environment Protection Measures national objectives will be demonstrated to be ALARP and acceptable.	Section 6.4 – Atmospheric Emissions Section 8.4.3 – Monitoring and recording emissions and discharges
National Greenhouse and Energy Reporting	Commonwealth – DCCEEW Clean Energy Regulator	The NGER Act provides for a single national reporting framework for the reporting and dissemination of information about greenhouse gas emissions, greenhouse gas projects and energy use and production of corporations.	Section 6.3 – Greenhouse gas emissions

Requirement for Environmental Management	Administering Authority	Summary of requirement and how it will be met	EP section
Act 2007 (Cth) (NGER Act) National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (Cth)	Climate Change Authority	The Safeguard Mechanism is also administered under the NGER Act. The Safeguard Mechanism applies to the Barossa Development gas production activities, specifically, the Barossa Development gas field will be a designated large facility under the NGER Act, and, as such will be subject to the Safeguard Mechanism. This means that Santos, among other things, will have an obligation to ensure that the net covered emissions of GHGs from the production of gas at the Barossa gas field do not exceed the applicable baseline (see section 6.3.2.8.2 above for further information on the Safeguard Mechanism and its application to the Barossa Development).	
Native Title Act 1993 (Cth) (Native Title Act)	Commonwealth – Attorney-General's Department Commonwealth – Department of the Prime Minister and Cabinet National Native Title Tribunal Federal Court of Australia	The NT Act recognises the rights and interests of Aboriginal and Torres Strait Islander people in land and waters according to their traditional laws and customs, and creates processes through which native title can be recognised and protected. Under s 280(2) of the OPGGS Act, petroleum activities must be carried out in a manner that does not interfere with the enjoyment of native title rights and interests under the NT Act to a greater extent than necessary. The NT Act is not directly relevant to environmental management of the Activity. There are no native title claims or determinations within the OA. However, the EMBA overlaps with the Croker Island Native Title Determination (DCD1998/001) and the Larrakia Native Title Determination (DCD2006/001). In addition, the NLC is a Representative Aboriginal/Torres Strait Islander Body under the NT Act for parts of the OA and EMBA. Accordingly, this Act has been identified for completeness (and to provide context for the consultation undertaken by Santos with the NLC in the course of preparing this environment plan).	Section 3.7 – Cultural features Table 4-18 – Consultation Summary Table (NLC)
Navigation Act 2012 (Cth)	AMSA (operational) Commonwealth - Department of Infrastructure, Transport, Regional Development, Communication and the Arts	This Act aims to promote the International Convention for the Safety of Life at Sea 1974 (SOLAS) and safe navigation, prevent pollution of the marine environment and ensure that AMSA has the power to carry out inspections of vessels, and enforce national and international standards. Specifically, this Act empowers AMSA to make Marine Orders, which are legislative instruments, with respect to any matter for which provision must or may be made by the Regulations. AMSA has the authority and responsibility for the operational activities under the Act, including vessel certification, seafarers qualifications, marine pollution prevention, monitoring and enforcement activities. All vessel movements associated with the Activity will be governed by marine safety regulations and Marine Orders made under the Act. See Marine Orders, above.	Section 6.6 – Interactions with other marine users Section 6.6.3 – Environmental performance outcomes and control measures Section 7.7.12 – Contingency spill response operations Section 7.6 – 7.7.11 – Hydrocarbon spills

Requirement for Environmental Management	Administering Authority	Summary of requirement and how it will be met	EP section
Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth) (OPGGS Act) Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (Cth) (OPGGS (E) Regulations)	Commonwealth – NOPSEMA Commonwealth – Department of Industry, Science and Resources	Petroleum exploration and development activities in Australia's offshore areas are subject to the environmental requirements specified in the OPGGS Act and associated Regulations. The OPGGS Act contains a broad requirement for titleholders to operate in accordance with 'good oil-field practice'. Specific environmental provisions relating to work practices essentially require operators to control and prevent the escape of wastes and petroleum. The Act also requires that activities are performed in a manner that does not unduly interfere with other rights or interests, including the conservation of the resources of the sea and seabed, such as fishing or shipping. In some cases, where there are environmental sensitivities or multiple use issues, it may be necessary to apply special conditions to an exploration permit area. The holder of a petroleum title must maintain adequate insurance against expenses or liabilities arising from activities in the title, including expenses relating to clean-up or other remedying of the effects of the escape of petroleum. The OPGGS (E) Regulations provide an objective based regime for managing environmental performance for Australian offshore petroleum exploration and production activities in areas of Commonwealth jurisdiction. Key objectives of the OPGGS (E) Regulations include to ensure that a petroleum activity carried out in an offshore area is: • carried out in a way that is consistent with the principles of ecologically sustainable development as set out in section 3A of the EPBC Act; and • carried out in a manner by which the environmental impacts and risks of the activity will be reduced to ALARP and be of an acceptable level. This EP demonstrates that the Activity will be undertaken in line with the principles of ecologically sustainable development, and that the environmental impacts and risks resulting from these activities are reduced to ALARP and are acceptable.	Section 2.9 – Subsea inspection, monitoring, maintenance and repair activities Section 6.3 – Greenhouse gas emissions Section 6.4 – Atmospheric emissions In addition, requirements under the OPGGS Act and associated Regulations are addressed throughout this EP.
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989 (Cth) (and associated Regulations)	Commonwealth – DCCEEW	This Act regulates the manufacture, importation and use of ozone depleting substances (ODSs) (typically used in fire-fighting equipment and refrigerants) and synthetic greenhouse gases, and is applicable to the handling of any ODS. The Act provides a licensing system for the import, export and manufacture of ODSs and equipment containing ODSs, while the Regulations control the end-use of ODSs, which are licenced by DCCEEW. While the Activity does not include import, export or manufacture activities of ODS, this Act applies where ODS is found on Activity vessel refrigeration systems (which is a rare occurrence). The Activity vessels may use ODSs which would be regulated under this Act. Santos, when engaging vessel contractors, shall assure the vessel contractors compliance with applicable maritime law and regulations.	Section 6.4 – Atmospheric emissions
Protection of the Sea (Powers of Intervention) Act 1981	AMSA	The Act authorises the Commonwealth (through AMSA) to take measures for the purpose of protecting the sea from pollution by oil and other noxious substances discharged from ships and provides legal immunity for persons acting under an AMSA direction, including measures provided for under both of the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties and the Protocol Relating to Intervention on the High Seas in Cases of Pollution by Substances other than Oil, 1973.	Section 6.6. – Interaction with other marine users Section 6.7 – Operational discharges Section 7.7.12 – Contingency spill response operations

Requirement for Environmental Management	Administering Authority	Summary of requirement and how it will be met	EP section
Protection of the Sea (Powers of Intervention) Regulations 1983 (Cth)	Commonwealth – Department of Infrastructure, Transport, Regional Development, Communication and the Arts	The Regulations set out requirements to notify AMSA in respect of changes in the ownership or master of a vessel. This Act applies to vessel discharges and movements associated with the Activity, and Santos is required to comply with the Act in the event of a spill of oil or noxious subjects from a ship. Further, the Act confers powers on AMSA to take action in the event of a spill of oil or noxious subjects from a ship, which functions are relevant in the event of an MDO spill arising from activities under this EP.	Section 7.6 – 7.7.11 – Hydrocarbon spills
Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Cth) *Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations 1994* (Cth)	AMSA Commonwealth – Department of Infrastructure, Transport, Regional Development, Communication and the Arts	This Act relates to the protection of the sea from pollution by oil and other harmful substances discharged from ships and implements into domestic law Australia's obligations under the MARPOL convention, which sets out the legislative obligations relating to the prevention of accidental and operational marine environment pollution from shipping. This Act disallows any harmful discharge of sewage, oil and noxious substances into the sea and sets the requirements for a shipboard waste management plan. This Act also provides for the making of marine orders relating to marine pollution prevention, which give effect to relevant regulations of Annexes I, II, III, IV, V and VI of MARPOL 73/78. This Act applies to vessel discharges and movements associated with the Activity. Santos and its contractors must comply with relevant requirements under this Act and Regulations in respect of Activity vessels, including requirements to have a shipboard oil pollution emergency plan and a marine pollution emergency plan. Santos notes that the requirement to maintain a ship energy efficiency management plan is not applicable to Activity vessels as the vessels will not be engaged on an overseas voyage when undertaking activities under this EP.	Section 6.4 – Atmospheric emissions Section 6.7 – Operational discharges Section 7.6 – 7.7.11 – Hydrocarbon spills
Protection of the Sea (Civil Liability of Bunker Oil Pollution Damage) Act 2008	AMSA	This Act implements the requirements for the International Convention on Civil Liability for Bunker Oil Pollution Damage imposing insurance certification requirements in respect of regulated Australian vessels carrying more than 2,000 tonnes of oil in bulk as cargo. This Act applies to MDO refuelling that may occur within the OAs.	Section 7.6 – 7.7.11 – Hydrocarbon spills
Protection of the Sea (Harmful Antifouling Systems) Act 2006	Commonwealth, Department of Infrastructure, Transport, Regional Development, Communications and the Arts AMSA	This Act relates to protecting the sea from the effects of harmful anti-fouling systems. It prohibits the use of harmful organotins in anti-fouling paints used on ships. This is also implemented through Marine Order 98 (Marine pollution – anti-fouling systems). This Act applies to vessel movements in Australian waters associated with the Activity, which are required to have biofouling systems in place to prevent introduction of IMS and harmful impacts on Australian biodiversity.	Section 7.2 – Introduction of invasive marine species
Underwater Cultural Heritage Act 2018 (Cth) (UCH Act) *Underwater Cultural Heritage*	Commonwealth – DCEEW The NT Heritage Branch has jurisdiction	The UCH Act replaces the *Historic Shipwrecks Act 1976* (Cth) and extends protection to other wrecks such as submerged aircrafts, human remains and other types of underwater cultural heritage including Aboriginal and Torres Strait Islander Underwater Cultural Heritage..	Section 3.6.9 – Underwater cultural heritage Section 3.7 – Cultural features

Requirement for Environmental Management	Administering Authority	Summary of requirement and how it will be met	EP section
(Consequential and Transitional Provisions) Act 2018 (Cth)	over Commonwealth waters North of the NT	Under the UCH Act, heritage that has been in Commonwealth / Australian waters for at least 75 years is automatically protected, while other heritage can be declared to be protected by the Minister. It is an offence to interfere with heritage covered by this Act. Key obligations imposed under the UCH Act include: • not disturbing protected underwater heritage during the course of a proposed action without a permit; • observing the requirements of protected zones and obtaining a permit to enter one if required; and • providing notification in respect of the discovery of any suspected underwater heritage identified during the course of proposed action within 21 days of discovery. Santos has not identified any known shipwrecks within the OAs. However, multiple known historic shipwrecks occur within the EMBA. Some unlocated wrecks could fall within the boundaries of the OAs or EMBA. Despite this, there is no predicted impact to cultural heritage values in relation to these shipwrecks resulting from activities under the EP, including from unplanned risks. Although there are no presently predicted impacts, the UCH Act imposes obligations in the event of an article of heritage being discovered. The UCH Act requires that that anyone who finds an article of underwater cultural heritage which appears to be of an archaeological character needs to notify the relevant authorities, via online form.	Section 6.5 – Seabed and benthic habitat disturbance.

Table C-2: Summary of Relevant Northern Territory Legislation

State Legislation	Administering Authority	Summary of relevant requirement and how it will be met	EP Section
Dangerous Goods Act 1998 (NT) and *Dangerous Goods Regulations 1985* (NT)	NT - Department of the Attorney-General and Justice	This Act relates to the handling of certain dangerous goods within the NT. The Regulations provide requirements for the safe handling, storage and transportation of dangerous goods, including the provision of adequate training for personnel, suitable labelling, storage facilities and on-site emergency response capability. This Act applies in relation to the handling of dangerous goods in NT waters.	Section 6.7 – Operational Discharges Section 6.8 – Produced water discharges
Environmental Protection Act 2019 (NT)	NT - Department of Environment, Parks and Water Security	This Act is the principle environment legislation in the NT. The Act establishes the NT EPA whose key objectives are to promote ecologically sustainable development, protect the environment, and promote key effective waste management and minimisation strategies. The Act also provides for environmental impact assessment and approval for specific actions that may have a significant impact on the environment or that meet a referral trigger. While this Act is not directly relevant to the environmental management of the Activity (rather, it is relevant to the DPD, which required assessment under the Act), the Act is relevant in the event that unplanned events may impact on NT waters and land, constituting an offence under the Act.	Section 7.6 – 7.7.11 – Hydrocarbon spills
Environment Protection (National Pollutant Inventory) Objective 2004 (NT)	NT EPA	The National Pollutant Inventory (NPI) provides information on the types and amounts of certain substances being emitted to the air, land and water or transported in waste. This is an objective under the *Waste Management and Pollution Control Act* that provides for compulsory reporting of air emissions by certain facilities, in accordance with the Commonwealth National Environment Protection (National Pollutant Inventory) Measure. Reporting for GHG emissions associated with the activity will comply with these requirements.	Section 6.3 – Greenhouse gas emissions Section 6.4 – Atmospheric emissions
Fisheries Act 1988 (NT) *Fisheries Regulations 1992* (NT)	NT - Department of Industry, Tourism and Trade – Fisheries Division	The *Fisheries Act 1988* (NT) provides for the regulation, conservation and management of fisheries and fishery resources so as to maintain their sustainable utilisation, to regulate the sale and processing of fish and aquatic life, and for related purposes. There are no requirements directly relevant to the environmental management of the Activity. However, in the event of an emergency, the Act provides the regulatory framework for the Joint Authority Fishery (such as the Timor Reef Fishery) to make any necessary fisheries management decisions. The OAs overlap the Timor Reef Fishery which is jointly managed by the NT and Commonwealth. The EMBA intersects with numerous NT-managed fisheries regulated under this Act. Accordingly, this Act has been identified for completeness (and to provide context for the consultation undertaken by Santos with the NT Department of Industry, Tourism and Trade in the course of preparing this EP).	Section 3.6.1 – Commercial fisheries Table 4-12 – Consultation Summary Table (NT Department of Industry, Tourism and Trade) Section 7 – Unplanned events risk and impact assessment

State Legislation	Administering Authority	Summary of relevant requirement and how it will be met	EP Section
Heritage Act 2011 (NT)	NT - Department of Territory Families, Housing and Communities	This Act establishes the NT Heritage Council and governs protection of both natural and cultural heritage places within the NT jurisdiction by establishing heritage offences and regulating activities that may impact heritage places and objects, including through a process for obtaining works approvals. The 'Subsea Telegraph Cables Landing Site' is located 112km to the south-east of OA2 and is within the EMBA. This site is listed under this Act. While the Activity is not likely to impact natural and cultural heritage places or objects in the NT (including the 'Subsea Telegraph Cables Landing Site'), the Act is relevant in the event that an unplanned loss of well control results in impact to natural and cultural places, or objects in the NT, constituting an offence under the Act.	Section 3.6.9 – Underwater cultural heritage Section 7.6 – 7.7.11 – Hydrocarbon spills
Northern Territory Aboriginal Sacred Sites Act 1989 (NT) *Northern Territory Aboriginal Sacred Sites Regulations 2004* (NT)	NT – Aboriginal Areas Protection Authority (AAPA)	This Act establishes procedures for the protection and registration of sacred sites and the avoidance of sacred sites in the development and use of land. The Act also provides for entry onto sacred sites and specifies the conditions that apply to such entry, and establishes the Aboriginal Areas Protection Authority, who is responsible for, among other things, the enforcement of the Act. The AAPA has issued Authority Certificates (C2022-098 and C202/034) for the DPD Project in NT waters (outside OA2), confirming based on AAPA's research findings that there are no sites of significance within NT pipeline licences (NTC/PL5 and PL37) (at least insofar as the extent of NT waters and pursuant to the relevant definitions they are guided by). In addition, there are many NT coastal sites along the mainland and island coastlines and potentially the surrounding waters that overlap the EMBA that are protected under the Act (whether registered, recorded, or not). There are no registered sacred sites in the OAs. As a result, no credible impacts to known sites are expected from planned activities. However, the Act will be applicable in the unlikely event that an unplanned event may impact sacred sites protected under this Act, constituting an offence.	Section 3.7 – Cultural features Section 7.6 – 7.7.11 – Hydrocarbon spills
Marine Pollution Act 1999 (NT) *Marine Pollution Regulations 2003* (NT)	NT – Department of Environment, Parks and Water Security	This Act protects the NT marine and coastal environment from shipsourced pollution, including litter and rubbish, hydrocarbons and substances that may be hazardous to the marine environment (including substances that may be in ballast and grey water). This Act also gives effect to the following annexes of MARPOL in NT waters: • Annex I (which deals with pollution by oil) • Annex II (which deals with pollution by noxious liquid substances in bulk) • Annex III (which deals with pollution by harmful substances in packaged form) • Annex V (which deals with pollution by garbage). This Act is applicable to the extent that unplanned events may impact NT waters.	Section 7.6 – 7.7.11 – Hydrocarbon spills
Waste Management and Pollution Control Act 1998 (NT) (WMPC Act)	NT EPA NT – Department of Environment, Parks and Water Security	This Act provides for the protection of the NT environment though encouraging effective waste management and pollution prevention and control practices. Under the WMPC Act, environmental protection approvals and licences are required to authorise specific activities and operations. This Act is applicable to the extent that an unplanned event may impact NT lands and waters, in which case, spill response operations will be undertaken in accordance with plans produced under this Act (e.g. the NT Oil Spill Contingency Plan), in consultation with relevant NT response agencies	Section 6.7 – Operational discharges Section 6.8 – Produced water discharges

Table C-3: Summary of relevant Western Australian legislation

State Legislation	Administering Authority	Summary of relevant requirement and how it will be met	EP Section
Aquatic Resources Management Act 2016 (WA)	WA – Department of Primary Industries and Regional Development	This Act will be the primary legislation for the management of fishing, aquaculture, pearling and aquatic resources in Western Australia. The Act was scheduled for commencement on 1 November 2023, however, this has been deferred while further sector consultation is facilitated. Vessel movements required for the Activity have the potential to introduce IMS. The legislative requirements set out in this Act were considered for the development of both of the Santos IMS Management Zone and the IMS Management Plan for the purpose of managing the risks associated with the introduction of IMS.	Section 7.2 – Introduction of invasive marine species
Biodiversity Conservation Act 2016 (WA) (BC Act)	WA – Department of Biodiversity, Conservation and Attractions	The BC Act provides a regime for the protection of certain listed and threatened species, for the purposes of conserving and protecting Western Australian wildlife. This Act will be applicable in the event that planned and unplanned releases impact listed species, constituting an offence under the Act.	Section 6 – Planned activities impact assessment Section 7 – Unplanned events risk and impact assessment
Environmental Protection Act 1986 (EP Act) *Environmental Protection (Unauthorised Discharges) Regulations 2004* (WA) (Unauthorised Discharges Regulations) *Environment Protection (Controlled Waste) Regulations 2004* (WA) (Controlled	WA – Department of Water and Environment Regulation EPA	The EP Act provides for the prevention, control and abatement of pollution and environmental harm and for the conservation, preservation, protection, enhancement and management of the environment. The EP Act establishes offences for certain environmental harms. The Unauthorised Discharges Regulations regulate certain discharges into the environment that do not cause pollution or harm for the purposes of the EP Act, but which result from business or commercial activity. The Controlled Waste Regulations regulate the transportation of controlled wastes, including the storage, handling, labelling, transport and tracking of such wastes. The Unauthorised Discharges Regulations will apply to the Activity to the extent that there are unplanned hydrocarbon and chemical releases during spill response actions in WA waters.	Section 7 – Unplanned events risk and impact assessment Section 7.7.12 – Contingency spill response operations

State Legislation	Administering Authority	Summary of relevant requirement and how it will be met	EP Section
Waste Regulations)		The Controlled Waste Regulations apply to the transportation of controlled wastes during spill response actions in WA waters.	
Fish Resources Management Act 1994 (WA) *Fish Resources Management Regulations 1995* (WA)	WA - Department of Primary Industries and Regional Development	This Act establishes a framework for managing fishery resources, including the development and management of fisheries and aquaculture and the conservation of fish and other aquatic resources and their habitats. The Act also provides for arrangements for management of specific fisheries, including through the establishment of Joint Authorities, who have management responsibilities in respect of fisheries in Western Australian waters. This Act is set to be repealed once the *Aquatic Resources Management Act 2016* (WA) comes into effect (see above). The Act is not directly relevant to the Activity. However, the Act will be relevant in relation to the management of the introduction of IMS during spill response actions in WA waters. In addition, the EMBA overlaps a number of WA-managed commercial fisheries regulated under this Act. Accordingly, this Act has been included for completeness (and to provide context for the consultation undertaken by Santos with the WA Department of Primary Industries and Regional Development).	Table 4-13 – Consultation Summary Table (DPIRD) Section 7.2 – Introduction of invasive marine species Section 7.7.12 – Contingency spill response operations

Table C-4: Summary of Relevant International Agreements and Conventions

International agreements and conventions	Summary of relevant requirement and how it will be met	EP section
1997 Treaty between Australia and Indonesia establishing the EEZ Boundary and Certain Seabed Boundaries (Perth Treaty)	This treaty has been signed but not yet ratified. When ratified, the treaty will finalise the EEZ boundary between Australia and Indonesia. Under the Perth Treaty, there are areas of overlapping jurisdiction where Australia exercises seabed jurisdiction including exploration for petroleum, and Indonesia exercises water column jurisdiction including fishing rights. While there are no direct requirements arising under the Perth Treaty that apply to the Activity, parts of the EMBA overlap with areas covered by the Perth Treaty. Although the Treaty has not been ratified and imposes no obligations on Santos, it is relevant to Santos's assessment of potential Relevant Persons and has therefore been identified in for completeness.	See section 3.6.2 – Indonesian and Timorese commercial and subsistence fishing.
Agreement Between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and Their Environment 1974 (commonly referred to as the Japan Australia Migratory Bird Agreement)	This agreement recognises the special international concern for protecting Migratory birds and birds in danger of extinction that migrate between Australia and Japan. The agreement is implemented in the EPBC Act. Birds listed on the annex to this agreement must be placed on the migratory species list under the EPBC Act. Only relevant in so far that a credible spill scenario may result in impacts to migratory seabirds foraging in the OAs or EMBA.	Section 3.4.3 – Threatened and migratory fauna Section 7.6 – 7.7.11 – Hydrocarbon spills
Agreement Between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and Their Environment 1986 (commonly referred to as the China Australia Migratory Bird Agreement)	This agreement recognises the special international concern for protecting Migratory birds and birds in danger of extinction that migrate between Australia and China. The agreement is implemented in the EPBC Act. Birds listed on the annex to this agreement must be placed on the migratory species list under the EPBC Act. Only relevant in so far that a credible spill scenario may result in impacts to migratory seabirds foraging in the OAs or EMBA.	Section 3.4.3 – Threatened and migratory fauna Section 7.6 – 7.7.11 – Hydrocarbon spills

International agreements and conventions	Summary of relevant requirement and how it will be met	EP section
Agreement Between the Government of Australia and the Government of the Republic of Korea for the Protection of Migratory Birds and Their Environment 1986 (commonly referred to as the Republic of Korea Australia Migratory Bird Agreement)	This agreement recognises the special international concern for the protection of migratory birds and birds in danger of extinction that migrate between Australia and Korea. The agreement is implemented in the EPBC Act. Birds listed on the annex to this agreement must be placed on the migratory species list under the EPBC Act. Only relevant in so far that a credible spill scenario may result in impacts to migratory seabirds foraging in the OAs or EMBA.	Section 3.4.3 – Threatened and migratory fauna Section 7.6 – 7.7.11 – Hydrocarbon spills
Convention for the Control of Transboundary Movements of Hazardous Wastes and Their Disposal 1989 (Basel Convention)	This convention deals with the transboundary movement of hazardous wastes, particularly by sea. The *Hazardous Waste (Regulation of Exports and Imports) Act 1989* (Cth) gives effect to the Basel Convention in Australian law. The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes. While the Activity does not involve transboundary movement of hazardous wastes, Santos has considered the requirements of the Basel Convention in respect of any import, export and transport of hazardous waste for the Activity).	Section 8.4.3 – Monitoring and recording emissions and discharges
Convention on Wetlands of International Importance (Ramsar Convention)	The Ramsar Convention provides a framework for the conservation and wise use of wetlands and their resources. The EPBC Act gives effect to the Ramsar Convention by providing specific protection for wetlands recognised by the Ramsar Convention under Parts 2, 3 and 4 of the EPBC Act. There are several Ramsar wetlands that overlap the EMBA (being the Ashmore Reef Marine Park and the Cobourg Peninsula). While no impacts are expected to these Ramsar wetlands, this convention is applicable in so far as the credible spill scenario may result in impacts to Ramsar wetlands.	Section 3.5.2 – Wetlands of National and international importance (Ramsar) Section 3.5.4 – Marine parks
Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGS)	The COLREGS are a set of rules that apply to prevent the collision of vessels at sea and apply to vessels navigating waters outside of the COLREGS demarcation lines. The COLREGS rules, include, among other things, requirements to travel at safe speeds and keep watch keepers on deck of vessels, to reduce the likelihood of collisions. Activity vessels will comply with the COLREGS, including in particular, through the use of appropriate lights and shapes to reflect the nature of operations. The convention is also given effect in Australia through Marine Order 30 (see above).	Section 6.2 – Light emissions Section 6.6 – Interactions with other marine users Section 7.5 – Surface release of MEG from the FPSO
Convention on Oil Pollution Preparedness, Response and Co-operation 1990 (OPRC 90)	This convention comprises national arrangements for responding to oil pollution incidents from ships, offshore oil facilities, sea ports and oil handling. The convention recognises that in the event of a pollution incident, prompt and effective action is essential. Parts of this convention are implemented by the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth). The convention is applicable to the Activity in the event of a worst-case credible spill scenario, which may enact a national arrangement for response. Refer to the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth).	Section 7.6 – 7.7.11 – Hydrocarbon spills Section 7.7.12 – Contingency spill response operations

International agreements and conventions	Summary of relevant requirement and how it will be met	EP section
Convention on the Conservation of Migratory Species of Wild Animals 1979 (Bonn Convention)	The Bonn Convention aims to improve the status of all threatened migratory species through national action and international agreements between range states of particular groups of species. This convention is only relevant in so far as a credible spill scenario may result in impact to MNES protected migratory species.	Section 3 – Description of the environment Section 7.6 – 7.7.11 – Hydrocarbon spills Section 7.7.12 – Contingency spill response operations
The Paris Agreement on Climate Change 2015	The Paris Agreement aims to tackle climate change and its negative impacts. It sets the long term goal of substantially reducing global GHG emissions to limit global temperature rise this century to well below 2°C above preindustrial levels while pursuing efforts to limit the temperature increase even further to 1.5°C to prevent dangerous human-induced interference with the climate system. Under the Paris Agreement, Australia must submit emissions reduction commitments known as nationally determined contributions. The Paris Agreement provides the international framework and context around Australia's nationally determined contributions (which is implemented through national schemes, such as the Safeguard Mechanism). Santos has developed its EPOs and control measures having regard to the Paris Agreement and the responsibility of each country to manage and reduce its emissions and the autonomy of each country in determining the role of gas in pursuing those efforts. See also the *Climate Change Act 2022* (Cth) and the Safeguard Mechanism above.	Section 6.3 – Greenhouse gas emissions Section 6.4 – Atmospheric emissions
International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004 (Ballast Water Convention)	The Ballast Water Convention was adopted by the IMO and entered into force globally in 2017. It aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for managing and controlling ships' ballast water and sediments. Thus, ballast water management systems must be approved in accordance with this convention. From 8 September 2017, all vessels that use ballast water are required to meet the Regulation D-2 discharge standard of this Convention at their next renewal survey. In Australia, Implementation of the convention is also provided for under the *Biosecurity Act 2015* (Cth). This convention applies to all foreign vessels operating in Australian waters that have the potential to introduce IMS and/or utilise or conduct ballast water exchange. Refer to Australian Ballast Water Management Requirements.	Section 7.2 – Introduction of invasive marine species Section 8.3.2.9.1 – Ballast water management
International Convention on Civil Liability for Bunker Oil Pollution Damage 1969	This convention provides a mechanism for ensuring the payment of compensation for oil pollution damage. In Australia, the convention is enacted under the *Protection of the Sea (Civil Liability of Bunker Oil Pollution Damage) Act 2008* (Cth). This convention applies in the event of a large-scale spill scenario associated with the Activity. Refer to *Protection of the Sea (Civil Liability of Bunker Oil Pollution Damage) Act 2008* (Cth).	Section 7.6 – 7.7.11 – Hydrocarbon spills

International agreements and conventions	Summary of relevant requirement and how it will be met	EP section
International Convention on the Control of Harmful Anti-fouling Systems on Ships	This convention prohibits the use of harmful organotin compounds in anti-fouling paints used on ships and establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems. Santos will ensure that the vessels and FPSO utilised for the Activity maintain anti-fouling systems in accordance with the convention. In addition, Santos will ensure it obtains an approved International Anti-Fouling Systems Certificate. See also *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth).	See Table 8-2 – Environmental performance standards and measurement criteria
International Convention for the Prevention of Pollution from Ships 1973/1978 (MARPOL 73/78)	This convention and protocol (together known as MARPOL 73/78) build on earlier conventions in the same area. MARPOL is concerned with operational discharges of pollutants from ships. It contains six Annexes, dealing respectively with oil, noxious liquid substances, harmful packaged substances, sewage, garbage and air pollution. Detailed rules are laid out as to the extent to which (if at all) such substances can be released in different sea areas. The legislation giving effect to MARPOL in Australia is the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), the *Navigation Act 2012* (Cth) and several Parts of Marine Orders made under this legislation. This convention applies to vessel discharges and movements associated with the Activity. Santos will ensure that all required audits and inspections of relevant contracted vessels assess compliance with the laws of the international shipping industry, including MARPOL. Refer also to the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), *Navigation Act 2012* (Cth) and Marine Orders.	Section 2.5 – 2.7 – FPSO Section 2.8 – Support and campaign vessel operations Section 6 – Planned activities impact assessment Section 7 – Unplanned events risk and impact assessment
International Convention for the Safety of Life at Sea 1974 (SOLAS) and its Protocol of 1988	This convention is generally regarded as the most important of all international treaties concerning the safety of merchant ships. In Australia, the convention is implemented by the *Navigation Act 2012* (Cth) and Marine Orders under that Act. The convention has been considered in relation to certain safety aspects of the Activity (such as in relation the configuration of the FPSO and the management of impacts associated with light emissions). Refer to the *Navigation Act 2012* (Cth) and Marine Orders.	Section 2.5 – 2.7 – FPSO Section 6 – Planned activities impact assessment Section 8.3.2 – Supporting management processes and procedures
International Convention on Standards of Training, Certification and Watchkeeping (STCW) for Seafarers 1978	This convention prescribes internationally agreed minimum standards relating to training, certification and watchkeeping for seafarers. This convention is given effect in Australia by Marine Order 71 (Masters and Deck Officers). Santos has implemented control measures directed to ensuring compliance with this Convention and with Marine Orders.	Section 8.1.1 – Environmental performance outcomes Section 8.4.8 – Marine Assurance
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties 1969	Under this convention a coastal state may take action to prevent, mitigate or eliminate danger to its coastline or related interests from pollution by oil or the threat thereof, following upon a maritime casualty. In Australia, this convention is enacted under the *Protection of the Sea (Powers of Intervention) Act 1981* (Cth) This convention is relevant in the unlikely event of a large-scale spill scenario associated with the Activity where that spill is likely to affect the shoreline of a coastal state. Refer to *Protection of the Sea (Powers of Intervention) Act 1981* (Cth).	Section 6.7 – Operational Discharges Section 7.6 – 7.7.11 – Hydrocarbon spills

International agreements and conventions	Summary of relevant requirement and how it will be met	EP section
International Maritime Dangerous Goods (IMDG) Code 1994	The IMDG Code was developed as a uniform international code for the transport of dangerous goods by sea covering such matters as packing, marking, labelling and stowage of dangerous goods. Dangerous marine goods that are shipped for the Activity will be stored, handled and transported in line with this code to reduce the risk of an environmental incident.	Section 2.5 – 2.7 – FPSO Section 7.1 – Release of solid objects
Kyoto Protocol	The international treaty that extends the 1992 United Nations Framework Convention on Climate Change, which commits state parties to reduce GHG emissions. Relevant to GHG emissions associated with the activity.	Section 6.3 – Greenhouse gas emissions
Memorandum of Understanding between Australia and Indonesia on the Operations of Indonesian Traditional Fishermen in Areas of the Australian Fishing Zone and Continental Shelf – 1974	This MoU provides the framework for fisheries and marine cooperation between Australia and Indonesia, and facilitates information exchange on research, management and technological developments, complementary management of shared stocks, training and technical exchanges, aquaculture development, trade promotion and cooperation to deter illegal fishing. The MoU also enables traditional fishing by Indonesian traditional fishers within the sections of the Australian EEZ, known as the 'MoU Box'. There are no requirements arising under the MoU that apply to the Activity directly. However, parts of the traditional Indonesian fishing area established under the MoU (i.e., the MoU Box) is located within the EMBA. Adherence to the terms of the MoU will be achieved for the Activity.	Section 3.5 – Protected areas, KEFs and BIAs Section 3.7 – Cultural features
Minamata Convention on Mercury 2013	The objective of the convention is an international treaty that seeks to protect human health and the environment from anthropogenic (caused by humans) emissions and releases of mercury and mercury compounds and sets out a range of measures to meet that objective. The convention covers all aspects of the lifecycle of mercury, controlling and reducing mercury across a range of products, processes and industries. Australia ratified the convention on 7 December 2021. DCCEEW leads Australia's involvement in the Minamata Convention, while DAFF controls the manufacture, import and export of mercury and mercury-containing products. The convention is relevant to the discharge of mercury associated with the Activity (PW discharge). Selection of PW treatment design is intended to meet the objectives of the convention.	Section 6.8 – Produced water discharges
Oil Companies International Marine Forum Guidelines for Offshore Tanker Operations	The Oil Companies International Marine Forum was formed in April 2019 in response to growing public concern about marine pollution, particularly by oil. The Guidelines for Offshore Tanker Operations provide guidance on equipment and procedures for mooring and transferring crude oil and other petroleum products between offshore terminals and offtake tankers, in particular FPSO terminals. These Guidelines are relevant to the use of offtake tankers required for the Activity, which are third party vessels. Santos will vet these vessels against the criteria under these Guidelines before acceptance for offtake operations.	Section 2.5 – 2.7 – FPSO

International agreements and conventions	Summary of relevant requirement and how it will be met	EP section
United Nations Convention on Biological Diversity 1992	This convention is the international legal instrument for the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. The overall objectives of the convention are to encourage actions leading to a sustainable future. Australia ratified this convention in June 1993 and the convention came into force in December 1993.Implementation of the measures provided for in the convention is achieved under the EPBC Act (in addition to other plans, policies and programmes at the Commonwealth, State, Territory and Local Government level). The convention is relevant only in so far as the Activity may interact with MNES (threatened and migratory species) that are protected under the EPBC Act.	Section 3.2 – Existing environment Section 6 – Planned activities impact assessment Section 7 – Unplanned event risk and impact assessment.
United Nations Convention on the Law of the Sea (UNCLOS) 1982	Part XII of the convention sets up a general legal framework for protecting the marine environment. The convention imposes obligations on State Parties to prevent, reduce and control marine pollution from the various major sources, including pollution from land, from the atmosphere, from vessels and from dumping (Articles 207 to 212). Subsequent articles provide a regime for enforcing national marine pollution laws in the many different situations that can arise. UNCLOS also defines maritime zones, including the territorial sea, contiguous zone, exclusive economic zone and the continental shelf. Australia signed the agreement relating to the implementation of Part XI of the Convention in 1982, and UNCLOS in 1994. The convention is relevant to the extent that Santos will comply with MARPOL through the following relevant Marine Orders relating to marine pollution prevention that have been put in place to give effect to relevant regulations provided in Annexes I, II, III, IV, V and VI of MARPOL 73/78: • Marine Order 91: Marine pollution prevention – oil • Marine Order 93: Marine pollution prevention – noxious liquid substances • Marine Order 94: Marine pollution prevention – packaged harmful substances • Marine Order 95: Marine pollution prevention – garbage • Marine Order 96: Marine pollution prevention – sewage • Marine Order 97: Marine pollution prevention – air pollution.	Section 6.6 – Interaction with other marine users Section 6.7 – Operational discharges Section 7.7.12 – Contingency spill response operations Section 7.6 – 7.7.11 – Hydrocarbon spills
United Nations Framework Convention on Climate Change 1992	The objective of the convention is to stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system. Australia ratified the convention in December 1992 and it came into force on 21 March 1994. The Paris Agreement was agreed under the convention. The convention is relevant to the extent that to reduce impact of GHG emissions associated with the Activity, Santos will comply with MARPOL (Marine Order 97: Marine pollution prevention – air pollution) and will require the use of low sulphur fuel.	Section 6.3 – Greenhouse gas emissions.

Australian Marine Park Licence

The proposed Barossa GEP traverses two zones of the Commonwealth Oceanic Shoals Marine Park: a 30 km section through the Multiple Use Zone and 31.5 km through the Habitat Protection Zone.

Multiple Use Zone

Mining operations, including offshore energy operationsconducted in a Multiple Use Zone (VI) are subject to the conditions of a class approval and the North Marine Parks Network Management Plan (DNP, 2018). The 'Class Approval – Mining Operations and Greenhouse Gas Activities' came into effect on 1 July 2018 at the same time as the North Marine Parks Network Management Plan (DNP, 2018a). The conditions of the Class Approval for the North Marine Parks Network Management Plan that are considered relevant to the scope of this EP are provided in Table B-5.

Habitat Protection Zone

Construction and operation of the Barossa GEP – and the performance of other activities for the purposes of those operations, such as surveys – through the Habitat Protection Zone (IV) was authorised in accordance with the EPBC Act pursuant to the issue of a Commercial Activity Licence by the DNP in April 2019 (, 5 April 2019)

Considered as part of the licence application process in relation to the Activty were:

- the values of the Oceanic Shoals Marine Park (Section 3.5.4.2.1);
- the environmental impacts and risks from the installation, operation and decommissioning of the Barossa GEP within the Oceanic Shoals Marine Park;
- consultation outcomes, including consultation in relation to the Barossa OPP
- the Barossa GEP route assessment, including potential alternative routes outside the Oceanic Shoals Marine Park.

Paragraph 4.2.9.6 of the North Marine Parks Network Management Plan provides that DNP will only authorise the construction and operation of a pipeline and the carrying on of other activities for the purpose of those operations through a Habitat Protection Zone if the DNP is satisfied that alternative routes are not feasible or practicable.

The licence application considered the alternative pipeline routes that were identified both through and around the Oceanic Shoals Marine Park. Each of the alternative routes were subjected to an assessment process that considered the:

- footprint of the proposed activity
- feasibility – whether the route could feasibly be constructed using available technologies and within the constraints of the Barossa Development
- practicability – a comparative assessment of the relevant environmental, societal, safety, technical and economic criteria.

Following the consideration of the above criteria, routing the Barossa GEP through the Oceanic Shoals Marine Park Habitat Protection Zone (being the route presented in this EP) was determined to meet the decision-making criteria of the North Marine Parks Management Plan.

The Commercial Activity Licence authorises the "construction, installation, operation, inspection, maintenance, repair and decommissioning of the Barossa GEP and the related capture of images, video and sound within or of the Park". The 'Licence Area' is described in detail in the Commercial Activity Licence and includes the Barossa GEP installation corridor "buffered by 2000 m on either side". The 'Licence Area' is consistent with the definition of 'operational area' in this EP (Section 2.2.3).

The licence is comprised of:

- Part A – the brief Particulars of the Licence and execution page
- Part B – terms and conditions specific to the Licenced Activities and/or the Park, plus an Annexure specifying further details of the Particulars
- Part C – the general terms and conditions that apply to the Licence.

Conditions considered relevant to the scope of this EP are provided in Table B-6.

The Commercial Activity Licence commenced on 3 November 2020, on the same date that Barossa GEP Licence NT/PL5 was granted under the OPGGS Act.

Table C-5: Conditions from the Class Approval – Mining Operations and Greenhouse Gas Activities for the North Marine Parks Network Management Plan 2018 relevant to the activities in this Environment Plan

Condition No.	Condition	Relevant Section of EP
1	Approved action must be conducted in accordance with: a) an environment plan accepted under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (2009) (Cth)	This EP
	b) the EPBC Act	Table C-1
	c) the Environment Protection Biodiversity Conservation Regulations 2000 (EPBC Regulations)	Table C-1
	d) the North Marine Parks Network Management Plan 2018	Section 3.5.4.2
	e) any prohibitions, restrictions or determinations made under the EPBC Regulations by the Director of National Parks	Not applicable
	f) all other applicable Commonwealth and state and territory laws (to the extent those laws are capable of operating concurrently with the laws and instruments described in paragraphs a to e).	Table C1, C-2 and C-3
2	If requested by the Director of National Parks, an Approved Person must notify the Director prior to conducting Approved Actions within Approved Zones. Note: the timeframe for prior notice will be agreed to by the Director of National Parks and the Approved person.	Section 8.4.9
3	If requested by the Director of National Parks, an Approved person must provide the Director with information relating to undertaking the Approved Actions (or gathered while undertaking the Approved Actions) that is relevant to the Director's management of the Approved Zones. Note: the information required and timeframe within which it is required will be agreed to by the Director of National Parks and the Approved Person.	Not applicable

Table C-6: Conditions from the Commercial Activity Licence relevant to the environmental management of the activities in this Environment Plan

Condition No.	Condition	Relevant Section of EP
Part B	**Park and Licensed Activities specific conditions**	
4.1	The Licensees must consult the Director as a Relevant Person during the development of all environment plans.	Section 4
4.2	The Licensees must ensure that they and their Personnel fully inform themselves of, and equip themselves for, all potential hazards and conditions they may encounter while conducting the Licensed Activities within the Licence Area.	Section 6, 7, 8.3.2.1, 8.5.4
4.4	The Licensees must: (b) notify the Director of the acceptance or refusal of an environment plan by NOPSEMA within 24 hours of its acceptance or refusal. (c) following acceptance of an environment plan by NOPSEMA, provide the Director with a copy of that environment plan within 10 business days of acceptance.	Section 8.4.9
5.1	The Licenced Activities conducted within the Licence Area must be conducted in accordance with an environment plan.	Section 8
5.2	In developing each environment plan, the Licencees must ensure they: a) consult all relevant representative organisations for Aboriginal or Torres Strait Islander persons whose custodianship or traditional use of the Licence Area or the Park may be negatively impacted by the Licenced Activities b) use reasonable endeavours to: (i) address any feedback received in consultation undertaken for the purposes of clause 5.2(a) (ii) mitigate or avoid negative impacts, by amending the proposed environment plan and manner in which the Licencees propose to undertake the Licenced Activities c) at the same time that the Licencees provide the Director with a copy of the relevant Environment Plan in accordance with clause 4.4 (c), provide the Director with a report setting out: (i) the scope of consultation undertaken in accordance with clause 5.2(a), including names of organisations from whom feedback was sought; (ii) a summary of the feedback received from organisations with whom consultation occurred; and (iii) a summary of the amendments to the environment plan and manner in which the Licenced Activities are proposed to occur, made by the Licencees in order to address feedback and mitigate or avoid negative impacts on Aboriginal or Torres Strait Islander persons referred to in clause 5.2(a).	Section 4, 8.4.9
Part C	**General Terms and Conditions**	
9.2	Compliance with Laws and Authorisations a) in undertaking the Licenced Activities within the Licence Area and performing the Licencees' obligations under the Licence, the Licencees must comply with: (i) all applicable laws, including the EPBC Act, EPBC Regulations and any Management Plan; (ii) all applicable Authorisations.	Table B-1
22	Allowance for Park Management Actions	Section 1.2

Condition No.	Condition	Relevant Section of EP
	22.1 Management actions by the Director a) The Licensee acknowledge that the Director is responsible for the administration, management and control of Commonwealth reserves (such as the Park) in accordance with the EPBC Act, EPBC Regulations and any Management Plan. b) Despite any other clause of this Licence, the Licensees agree that the Director may, subject to clause 22.2, exercise all rights and powers of the Director under the EPBC Act, EPBC Regulations and otherwise at Law to: (i) implement any Management Plan for the Park; (ii) conserve the environment and heritage in the Park; (iii) preserve or promote the safety of persons in the Park, including in response to emergencies; and (iv) preserve or promote the efficient use and enjoyment of the Park by Third Parties.	

Appendix D Concordance with the Barossa Development OPP

The ConocoPhillips Australia, Barossa Area Development, Offshore Operation Proposal (OPP) outlines the scope of the development and its activities in sufficient detail to enable a thorough evaluation of environmental impacts and risks, as well as the establishment of appropriate Environmental Performance Outcomes (EPOs). Offshore Project Proposals are developed at an early stage of project planning, before the detailed planning of specific activities is completed. Consequently, more detailed descriptions of these activities and their associated impacts and risks are expected to be provided in subsequent Environment Plans (EPs) as project/activity definition matures (NOPSEMA Guidance Note: Offshore project proposal content requirements N-04790-GN1663 A473026).

Following the acceptance of an OPP and prior to the submission of EPs, refinements or modifications to the methods or timing of individual project activities may occur. These refinements or modifications to the accepted project cannot be new activities and cannot significantly change the overall environmental impacts and risks of the project as described in the accepted OPP (NOPSEMA Guidance Note: Offshore project proposal content requirements N-04790-GN1663 A473026).

With the above requirements in mind, the Production Operations EP has been assessed against the Barossa Development OPP to confirm that there are no new activities or significant changes to the environmental impacts or risks in this EP. Table 9-1 presents the results of that assessment.

Table 9-1 presents a comparison of Environmental Performance Outcomes (EPOs) between the Barossa Development OPP and this EP (of relevance to the scope of this EP) and evaluates the significance of any changes.

Table 9-1: Concordance with the Barossa Development OPP

OPP Section	OPP Overview	EP description	Refinement or modification	New activity or infrastructure	Significance of change to overall environmental impact or risk described in accepted Barossa OPP
4.3.3.1 FPSO Facility	A ship shaped FPSO facility will be permanently moored using a turret mooring system to enable positioning in all metocean conditions. The mooring system will have multiple legs anchored to the seabed. The FPSO facility shall remain on station and be able to weather 10,000-year cyclonic metocean conditions, ensuring no loss of cargo containment or structural integrity. A ship shaped FPSO facility may have thrusters to enable heading control of the facility to assist with operational requirements.	The Barossa FPSO is a ship shaped, purpose-built facility for the Activity. It will be brought into position by support vessels to be permanently moored. The FPSO is entirely reliant on the mooring system to maintain position. The facility does not have thrusters.	YES	NO	This change does not significantly alter the overall environmental impacts and risks of the project as described in the accepted Barossa OPP. Final design of the FPSO does not require thrusters. This eliminates noise emissions, representing a reduction in impact and risk from Activity noise emissions.
4.3.3.2 Gas Export Pipeline	The FPSO facility will be connected to the existing Bayu-Undan to Darwin pipeline (subject to suitable commercial arrangements being in place) via a new dry gas export pipeline. ConocoPhillips is proposing to tie-in to the existing Bayu-Undan to Darwin pipeline to avoid duplication of existing pipeline infrastructure within the vicinity of Darwin Harbour.	The Barossa GEP extends from the Barossa field to the existing onshore facilities at DLNG facility (Figure 1-1). The Barossa GEP is in both Commonwealth and NT waters, with the section of the Barossa GEP within Commonwealth waters licensed under pipeline licenses NT/PL5 and NT/PL6. The total length of the Barossa GEP within Commonwealth waters is 285 km	YES	YES	To address the change to the extent of the Barossa GEP, Santos referred the additional section of the Barossa GEP to DLNG facility for assessment under the EPBC Act. The 'action' referred for assessment included the installation, pre-commissioning, operation and decommissioning of a gas export pipeline and associated infrastructure located in Commonwealth waters and NT waters and land. The 'action' was approved by the Minister on 15 March 2024 (EPBC 2022/09372).
4.3.3.3 Fibre Optic	The fibre optic cable between the Barossa offshore development area and Darwin is the current premise to provide the project with a reliable and stable high-speed data service that allows effective and efficient operations at the FPSO facility. The cable will be installed using a specialised vessel and be either laid on the seabed or buried. It is expected that most of the cable will be buried to provide extra protection and stabilisation	• There is no fibre optic cable being installed • The subsea fibre optic cable was removed from Project scope during detailed design. Alternative technology for communication between FPSO and onshore adopted ie. satellite technology.	YES	NO	This change results in a reduction in seabed disturbance and does not significantly alter the overall environmental impacts and risks of the project as described in the accepted Barossa OPP.

Table 9-2: Concordance with the Barossa Development OPP Environmental Performance Outcomes

Aspect	Barossa Development OPP Environmental Performance Outcome	EP Environmental Performance Outcome	Evaluation of change to environmental outcome (where applicable)	EP EPO number
Interactions with other marine users	No vessel collisions or significant adverse interactions with other marine users.	No vessel collisions or adverse interactions with other marine users.	This EPO has been revised to remove the word "significant" to cover all adverse interactions Improvement in environmental performance	EPO-01
Interactions with marine fauna	Vessel speeds restricted in defined operational areas within the project area, to reduce the risk of physical interactions between cetaceans/marine reptiles and project vessels.	Vessel speeds in operational areas will not exceed applicable restrictions, to reduce the risk of physical interactions between cetaceans / marine reptiles and vessels	This EPO has been revised to refer to "vessels" as described in Section 2.8 No change to environmental performance	EPO-02
	Zero incidents of injury/mortality of cetaceans/marine reptiles from collision with project vessels operating within the project area.	Zero incidents of injury/mortality of cetaceans/marine reptiles from collision with vessels.	This EPO has been revised to refer to "vessels" as described in Section 2.8 No change to environmental performance	EPO-03
Seabed disturbance	No permanent disturbance to benthic habitats beyond the physical footprint of offshore facilities/infrastructure within the Barossa offshore development area and gas export pipeline, as relevant to both direct and indirect sources of disturbance to seabed and associated benthic habitats.	Seabed disturbance to be limited to planned activities and impacts described as part of the Activity and will not occur outside the Operational Areas.	This EPO has been revised to limit the seabed disturbance to within the operational areas given this is the extent of seabed disturbance under the Production Operations EP. No change to environmental performance	EPO-04
	No anchoring or mooring of the FPSO facility and MODU/vessels on shoals/banks, except in emergency conditions.	No anchoring or mooring of the FPSO facility or vessels on shoals/banks.	This EPO has been revised to refer to "vessels" as described in Section 2.8. Reference to MODU/drill ship has also been removed from EPO, as activities from the MODU/drill ship are managed under a separate activity specific EP and are not authorised under this EP. "except in emergency conditions" has also been removed to cover all seabed disturbance.	EPO-05

Aspect	Barossa Development OPP Environmental Performance Outcome	EP Environmental Performance Outcome	Evaluation of change to environmental outcome (where applicable)	EP EPO number
			Improvement in environmental performance.	
	Minimise disturbance beyond the physical footprint by preventing the loss of significant equipment/ cargo overboard from the MODU/ drill ship, FPSO facility or vessels.	No loss of equipment or cargo overboard from the FPSO facility or vessels.	This EPO has been revised to align with defined acceptable levels and is now structured to facilitate measurement and monitoring to ensure compliance. Reference to MODU/drill ship removed from EPO as activities for the MODU/drill ship are managed under the Drilling and Completions EP and are not authorised under this EP. This EPO has also been updated to ensure no loss of cargo, replacing the previous focus on minimizing disturbance beyond the physical footprint. This EPO has been revised to change is to align with defined acceptable levels and is now structured to facilitate measurement and monitoring to ensure compliance. This EPO has been revised to refer to "vessels" as described in Section 2.8 Improvement in environmental performance.	EPO-06
IMS (Biosecurity)	Prevent the displacement of native marine species as a result of the introduction and establishment of IMS via project-related activities, facilities and vessels.	No introduction, establishment or spread of IMS in the natural environment as a result of the Activity.	Updated EPO to prevent introduction of IMS instead of preventing displacement of native species. Revised to align with defined acceptable levels and is now structured to facilitate measurement and monitoring to ensure compliance. No change to environmental performance.	EPO-07
Underwater Noise Emissions	The outer boundary of the planned operational noise footprint (approximately 12 km from source) within the Barossa offshore development area will not impact the	No injury of, or mortality to, EPBC Act 1999 listed marine fauna or to marine fauna listed as threatened species under the *Territory Parks and Wildlife*	This EPO has been revised to align with defined acceptable levels and is now structured to facilitate	EPO-08

Aspect	Barossa Development OPP Environmental Performance Outcome	EP Environmental Performance Outcome	Evaluation of change to environmental outcome (where applicable)	EP EPO number
	nearest shoals/banks of Lynedoch Bank, Tassie Shoal or Evans Shoal (located > 27 km away).	*Conservation Act 1976* (NT) as a result of the Activity.	measurement and monitoring to ensure compliance. This EPO has also been revised to be applicable to all relevant aspects of the Activity.	
		No displacement of marine turtles from habitat critical during nesting/breeding (including internesting periods for turtles) and ensure biologically important behaviour can continue in biologically important areas	This EPO has been included to ensure underwater noise emissions will be managed to prevent any displacement of threatened species in all protected areas, as per EPBC species conservation requirements. Improvement in environmental performance as it is not limited to just shoals and banks.	EPO-15
	The use of FPSO facility thrusters will be limited to that required for safe operations and working requirements.	As described in Table 9-1, the FPSO no longer includes thrusters and therefore the EPO is no longer relevant to the FPSO design.	Thruster no longer incorporated in design and therefore no management measures required to be implemented to minimise thruster noise.	NA
Atmospheric Emissions	Atmospheric emissions associated with the Activity will me*et a*ll regulatory source emission standards.	No Change	NA	EPO-09
	Engineering design of the FPSO facility will seek to reduce atmospheric and GHG emissions through energy efficient design.	This EPO has not been carried over as it was fulfilled by ensuring the FPSO design minimizes atmospheric and GHG emissions. This was accomplished through ALARP studies and HAZID/HAZOP/LOPA assessments. Additionally, a Novel Technology Plan and Report was developed to guide the management of the design and construction processes, including components such as the thermal oxidizer and CCGT system. Section 6.3.5.1 presents the facility design Greenhouse Gas Emissions reduction measures that have been adopted.	There is no change to environmental performance by not including this EPO.	NA

Aspect	Barossa Development OPP Environmental Performance Outcome	EP Environmental Performance Outcome	Evaluation of change to environmental outcome (where applicable)	EP EPO number
	Combustion engines and flaring equipment will be maintained according to vendor specifications to achieve optimal performance.	This EPO has not been included as an EPO, but rather this is covered by control measure BAO-CM-6.4.10.	No change to environmental performance	NA
Greenhouse Gas Emissions	NA	Manage indirect GHG emissions associated with the Activity consistent with the temperature objectives of the Paris Agreement including by implementing company-wide targets and strategies for scope 3 emissions reduction at Barossa as appropriate (having regard to joint venture arrangements and Barossa operations) and supporting customers and suppliers to reduce their GHG emissions.	This new EPO has been introduced into the EP to cover indirect GHG emissions associated with the Activity. Improvement in environmental performance.	EPO-10
Light Emissions	Light spill from the MODUs/drill ships, FPSO facility and project vessels will be limited to that required for safe operations and working requirements.	No light emissions from the Activity except as required for safe operations and working requirements.	This EPO has been revised to refer to “vessels” as described in Section 2.8 Reference to MODU/drill ship removed from this EPO as outside scope of activity for this EP and included in the in force Barossa Drilling and Completions EP. No change to environmental performance	EPO-12
		No displacement of marine turtles from habitat critical during nesting/breeding (including internesting periods for turtles) and ensure biologically important behaviour can continue in biologically important areas	This EPO has been included to ensure underwater noise emissions will be managed to prevent any displacement of threatened species in all protected areas, as per EPBC species conservation requirements. Improvement in environmental performance as it is not limited to just shoals and banks.	EPO-15

Aspect	Barossa Development OPP Environmental Performance Outcome	EP Environmental Performance Outcome	Evaluation of change to environmental outcome (where applicable)	EP EPO number
Planned discharges	All planned operational discharges from the FPSO facility: • will not exceed the natural variation of existing baseline quality conditions for temperature and hydrocarbons, and mercury or chlorine concentrations outside the Barossa offshore development area, and • will not impact areas of seabed that are associated with the seafloor features/ values of KEFs or the nearest shoals/banks of Lynedoch Bank, Tassie Shoal or Evans Shoal (located > 27 km away from the Barossa offshore development area, which is beyond the outer boundary of planned operational discharges), and • meet relevant ANZECC/ ARMCANZ and/or natural variation in ambient baseline conditions (where determined to be more relevant to the site-specific context to derive reference values) beyond the predicted mixing zone(s).	Produced water discharge will not exceed ANZG (2018) 99% Species Protection water quality guideline values and ANZG (2018) default sediment quality values beyond the PW Mixing Zone and will meet the level of dilution required for 99% Species Protection (based on ecotoxicity testing) within the PW Mixing Zone	This EPO has been updated specifically for produced water to facilitate measurement and monitoring to ensure compliance. The EPO considers sediment quality, water quality and marine species and therefore specific reference to seabed features (named shoals) and associated values is not considered warranted especially given the listed features are orders of magnitude further away from than the scale of the modelled mixing zone. Improvement in environmental performance.	EPO-13
		Treated seawater discharge will not exceed the 99% species protection level beyond the validated mixing zone	This EPO has been updated specifically for treated seawater to facilitate measurement and monitoring to ensure compliance. No change to environmental performance	EPO-21
		Planned discharges will meet relevant maritime obligations and Santos chemical assessment and approval process.	EPO updated and considered more appropriate to the routine operational discharges from vessels and the FPSO which are managed under well-established maritime practices (MARPOL) and Santos chemical assessment and approval process for which monitoring in the receiving environment is not required.	EPO-14

Aspect	Barossa Development OPP Environmental Performance Outcome	EP Environmental Performance Outcome	Evaluation of change to environmental outcome (where applicable)	EP EPO number
	Reduce impacts to the marine environment from planned discharges through the application of a chemical assessment process, which includes an environment risk assessment.	Planned discharges will meet relevant maritime obligations and Santos chemical assessment and approval process.	EPO updated and considered more appropriate to the routine operational discharges from vessels and the FPSO, which are managed under well-established maritime practices (MARPOL) and the Santos chemical assessment and approval process. No change to environmental performance.	EPO-14
Waste management	Zero unplanned discharge of hazardous and non-hazardous wastes into the marine environment as a result of project activities.	Zero unplanned discharge of hazardous and non-hazardous wastes into the marine environment from the Activity.	This EPO has been updated and is considered more appropriate for managing unplanned discharges directly related to the Activity. No change to environmental performance.	EPO-16
	Hazardous waste will be transported onshore for treatment and/or disposal at licenced treatment and disposal facilities.	No release of controlled waste generated during the Activity, except through licensed onshore treatment and disposal facilities.	This EPO has been revised to align with defined acceptable levels and is now structured to facilitate measurement and monitoring to ensure compliance. The terminology of the EPO has also been updated to now include all controlled waste, replacing the previous focus on hazardous waste. No change to environmental performance.	EPO-17
Unplanned discharges	Zero unplanned discharge of hydrocarbons or chemicals to the marine environment as a result of project activities.	Zero unplanned discharge of hydrocarbons or chemicals to the marine environment from the Activity.	This EPO has been updated and is considered more appropriate for managing unplanned discharges directly related to the Activity.	EPO-18

Aspect	Barossa Development OPP Environmental Performance Outcome	EP Environmental Performance Outcome	Evaluation of change to environmental outcome (where applicable)	EP EPO number
			No change to environmental performance.	
	An activity-specific OPEP that demonstrates adequate arrangements for responding to and monitoring oil pollution, in the event of a major unplanned release, will be accepted by NOPSEMA prior to commencing the activity.	This EPO has not been carried over to the EP. An activity-specific Barossa Production Operations OPEP has been developed, demonstrating adequate arrangements for responding to and monitoring oil pollution in the event of a major unplanned release. The OPEP will be accepted by NOPSEMA prior to commencing the activity as per control measure BAO-CM-7.7.8.7.	No change to environmental performance.	NA
	An OSMP will be implemented in the event of a major unplanned release. The OSMP will include a number of operational monitoring plans and scientific monitoring plans to guide the spill response, and assess potential environmental impacts.	This EPO has not been carried over to the EP. An OSMP has been developed and is ready for implementation in the event of a major unplanned release. The OSMP encompasses detailed operational and scientific monitoring plans to effectively guide spill response efforts and assess potential environmental impacts. The OSMP forms part of the OPEP that will be accepted by NOPSEMA prior to commencing the activity as per control measure BAO-CM-7.7.8.7.	NA No change to environmental performance.	NA
	NA	Undertake the Activity in a manner that is compliant with the requirements of the Safeguard Mechanism.	New EPO to address changing external legislative context and community expectations. Improvement in environmental performance.	EPO-11
	NA	No significant[1] impacts to cultural features from the Activity.	New EPO to address new impacts/risks identified from EP relevant persons consultation. Improvement in environmental performance.	EPO-19

Aspect	Barossa Development OPP Environmental Performance Outcome	EP Environmental Performance Outcome	Evaluation of change to environmental outcome (where applicable)	EP EPO number
	NA	No impacts to underwater cultural heritage from the Activity.	New EPO to address new impacts/risks identified from EP relevant persons consultation. Improvement in environmental performance.	EPO-20
Decommissioning	Decommissioning will not commence until a Decommissioning EP is accepted (by the regulator with jurisdiction for decommissioning at the time) to be informed by the outcomes of a decommissioning study that considers ALARP and acceptability.	No Change	NA	NA

Note 1: Significant is defined in the Santos Environment Consequence Descriptors (Appendix G).

Appendix E Environment Protection and Biodiversity Conservation Act Protected Matters Searches

Appendix E1: Operational Area 1

Appendix E2: Operational Area 2

Appendix E3: EMBA

Appendix E4: MEVA

Australian Government

Department of Climate Change, Energy, the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 10-Feb-2025

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	20
Listed Migratory Species:	33

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	59
Whales and Other Cetaceans:	22
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	8
Key Ecological Features (Marine):	1
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)

Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
MAMMAL		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
SHARK		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat may occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Megaptera novaeangliae		
Humpback Whale [38]		Species or species habitat may occur within area
Mobula birostris as Manta birostris		
Giant Manta Ray [90034]		Species or species habitat may occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus		
Sperm Whale [59]		Species or species habitat may occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat may occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Fish		
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Reptile		
Aipysurus laevis Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Hydrophis atriceps Black-headed Sea Snake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Cogger's Sea Snake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis hardwickii as Lapemis hardwickii		
Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area
Hydrophis kingii as Disteira kingii		
Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis major as Disteira major		
Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus		
Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area
Hydrophis pacificus		
Pacific Sea Snake, Large-headed Sea Snake [1112]		Species or species habitat may occur within area
Hydrophis peronii as Acalyptophis peronii		
Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis stokesii as Astrotia stokesii		
Stokes' Sea Snake [93510]		Species or species habitat may occur within area
Hydrophis zweiffei as Enhydrina schistosa		
Australian Beaked Sea Snake [93514]		Species or species habitat may occur within area
Lepidochelys olivacea		
Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		

Current Scientific Name	Status	Type of Presence
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Extra Information

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Barossa-1 (NT/P69), Caldita-2 (NT/P61) exploration wells	2006/2793	Not Controlled Action	Completed
Not controlled action (particular manner)			
2D Marine Seismic Survey	2009/4728	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic survey	2009/5076	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Basin Barossa Appraisal Drilling Campaign, NT	2012/6481	Not Controlled Action (Particular Manner)	Post-Approval
Caldita 3D Marine Seismic Survey - NT/P61, NT/P69, and acreage release area NT06-5	2006/3142	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
2D Marine Seismic Survey	2008/4623	Referral Decision	Completed

Key Ecological Features

[Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Shelf break and slope of the Arafura Shelf	North

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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Australian Government

Department of Climate Change, Energy, the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 10-Feb-2025

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	3
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	21
Listed Migratory Species:	42

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	73
Whales and Other Cetaceans:	25
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	2
Habitat Critical to the Survival of Marine Turtles:	2

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	17
Key Ecological Features (Marine):	2
Biologically Important Areas:	1
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
MAMMAL		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Congregation or aggregation known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
SHARK		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor		
Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area

Scientific Name	Threatened Category	Presence Text
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Congregation or aggregation known to occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat likely to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area

Scientific Name	Threatened Category	Presence Text
Orcaella heinsohni		
Australian Snubfin Dolphin [81322]		Species or species habitat may occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus		
Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa sahulensis as Sousa chinensis		
Australian Humpback Dolphin [87942]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Fish		
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptile		
Aipysurus duboisii Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
Aipysurus laevis Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Aipysurus mosaicus as Aipysurus eydouxii Mosaic Sea Snake [87261]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrelaps darwiniensis Port Darwin Sea Snake, Black-ringed Mangrove Sea Snake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Sea Snake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Cogger's Sea Snake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis inornatus Plain Sea Snake [1107]		Species or species habitat may occur within area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Pacific Sea Snake, Large-headed Sea Snake [1112]		Species or species habitat may occur within area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area
Hydrophis zweiffei as Enhydrina schistosa Australian Beaked Sea Snake [93514]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Congregation or aggregation known to occur within area

Scientific Name	Threatened Category	Presence Text
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Parahydrophis mertoni Arafura Smooth Sea Snake, Northern Mangrove Sea Snake [1090]		Species or species habitat may occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa sahulensis Australian Humpback Dolphin [87942]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks

[Resource Information]

Park Name	Zone & IUCN Categories
Oceanic Shoals	Habitat Protection Zone (IUCN IV)
Oceanic Shoals	Multiple Use Zone (IUCN VI)

Habitat Critical to the Survival of Marine Turtles

[Resource Information]

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
May - Jul		
Lepidochelys olivacea Olive Ridley Turtle [1767]	Nesting	Known to occur

Extra Information

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
Darwin Pipeline Duplication (DPD) Project	2022/09372		Post-Approval
Controlled action			
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval
Not controlled action			
Barossa-1 (NT/P69), Caldita-2 (NT/P61) exploration wells	2006/2793	Not Controlled Action	Completed
Caldita-1 Hydrocarbon Exploration Well, NT/P61	2004/1854	Not Controlled Action	Completed
Construction and operation of Radar Infrastructure	2004/1406	Not Controlled Action	Completed
Marine Survey for the Australia-ASEAN Power Link AAPL	2020/8714	Not Controlled Action	Completed
Not controlled action (particular manner)			
2D Marine Seismic Survey	2009/4728	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic survey	2009/5076	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte 3D & 2D Seismic Survey, in NT/P82, Timor Sea	2012/6398	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Basin Barossa Appraisal Drilling Campaign, NT	2012/6481	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Basin Seabed Mapping Survey	2009/4951	Not Controlled Action (Particular Manner)	Post-Approval
Caldita 3D Marine Seismic Survey - NT/P61, NT/P69, and acreage release area NT06-5	2006/3142	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Joseph Bonaparte Gulf Seabed mapping survey	2010/5517	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
2D Marine Seismic Survey	2008/4623	Referral Decision	Completed

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Carbonate bank and terrace system of the Van Diemen Rise	North
Shelf break and slope of the Arafura Shelf	North

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Marine Turtles		
Natator depressus		
Flatback Turtle [59257]	Internesting	Likely to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 10-Feb-2025

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance (Ramsar	3
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	10
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	79
Listed Migratory Species:	86

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	75
Commonwealth Heritage Places:	8
Listed Marine Species:	136
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	1
Australian Marine Parks:	12
Habitat Critical to the Survival of Marine Turtles:	4

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	9
Regional Forest Agreements:	None
Nationally Important Wetlands:	9
EPBC Act Referrals:	176
Key Ecological Features (Marine):	8
Biologically Important Areas:	42
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

World Heritage Properties		[Resource Information]
Name	State	Legal Status
Kakadu National Park	NT	Declared property

National Heritage Places		[Resource Information]
Name	State	Legal Status
Natural		
Kakadu National Park	NT	Listed place

Wetlands of International Importance (Ramsar Wetlands)	[Resource Information]
Ramsar Site Name	Proximity
Ashmore reef national nature reserve	Within Ramsar site
Cobourg peninsula	Within Ramsar site
Kakadu national park	Within Ramsar site

Commonwealth Marine Area	[Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Chloebia gouldiae listed as Erythrura gouldiae Gouldian Finch [90091]	Endangered	Species or species habitat known to occur within area
Epthianura crocea tunneyi Alligator Rivers Yellow Chat, Yellow Chat (Alligator Rivers) [67089]	Endangered	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat likely to occur within area
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Foraging, feeding or related behaviour known to occur within area
Geophaps smithii smithii Partridge Pigeon (eastern) [64441]	Vulnerable	Species or species habitat known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Endangered	Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area
Melanodryas cucullata melvillensis Tiwi Islands Hooded Robin, Hooded Robin (Tiwi Islands) [67092]	Critically Endangered	Species or species habitat known to occur within area
Mirafra javanica melvillensis Horsfield's Bushlark (Tiwi Islands) [81011]	Vulnerable	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Papasula abbotti		
Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus		
Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Phaethon rubricauda westralis		
Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird [91824]	Endangered	Breeding known to occur within area
Pluvialis squatarola		
Grey Plover [865]	Vulnerable	Roosting known to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area
Tyto novaehollandiae kimberli		
Masked Owl (northern) [26048]	Vulnerable	Species or species habitat known to occur within area
Tyto novaehollandiae melvillensis		
Tiwi Masked Owl, Tiwi Islands Masked Owl [26049]	Endangered	Species or species habitat known to occur within area
Xenus cinereus		
Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area
FROG		
Uperoleia daviesae		
Howard River Toadlet, Davies's Toadlet [85375]	Vulnerable	Species or species habitat known to occur within area
MAMMAL		
Antechinus bellus		
Fawn Antechinus [344]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Mesembriomys gouldii gouldii Black-footed Tree-rat (Kimberley and mainland Northern Territory), Djintamoonga, Manbul [87618]	Endangered	Species or species habitat known to occur within area
Mesembriomys gouldii melvillensis Black-footed Tree-rat (Melville Island) [87619]	Vulnerable	Species or species habitat known to occur within area
Petrogale concinna canescens Nabarlek (Top End) [87606]	Endangered	Species or species habitat likely to occur within area
Phascogale pirata Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat known to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Sminthopsis butleri Butler's Dunnart [302]	Vulnerable	Species or species habitat known to occur within area
Trichosurus vulpecula arnhemensis Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat known to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat known to occur within area
PLANT		
Burmannia championii listed as Burmannia sp. Bathurst Island (R.Fensham 1021) [93461]	Endangered (listed as Burmannia sp. Bathurst Island	Species or species habitat likely to occur within area
Elaeocarpus miegei [65147]	Endangered	Species or species habitat known to occur within area
Hoya australis subsp. oramicola a vine [55436]	Vulnerable	Species or species habitat known to occur within area
Mitrella tiwiensis a vine [82029]	Vulnerable	Species or species habitat likely to occur within area
Stylidium ensatum a triggerplant [86366]	Endangered	Species or species habitat known to occur within area
Tarennoidea wallichii [65173]	Endangered	Species or species habitat known to occur within area
Typhonium jonesii a herb [62412]	Endangered	Species or species habitat known to occur within area
Typhonium mirabile a herb [79227]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Xylopia monosperma a shrub [82030]	Endangered	Species or species habitat known to occur within area
REPTILE		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat known to occur within area
Aipysurus apraefrontalis Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Aipysurus fuscus Dusky Sea Snake [1119]	Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Carettochelys insculpta Pig-nosed Turtle, Pitted Shell Turtle [1762]	Vulnerable	Species or species habitat may occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Lucasium occultum		
Yellow-snouted Gecko, Yellow-snouted Ground Gecko [82993]	Endangered	Species or species habitat likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Tiliqua scincoides intermedia		
Northern Blue-tongued Skink [89838]	Critically Endangered	Species or species habitat known to occur within area
Varanus mertensi		
Mertens' Water Monitor, Mertens's Water Monitor [1568]	Endangered	Species or species habitat known to occur within area
Varanus mitchelli		
Mitchell's Water Monitor [1569]	Critically Endangered	Species or species habitat known to occur within area
SHARK		
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki		
Northern River Shark, New Guinea River Shark [82454]	Endangered	Breeding known to occur within area
Glyphis glyphis		
Speartooth Shark [82453]	Critically Endangered	Species or species habitat known to occur within area
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Breeding known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Foraging, feeding or related behaviour known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica		
Red-rumped Swallow [80610]		Species or species habitat known to occur within area
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis		
Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres		
Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area
Calidris alba		
Sanderling [875]		Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting known to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Tringa incana Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State
Attorney-General - Australian Customs Service	
Commonwealth Land - Australian Customs Service [70998]	NT
Attorney-General - Australian Government Solicitor	
Commonwealth Land - Australian Government Solicitor [70444]	NT
Commonwealth Land - Australian Government Solicitor [70093]	NT
Commonwealth Land - Australian Government Solicitor [70092]	NT
Commonwealth Land - Australian Government Solicitor [70450]	NT
Commonwealth Land - Australian Government Solicitor [70089]	NT
Commonwealth Land - Australian Government Solicitor [71135]	NT
Commonwealth Land - Australian Government Solicitor [70996]	NT
Commonwealth Land - Australian Government Solicitor [70332]	NT
Commonwealth Land - Australian Government Solicitor [70208]	NT
Commonwealth Land - Deputy Crown Solicitor [70994]	NT
Commonwealth Land - Deputy Crown Solicitor [70333]	NT
Commonwealth Land - Deputy Crown Solicitor [70334]	NT

Commonwealth Land Name	State
Defence	
Defence - AUSTRALIAN ARMY BAND - DARWIN [70042]	NT
Defence - BERRIMAH ONE [70053]	NT
Defence - DARWIN - AP10 RADAR SITE - LEE POINT [70021]	NT
Defence - DARWIN - AP3 RECEIVING STATION - LEE POINT [70044]	NT
Defence - DARWIN RELOCATIONS CENTRE [70045]	NT
Defence - DARWIN - TRANSMITTING STATION '11 MILE' [70027]	NT
Defence - DEFENCE FORCE CAREERS REFERENCE CENTRE [70046]	NT
Defence - Esanda Builidng [70048]	NT
Defence - HMAS COONAWARRA (Berrimah) [70051]	NT
Defence - HMAS COONAWARRA (Berrimah) [70049]	NT
Defence - HMAS COONAWARRA (Berrimah) [70050]	NT
Defence - LARRAKEYAH BARRACKS [70061]	NT
Defence - LEANYER BOMBING RANGE [70024]	NT
Defence - LEANYER BOMBING RANGE [70022]	NT
Defence - LEANYER BOMBING RANGE [70023]	NT
Defence - MT GOODWIN RADAR SITE [70063]	NT
Defence - Patrol Boat Base (DARWIN NAVAL BASE) [70041]	NT
Defence - QUAIL ISLAND BOMBING RANGE [70003]	NT
Defence - RAAF BASE DARWIN [70073]	NT
Defence - RAAF BASE DARWIN [70072]	NT
Defence - SHOAL BAY RECEIVING STATION [70038]	NT
Defence - SHOAL BAY RECEIVING STATION [70036]	NT
Defence - SHOAL BAY RECEIVING STATION [70037]	NT
Defence - STOKES HILL OIL FUEL INSTALLATION [70035]	NT
Defence - WINNELLIE ONE [70076]	NT
Defence - WINNELLIE TWO [70077]	NT
Defence - Defence Housing Authority	

Commonwealth Land Name	State
Commonwealth Land - Director of Property Services Defence Estate [70715]	NT
Commonwealth Land - Director of Property Services Defence Estate [70714]	NT
Commonwealth Land - Director of Property Services Defence Estate [70855]	NT
Commonwealth Land - Director of Property Services Defence Estate [70856]	NT
Commonwealth Land - Director of Property Services Defence Estate [70722]	NT
Environment and Heritage	
Commonwealth Land - Kakadu National Park [70850]	NT
Commonwealth Land - Kakadu National Park [71099]	NT
Commonwealth Land - Kakadu National Park [70835]	NT
Family and Community Services - Department of Community Services & Health	
Commonwealth Land - Department of Community Services & Health [70720]	NT
Finance and Administration	
Commonwealth Land - Department of Administrative Services [70091]	NT
Commonwealth Land - Department of Administrative Services [70210]	NT
Commonwealth Land - Department of Administrative Services [70590]	NT
Immigration and Multicultural and Indigenous Affairs - Department of Immigration Local Government and Ethnic Affairs	
Commonwealth Land - Department of Immigration Local Government & Ethnic Affairs [70336]	NT
Transport and Regional Services	
Commonwealth Land - Department of Transport & Regional Development [70207]	NT
Unknown	
Commonwealth Land - [70090]	NT
Commonwealth Land - [70993]	NT
Commonwealth Land - [70995]	NT
Commonwealth Land - [70999]	NT
Commonwealth Land - [70327]	NT

Commonwealth Land Name	State
Commonwealth Land - [70204]	NT
Commonwealth Land - [70595]	NT
Commonwealth Land - [52277]	ACI
Commonwealth Land - [70580]	NT
Commonwealth Land - [52278]	ACI
Commonwealth Land - [52276]	ACI
Commonwealth Land - [70335]	NT
Commonwealth Land - [70338]	NT
Commonwealth Land - [70721]	NT
Commonwealth Land - [70337]	NT
Commonwealth Land - [70447]	NT
Commonwealth Land - [70205]	NT
Commonwealth Land - [70203]	NT
Commonwealth Land - [70206]	NT
Commonwealth Land - [70591]	NT
Commonwealth Land - [70594]	NT
Commonwealth Land - [70593]	NT

Commonwealth Heritage Places

[Resource Information]

Name	State	Status
Historic		
Larrakeyah Barracks Headquarters Building	NT	Listed place
Larrakeyah Barracks Precinct	NT	Listed place
Larrakeyah Barracks Sergeants Mess	NT	Listed place
RAAF Base Commanding Officers Residence	NT	Listed place
RAAF Base Precinct	NT	Listed place
RAAF Base Tropical Housing Type 2	NT	Listed place
RAAF Base Tropical Housing Type 3	NT	Listed place
Natural		

Name	State	Status
Ashmore Reef National Nature Reserve	EXT	Listed place

Listed Marine Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area overfly marine area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous minutus Black Noddy [824]		Breeding known to occur within area
Anous stolidus Common Noddy [825]		Breeding known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area overfly marine area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area overfly marine area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area overfly marine area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Cecropis daurica as Hirundo daurica Red-rumped Swallow [80610]		Species or species habitat known to occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area overfly marine area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area overfly marine area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area overfly marine area
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Foraging, feeding or related behaviour known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting known to occur within area overfly marine area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area overfly marine area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area overfly marine area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area overfly marine area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area overfly marine area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area overfly marine area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area overfly marine area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Onychoprion anaethetus as Sterna anaethetus Bridled Tern [82845]		Breeding known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area overfly marine area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Rostratula australis as Rostratula benghalensis (sensu lato)		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area
Sterna dougallii		
Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons as Sterna albifrons		
Little Tern [82849]		Breeding known to occur within area
Stiltia isabella		
Australian Pratincole [818]		Roosting known to occur within area overfly marine area
Sula dactylatra		
Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster		
Brown Booby [1022]		Breeding known to occur within area
Sula sula		
Red-footed Booby [1023]		Breeding known to occur within area
Thalasseus bengalensis as Sterna bengalensis		
Lesser Crested Tern [66546]		Breeding known to occur within area
Thalasseus bergii as Sterna bergii		
Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes as Heteroscelus brevipes		
Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola		
Wood Sandpiper [829]		Roosting known to occur within area overfly marine area
Tringa incana as Heteroscelus incanus		
Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area overfly marine area
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area overfly marine area
Fish		
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Syngnathoides biaculeatus		
Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus		
Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris		
Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
Dugong dugon		
Dugong [28]		Breeding known to occur within area
Reptile		
Aipysurus apraefrontalis		
Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii		
Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
Aipysurus foliosquama		
Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Aipysurus fuscus		
Dusky Sea Snake [1119]	Endangered	Species or species habitat known to occur within area
Aipysurus laevis		
Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area
Aipysurus mosaicus as Aipysurus eydouxii		
Mosaic Sea Snake [87261]		Species or species habitat may occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Emydocephalus annulatus Eastern Turtle-headed Sea Snake [1125]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Port Darwin Sea Snake, Black-ringed Mangrove Sea Snake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Sea Snake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Cogger's Sea Snake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis inornatus Plain Sea Snake [1107]		Species or species habitat may occur within area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Pacific Sea Snake, Large-headed Sea Snake [1112]		Species or species habitat may occur within area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area
Hydrophis zweiffei as Enhydrina schistosa Australian Beaked Sea Snake [93514]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Parahydrophis mertoni Arafura Smooth Sea Snake, Northern Mangrove Sea Snake [1090]		Species or species habitat may occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa sahulensis Australian Humpback Dolphin [87942]		Breeding known to occur within area

Current Scientific Name	Status	Type of Presence
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Commonwealth Reserves Terrestrial [Resource Information]

Name	State	Type
Kakadu	NT	National Park (Commonwealth)

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Oceanic Shoals	Habitat Protection Zone (IUCN IV)
Joseph Bonaparte Gulf	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Multiple Use Zone (IUCN VI)

Park Name	Zone & IUCN Categories
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	National Park Zone (IUCN II)
Christmas Island	National Park Zone (IUCN II)
Oceanic Shoals	National Park Zone (IUCN II)
Ashmore Reef	Recreational Use Zone (IUCN IV)
Ashmore Reef	Sanctuary Zone (IUCN Ia)
Cartier Island	Sanctuary Zone (IUCN Ia)
Joseph Bonaparte Gulf	Special Purpose Zone (IUCN VI)
Oceanic Shoals	Special Purpose Zone (Trawl) (IUCN VI)

Habitat Critical to the Survival of Marine Turtles

[Resource Information]

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Dermochelys coriacea Leatherback Turtle [1768]	Nesting	Known to occur
May - Jul		
Lepidochelys olivacea Olive Ridley Turtle [1767]	Nesting	Known to occur

Extra Information

State and Territory Reserves

[Resource Information]

Protected Area Name	Reserve Type	State
Casuarina	Coastal Reserve	NT
Charles Darwin	National Park	NT
Djukbinj	National Park	NT

Protected Area Name	Reserve Type	State
Garig Gunak Barlu	National Park	NT
Garig Gunak Barlu	Marine Park	NT
Holmes Jungle	Nature Park	NT
Knuckey Lagoons	Conservation Reserve	NT
Marri-Jabin (Thamurrurr - Stage 1)	Indigenous Protected Area	NT
Mary River	National Park	NT

Nationally Important Wetlands

[Resource Information]

Wetland Name	State
Adelaide River Floodplain System	NT
Ashmore Reef	EXT
Cobourg Peninsula System	NT
Daly-Reynolds Floodplain-Estuary System	NT
Finniss Floodplain and Fog Bay Systems	NT
Kakadu National Park	NT
Mary Floodplain System	NT
Port Darwin	NT
Shoal Bay - Micket Creek	NT

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Bayview, The Boulevarde, Darwin, NT	2015/7466		Completed
Berrimah Freight Terminal Expansion Project	2024/09847		Assessment
Browse Carbon Capture and Storage Project	2024/10028		Referral Decision
Browse to North West Shelf Development, Indian Ocean, WA	2018/8319		Approval
Clarence Strait Offshore Tidal Energy Project	2008/4660		Assessment

Title of referral	Reference	Referral Outcome	Assessment Status
Darwin Pipeline Duplication (DPD) Project	2022/09372		Post-Approval
Darwin Pipeline Duplication DPD Project	2022/9166		Completed
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260		Completed
East Arm Marine Industry Park, Darwin, NT	2014/7318		Completed
Marine Route Survey for Subsea Fibre Optic Data Cable System - Australia West	2024/09826		Completed
Northern Endeavour Phase 1 Decommissioning	2022/09327		Post-Approval
Port Melville marine supply base, Melville Island	2015/7510		Completed
Project Crux Cable Lay and Operation	2022/09441		Completed
Project Fitzroy Expansion Offshore Cable Lay	2023/09674		Referral Decision
Puffin Oil wells 7, 8 & 9 development	2005/2336		Completed
Replacement of the East Point Outfall	2011/6099		Completed
Tiwi H2 Project	2022/09347		Assessment
Controlled action			
2-D seismic survey Scott Reef	2000/125	Controlled Action	Post-Approval
Andranangoo Creek & Lethbridge Bay mineral sand mining	2005/2155	Controlled Action	Completed
Audacious Oil Field Standalone Development	2001/407	Controlled Action	Completed
Augmentation of the East Point Effluent Rising Main and Extension of East Point Outfall	2009/5113	Controlled Action	Post-Approval
Barramundi Nursery Farm	2005/2378	Controlled Action	Completed
Bonaparte Liquified Natural Gas Project	2011/6141	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Browse FLNG Development, Commonwealth Waters	2013/7079	Controlled Action	Post-Approval
Condensate Processing Facility, East Arm	2006/2734	Controlled Action	Proposed Decision
Conduct an exploration drilling campaign	2010/5718	Controlled Action	Completed
Darwin to Moomba Gas Pipeline	2001/213	Controlled Action	Completed
Decommissioning of Buffalo Oil Field	2003/984	Controlled Action	Post-Approval
Decommissioning of Challis Oilfield	2003/942	Controlled Action	Post-Approval
Development of Blacktip Gas Field	2003/1180	Controlled Action	Post-Approval
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Floating Liquefied Natural Gas facility	2001/533	Controlled Action	Completed
Glyde Point and Middle Arm Peninsula Infrastructure Support	2001/334	Controlled Action	Completed
Glyde Point Industrial Estate	2001/336	Controlled Action	Completed
Glyde Point Industrial Estate and Associated Infrastructure	2004/1506	Controlled Action	Completed
Hardwood Plantation	2001/229	Controlled Action	Post-Approval
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval
Kilimiraka Mineral Sands and Associated Infrastructure (Bathurst Island), NT	2012/6587	Controlled Action	Assessment Approach
Lee Point Master-planned urban development, Darwin, NT	2015/7591	Controlled Action	Post-Approval
Methanol Plant	2001/195	Controlled Action	Completed
Middle Arm Peninsula Industrial Area Development	2001/339	Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Montara 4, 5, and 6 Oil Production Wells, and Montara 3 Gas Re-Injection Well	2002/755	Controlled Action	Post-Approval
Muirhead Subdivision	2010/5525	Controlled Action	Post-Approval
Operation of 17 Tiger Helicopters at Robertson Barracks	2004/1459	Controlled Action	Post-Approval
PTTEP AA Floating LNG Facility	2011/6025	Controlled Action	Completed
Residential subdivision of Lot 9793 (formerly Lots 9774 and 9779) Lee Point Road	2005/2108	Controlled Action	Post-Approval
Shipping Channel Enhancement	2010/5431	Controlled Action	Completed
Snake Bay Barramundi Sea Cage Farm	2005/2150	Controlled Action	Completed
Talisman Saber 2005 Military Exercise	2004/1819	Controlled Action	Post-Approval
Tassie Shoal Gas Reforming and Methanol Production Plants - NT/P48	2000/108	Controlled Action	Post-Approval
Tassie Shoal LNG Project	2003/1067	Controlled Action	Post-Approval
Trans-territory Gas Pipeline	2003/1186	Controlled Action	Completed
Tropical Tidal Testing Centre, Clarence Strait, 50km NE Darwin	2014/7299	Controlled Action	Guidelines Issued
Not controlled action			
2D seismic survey, exploration permit NT/P67	2004/1587	Not Controlled Action	Completed
2D Seismic Survey in Permit Areas WA-318-P & WA-319-P, near Cape Londonderry	2004/1687	Not Controlled Action	Completed
3D marine seismic survey in WA 314P and WA 315P	2004/1927	Not Controlled Action	Completed
AEC International Hydrocarbon Well Puffin 6	2000/36	Not Controlled Action	Completed
Andranangoo Mine Site Aircraft Landing Area	2007/3743	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Audacious-3 oil drilling well	2003/1042	Not Controlled Action	Completed
Backpacker-1 Offshore Hydrocarbon Exploration Well	2001/300	Not Controlled Action	Completed
Barossa-1 (NT/P69), Caldita-2 (NT/P61) exploration wells	2006/2793	Not Controlled Action	Completed
Buffalo In-Fill Production Wells	2001/475	Not Controlled Action	Completed
Caldita-1 Hydrocarbon Exploration Well, NT/P61	2004/1854	Not Controlled Action	Completed
Channel Island Bridge Pipeline Replacement Project	2020/8672	Not Controlled Action	Completed
Construction and operation of Radar Infrastructure	2004/1406	Not Controlled Action	Completed
Controlled Source Electromagnetic 2D Survey	2009/4980	Not Controlled Action	Completed
Controlled Source Electromagnetic Survey	2010/5434	Not Controlled Action	Completed
Coot-1 hydrocarbon exploration well, Permit Area AC/L2 or AC/L3	2001/296	Not Controlled Action	Completed
Cox Peninsular Remediation Project, NT	2015/7587	Not Controlled Action	Completed
Crowley Government Services Inc Bulk Fuel Storage Facility	2021/9015	Not Controlled Action	Completed
Crux-A and Crux-B appraisal wells, Petroleum Permit Area AC/P23	2006/2748	Not Controlled Action	Completed
Crux gas-liquids development in permit AC/P23	2006/3154	Not Controlled Action	Completed
Darwin Port Maintenance Dredging, Darwin Harbour, NT	2017/8122	Not Controlled Action	Completed
Drilling of exploration well Audacious-1 in AC/P17	2000/5	Not Controlled Action	Completed
Drilling of exploration wells, Permit areas WA-301-P to WA-305-P	2002/769	Not Controlled Action	Completed
Exploration Drilling in AC/P17, AC/P18 and AC/P24	2001/359	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Exploration Well AC/P23	2001/234	Not Controlled Action	Completed
Marine Survey for the Australia-ASEAN Power Link AAPL	2020/8714	Not Controlled Action	Completed
Montara-3 Offshore Hydrocarbon Exploration Well Permit Area AC/RL3	2001/489	Not Controlled Action	Completed
Nexus Drilling Program NT-P66	2007/3745	Not Controlled Action	Completed
NT/P68 2007 Two Well Drilling Program	2007/3569	Not Controlled Action	Completed
P30 Hydrocarbon Exploration Well	2001/293	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Project Sea Dragon Stage 1 Hatchery - Gunn Point, NT	2017/8092	Not Controlled Action	Completed
Residential Complex - Lots 6575 and 6576	2001/163	Not Controlled Action	Completed
Residential Secondary College	2007/3276	Not Controlled Action	Completed
Saucepan 1 Exploration Well ACP23	2000/2	Not Controlled Action	Completed
Skua and Swift Oilfields	2006/3195	Not Controlled Action	Completed
Subdivision of Two Sites (1712 and 1713) into four Portions	2006/2755	Not Controlled Action	Completed
Waterfront Redevelopment	2003/1256	Not Controlled Action	Completed
Wickham Point Interconnect Gas Pipeline	2008/4309	Not Controlled Action	Completed
Woodside Geotechnical Investigation Sunrise Bank	2000/13	Not Controlled Action	Completed
Not controlled action (particular manner)			
2 (3D) Marine Seismic Surveys	2009/4994	Not Controlled Action (Particular Manner)	Completed
2D and 3D Seismic Survey	2011/6197	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
2D and 3D Seismic Survey WA-405-P	2008/4133	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D Seismic Survey WA-405-P	2009/5104	Not Controlled Action (Particular Manner)	Post-Approval
2D Marine Seismic Survey	2009/4728	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey of Braveheart,Kurrajong,Sunshine and Crocodile	2006/2917	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey within permit area WA-318-P	2007/3879	Not Controlled Action (Particular Manner)	Post-Approval
2D or 3D Marine Seismic Survey in Petroleum Permit Area AC/P35	2009/4864	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Marine Survey	2001/363	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic survey	2009/5076	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey in permit areas WA-274P and WA-281P	2004/1521	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey in WA Permit Area TP/22 and Commonwealth Permit Area WA-280-P	2005/2100	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey - Petroleum Exploration Area NT/P68, Eastern Bonaparte Basin	2006/2922	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
3D Marine Seismic Survey	2008/4437	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey	2009/4681	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey, Permit AC/P 23	2005/2364	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey	2006/2729	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, Browse Basin, WA	2009/5048	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, near Scott Reef, Browse Basin	2005/2126	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, petroleum exploration permit AC/P33	2006/2918	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey (NT/P68)	2006/2980	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey (NT/P68)	2008/4121	Not Controlled Action (Particular Manner)	Post-Approval
3D seismic survey of AC/P4, AC/P17 and AC/P24	2006/2857	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey WA-406-P Bonaparte Basin	2007/3904	Not Controlled Action (Particular Manner)	Post-Approval
AC/P37 3D Seismic Survey Ashmore Cartier	2007/3774	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Auralandia 3D marine seismic survey	2011/5961	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte 2D & 3D marine seismic survey	2011/5962	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte 3D & 2D Seismic Survey, in NT/P82, Timor Sea	2012/6398	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Basin Seabed Mapping Survey	2009/4951	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Seismic and Bathymetric Survey	2012/6295	Not Controlled Action (Particular Manner)	Post-Approval
Braveheart 2D Marine Seismic Survey	2005/2322	Not Controlled Action (Particular Manner)	Post-Approval
Caldita 3D Marine Seismic Survey - NT/P61, NT/P69, and acreage release area NT06-5	2006/3142	Not Controlled Action (Particular Manner)	Post-Approval
Canis 3D Marine Seismic Survey	2008/4492	Not Controlled Action (Particular Manner)	Post-Approval
Cartier East and Cartier West 3D Marine Seismic Surveys	2009/5230	Not Controlled Action (Particular Manner)	Post-Approval
Caswell MC3D Marine Seismic Survey	2012/6594	Not Controlled Action (Particular Manner)	Post-Approval
Conduct an exploration drilling campaign	2011/5964	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Dillon South-1 Exploration Well Drilling - AC/P4, Territory of Ashmore/Cartier	2013/6849	Not Controlled Action (Particular Manner)	Post-Approval
Dredging the outer shipping channels of Darwin Harbour	2013/6988	Not Controlled Action (Particular Manner)	Post-Approval
Drilling of Audacious-5 appraisal well	2008/4327	Not Controlled Action (Particular Manner)	Post-Approval
Drilling of two appraisal wells	2011/5840	Not Controlled Action (Particular Manner)	Post-Approval
Eni Bathurst 3D Seismic Survey	2011/6118	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling Campaign	2011/6047	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling in Permit Areas WA-402-P & WA-403-P	2010/5297	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling Program - Permit areas - WA-314-P, WA-315-P, WA-398-P.	2008/4064	Not Controlled Action (Particular Manner)	Post-Approval
Fishburn2D Marine Seismic Survey	2012/6659	Not Controlled Action (Particular Manner)	Post-Approval
Floyd 3D and Chisel 3D Seismic Surveys	2011/6220	Not Controlled Action (Particular Manner)	Post-Approval
Gicea 3D Marine Seismic Survey	2008/4389	Not Controlled Action (Particular Manner)	Post-Approval
Gold 2D Marine Seismic Survey Permit Areas WA375P and WA376P	2009/4698	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval
Joseph Bonaparte Gulf Seabed mapping survey	2010/5517	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
Kraken, Lusca & Asperus 3D Marine Seismic Survey	2013/6730	Not Controlled Action (Particular Manner)	Post-Approval
Malita West 3D Seismic Survey WA-402-P and WA-403-P	2007/3936	Not Controlled Action (Particular Manner)	Post-Approval
Marine Environmental Survey 2012	2012/6310	Not Controlled Action (Particular Manner)	Post-Approval
Mariner Non-Exclusive 2D Seismic Survey	2011/6172	Not Controlled Action (Particular Manner)	Post-Approval
Nova 3D Seismic Survey	2013/6825	Not Controlled Action (Particular Manner)	Post-Approval
NT/P77 3D Marine Seismic Survey	2009/4683	Not Controlled Action (Particular Manner)	Post-Approval
NT/P80 2010 2D Marine Seismic Survey	2010/5487	Not Controlled Action (Particular Manner)	Post-Approval
Octantis 3D Marine Seismic Survey, Permit Area AC/P41 off northern Western Australia	2007/3369	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval
Panda NT/P76 3D Seismic Acquisition Survey Program	2009/4992	Not Controlled Action (Particular Manner)	Post-Approval
Petrel MC2D Marine Seismic Survey	2010/5368	Not Controlled Action (Particular Manner)	Post-Approval
Removal of Potential Unexploded Ordnance within NAXA	2012/6503	Not Controlled Action (Particular Manner)	Post-Approval
Sandalford 3D Seismic Survey	2012/6261	Not Controlled Action (Particular Manner)	Post-Approval
Santos Petrel-7 Offshore Appraisal Drilling Programme (Bonaparte Basin)	2011/5934	Not Controlled Action (Particular Manner)	Post-Approval
Schild Phase 11 MC3D Marine Seismic Survey, Browse Basin	2013/6894	Not Controlled Action (Particular Manner)	Post-Approval
Searcher bathymetry & geochemical seismic survey, Brawse Basin,Timor Sea,WA	2013/6980	Not Controlled Action (Particular Manner)	Post-Approval
Sonar and Acoustic Trials	2001/345	Not Controlled Action (Particular Manner)	Post-Approval
Songa Venus Drilling and Testing Operations	2009/5122	Not Controlled Action (Particular Manner)	Post-Approval
Songa Venus Drilling Programme, Bonaparte Basin	2009/4990	Not Controlled Action (Particular Manner)	Post-Approval
Sunshine Infill 2D and Mimosa 2D Marine Seismic Surveys	2009/4699	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Thoar 3D Marine Seismic Survey	2010/5668	Not Controlled Action (Particular Manner)	Post-Approval
Tiffany 3D Seismic Survey	2010/5339	Not Controlled Action (Particular Manner)	Post-Approval
Tow West Atlas wreck from present location to boundary of EEZ	2010/5652	Not Controlled Action (Particular Manner)	Post-Approval
Ursa 3D Marine Seismic Survey	2008/4634	Not Controlled Action (Particular Manner)	Post-Approval
Vampire 2D Non Exclusive Seismic Survey, WA	2010/5543	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Zeppelin 3D Seismic Survey	2011/6148	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
2D Marine Seismic Survey	2008/4623	Referral Decision	Completed
3D Seismic Survey (NT/P68)	2006/2949	Referral Decision	Completed
Installation of Telecommunication Facilities	2001/254	Referral Decision	Completed
Nova 3D Seismic Survey, WA 442-NT/P81, Joseph Bonaparte Gulf	2013/6820	Referral Decision	Completed
Phillips Petroleum Wickham Point LNG facility	2001/391	Referral Decision	Completed
Puffin South-West Development of Oil Reserves	2007/3834	Referral Decision	Completed

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Ancient coastline at 125 m depth contour	North-west
Ashmore Reef and Cartier Island and surrounding Commonwealth waters	North-west
Carbonate bank and terrace system of the Sahul Shelf	North-west
Carbonate bank and terrace system of the Van Diemen Rise	North
Continental Slope Demersal Fish Communities	North-west
Pinnacles of the Bonaparte Basin	North
Pinnacles of the Bonaparte Basin	North-west
Shelf break and slope of the Arafura Shelf	North

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Dolphins		
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Breeding	Known to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Breeding	Known to occur
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Breeding	Known to occur
Dugong		
Dugong dugon Dugong [28]	Breeding	Known to occur
Dugong dugon Dugong [28]	Calving	Known to occur
Dugong dugon Dugong [28]	Foraging	Known to occur
Dugong dugon Dugong [28]	Foraging (high density	Known to occur

Scientific Name	Behaviour	Presence
	seagrass beds)	
Dugong dugon Dugong [28]	Nursing	Known to occur
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Likely to occur
Chelonia mydas Green Turtle [1765]	Internesting	Likely to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Likely to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Chelonia mydas Green Turtle [1765]	Mating	Likely to occur
Chelonia mydas Green Turtle [1765]	Nesting	Likely to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Likely to occur

Scientific Name	Behaviour	Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Foraging	Likely to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Foraging	Known to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Internesting	Likely to occur
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting	Likely to occur
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Seabirds		
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Fregata ariel Lesser Frigatebird [1012]	Breeding	Known to occur
Fregata minor Greater Frigatebird [1013]	Breeding	Known to occur
Phaethon lepturus White-tailed Tropicbird [1014]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sternula albifrons sinensis Little Tern [82850]	Resting	Known to occur
Sula leucogaster Brown Booby [1022]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Sula sula Red-footed Booby [1023]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Thalasseus bergii Crested Tern [83000]	Breeding (high numbers)	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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Department of Climate Change, Energy, the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 10-Feb-2025

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	3
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	52
Listed Migratory Species:	57

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	98
Whales and Other Cetaceans:	25
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	6
Habitat Critical to the Survival of Marine Turtles:	5

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	5
Regional Forest Agreements:	None
Nationally Important Wetlands:	1
EPBC Act Referrals:	17
Key Ecological Features (Marine):	4
Biologically Important Areas:	11
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity
Cobourg peninsula	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Chloebia gouldiae listed as Erythrura gouldiae Gouldian Finch [90091]	Endangered	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat likely to occur within area
Geophaps smithii smithii Partridge Pigeon (eastern) [64441]	Vulnerable	Species or species habitat known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Phaethon rubricauda westralis Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird [91824]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat known to occur within area
MAMMAL		
Antechinus bellus Fawn Antechinus [344]	Vulnerable	Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Isoodon auratus auratus Golden Bandicoot (mainland) [66665]	Vulnerable	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Mesembriomys gouldii gouldii		
Black-footed Tree-rat (Kimberley and mainland Northern Territory), Djintamoonga, Manbul [87618]	Endangered	Species or species habitat known to occur within area
Petrogale concinna canescens		
Nabarlek (Top End) [87606]	Endangered	Species or species habitat likely to occur within area
Phascogale pirata		
Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat likely to occur within area
Saccolaimus saccolaimus nudicluniatus		
Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Trichosurus vulpecula arnhemensis		
Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat known to occur within area
Xeromys myoides		
Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
Acanthophis hawkei		
Plains Death Adder [83821]	Vulnerable	Species or species habitat may occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Carettochelys insculpta		
Pig-nosed Turtle, Pitted Shell Turtle [1762]	Vulnerable	Species or species habitat may occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Cryptoblepharus gurrmul		
Arafura Snake-eyed Skink [83106]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Tiliqua scincoides intermedia Northern Blue-tongued Skink [89838]	Critically Endangered	Species or species habitat known to occur within area
Varanus mertensi Mertens' Water Monitor, Mertens's Water Monitor [1568]	Endangered	Species or species habitat known to occur within area
Varanus mitchelli Mitchell's Water Monitor [1569]	Critically Endangered	Species or species habitat may occur within area
SHARK		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat known to occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Foraging, feeding or related behaviour known to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor		
Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Phaethon lepturus		
White-tailed Tropicbird [1014]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat likely to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Limosa limosa		
Black-tailed Godwit [845]	Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Thalasseus bergii		
Greater Crested Tern [83000]		Breeding likely to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State
Unknown	
Commonwealth Land - [71140]	NT

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Acrocephalus orientalis		
Oriental Reed-Warbler [59570]		Species or species habitat may occur within area overfly marine area
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Anous stolidus Common Noddy [825]		Foraging, feeding or related behaviour known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Calidris tenuirostris Great Knot [862]	Vulnerable	Species or species habitat likely to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Cecropis daurica as Hirundo daurica		
Red-rumped Swallow [80610]		Species or species habitat may occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans		
Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor		
Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat known to occur within area overfly marine area
Limnodromus semipalmatus		
Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Species or species habitat likely to occur within area overfly marine area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Breeding known to occur within area
Thalasseus bergii as Sterna bergii Greater Crested Tern [83000]		Breeding likely to occur within area

Scientific Name	Threatened Category	Presence Text
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area overfly marine area
Fish		
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Syngnathoides biaculeatus		
Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus		
Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris		
Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
Dugong dugon		
Dugong [28]		Species or species habitat known to occur within area
Reptile		
Aipysurus duboisii		
Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
Aipysurus laevis		
Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area
Aipysurus mosaicus as Aipysurus eydouxii		
Mosaic Sea Snake [87261]		Species or species habitat may occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni		
Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus		
Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Port Darwin Sea Snake, Black-ringed Mangrove Sea Snake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Sea Snake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Cogger's Sea Snake [25925]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Sea Snake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area
Hydrophis inornatus Plain Sea Snake [1107]		Species or species habitat may occur within area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Pacific Sea Snake, Large-headed Sea Snake [1112]		Species or species habitat may occur within area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area
Hydrophis zweiffei as Enhydrina schistosa Australian Beaked Sea Snake [93514]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni Arafura Smooth Sea Snake, Northern Mangrove Sea Snake [1090]		Species or species habitat may occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area

Current Scientific Name	Status	Type of Presence
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Breeding known to occur within area

Current Scientific Name	Status	Type of Presence
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa sahulensis Australian Humpback Dolphin [87942]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area

Current Scientific Name	Status	Type of Presence
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks

[Resource Information]

Park Name	Zone & IUCN Categories
Arafura	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Arafura	Special Purpose Zone (IUCN VI)
Arnhem	Special Purpose Zone (IUCN VI)
Arafura	Special Purpose Zone (Trawl) (IUCN VI)
Wessel	Special Purpose Zone (Trawl) (IUCN VI)

Habitat Critical to the Survival of Marine Turtles

[Resource Information]

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Dermochelys coriacea Leatherback Turtle [1768]	Nesting	Known to occur
May - Jul		
Lepidochelys olivacea Olive Ridley Turtle [1767]	Nesting	Known to occur
Nov - May		
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur

Scientific Name	Behaviour	Presence

Extra Information

State and Territory Reserves		[Resource Information]
Protected Area Name	Reserve Type	State
Crocodile Islands Maringa	Indigenous Protected Area	NT
Crocodile Islands Maringa	Indigenous Protected Area	NT
Garig Gunak Barlu	National Park	NT
Garig Gunak Barlu	Marine Park	NT
Marthakal	Indigenous Protected Area	NT

Nationally Important Wetlands	[Resource Information]
Wetland Name	State
Cobourg Peninsula System	NT

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Tassie Shoal Gas Reforming and Methanol Production Plants - NT/P48	2000/108	Controlled Action	Post-Approval
Tassie Shoal LNG Project	2003/1067	Controlled Action	Post-Approval
Not controlled action			
Barossa-1 (NT/P69), Caldita-2 (NT/P61) exploration wells	2006/2793	Not Controlled Action	Completed
Caldita-1 Hydrocarbon Exploration Well, NT/P61	2004/1854	Not Controlled Action	Completed
Geo-scientific survey	2005/2004	Not Controlled Action	Completed
Not controlled action (particular manner)			

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
2D Marine Seismic Survey	2009/4728	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey of Braveheart,Kurrajong,Sunshine and Crocodile	2006/2917	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic survey	2009/5076	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey	2006/2729	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte 3D & 2D Seismic Survey, in NT/P82, Timor Sea	2012/6398	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Basin Barossa Appraisal Drilling Campaign, NT	2012/6481	Not Controlled Action (Particular Manner)	Post-Approval
Caldita 3D Marine Seismic Survey - NT/P61, NT/P69, and acreage release area NT06-5	2006/3142	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
NT/P74 & NT/P75 - 2D marine seismic survey	2008/4316	Not Controlled Action (Particular Manner)	Post-Approval
Panda NT/P76 3D Seismic Acquisition Survey Program	2009/4992	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
2D Marine Seismic Survey	2008/4623	Referral Decision	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Referral decision			

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Carbonate bank and terrace system of the Van Diemen Rise	North
Gulf of Carpentaria basin	North
Shelf break and slope of the Arafura Shelf	North
Tributary Canyons of the Arafura Depression	North

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Dolphins		
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Breeding	Known to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Breeding	Known to occur
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Breeding	Known to occur
Marine Turtles		
Chelonia mydas Green Turtle [1765]	Internesting	Likely to occur
Dermochelys coriacea Leatherback Turtle [1768]	Internesting	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting	Likely to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Internesting	Likely to occur
Natator depressus Flatback Turtle [59257]	Internesting	Likely to occur
Seabirds		
Onychoprion anaethetus Bridled Tern [82845]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Sterna dougallii		
Roseate Tern [817]	Breeding (high numbers)	Known to occur
Thalasseus bergii		
Crested Tern [83000]	Breeding	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 10-Feb-2025

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	8
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	74
Listed Migratory Species:	80

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	13
Commonwealth Heritage Places:	1
Listed Marine Species:	130
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	11
Habitat Critical to the Survival of Marine Turtles:	4

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	2
EPBC Act Referrals:	113
Key Ecological Features (Marine):	8
Biologically Important Areas:	36
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity
Ashmore reef national nature reserve	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Arenaria interpres		
Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Chloebia gouldiae listed as Erythrura gouldiae Gouldian Finch [90091]	Endangered	Species or species habitat known to occur within area
Epthianura crocea tunneyi Alligator Rivers Yellow Chat, Yellow Chat (Alligator Rivers) [67089]	Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat likely to occur within area
Geophaps smithii smithii Partridge Pigeon (eastern) [64441]	Vulnerable	Species or species habitat known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Endangered	Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area
Melanodryas cucullata melvillensis Tiwi Islands Hooded Robin, Hooded Robin (Tiwi Islands) [67092]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Phaethon rubricauda westralis Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird [91824]	Endangered	Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Tyto novaehollandiae kimberli		
Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area
Tyto novaehollandiae melvillensis		
Tiwi Masked Owl, Tiwi Islands Masked Owl [26049]	Endangered	Species or species habitat known to occur within area
Xenus cinereus		
Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area
FROG		
Uperoleia daviesae		
Howard River Toadlet, Davies's Toadlet [85375]	Vulnerable	Species or species habitat known to occur within area
MAMMAL		
Antechinus bellus		
Fawn Antechinus [344]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Conilurus penicillatus		
Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus		
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas		
Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Mesembriomys gouldii gouldii		
Black-footed Tree-rat (Kimberley and mainland Northern Territory), Djintamoonga, Manbul [87618]	Endangered	Species or species habitat known to occur within area
Mesembriomys gouldii melvillensis		
Black-footed Tree-rat (Melville Island) [87619]	Vulnerable	Species or species habitat known to occur within area
Petrogale concinna canescens		
Nabarlek (Top End) [87606]	Endangered	Species or species habitat may occur within area
Phascogale pirata		
Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat likely to occur within area
Saccolaimus saccolaimus nudicluniatus		
Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Sminthopsis butleri		
Butler's Dunnart [302]	Vulnerable	Species or species habitat known to occur within area
Trichosurus vulpecula arnhemensis		
Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat known to occur within area
Xeromys myoides		
Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat known to occur within area
PLANT		
Burmannia championii listed as Burmannia sp. Bathurst Island (R.Fensham 1021)		
[93461]	Endangered (listed as Burmannia sp. Bathurst Island	Species or species habitat likely to occur within area
Elaeocarpus miegei		
[65147]	Endangered	Species or species habitat may occur within area
Hoya australis subsp. oramicola		
a vine [55436]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Stylidium ensatum a triggerplant [86366]	Endangered	Species or species habitat known to occur within area
Tarennoidea wallichii [65173]	Endangered	Species or species habitat likely to occur within area
Typhonium jonesii a herb [62412]	Endangered	Species or species habitat likely to occur within area
Typhonium mirabile a herb [79227]	Endangered	Species or species habitat likely to occur within area
Xylopia monosperma a shrub [82030]	Endangered	Species or species habitat likely to occur within area
REPTILE		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat known to occur within area
Aipysurus apraefrontalis Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Aipysurus fuscus Dusky Sea Snake [1119]	Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Tiliqua scincoides intermedia Northern Blue-tongued Skink [89838]	Critically Endangered	Species or species habitat known to occur within area
Varanus mertensi Mertens' Water Monitor, Mertens's Water Monitor [1568]	Endangered	Species or species habitat known to occur within area
Varanus mitchelli Mitchell's Water Monitor [1569]	Critically Endangered	Species or species habitat known to occur within area
SHARK		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Breeding known to occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Breeding known to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor		
Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Phaethon lepturus		
White-tailed Tropicbird [1014]		Breeding known to occur within area
Sterna dougallii		
Roseate Tern [817]		Breeding likely to occur within area

Scientific Name	Threatened Category	Presence Text
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		

Scientific Name	Threatened Category	Presence Text
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat known to occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting known to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding likely to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa incana Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State
Attorney-General - Australian Government Solicitor	
Commonwealth Land - Australian Government Solicitor [70092]	NT
Commonwealth Land - Australian Government Solicitor [70332]	NT
Commonwealth Land - Deputy Crown Solicitor [70994]	NT
Defence	
Defence - DARWIN - AP10 RADAR SITE - LEE POINT [70021]	NT
Defence - QUAIL ISLAND BOMBING RANGE [70003]	NT
Defence - RAAF BASE DARWIN [70073]	NT
Finance and Administration	
Commonwealth Land - Department of Administrative Services [70091]	NT
Immigration and Multicultural and Indigenous Affairs - Department of Immigration Local Government and Ethnic Affairs	
Commonwealth Land - Department of Immigration Local Government & Ethnic Affairs [70336]	NT
Transport and Regional Services	
Commonwealth Land - Department of Transport & Regional Development [70207]	NT
Unknown	
Commonwealth Land - [70206]	NT
Commonwealth Land - [70447]	NT
Commonwealth Land - [52276]	ACI
Commonwealth Land - [70995]	NT

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Ashmore Reef National Nature Reserve	EXT	Listed place

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area overfly marine area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Breeding known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area overfly marine area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area overfly marine area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area overfly marine area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Cecropis daurica as Hirundo daurica Red-rumped Swallow [80610]		Species or species habitat known to occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area overfly marine area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area overfly marine area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting known to occur within area overfly marine area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area overfly marine area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area overfly marine area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area overfly marine area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat likely to occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area overfly marine area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area overfly marine area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area
Sterna dougallii Roseate Tern [817]		Breeding likely to occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Breeding known to occur within area
Stiltia isabella Australian Pratincole [818]		Roosting known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalasseus bengalensis as Sterna bengalensis Lesser Crested Tern [66546]		Breeding known to occur within area
Thalasseus bergii as Sterna bergii Greater Crested Tern [83000]		Breeding likely to occur within area
Tringa brevipes as Heteroscelus brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area overfly marine area
Tringa incana as Heteroscelus incanus Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area overfly marine area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area overfly marine area
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area overfly marine area
Fish		
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
Dugong dugon Dugong [28]		Breeding known to occur within area
Reptile		

Scientific Name	Threatened Category	Presence Text
Aipysurus apraefrontalis Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Aipysurus fuscus Dusky Sea Snake [1119]	Endangered	Species or species habitat known to occur within area
Aipysurus laevis Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area
Aipysurus mosaicus as Aipysurus eydouxii Mosaic Sea Snake [87261]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Emydocephalus annulatus Eastern Turtle-headed Sea Snake [1125]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hydrelaps darwiniensis Port Darwin Sea Snake, Black-ringed Mangrove Sea Snake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Sea Snake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Cogger's Sea Snake [25925]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Sea Snake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area
Hydrophis inornatus Plain Sea Snake [1107]		Species or species habitat may occur within area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Pacific Sea Snake, Large-headed Sea Snake [1112]		Species or species habitat may occur within area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area
Hydrophis zweiffei as Enhydrina schistosa Australian Beaked Sea Snake [93514]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni Arafura Smooth Sea Snake, Northern Mangrove Sea Snake [1090]		Species or species habitat may occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area

Current Scientific Name	Status	Type of Presence
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa sahulensis Australian Humpback Dolphin [87942]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks

[Resource Information]

Park Name	Zone & IUCN Categories
Oceanic Shoals	Habitat Protection Zone (IUCN IV)
Arafura	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Oceanic Shoals	National Park Zone (IUCN II)
Ashmore Reef	Recreational Use Zone (IUCN IV)
Ashmore Reef	Sanctuary Zone (IUCN Ia)
Cartier Island	Sanctuary Zone (IUCN Ia)
Joseph Bonaparte Gulf	Special Purpose Zone (IUCN VI)
Arafura	Special Purpose Zone (Trawl) (IUCN VI)
Oceanic Shoals	Special Purpose Zone (Trawl) (IUCN VI)

Habitat Critical to the Survival of Marine Turtles		[Resource Information]
Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Dermochelys coriacea Leatherback Turtle [1768]	Nesting	Known to occur
May - Jul		
Lepidochelys olivacea Olive Ridley Turtle [1767]	Nesting	Known to occur

Extra Information

State and Territory Reserves		[Resource Information]
Protected Area Name	Reserve Type	State
Casuarina	Coastal Reserve	NT
Djukbinj	National Park	NT

Nationally Important Wetlands	[Resource Information]
Wetland Name	State
Adelaide River Floodplain System	NT
Finniss Floodplain and Fog Bay Systems	NT

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
Clarence Strait Offshore Tidal Energy Project	2008/4660		Assessment
Darwin Pipeline Duplication (DPD) Project	2022/09372		Post-Approval
Darwin Pipeline Duplication DPD Project	2022/9166		Completed
Marine Route Survey for Subsea Fibre Optic Data Cable System - Australia West	2024/09826		Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Northern Endeavour Phase 1 Decommissioning	2022/09327		Post-Approval
Project Fitzroy Expansion Offshore Cable Lay	2023/09674		Referral Decision
Puffin Oil wells 7, 8 & 9 development	2005/2336		Completed
Replacement of the East Point Outfall	2011/6099		Completed
Controlled action			
Audacious Oil Field Standalone Development	2001/407	Controlled Action	Completed
Augmentation of the East Point Effluent Rising Main and Extension of East Point Outfall	2009/5113	Controlled Action	Post-Approval
Bonaparte Liquified Natural Gas Project	2011/6141	Controlled Action	Post-Approval
Darwin to Moomba Gas Pipeline	2001/213	Controlled Action	Completed
Decommissioning of Buffalo Oil Field	2003/984	Controlled Action	Post-Approval
Decommissioning of Challis Oilfield	2003/942	Controlled Action	Post-Approval
Floating Liquefied Natural Gas facility	2001/533	Controlled Action	Completed
Glyde Point and Middle Arm Peninsula Infrastructure Support	2001/334	Controlled Action	Completed
Glyde Point Industrial Estate	2001/336	Controlled Action	Completed
Glyde Point Industrial Estate and Associated Infrastructure	2004/1506	Controlled Action	Completed
Hardwood Plantation	2001/229	Controlled Action	Post-Approval
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval
Kilimiraka Mineral Sands and Associated Infrastructure (Bathurst Island), NT	2012/6587	Controlled Action	Assessment Approach
Montara 4, 5, and 6 Oil Production Wells, and Montara 3 Gas Re-Injection Well	2002/755	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
PTTEP AA Floating LNG Facility	2011/6025	Controlled Action	Completed
Residential subdivision of Lot 9793 (formerly Lots 9774 and 9779) Lee Point Road	2005/2108	Controlled Action	Post-Approval
Shipping Channel Enhancement	2010/5431	Controlled Action	Completed
Talisman Saber 2005 Military Exercise	2004/1819	Controlled Action	Post-Approval
Tassie Shoal Gas Reforming and Methanol Production Plants - NT/P48	2000/108	Controlled Action	Post-Approval
Tassie Shoal LNG Project	2003/1067	Controlled Action	Post-Approval
Tropical Tidal Testing Centre, Clarence Strait, 50km NE Darwin	2014/7299	Controlled Action	Guidelines Issued
Not controlled action			
2D Seismic Survey in Permit Areas WA-318-P & WA-319-P, near Cape Londonderry	2004/1687	Not Controlled Action	Completed
AEC International Hydrocarbon Well Puffin 6	2000/36	Not Controlled Action	Completed
Audacious-3 oil drilling well	2003/1042	Not Controlled Action	Completed
Backpacker-1 Offshore Hydrocarbon Exploration Well	2001/300	Not Controlled Action	Completed
Barossa-1 (NT/P69), Caldita-2 (NT/P61) exploration wells	2006/2793	Not Controlled Action	Completed
Buffalo In-Fill Production Wells	2001/475	Not Controlled Action	Completed
Caldita-1 Hydrocarbon Exploration Well, NT/P61	2004/1854	Not Controlled Action	Completed
Construction and operation of Radar Infrastructure	2004/1406	Not Controlled Action	Completed
Controlled Source Electromagnetic 2D Survey	2009/4980	Not Controlled Action	Completed
Controlled Source Electromagnetic Survey	2010/5434	Not Controlled Action	Completed
Coot-1 hydrocarbon exploration well, Permit Area AC/L2 or AC/L3	2001/296	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Cox Peninsular Remediation Project, NT	2015/7587	Not Controlled Action	Completed
Drilling of exploration well Audacious-1 in AC/P17	2000/5	Not Controlled Action	Completed
Exploration Drilling in AC/P17, AC/P18 and AC/P24	2001/359	Not Controlled Action	Completed
Geo-scientific survey	2005/2004	Not Controlled Action	Completed
Marine Survey for the Australia-ASEAN Power Link AAPL	2020/8714	Not Controlled Action	Completed
Montara-3 Offshore Hydrocarbon Exploration Well Permit Area AC/RL3	2001/489	Not Controlled Action	Completed
Nexus Drilling Program NT-P66	2007/3745	Not Controlled Action	Completed
NT/P68 2007 Two Well Drilling Program	2007/3569	Not Controlled Action	Completed
Project Sea Dragon Stage 1 Hatchery - Gunn Point, NT	2017/8092	Not Controlled Action	Completed
Skua and Swift Oilfields	2006/3195	Not Controlled Action	Completed
Waterfront Redevelopment	2003/1256	Not Controlled Action	Completed
Woodside Geotechnical Investigation Sunrise Bank	2000/13	Not Controlled Action	Completed
Not controlled action (particular manner)			
2 (3D) Marine Seismic Surveys	2009/4994	Not Controlled Action (Particular Manner)	Completed
2D and 3D Seismic Survey	2011/6197	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D Seismic Survey WA-405-P	2009/5104	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D Seismic Survey WA-405-P	2008/4133	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
2D Marine Seismic Survey	2009/4728	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey of Braveheart,Kurrajong,Sunshine and Crocodile	2006/2917	Not Controlled Action (Particular Manner)	Post-Approval
2D or 3D Marine Seismic Survey in Petroleum Permit Area AC/P35	2009/4864	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Marine Survey	2001/363	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic survey	2009/5076	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey - Petroleum Exploration Area NT/P68, Eastern Bonaparte Basin	2006/2922	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey	2008/4437	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey	2009/4681	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey	2006/2729	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, petroleum exploration permit AC/P33	2006/2918	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey (NT/P68)	2006/2980	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey (NT/P68)	2008/4121	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
3D seismic survey of AC/P4, AC/P17 and AC/P24	2006/2857	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey WA-406-P Bonaparte Basin	2007/3904	Not Controlled Action (Particular Manner)	Post-Approval
Auralandia 3D marine seismic survey	2011/5961	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte 2D & 3D marine seismic survey	2011/5962	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte 3D & 2D Seismic Survey, in NT/P82, Timor Sea	2012/6398	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Basin Barossa Appraisal Drilling Campaign, NT	2012/6481	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Basin Seabed Mapping Survey	2009/4951	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Seismic and Bathymetric Survey	2012/6295	Not Controlled Action (Particular Manner)	Post-Approval
Caldita 3D Marine Seismic Survey - NT/P61, NT/P69, and acreage release area NT06-5	2006/3142	Not Controlled Action (Particular Manner)	Post-Approval
Cartier East and Cartier West 3D Marine Seismic Surveys	2009/5230	Not Controlled Action (Particular Manner)	Post-Approval
Dillon South-1 Exploration Well Drilling - AC/P4, Territory of Ashmore/Cartier	2013/6849	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Dredging the outer shipping channels of Darwin Harbour	2013/6988	Not Controlled Action (Particular Manner)	Post-Approval
Drilling of Audacious-5 appraisal well	2008/4327	Not Controlled Action (Particular Manner)	Post-Approval
Drilling of two appraisal wells	2011/5840	Not Controlled Action (Particular Manner)	Post-Approval
Eni Bathurst 3D Seismic Survey	2011/6118	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling in Permit Areas WA-402-P & WA-403-P	2010/5297	Not Controlled Action (Particular Manner)	Post-Approval
Joseph Bonaparte Gulf Seabed mapping survey	2010/5517	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
Malita West 3D Seismic Survey WA-402-P and WA-403-P	2007/3936	Not Controlled Action (Particular Manner)	Post-Approval
Marine Environmental Survey 2012	2012/6310	Not Controlled Action (Particular Manner)	Post-Approval
NT/P74 & NT/P75 - 2D marine seismic survey	2008/4316	Not Controlled Action (Particular Manner)	Post-Approval
NT/P77 3D Marine Seismic Survey	2009/4683	Not Controlled Action (Particular Manner)	Post-Approval
NT/P80 2010 2D Marine Seismic Survey	2010/5487	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Octantis 3D Marine Seismic Survey, Permit Area AC/P41 off northern Western Australia	2007/3369	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval
Panda NT/P76 3D Seismic Acquisition Survey Program	2009/4992	Not Controlled Action (Particular Manner)	Post-Approval
Petrel MC2D Marine Seismic Survey	2010/5368	Not Controlled Action (Particular Manner)	Post-Approval
Removal of Potential Unexploded Ordnance within NAXA	2012/6503	Not Controlled Action (Particular Manner)	Post-Approval
Sandalford 3D Seismic Survey	2012/6261	Not Controlled Action (Particular Manner)	Post-Approval
Santos Petrel-7 Offshore Appraisal Drilling Programme (Bonaparte Basin)	2011/5934	Not Controlled Action (Particular Manner)	Post-Approval
Searcher bathymetry & geochemical seismic survey, Brawse Basin,Timor Sea,WA	2013/6980	Not Controlled Action (Particular Manner)	Post-Approval
Sonar and Acoustic Trials	2001/345	Not Controlled Action (Particular Manner)	Post-Approval
Songa Venus Drilling and Testing Operations	2009/5122	Not Controlled Action (Particular Manner)	Post-Approval
Songa Venus Drilling Programme, Bonaparte Basin	2009/4990	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Sunshine Infill 2D and Mimosa 2D Marine Seismic Surveys	2009/4699	Not Controlled Action (Particular Manner)	Post-Approval
Thoar 3D Marine Seismic Survey	2010/5668	Not Controlled Action (Particular Manner)	Post-Approval
Tiffany 3D Seismic Survey	2010/5339	Not Controlled Action (Particular Manner)	Post-Approval
Tow West Atlas wreck from present location to boundary of EEZ	2010/5652	Not Controlled Action (Particular Manner)	Post-Approval
Ursa 3D Marine Seismic Survey	2008/4634	Not Controlled Action (Particular Manner)	Post-Approval
Vampire 2D Non Exclusive Seismic Survey, WA	2010/5543	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Zeppelin 3D Seismic Survey	2011/6148	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
2D Marine Seismic Survey	2008/4623	Referral Decision	Completed
3D Seismic Survey (NT/P68)	2006/2949	Referral Decision	Completed
Puffin South-West Development of Oil Reserves	2007/3834	Referral Decision	Completed

Key Ecological Features

[Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region

Name	Region
Ashmore Reef and Cartier Island and surrounding Commonwealth waters	North-west
Carbonate bank and terrace system of the Sahul Shelf	North-west
Carbonate bank and terrace system of the Van Diemen Rise	North
Continental Slope Demersal Fish Communities	North-west
Pinnacles of the Bonaparte Basin	North-west
Pinnacles of the Bonaparte Basin	North
Shelf break and slope of the Arafura Shelf	North
Tributary Canyons of the Arafura Depression	North

Biologically Important Areas		[Resource Information]
Scientific Name	Behaviour	Presence
Dolphins		
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Breeding	Known to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Breeding	Known to occur
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Breeding	Known to occur
Dugong		
Dugong dugon Dugong [28]	Breeding	Known to occur
Dugong dugon Dugong [28]	Calving	Known to occur
Dugong dugon Dugong [28]	Foraging	Known to occur
Dugong dugon Dugong [28]	Foraging (high density seagrass beds)	Known to occur

Scientific Name	Behaviour	Presence
Dugong dugon Dugong [28]	Nursing	Known to occur
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Likely to occur
Chelonia mydas Green Turtle [1765]	Internesting	Likely to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Likely to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Chelonia mydas Green Turtle [1765]	Mating	Likely to occur
Chelonia mydas Green Turtle [1765]	Nesting	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Likely to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Foraging	Known to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Foraging	Likely to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Internesting	Likely to occur

Scientific Name	Behaviour	Presence
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting	Likely to occur
Seabirds		
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Fregata ariel Lesser Frigatebird [1012]	Breeding	Known to occur
Fregata minor Greater Frigatebird [1013]	Breeding	Known to occur
Phaethon lepturus White-tailed Tropicbird [1014]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sternula albifrons sinensis Little Tern [82850]	Resting	Known to occur
Sula leucogaster Brown Booby [1022]	Breeding	Known to occur
Sula sula Red-footed Booby [1023]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Thalasseus bergii Crested Tern [83000]	Breeding (high numbers)	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		

Scientific Name	Behaviour	Presence
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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Appendix F Relevant Persons Consultation and Advertising Materials

Appendix F1: Relevant Persons Consultation Material

Preliminary consultation email

From: Consultation, Santos
Sent: Friday, February 9, 2024 1:51 PM
Subject: Santos Barossa Productions Operations - - Environment Plan and Environmental Management Plan - Preliminary Consultation

Consultation on Barossa Production Operations Activity covered by:

- **the Barossa Production Operations Environment Plan (Commonwealth waters)**
- **the Barossa Operations Environmental Management Plan (Northern Territory waters)**

Overview

The Santos-operated Barossa Gas Project is an offshore gas and condensate project with the purpose of providing a new source of gas for the existing Darwin liquified natural gas (DLNG) facility at Wickham Point in the Northern Territory (NT).
Santos is contacting you as we are proposing to undertake Barossa Production Operations Activity in Commonwealth waters and NT waters. As part of obtaining authorisation for this activity, Santos is undertaking consultation for the following regulatory approvals:

- The Production Operations Environment Plan (EP) relating to the arrival and operations of the FPSO, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the GEP located in Commonwealth waters where offshore petroleum activities are regulated under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth) (OPGGS Act).
- The Operations Environmental Management Plan (OEMP) which includes the:
    - 8.26 km section of the GEP in NT coastal waters covered by the *Petroleum (Submerged Lands Act) 1981* (NT) (PSL Act); and
    - ~92 km section of the GEP inshore of NT waters covered by the *Energy Pipelines Act 1981* (NT) (Energy Pipelines Act).

Under section 25 of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations* (Cth) 2023 (OPGGS Environment Regulations), in preparing the Environment Plan for Barossa Production Operations activities in Commonwealth waters, Santos is required to consult with relevant persons, which includes:

- Commonwealth Departments or agencies to which our proposed activities may be relevant;
- State/Territory Departments or agencies to which our proposed activities may be relevant;
- the Department of the responsible Northern Territory Minister; and
- persons or organisations whose functions, interests and activities may be affected by our proposed activities.

In preparing an OEMP for activities in Northern Territory coastal waters under the Northern Territory PSL Act and applied Commonwealth environmental regulations, Santos is required to consult with relevant persons.

You or your department, agency or organisation may be a relevant person for the purposes of the Barossa Production Operations EP or OEMP.

https://www.santos.com/wp-content/uploads/2024/02/Production-Operations-Information-Booklet.pdfA booklet containing information about these activities in Commonwealth and NT waters can be found online at Barossa Production Operations Activity Information Booklet

The booklet includes information on the proposed activities, potential impacts, risks and management measures and the presence, based on a review of publicly available information, of environmental, social, economic, and cultural features and/or values within the environment that may be affected. The booklet and further information are located on the Production Operations section of the Santos website.

Seeking information and what's next

At this stage, Santos is seeking information to better understand:

- if you are from a Department or agency, or a person (or organisation) whose functions, interests or activities may be affected by the activity proposed to be carried out under the EP or OEMP; and
- what the functions, interests or activities you or your organisation have that may be affected by the proposed Production Operations activities.

Please contact us at the earliest opportunity if you consider you may be a relevant person to allow time to initiate consultation with you. Please also let us know if you know of other Departments, agencies, persons, or organisations which you believe we should consult. You can do this online via the relevant person nomination form located at Production Operations, via return email at offshore.consultation@santos.com or by calling us toll free on **1800 267 600**.

Consultation

Consultation for Production Operations Activity under Commonwealth environmental regulations will formally commence on **Monday 11 March 2024** with the consultation period closing on **Tuesday 9 April 2024.**

If you would like to provide information, please note that the information you provide will be included in documentation submitted to NOPSEMA and DITT (defined below) for assessment. This will include our assessment of the information you provide so that Santos can better understand the environmental risks and impacts from the activities and our response to you.

The information you provide during consultation will be used for the development of the following documents:

- an Environment Plan for the activity in Commonwealth waters, which will be assessed by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA); and
- an Operations Environmental Management Plan for the activity in Northern Territory coastal waters, which will be assessed by the Energy Division within the Northern Territory Department of Industry, Tourism and Trade (DITT).

Please let us know if you would like any particular information you provide to not be published. If requested, Santos will include your information in a separate report which will not be published on NOPSEMA's website. Santos will handle your information in accordance with our *Offshore Western Australia and Northern Territory Consultation Privacy Policy*. Importantly, we recognise that First Nations people and groups may have concerns about sharing culturally sensitive information so we will follow your guidance when undertaking consultation activities.

https://www.nopsema.gov.au/sites/default/files/documents/Consultation on offshore petroleum environment plans brochure.pdf

Additional resources

NOPSEMA has published information that sets out titleholders' responsibilities for consultation, as well as opportunities for relevant persons to provide guidance for consultation expectations.
Click the image to read the information in full.

We look forward to hearing from you soon.
Regards

Barossa Consultation Coordinator
Email: offshore.consultation@santos.com
Phone: 1800 267 600

Consultation email

From: Consultation, Santos
Sent: Monday, March 11, 2024 5:02 PM
Subject: Santos Barossa Productions Operations - - Environment Plan and Environmental Management Plan - Consultation

Consultation on Barossa Production Operations Activity covered by:

- **the Barossa Production Operations Environment Plan (Commonwealth waters)**
- **the Barossa GEP Operations Environmental Management Plan (Northern Territory waters)**

Santos is contacting you as we are proposing to undertake Barossa Production Operations activities in Commonwealth waters and Northern Territory (NT) waters.
As part of obtaining authorisation for this activity, Santos is undertaking consultation for the following regulatory approvals:

- The Production Operations Environment Plan (EP) relating to the arrival and operations of the FPSO, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the GEP located in Commonwealth waters where offshore petroleum activities are regulated under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth) (OPGGS Act).

- The GEP Operations Environmental Management Plan (OEMP) which includes the:
    - 8.26 km section of the GEP in NT coastal waters covered by the *Petroleum (Submerged Lands Act) 1981* (NT) (PSL Act); and
    - ~92 km section of the GEP inshore of NT waters covered by the *Energy Pipelines Act 1981* (NT) (Energy Pipelines Act).

Under section 25 of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations* (Cth) 2023 (OPGGS Environment Regulations), in preparing the EP for the activities in Commonwealth waters, Santos is required to consult with relevant persons, which includes:

Commonwealth Departments or agencies to which our proposed activities may be relevant;
State/Territory Departments or agencies to which our proposed activities may be relevant;
the Department of the responsible Northern Territory Minister; and
persons or organisations whose functions, interests and activities may be affected by our proposed activities.

In preparing an OEMP for activities in Northern Territory coastal waters under the Northern Territory PSL Act and applied Commonwealth environmental regulations, Santos is required to consult with relevant persons.

On 9 February 2024, Santos contacted you to advise that consultation for Barossa Production Operations activities under Commonwealth environmental regulations would commence on 11 March 2024 and to seek information as to whether your department, agency or organisation may be a relevant person for the purposes of the EP or OEMP.

Consultation
<u>As advised in the email of 9 February, consultation for Barossa Production Operations activities under Commonwealth environmental regulations has now commenced, with the consultation period closing on **Tuesday, 9 April 2024**.</u>

During the consultation period we are seeking information on the environmental values in the operational area and the environment that may be affected by the proposed activities, and the environmental impacts and risks associated with the proposed activities.

You can provide information via return email or call us toll free on 1800 267 600.

The information provided by you during consultation will be used for the development of the following documents:

- The EP for the activity in Commonwealth waters, which will be assessed by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA); and
- The OEMP for the activity in NT coastal waters, which will be assessed by the Energy Division within the NT Department of Industry, Tourism and Trade (DITT).

https://www.santos.com/wp-content/uploads/2024/02/Production-Operations-Information-Booklet.pdfA booklet containing information about these activities in Commonwealth and NT coastal waters has been prepared by Santos.
It includes information on the proposed activities, potential impacts, risks and management measures and the presence, based on a review of publicly available information, of environmental, social, economic, and cultural features and/or values within the environment that may be affected.

The booklet can be found online at Barossa Production Operations Activity Information Booklet or by clicking on the image opposite. The booklet and further information are located on the Production Operations section of the Santos website.

Please note that the information you provide will be included in the documentation submitted to NOPSEMA and DITT for assessment. This will include our assessment of the information you provide so that Santos can better understand the environmental risks and impacts from the activities and our response to you.

Please let us know if you would like any particular information you provide to not be published. If requested, Santos will include your information in a separate report which will not be published on NOPSEMA's website. Santos will handle your information in accordance with our *Offshore Western Australia and Northern Territory Consultation Privacy Policy*.

Importantly, we recognise that Indigenous people and groups may have concerns about sharing culturally sensitive information so we will follow your guidance when undertaking consultation activities.

Relevant persons being consulted under the OPGGS Environment Regulations should note that they:

- are entitled to be given sufficient information to allow them to make an informed assessment of the possible consequences of the activity on their functions, interests or activities; and
- are entitled to be allowed a reasonable period for the consultation.

NOPSEMA has published information that sets out titleholders' responsibilities for consultation, as well as opportunities for relevant persons to provide guidance for consultation expectations. Click the image to read in full.

Santos has previously sought information to better understand:

- if you are from a government Department or agency, how the proposed Production Operations activities may be relevant to your Department or agency;
- if you know of other government Departments, agencies, persons or organisations which you believe we should consult; and
- what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed activities.

You can still contact us with this information during consultation.

We look forward to hearing from you soon.

Regards

Barossa Consultation Coordinator
Email: offshore.consultation@santos.com
Phone: 1800 267 600

Production operations information booklet – original version

Santos

INFORMATION BOOKLET

BAROSSA PRODUCTION OPERATIONS ACTIVITY

INTRODUCTION

The activities described in this booklet relate to the extraction, processing, and distribution of gas and condensate from the Barossa Field.

The Barossa Development facilities used in these activities consist of a Floating Production Storage and Offloading (FPSO) facility, subsea production wells, supporting in-field subsea infrastructure **(Figure 1)**, a 285 km Gas Export Pipeline (GEP) in Commonwealth waters, and an 8.26 km section of the GEP in Northern Territory (NT) coastal waters; collectively termed in this booklet as "Production Operations Activity".

As part of obtaining authorisation for this activity, Santos is undertaking consultation for the following regulatory approvals:

- The Production Operations Environment Plan (EP) relating to the arrival and operations of the FPSO, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285km section of the GEP located in Commonwealth waters where offshore petroleum activities are regulated under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth)* (OPGGS Act).
- The Operations Environmental Management Plan (OEMP) which includes the:
  - 8.26 km section of the GEP in NT coastal waters covered by the *Petroleum (Submerged Lands Act) 1981 (NT)* (PSL Act); and
  - ~92km section of the GEP inshore of NT waters covered by the *Energy Pipelines Act 1981 (NT)* (Energy Pipelines Act).

The term 'GEP' refers to the Gas Export Pipeline through which Barossa gas will be transported from the Barossa field to Darwin LNG. However, the scope of the GEP covered in this booklet, is limited to the 8.26 km section of the GEP located in NT coastal waters.

The activities, environmental impacts, and risks for the GEP in NT waters (~92km) are broadly similar to those for the GEP in Commonwealth waters (described in this booklet). The activities, environmental impacts and risks specific to the GEP in NT waters, not covered in this booklet, will be provided in a separate factsheet.

The estimated life of the Barossa Development is 25 years, and the Production Operations EP and the OEMP will be reviewed every five years following initial regulator authorisation. This booklet provides a summary of the credible environmental impacts and risks associated with the first five years (also known as Barossa Phase 1) of the Production Operations Activity.

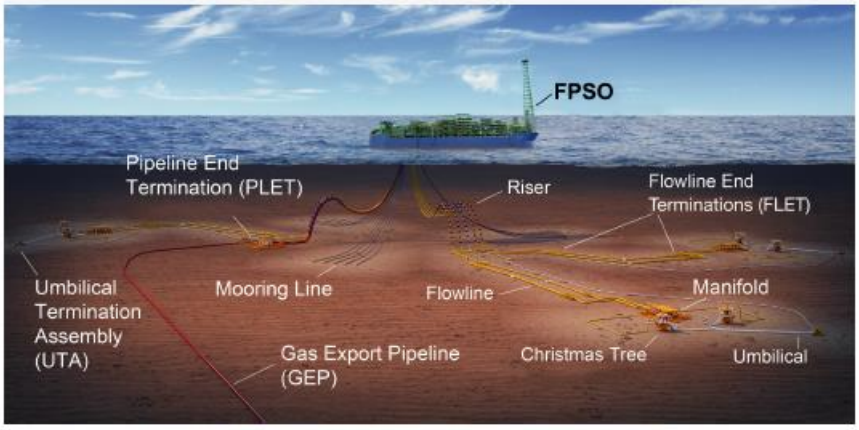


Figure 1: Schematic of the Barossa Field Subsea production system and infrastructure, and FPSO

BAROSSA GAS PROJECT OVERVIEW

The Santos-operated Barossa Gas Project is an offshore gas and condensate project with the purpose of providing a new source of gas to the existing Darwin liquified natural gas (DLNG) facility at Wickham Point in the NT. It is intended that natural gas and condensate would be extracted from the Barossa field, located in Commonwealth waters approximately 285 kilometres offshore north-northwest from Darwin. Initial processing would occur at the FPSO, to separate the natural gas, water and condensate. The dry natural gas would be transported through the GEP for onshore processing at the DLNG facility. The condensate would be transferred from the FPSO facility to purpose-built tankers for international export.

DLNG facility at Wickham Point where Barossa gas will be sent for onshore processing.

ACTIVITY LOCATION

The planned Production Operation Activity is confined to two key operational areas. These areas are simply termed Operational Area 1 (OA1) and Operational Area 2 (OA2) **(Figure 2)**.

OA1: The Barossa field. This is the area in which the FPSO, subsea production system, and supporting subsea infrastructure will be used to process gas and condensate extracted from the Barossa wells. The area is confined to Commonwealth waters, approximately 285 km north-north-west of Darwin (the closest major populated centre), approximately 210 km north-west of the mainland NT coastline, and approximately 130 km north of the Tiwi Islands at the closest point (Seagull Island).

OA2: The 285 km section of the GEP from OA1 to the Commonwealth waters/ NT waters boundary; and the 8.26 km section of the GEP situated in NT coastal waters between the Commonwealth waters/NT coastal waters boundary and the Territorial Sea Baseline (TSB). Not included in this section is the remaining GEP in NT waters (~92 kms). Information on this is covered elsewhere.

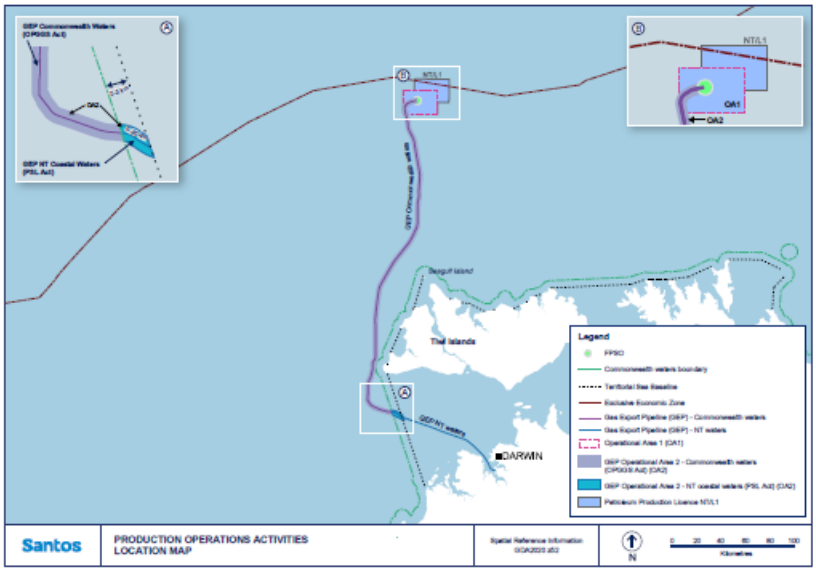


Figure 2: Location of the Barossa Operational Area 1 (OA1) in Commonwealth waters (OPPGS Act) and Operational Area 2 (OA2) in Commonwealth waters and NT coastal waters (PSL Act).

SUMMARY OF ACTIVITIES

The Barossa FPSO, which will be known as BW Opal, is a permanently moored vessel which is able to freely rotate with the strongest wind direction and remain connected to subsea facilities. The operational design life for all Barossa facilities is 25 years. **Figures 3 and 4** depict key features of the FPSO and utilities/marine systems.

Gas and condensate extracted from the Barossa field will be processed on the FPSO to separate the natural gas and condensate (a light liquid hydrocarbon, straw coloured and flammable). The dry gas will be exported to the DLNG facility via the GEP, and the condensate will be transferred from the FPSO to offtake tankers for export approximately four to five times per year. The key activities proposed under the Production Operations EP are detailed below.

Most of the below activities are only applicable to OA1 as this is where the FPSO and subsea infrastructure is located, and the condensate offtakes will occur. The main activity in OA2 will be inspection, maintenance, monitoring, and repair (IMMR) of the GEP.

- **FPSO arrival in the field:** connection of the FPSO to the mooring buoy; equipment and systems testing (also termed commissioning), start-up operations.
- **FPSO operations:** process gas and condensate from the Barossa field. The gas and condensate separation and treatment systems have a gas export capacity of approximately 635 million standard cubic feet per day (a little over 7000 Olympic-size swimming pools) with a condensate processing capacity of approximately 11,000 barrels per day (a little more than half an Olympic-size swimming pool) and a produced water processing maximum capacity of 20,000 barrels per day (over one Olympic-size swimming pool). Under normal operating conditions produced water discharge rates will be approximately a quarter (~5,000 barrels per day) of the maximum discharge capacity (~1/4 of an Olympic-size swimming pool). The FPSO generates its own electricity using Barossa production gas, and potable water supply. Living quarters are provided for the operations workforce.
- **Gas export to DLNG:** dry natural gas will be transported through the GEP for onshore processing at the DLNG facility.
- **Storage and Offtake operations:** storage of condensate onboard the FPSO and offloading of condensate to offtake tankers. Approximately 650,000 barrels (~ 40 Olympic-size swimming pools) will be offloaded approximately once every two to three months (four to five times per year).

- **Support operations:** offshore support vessels periodically visit the FPSO to resupply materials (such as stores, consumables, chemicals and fuel) and return surplus goods and wastes to the Australian mainland for disposal or recycling. Helicopters will be used to transport the operations workforce to and from operations facilities.
- **Subsea system and GEP inspection, maintenance, monitoring and repair (IMMR):** visual inspection of subsea infrastructure and/or the GEP using Remotely Operated Vehicles (a submersible craft used to perform underwater visual inspections operated from a vessel). This activity will be performed according to a planned inspection and maintenance schedule, or at other intervals if unplanned inspections or repairs are required.

1. Engine Room
2. Living Quarters
3. Laydown Areas
4. Seawater Lift Caissons
5. Utilities
6. Gas Treatment A & B
7. Condensate & Produced Water Treatment
8. Production Separation Module
9. Flare Knock Out Drum
10. Flare
11. Electrical-House
12. Central Piperack
13. Power Generation A, B & C
14. Gas Treatment C
15. Flash Gas Compressor
16. Future LP Gas Compressor
17. Export Gas Compressor
18. Turret

Key infrastructure information

A Length 355 m B Depth 32 m C Breadth 64 m ● Maximum persons on board - 140

Figure 3: FPSO key features

1. Condensate Offloading System
2. Aft Service Crane
3. Communications & Radar
4. Aft Pedestal Crane
5. Thermal Oxidiser
6. Helideck Parking Area
7. Forward Pedestal Crane
8. Power Generation Exhaust
9. Midship Pedestal Crane
10. Helideck Landing Area
11. Daughter Craft
12. Freefall Lifeboats
13. Engine Room Exhaust

Figure 4: FPSO utilities and marine systems

REGIONAL EXISTING ENVIRONMENT SUMMARY

Environment that may be affected (EMBA)

Santos recognises the region's various environmental values and sensitivities. In an EP, although planned activity occurs in OA1 and OA2, it is common to present a geographically defined area of the environment that may be affected (EMBA) by an offshore activity e.g. an unplanned hydrocarbon spill.

In the case of the Production Operations Activity, the broadest extent of the EMBA, is determined by a potential loss of heavy fuel oil from a condensate offtake tanker due to impact from another vessel. Potential loss of heavy fuel oil is a risk associated with any large marine vessel and is managed through established maritime laws and safeguards. Barossa condensate offtake operations are a low frequency activity (four to five times a year) which further reduces the likelihood of such an event, which is already a very low probability of occurring.

Figure 5 depicts operational areas OA1 and OA2 and the EMBA (blue line). The EMBA is generated by modelling and represents the greatest geographical extent that could be affected by 300 individual hydrocarbon spill scenarios occurring simultaneously across the full range of seasonal conditions. It should be noted that an actual spill event is more accurately represented by only one of the 300 simulations from the modelling, meaning a much smaller geographical area would be affected in the event of an actual spill; and the EMBA does not take account of spill response mitigations which would reduce the extent of an unplanned spill. The primary purpose of the EMBA is to assist with spill response planning and preparedness in the unlikely event of a hydrocarbon spill. The EMBA also provides the basis for assessing the range of potential socio-economic impacts and establishes a planning area for scientific monitoring during an unplanned spill event.

The Moderate Exposure Value (MEVA) (pink line) represents the predicted extent of ecological impacts and is used to inform the environmental impact assessment and spill response plans. Beyond the MEVA, impacts to ecological receptors are not expected.

To learn more about spill modelling, exposure values and spill response, see NOPSEMA Spill Modelling Video.

Regional protected and significant areas

Figures 6, 7, and 8 illustrate the boundaries and zonings of regional marine parks and reserves, key ecological features, wetlands, EMBA, the MEVA and the OAs. **Figure 9** illustrates the shoals and banks in relation to the OAs.

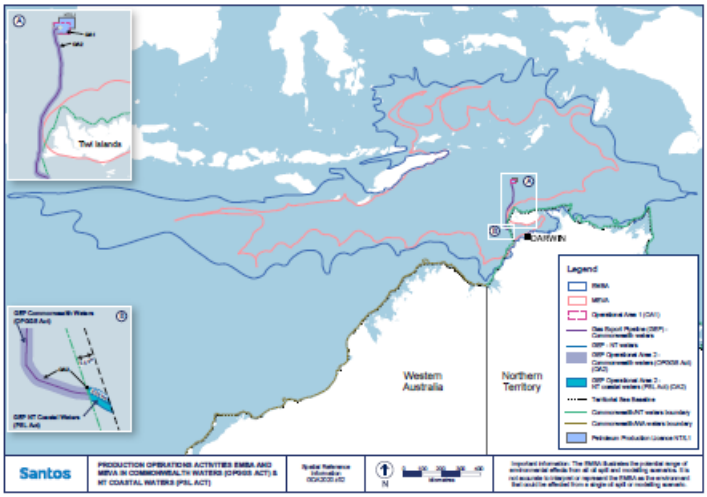


Figure 5: Production Operations Activities EMBA and MEVA in Commonwealth waters (OPGGS Act) and NT coastal waters (PSL Act)

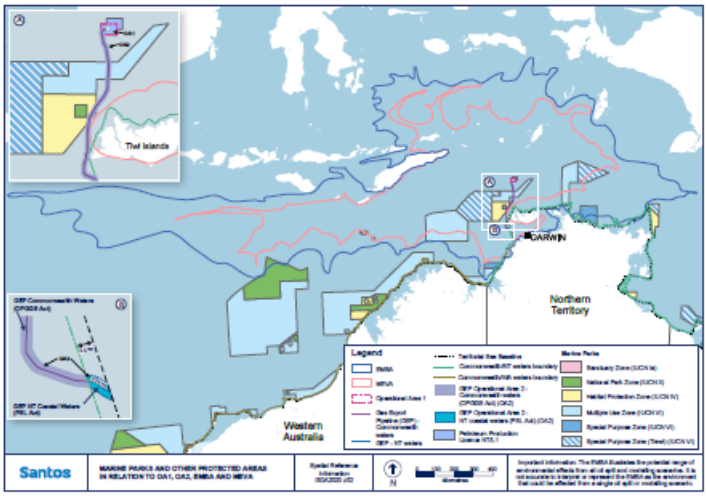


Figure 6: Marine Parks and Other Protected Areas in relation to OA1, OA2, EMBA and MEVA

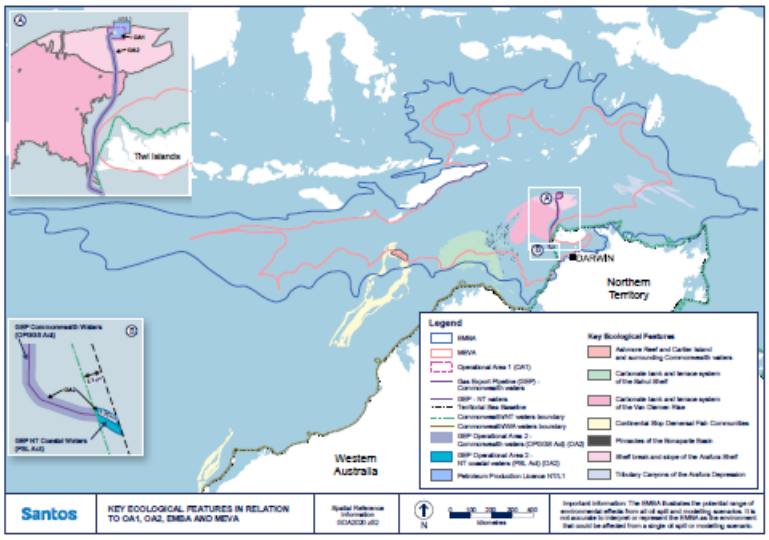


Figure 7: Key Ecological Features in relation to OA1, OA2, EMBA and MEVA

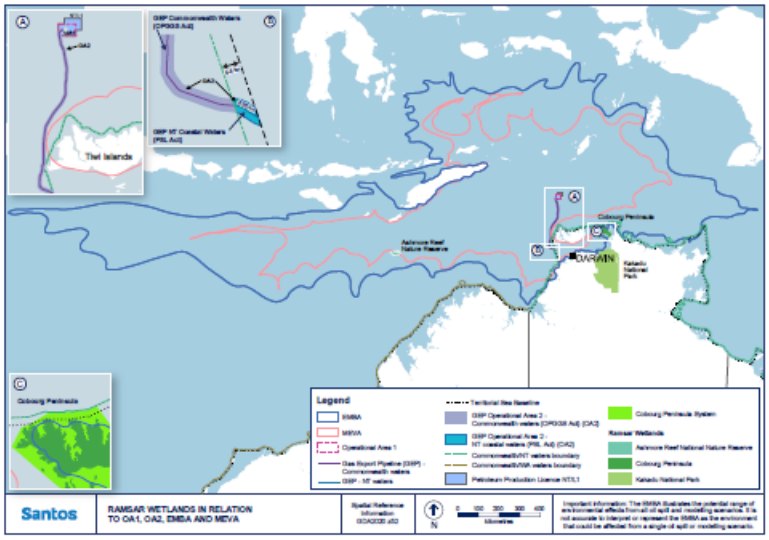


Figure 8: RAMSAR wetlands in relation to OA1, OA2, EMBA and MEVA

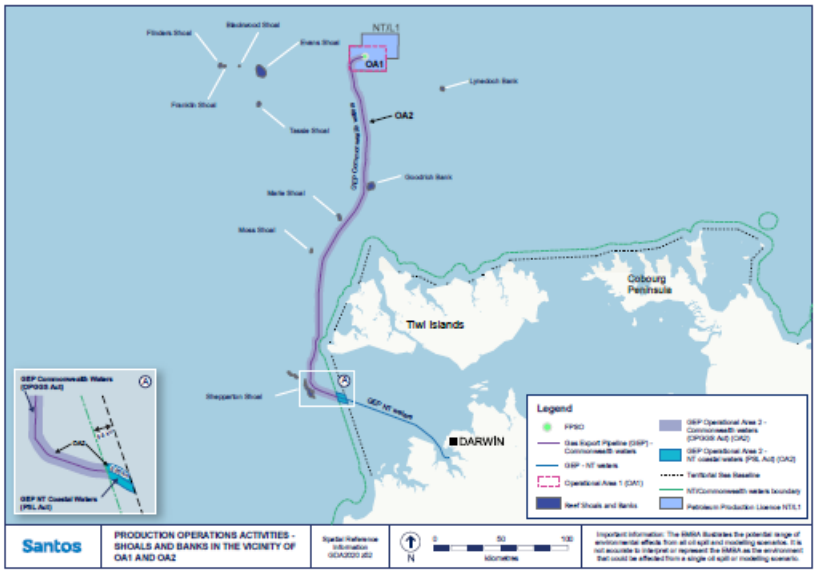


Figure 9: Shoals and Banks in the vicinity of OA1 and OA2

Marine fauna and biologically important areas

Biologically important areas (BIAs) are areas used by protected marine species for carrying out critical life functions, such as reproduction, feeding, migration or resting. BIAs are areas that contain habitat crucial to the survival of protected species and are defined by the Australian Government under the Environment Protection and Biodiversity Conservation Act 2009 (EPBC Act). As shown in Figure 10, some BIAs occur within the EMBA. These areas are known to include protected marine species such as whale sharks, pygmy blue whales, dugongs, olive ridley turtles, loggerhead turtles, green turtles, hawksbill turtles, flatback turtles, and 12 types of seabirds and shorebirds. In addition, the EMBA overlaps the spawning grounds for southern bluefin tuna, a listed species under the EPBC Act, between northern Western Australia and Java.

The BIAs for flatback turtles overlap with OA2. There are no BIAs within OA1. Two turtle species, the flatback turtle and olive ridley turtle, have critical habitat that overlap with OA2.

Activities in OA1 will be conducted in water depths ranging from approximately 220 – 280 m. There are a variety of highly mobile marine fauna that may transit OA1 in low numbers, such as:

- Bryde's, blue, fin, humpback, sperm and sei whales
- orcas, Australian snubfin dolphin and spotted bottlenose dolphin
- dugongs (mostly in shallow waters)
- olive ridley, green, loggerhead, hawksbill, leatherback and flatback turtles
- sea snakes
- whale sharks
- migratory seabirds and shorebirds
- fishes, sharks, rays and sawfish.

An additional three species – the grey nurse shark, Omura's whale and the turtle-headed sea snake have been included as they were observed within or near OA1 and OA2 during the Barossa Marine Studies Program.

Santos recognises the region's various environmental values and sensitivities and has considered government guidance, including protected species management plans, recovery plans, conservation advice and threat abatement plans in the development of the Production Operations and OEMP, and has developed control measures to reduce impacts and risks to marine fauna and biologically important areas to as low as reasonably practicable and acceptable levels.

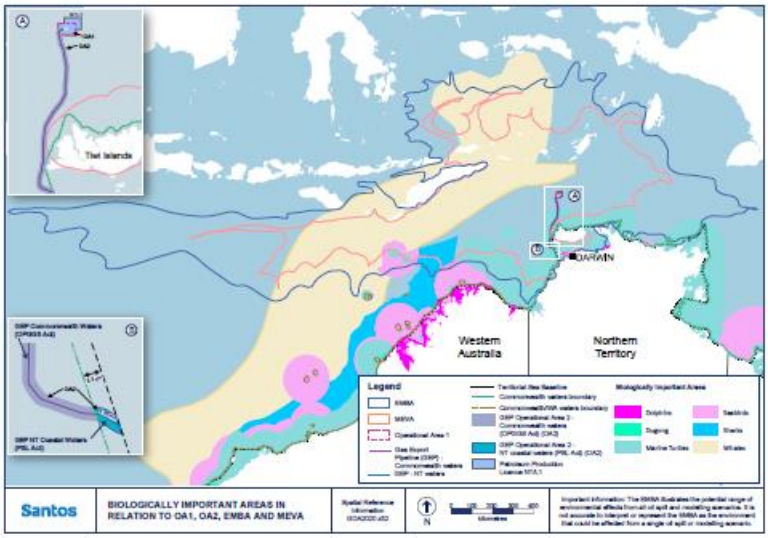


Figure 10: Biologically important areas in relation to OA1, OA2, EMBA and MEVA.

REGIONAL SOCIO-ECONOMIC SUMMARY

Socioeconomic activities that may occur within the OAs or EMBA might include commercial, recreational and traditional (subsistence) fishing, aquaculture, tourism, petroleum industry activities, defence activities, shipping and to a lesser extent in the deeper offshore waters, recreational fishing and tourism.

Underwater cultural heritage and cultural values may also exist across the region. Darwin will be the logistics hub and supply base for the capitals when stating Production Operations Activity bringing employment and economic benefits to the local community.

Nearest population centres

OA2, at its closest point, is located approximately seven kilometres from Bathurst Island, which is part of the Tiwi Islands. Darwin is the closest regional city, which approximately 285 km north-north-west of OA1.

Summary of other uses within the EMBA

Santos' existing understanding of the uses and values of the area and its strategies to reduce impacts or risks to these uses and values, will be supplemented with any new information obtained during consultation. Santos has set out in the list below a summary of the uses and values of the area based on existing information or previous consultation. Santos welcomes further information that may be provided during consultation to inform the Production Operations EP and OEMP.

Commercial fishing

Santos recognises the presence and rights of commercial fishers within the operational area and EMBA. Within the OAs, interaction with some commercial fishing is possible. These fisheries include Northern Prawn, Spanish Mackerel, Pearl Oyster, Offshore Net and Line, and Demersal. Santos has been consulting with the relevant fisheries representative associations, licence-holders and government over many years.

Petroleum industry

Several oil and gas companies hold petroleum permits near the OAs; however, no established oil and gas operations are located within or in the immediate surrounds. The closest operational offshore production facilities and in-field subsea infrastructure are associated with the Santos-operated Bayu-Undan platform, located approximately 400km to the southwest of OA1 and west of OA2.

Tourism, recreational fishing and traditional fishing

The OA1 is located in offshore waters that are not likely to be accessed for tourism activities (e.g. charter boat operations) or recreational fishing, as these tend to be centred around nearshore waters, islands and coastal areas. However, previous consultation on a different Barossa Gas Project EP has identified one fishing charter operator who may on occasions conduct tours near Evans Shoal, approximately 62km west of OA1. Tourism activities may occur within OA2, but they are likely to be limited to vessels transiting the area to access other destinations within the region e.g. islands, shoals, and shipwrecks. Indonesian and Timorese traditional fishers, as well as Australian recreational fishers, are expected to transit and fish in the EMBA. Santos continues to consult regarding recreational and traditional fishing and hunting within the EMBA.

Defence Activities

Several oil and gas companies hold petroleum permits near the OAs; however, no established oil and gas operations are located within or in the immediate surrounds. The closest operational offshore production facilities and in-field subsea infrastructure are associated with the Santos-operated Bayu-Undan platform, located approximately 400km to the southwest of OA1 and west of OA2.

Telecommunications cables

The North-West Cable System (NWCS) is a submarine telecommunication fibre cable system located within the EMBA and crosses the GEP in the southern portion of OA1. It is located approximately 230 km and 30 km south of OA1 and OA2. Extending 2100 km from Darwin to Port Hedland, the NWCS connects Australia's remote northern and western regions, including offshore oil and gas facilities, with onshore locations.

Listed Heritage

There are no world heritage properties, national heritage places or Commonwealth heritage places within the OAs; however, the EMBA (including the MEVA) overlaps the Ashmore Reef Marine Park, a Commonwealth heritage place. The closest World Heritage Property is the Kakadu National Park, located onshore in the NT. A small portion of the coastal edge overlaps the EMBA. **(Figure 8)**

There are no recorded Aboriginal heritage sites within the OAs. The Tiwi Islands are a declared Aboriginal reserve and a number of protected sacred sites under the Aboriginal Sacred Sites Act 1989 (NT) have been recorded on the islands.

Under the Commonwealth Underwater Cultural Heritage Act 2018, Australia's underwater cultural heritage is protected in Commonwealth waters, such as shipwrecks, sunken aircraft and other types of underwater cultural heritage including Australia's Aboriginal and Torres Strait Islander underwater cultural heritage. No known shipwrecks are located within the OAs. Multiple known shipwrecks, sunken aircrafts, historic aircrafts and shipwrecks (greater than 75 years old) and other sites occur within the EMBA. Some unlocated wrecks could fall within the boundaries of the OAs or EMBA.

In the course of preparing the Barossa Drilling and Completions EP, SURF EP and commencing works under the GEP EP, Santos engaged independent consultants to investigate potential for underwater cultural heritage within OA1. First Nations underwater cultural heritage is not relevant to OA1 due to its location in water depths beyond the extent of the ancient coastline at the 125 m water depth contour. A 262km section of the GEP within OA2 has been surveyed for both First Nations and other underwater cultural heritage

The results of those surveys concluded there are no specific underwater cultural heritage places along the Barossa GEP to which people, in accordance with Indigenous tradition, may have spiritual and cultural connections that may be affected by the activities covered by the GEP Environment Plan. Further similar surveys are planned for the remainder of OA2 in 2024.

Shipping

The closest port to the OAs is Darwin Port, which is approximately 290km away from OA1 and 116km away from OA2. No designated shipping fairways overlap the OAs, however the southern end of OA2 is an area of high shipping activity.

Cultural Values

Traditional hunting and fishing continue to occur on the Tiwi Islands, although typically these occur within 3 nm of the shoreline.

Mapping exercises and workshops conducted on the Tiwi Islands have identified Aboriginal heritage sites along the northern, western and southern coastlines of the Tiwi Islands, including areas used for food collection, sacred sites, camping sites and a dreaming site. These coastlines are within the EMBA but outside the OAs.

Santos has identified that the Croker Island native title determination (DCD1998/001) partially overlaps the EMBA. The native title holders within the Croker Island native title determination are the Yuwurrumu members of the Mandilarri-Ildugij, the Mangalara, the Murran, the GaduraMinaga and the Ngaynjaharr clans. The Larrakia native title determination (DCD2006/001) also partially overlaps the EMBA. This determination found that native title does not exist within the claim area.

Mapping exercises and workshops conducted on the Tiwi Islands have identified Aboriginal heritage sites along the northern, western and southern coastlines of the Tiwi Islands, including areas used for food collection, sacred sites, camping sites and a dreaming site. These coastlines are within the EMBA but outside the OAs.

Santos acknowledges coastal First Nations peoples' connection with culture through Sea Country and is seeking to improve knowledge and understanding of cultural features within the EMBA, including through consultation with First Nations people and their relevant representative bodies.

SUMMARY OF ENVIRONMENTAL IMPACTS AND RISKS

Environmental impact and risk assessment is the process by which proposed activities are assessed for their impacts (consequences) on the environment (physical, biological, socio-economic and cultural). For the purposes of assessing impacts and risks, proposed activities are divided into planned activities and unplanned events.

Planned activities occur within OA 1 and OA 2 can have unavoidable impacts, such as light, noise and atmospheric emissions, seabed disturbance, discharges to the marine environment, and interactions with other marine users. Unplanned events are not expected to occur but are considered so that contingency measures are in place should they ever eventuate. Unplanned events include dropped objects, introduction of invasive marine species, interactions with marine fauna, accidental discharges, or spills.

Planned activities are assessed based on consequence of impact. Unplanned events are assessed based on their potential impact (consequence) and likelihood of occurrence, which informs the associated risk level.

Santos has conducted an environmental assessment in order to consider the potential environmental impacts and risks associated with activities under this EP. The identification of potential impacts and risks, and the measures proposed to reduce these impacts and risks, may be revised and amended as a result of the consultation process. This includes information obtained during consultation to improve Santos' understanding of potential impacts and risks in regards to cultural values within the EMBA and adoption of any appropriate measures.

PLANNED ACTIVITIES

Santos proposes to adopt a suite of control measures to reduce impacts and risks associated with planned activities to a level that results in a minor or negligible environmental consequence. These consequence levels are considered by Santos to be acceptable and to have been reduced to as low as reasonably practicable (ALARP). **Figure 11** shows several emissions and discharges from planned activities associated with the operation of the FPSO.

Figure 11: Emissions and discharges from planned activities associated with the operation of the Floating Storage and Offloading (FPSO) facility.

GHG EMISSIONS

The Production Operations EP will consider the contribution of emissions from the Barossa Development to national and global emissions and the potential indirect impacts of climate change on the Australian environment, noting that as a result of the complex nature of the global emissions system, climate change impacts cannot be meaningfully linked to any one activity or emissions source.

GHG emissions can be categorised into Scope 1, Scope 2 and Scope 3.

- Scope 1 - direct emissions from sources that Santos owns or controls, due to fuel combustion, flaring, venting, CO2 removal and fugitive emissions.
- Scope 2 - indirect emissions from the generation of energy that Santos purchases for its operations including electricity purchased for ancillary activities such as office buildings.
- Scope 3 - includes all indirect emissions not included in Scope 2. The vast majority of Scope 3 emissions from Santos' activities are emissions from the use of sold products.

The Production Operations Activity will not produce scope 2 emissions as it does not consume externally generated electricity or other forms of externally generated energy.

Total annual Barossa Scope 1 emissions are estimated to be 2.5 Mt CO2e (carbon dioxide equivalent), and total annual Scope 3 emissions are estimated to be 12.7 Mt CO2e.

What impacts are expected?

Barossa GHG emissions (Scope 1 and 3) estimates account for approximately 0.86% of annual Australian GHG emissions (Department of Climate Change, Energy, the Environment and Water, 2022).

The GHG emissions attributable to the Barossa Development are not expected to be significant relative to national and international GHG emissions and are considered to be low risk.

How will Santos manage impacts?

Scope 1 emissions from Barossa are managed under Australian regulations and scope 3 emissions are managed using control measures consistent with the UN Paris Agreement, to which the Australian Government is a signatory. Key proposed control measures include:

Scope 1 emissions:

- Barossa will comply with Safeguard Mechanism obligations, including surrendering carbon credit units for any emissions above the Safeguard baseline for the assessment year.
- Barossa will implement a GHG management plan that minimises GHG emissions to ALARP and acceptable levels over the life of the field operations.
- Barossa facilities design has been optimised to reduce fuel, flare and vent (FFV) emissions, and to enable the possibility of future export of reservoir CO2 to a Carbon Capture and Storage (CCS) project.

Scope 3 emissions:

- Products generated from the Barossa Development will only be sold to customers from countries that are signatories to the Paris Agreement (or that have policies for reducing greenhouse gas emissions that are equivalent to policies required by the Paris Agreement), as at the date of the relevant contract of sale.

ATMOSPHERIC EMISSIONS

Fuel consumption, flaring and venting excess gas is required to process gas and condensate which results in the release of air pollutants, such as sulphur oxides (SOX), nitrogen oxides (NOX) and volatile organic compounds (VOCs) to the atmosphere. This mix of continuous and infrequent (e.g. flaring of excess gas) sources of atmospheric emissions associated with operating the Barossa facilities may result in a temporary, localised reduction in air quality.

Intermittent flaring is expected to be of short duration during initial start-up operations and unplanned process trips/upsets during steady-state operations.

Atmospheric emissions will also be generated from support vessel and helicopter operations.

All activities described above that may result in air emissions could be expected within OA1, however only emissions associated with vessel activities would be expected in OA2. In the offshore environment, air emissions quickly dissipate into the surrounding airshed.

What impacts are expected?

Impacts are considered very localised and not significant. Seabirds and migratory shorebirds are unlikely to be impacted by the localised and temporary reduction in air quality.

The potential impact from the release of air emissions includes the decrease in air quality of the local airshed.

Behavioural impacts, such as avoidance, could be expected if seabirds fly in the vicinity of OA1. Impacts to threatened, migratory or local fauna (seabirds) are considered to be minor.

As Barossa's operational activities occur in remote offshore waters, Production Operations Activity emissions will not impact air quality in coastal towns. Atmospheric emissions will quickly dissipate into the surrounding atmosphere and are not considered to be a potential source of impact for protected areas or threatened ecological communities.

How will Santos manage impacts?

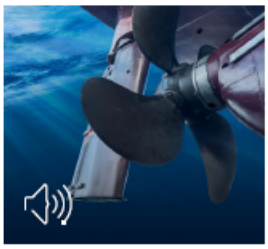
The FPSO power generation system reduces emissions to the atmosphere by primarily using production gas as fuel. Combined-cycle gas turbines (CCGT) will also be used to improve fuel use efficiency. CCGT are highly efficient and best practice resulting in reduced pollution. The steam turbines use low NOx burners, which significantly reduces NOx emissions.

Further FPSO facility design measures to reduce atmospheric emissions include:

- surplus waste gas burned to completely remove methane (minimal flaring)
- vapor recovery instead of releasing to atmosphere
- ozone Depleting Substances (ODS) are not used as refrigerants.

Santos proposes to adopt numerous control measures to manage vessel emissions, including requiring contractor vessels' compliance with MARPOL requirements for low-sulphur fuel and air pollution prevention certifications. ('MARPOL' is a reference to the International Convention for the Prevention of Pollution from Ships).

The control measures to be adopted are designed to be consistent with maritime regulations and petroleum industry standards.



NOISE SOURCES

In OA1 the main FPSO noise sources are intermittent and short-term flaring during initial start-up operations and unplanned process trips/upsets during steady-state operations. FPSO power and processing equipment will also generate a continuous source of noise. Other noise sources include:

- support vessels;
- helicopters;
- ROVs, acoustic positioning systems and survey equipment
- operation of subsea infrastructure such as wellheads, flowlines and valves.

In OA2 the types of noise generated by these activities can be categorised as either: impulsive (brief, high intensity) e.g. from operation of survey equipment or, non-impulsive noises (ongoing or continuous) e.g., from vessel engines. Noise emitted from activities in OA1 and OA2 are expected to be at low levels, similar to ambient noise levels in the region.

What impacts are expected?

Santos has engaged subject matter experts to conduct the underwater noise assessments for the activities.

Noise emissions from the FPSO, helicopters, survey equipment and vessels may result in marine mammals (e.g. whales) changing their behaviour (e.g. avoidance or diving to avoid noise). This change in behaviour is expected to be localised (within the area of the noise source in OA1 or OA2) and short term (e.g. periods of minimal flaring in OA1). Noise emissions are not expected to cause long term population impacts (e.g. distribution & abundance).

Low level noise can occur from the operation of the pipeline which will dissipate to background levels within 100m of the pipeline. The GEP route (OA2) crosses two small areas of important turtle habitat and impacts to marine turtles in these areas are expected to be limited to behavioural (e.g. avoidance). Impacts to marine turtles from any infrequent survey equipment use is also expected to result only in temporary and localised behavioural changes, given the low level of noise. Vessels will be moving when undertaking surveys and it is highly unlikely any individual would remain near the noise source for any length of time.

Other protected species of marine reptiles (such as sea snakes), seabirds and fish (such as sharks and sawfish) are not expected to be affected at the population level, given their wide distribution (in the case of sea snakes and sharks), distances to seabird breeding colonies, and preference for shallow coastal habitats (sawfish).

Noise emissions could result in behavioural changes in marine fauna within the Oceanic Shoals Marine Park, as OA2 is located in this area **(Figure 4)**.

Noise is not expected to impact socio-economic receptors, including commercial fisheries, due to low noise levels and low socio-economic activity levels within and near the Operation Areas. Behavioural impacts to fish of potential commercial value would be restricted to within hundreds of metres of the noise source, a very small portion of the total available fishing area.

How will Santos manage impacts?

A source of significant underwater noise has been eliminated from the FPSO facility by designing the facility to be permanently moored without the use of a propulsion system.

Vapour recovery on the flare system reduces the frequency at which flaring occurs during operations and therefore reduces the amount of noise emitted during routine operations.

Activity vessels are required to comply with Santos's Protected Marine Fauna Interaction and Sighting Procedure to comply with regulatory requirements for managing fauna noise impacts. Marine assurance standards and planned vessel maintenance will minimise noise generated from vessels by ensuring contracted vessels are operated, maintained and crewed in accordance with industry standards and regulatory requirements.

LIGHT SOURCES

Artificial lighting is required for operational and navigational safety during the activity. Light sources include safety and navigational lighting on vessels, campaign-specific lighting when needed, such as deploying or retrieving equipment or when ROVs are working underwater, and intermittent flaring from the FPSO.

What impacts are expected?

Permanent safety and navigational lighting on the FPSO and intermittent flaring will result in light emissions in OA1. Light emissions are not expected to have an effect on adult turtles or hatchlings, given the offshore location and distance from the nearest turtles nesting beaches.

OA2 overlaps BIAs for marine turtles surrounding the Tiwi Islands. The closest turtle nesting beach is Cape Fourcroy, on the Tiwi Islands. Lighting emissions in OA2 will only occur from infrequent vessel inspection and maintenance activities in this location, which are of short durations. Vessel activities in OA2 are expected to produce similar light levels to other marine vessel activities in the region.

Impact to nesting females or hatchlings is not expected to occur. There is potential for hatchlings at sea to be attracted to light emissions if they are carried by currents to within approximately 3.3 km of an IMMR vessel. In the unlikely event hatchlings are attracted to vessel light, the proportion impacted is considered negligible when compared to the total number of hatchlings emerging from Bathurst Island beaches across the year. It will also be a temporary phenomenon, occurring during hours of darkness only. After sunrise, hatchling dispersal behaviour will resume. Displacement of individuals from critical habitat areas is therefore not a credible outcome.

Fish, sharks and birds have been shown to be attracted to artificial light sources, leading to a short-term localised increase in fauna activity, however large-scale changes in species abundance or distribution are unlikely.

How will Santos manage impacts?

The FPSO facility is equipped with a centralised battery system providing an uninterrupted power supply to the FPSO LED lighting which also allows for dimming and controlling in individual areas. Lighting is to be limited to that required for safe operations and navigation and will be compliant with maritime regulations (similar to other commercial vessels operating in the region).

SEABED DISTURBANCE

Seabed disturbance will occur because of:

- physical presence of installed subsea infrastructure and GEP on the seabed
- temporary placement and set down of equipment and subsea infrastructure on the seabed used during IMMR activities

What impacts are expected?

Seabed disturbance resulting from IMMR activities will be confined to the OAs and might result in localised disturbance under the subsea infrastructure and GEP. Seabed disturbance resulting from a subsea repair or replacement will be localised with a potential footprint of approximately 50 m^2 up to 1,600 m^2.

Given the nature and relatively small scale of seabed disturbance, it is not expected to cause a decrease in local population size, area of occupancy of species, loss or disruption of critical habitat, or disruption to the breeding cycle of any protected marine fauna.

Given localised disturbance is restricted to the OAs, which is mostly bare sediment and does not contain any significant habitat features, the consequence level for the physical environment or habitat is negligible. Impacts to the seabed within the Oceanic Shoals Marine Park or overlapping key ecological features (KEFs) (Carbonate bank and terrace system of the Van Diemen Rise KEF and the Shelf break and slope of the Arafura Shelf KEF) are considered to be minor.

While OA1 does not overlap any marine turtle BIAs, the southern end of OA2 traverses internesting buffer habitat critical to survival for flatback and olive ridley turtles, overlaps a portion of the the internesting BIA for flatback turtles, and is adjacent to the internesting BIA for olive ridley turtles. Considering the water depth along the pipeline route in OA2 is greater than the maximum turtle interesting depth of 30 m , it is unlikely the species will be present in significant numbers or for significant periods. Any impact to marine turtles from seabed disturbance or resultant turbidity in both OA1 and OA2 would likely be temporary and negligible, based on the nature and scale of impact.

Seabed disturbance is not expected to impact commercial fisheries, based on the small size of disturbance compared with the total available fishing area.

How will Santos manage impacts?

During IMMR activities Santos' vessels will undertake safe and accurate placement of infrastructure using dynamic positioning to minimise seabed disturbance during placement. Santos will also maintain a comprehensive inventory of all installed equipment to enable recovery of all equipment during decommissioning to limit impacts to the seabed.

INTERACTIONS WITH OTHER MARINE USERS

Other marine users will be displaced from part of OA1 over the life of Barossa operations, and temporarily restricted within parts of OA2 during IMMR. In OA2, the GEP may present a hazard to marine users due to the potential for snagging.

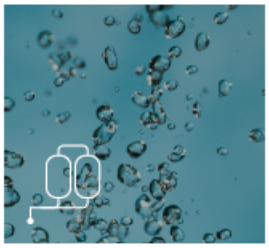
What Impacts are expected?

Other marine users will have restricted access within petroleum safety zones (PSZ). A permanent 500m exclusion PSZ will extend around the outer edge of the Barossa Production Operations wells, the subsea infrastructure and mooring system in OA1. During IMMR activities along the GEP IN OA2, a temporary 500m PSZ will be maintained around vessel operations.

Commercial fishing, shipping, military exercises and other incidental marine traffic in the OAs are expected to be low frequency. The area marine users will be excluded from is small when compared to the large area available for their use.

How will Santos manage Impacts?

Santos will notify and communicate with other marine users using standard maritime notifications (e.g. Notice to Mariners) before, during and at the end of IMMR activities. Infrastructure locations will be marked on nautical charts. These proposed control measures are consistent with maritime regulations and industry practices.



PRODUCED WATER DISCHARGES

Produced water is naturally occurring water that is extracted from the seabed along with hydrocarbons (condensate and gas in the case of the Barossa field). It is separated from the hydrocarbon components during processing and treated before being discharged to the marine environment from a pipe at least 10 m below the sea surface on the FPSO. This produced water consists of naturally occurring formation water (from the body of rock below the hydrocarbon formation), condensed water (water vapour present within the produced hydrocarbons which condenses when brought to the surface) as well as introduced water-soluble chemicals and other contaminants. While produced water treatment is performed before discharge, the effluent may contain residual inorganic (such as chemicals used for production) and organic (such as oil) contaminants.

The produced water treatment system is divided into two stages - removal of hydrocarbons through a filtration system and designed to handle 20,000 barrels per day (over one Olympic-size swimming pool). During operations the produced water discharge will vary from 3,500 to 5,000 barrels per day (bbl/day), or a quarter to a third of an Olympic-size swimming pool, with a peak rate after 11 years estimated up to 16,500 bbl/day (one Olympic-size swimming pool). Best available technology has been selected to remove oil-in-water concentrations to as low as reasonably practicable (ALARP) and the treatment system will operate well below its design capacity over the majority of the field life.

What Impacts are expected?

Water quality may be impacted at the discharge point while the produced water is discharged **(Figure 12)**. Discharge modelling has been undertaken for a conservative maximum discharge rate of 20,000 bbl/day (over one Olympic-size swimming pool). Under normal operating conditions produced water discharge rates will be approximately a quarter (~5,000 bbl/day) of the modelled maximum discharge rate. Modelling results indicated that species protection thresholds for waterborne contaminants is achieved at approximately 6 km from the FPSO. As a result, predicted impacts will be localised and considered minor.

Marine turtles may occur within the produced water mixing zone. It is possible individual turtles may traverse the mixing zone; however significant impacts are not expected to occur, and large numbers of animals are not expected to be exposed. That is because the discharge water depth and discharge location are not within the proximity of internesting turtle habitat, and there is minimal reef habitat in the mixing zone. Given marine turtles are transient through the produced water mixing zone, they will not be exposed to the produced water for enough time for contaminants to accumulate within their body. Behavioural impacts (such as avoidance) may occur to a small proportion (individuals) of a local population close to the produced water discharge.

Like turtles, produced water exposure to plankton, fish, invertebrates and sharks is expected to be brief due to the transient nature of these animals.

Potential impacts to fishery resources are unlikely to result in changes in distribution and abundance of fish species outside the produced water mixing zone.

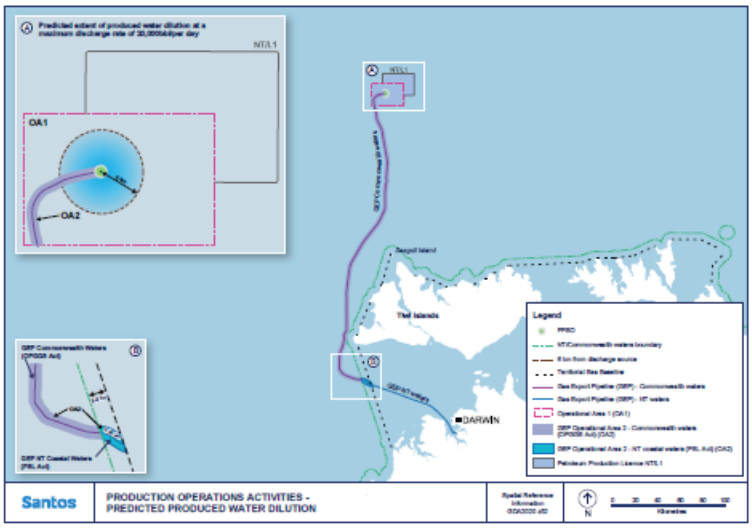


Figure 12: Predicted extent of the produced water dilution at a maximum discharge rate of 20,000 bbl/day.

How will Santos manage impacts?

Activity discharges are to be managed through the application of Santos' Chemical Selection Process, designed so that environmentally acceptable process chemicals (which are likely to be mixed with produced water discharge) are used. Additives have been selected and optimised for biodegradability as well as low aquatic toxicity and bioaccumulation potential.

The produced water discharge will be continuously monitored for oil-in-water content and any reading over the limit of 30 mg/l over any 24-hour period, will be diverted to a dedicated storage tank and returned to the produced water treatment system until suitable for discharge. Strict protocols will be in place for taking regular water samples and perform laboratory testing to ensure the produced water is within acceptable levels before disposing into the marine environment. The Production Operations Environment Plan will include a produced water adaptive management plan that prescribes a water quality monitoring regime which enables the detection of potential impacts of produced water discharge on the marine environment and if remedial actions are necessary to retain the discharge within acceptable limits.

OPERATIONAL DISCHARGES

Operational discharges associated with the activities may cause localised impacts to water quality in the direction of the prevailing current. The environment that may be affected by operational discharges will likely be contained within the OAs. Water quality conditions will return to normal within minutes to hours once discharging stops.

FPSO facility and subsea system discharges

Operational discharges from the FPSO in OA1 will occur each day resulting in localised changes to water quality. Discharges of warm cooling water will include low concentrations of chlorine which break down quickly in the environment and is non-toxic at low concentrations. Minor discharges of water based hydraulic fluid used in the subsea system are classified by the offshore chemical notification scheme as being environmentally acceptable.

Vessel discharges

The types of anticipated discharges in OA1 and OA2 are typical of most offshore commercial vessels and include deck runoff, treated sewage, grey water, machinery cooling water, bilge water (treated via the oily water system), ballast water, macerated food scraps and brine (from water making). These discharges will be small in volume and released into surface waters.

What impacts are expected?

Sensitive receptors that may be impacted include plankton, fish, seabirds, marine turtles and mammals. Impacts to water quality will be localised and temporary occurring only during discharge.

Some fish and oceanic seabirds may be attracted to the FPSO by the discharge of food scraps. However, given the small quantities, intermittent nature of disposal and swift currents, any attraction is likely to be minor and is not anticipated to result in adverse impacts at an ecosystem or population level. Given the controls in place to manage the FPSO discharges in OA1 in accordance with regulatory requirements, impacts to commercial fish species are not predicted.

Operational discharges in OA1 are predicted to quickly dilute and disperse in the offshore environment. Water quality changes will be localised and will occur only when the discharges occur. Given the temporary nature of activities within OA2 (limited to vessel based IMMR) and the relatively deep offshore environment with significant current and tidal action, impacts to water quality will be localised and will occur only for the duration of the discharge.

How will Santos manage impacts?

Vessel discharges are to be managed to acceptable levels as regulated by maritime laws and conventions (e.g. management of sewage treatment systems and oily water systems), such as MARPOL and relevant Marine Orders. Santos also intends to implement management measures including waste management procedures and chemical management and selection procedures.

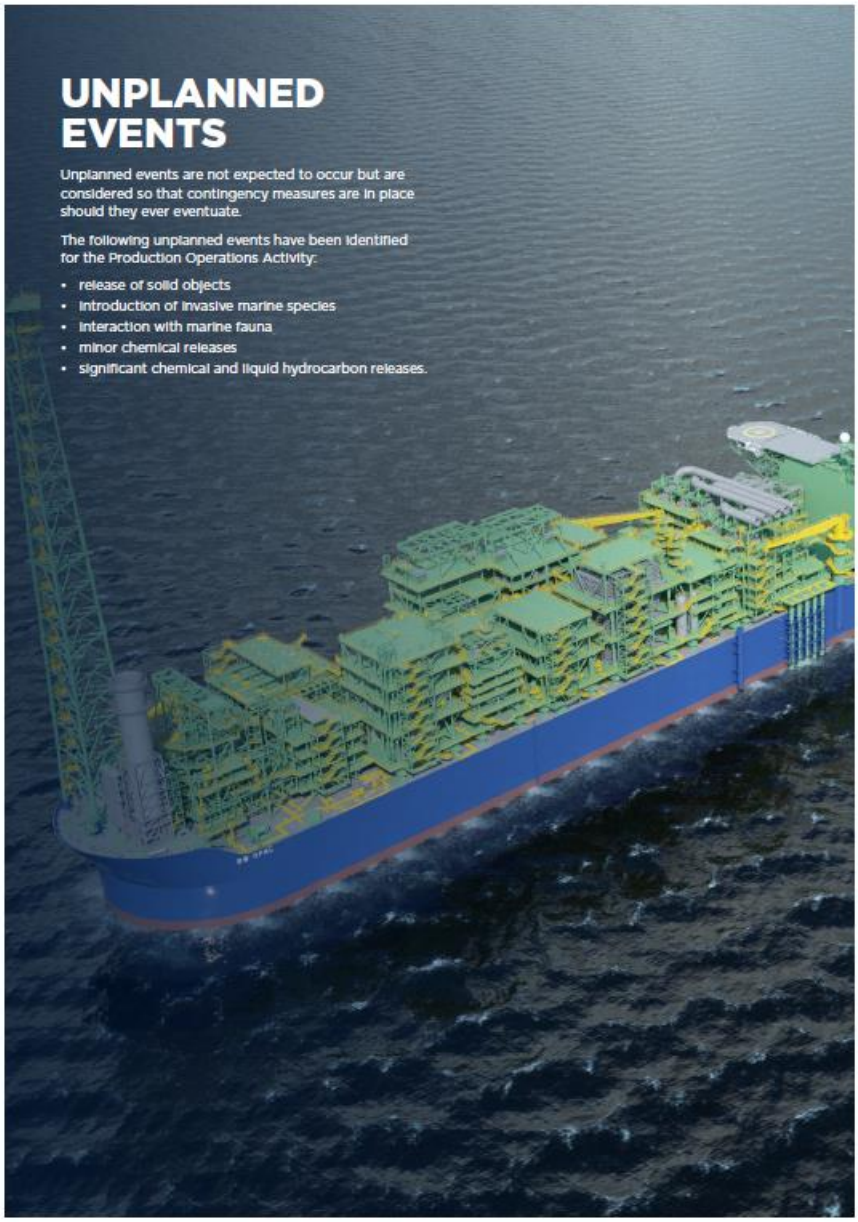
Santos procedures require that all operational chemicals used on the FPSO and chemicals potentially discharged to sea are risk assessed. Santos also implements general chemical management procedures to reduce the risk of accidental discharges.

UNPLANNED EVENTS

Unplanned events are not expected to occur but are considered so that contingency measures are in place should they ever eventuate.

The following unplanned events have been identified for the Production Operations Activity:

- release of solid objects
- introduction of invasive marine species
- interaction with marine fauna
- minor chemical releases
- significant chemical and liquid hydrocarbon releases.



DROPPED OBJECTS

How could dropped objects occur?

There is the potential for objects to be accidentally released to the marine environment from support vessels during steady state operations in OA1 or during IMMR activities in OA2. Dropped objects may be non-hazardous solid waste (e.g. paper, packaging materials), hazardous waste (e.g. batteries, aerosol cans etc.). A dropped object event could result from overfilling waste containers, unsecured objects during lifting operations or failed sea fastening.

What environmental impacts could occur?

Objects that float could potentially move beyond the OAs. All non-buoyant objects are expected to sink to the seabed and remain within the OAs. This could cause localised and short-term damage to the seabed.

Marine debris (including plastics and microplastics) is listed as a potential threat to several marine fauna species. Depending on debris size of the dropped object, there is potential for entanglement or ingestion by marine fauna, including turtles and vertebrate wildlife, which could result in injury or death. However, given the limited quantities that might be dropped, impacts to fauna would be limited.

Considering the low frequency of such an unplanned event, even in a worst-case release of a solid object, impacts to fauna would be very localised and limited to individuals, and are not expected to result in impacts to the local population.

How will Santos manage the risk?

Santos has numerous control measures to prevent dropped objects, and to mitigate consequence of impacts of an event does occur. These measures include:

- safety standards and procedures to reduce the likelihood of tools and other equipment being dropped during lifting operations
- waste management procedures to reduce the likelihood of windblown waste entering the marine environment
- implementation of chemical selection processes and the International Maritime Dangerous Goods Code to limit the environmental impact of chemicals if lost overboard
- dropped objects, regardless of size, must be reported and attempts made to recover the object according to safety and environment criteria.

These control measures are designed to comply with maritime legislation. In addition, these control measures are consistent with applicable actions described in the relevant fauna recovery plans and conservation advice, reducing the residual risk to low.

INVASIVE MARINE SPECIES

What are IMS?

Invasive marine species (IMS) are marine flora and fauna that have been introduced into a region that is beyond their natural range but have the ability to survive, and possibly thrive. The majority of climatically compatible IMS to northern Australia are found in south-east Asian countries.

How might IMS be introduced?

Some IMS pose a significant risk to environmental values, biodiversity, ecosystem health, human health, fisheries, aquaculture, shipping, ports and tourism. The risk of introducing IMS is common for all maritime activities. The introduction of IMS may occur due to the following:

- biofouling on FPSO and vessels, external/internal niches (such as sea chests and sea water systems) and routinely submerged equipment
- discharge of FPSO ballast water when the FPSO first transits from the international shipyard to the Barossa field
- discharge of high-risk ballast water where vessels have transited from international destinations.

What environmental impacts could occur?

If successfully established, IMS can:

- outcompete native species for food or space
- prey on native species
- impact fisheries or aquaculture
- impact on human health through released toxins
- reduce coastal aesthetics
- cause damage to marine and industrial equipment and infrastructure.

The above impacts can result in flow-on detrimental effects to marine parks, tourism and recreation.

The ability of invasive marine species to colonise a habitat depends on several environmental conditions. For example, highly disturbed environments (such as marinas) or shallower areas are more susceptible to colonisation than open-water environments (OA2 is 33 metres deep at its shallowest point and not considered sufficiently shallow to be conducive for IMS colonisation). OA1 provides an unfavourable habitat for IMS due to water depth (over 200 metres) and the long distance to the coast. These conditions limit light availability and have low habitat biodiversity with sparse epibiota, therefore, it is highly unlikely that IMS would be able to survive or colonise in OA1.

How will Santos manage the risk?

The pathways and vessel mitigation measures for IMS introduction are well established. The offtake tankers used for condensate export and specialised IMMR vessel(s) (if required) are sourced internationally, whilst the regular support vessels to and from the FPSO are sourced domestically. Vessels contracted to Santos, and vessel ballast, are to be managed according to control measures that comply with maritime regulations, industry practices, and the Biosecurity Act 2015. The FPSO and support vessels will also have ballast water management, vessel biofouling management and anti-fouling systems in place. With these control measures adopted, the residual risk of introducing IMS is assessed as low and reduced to as low as reasonably practicable.

The initial mobilisation of the FPSO out of Singapore to the Barossa gas field will be managed under a quarantine management plan including arrangements for invasive species, biofouling and ballast water exchange.

INTERACTION WITH MARINE FAUNA

How could interactions with marine fauna occur?

During the Production Operations Activity, approximately two vessels per week will travel between the Barossa field and Darwin servicing the FPSO, which is a minor increase relative to the existing levels of regional marine vessel traffic.

The highest potential for interactions with marine fauna, including potential accidental strike or collision resulting in injury or mortality, will be during IMMR vessel operations in OA2 where there is higher likelihood of marine fauna presence. In OA1, where marine fauna presence is of a lower likelihood, the FPSO will remain stationary once on location in position and support vessel movements within the operational area are limited and slow-moving, hence marine fauna interactions are not anticipated and are expected to be minimal.

Marine fauna such as marine mammals (such as whales and dolphins), marine turtles and whale sharks that swim at or near the water surface are most at risk from vessel collisions. Some of these species are threatened, and some marine fauna may have cultural significance.

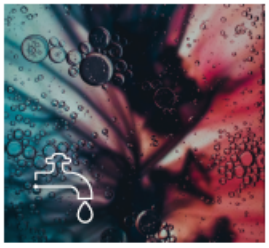
Marine mammals (such as whales and dolphins) and whale sharks may transit through the OAs but are expected to be in low numbers in OA1 **(Figure 10)**. Considering the relatively slow vessel speeds, short duration of activities, and the mobility of these species, it is unlikely that activity vessels will adversely interact with any individuals.

How will Santos manage the risk?

The likelihood of marine fauna interaction resulting in injury or death is considered unlikely given the proposed implementation of the following control measures:

- Santos' Protected Marine Fauna Interaction and Sighting Procedure, which aligns with the *Environment Protection and Biodiversity Conservation Regulations 2000*. This procedure limits marine fauna approach distances and speed, allowing marine fauna to be avoided or to move away.
- Operational area vessel speed restrictions

The control measures are designed to align with management actions outlined in government-published fauna recovery plans and conservation advice. The risk of interactions with marine fauna is assessed as very low and reduced to as low as reasonably practicable and acceptable levels. The risk is no higher than for any other regional maritime activity.



NON-HYDROCARBON LIQUID RELEASE

How could non-hydrocarbon liquids be released?

Non-hydrocarbon liquids including miscellaneous chemicals for use during the Production Operations Activity and waste by-products are transferred to and from supply vessels to the FPSO in OA1. Examples of non-hydrocarbon liquids include chemicals used in the production process, domestic products used in the living quarters for cleaning and general maintenance products such as greases and paints.

An accidental release of non-hydrocarbon liquids into the marine environment has the potential to occur from:

- transferring, storing or using bulk products (e.g. production chemicals)
- mechanical failure of equipment, such as a tank or pipework failure
- handling and storage spills and leaks due to insufficient fastening or inadequate bunding
- floating hose failure or rupture, coupling failure or tank overfilling
- lifting and incorrect handling (e.g. dropped objects damaging storage containers)
- firefighting foam during an emergency response incident.

What environmental impacts could occur?

A release of non-hydrocarbon liquids may result in impacts to water quality and any sensitive environmental receptors.

The maximum volume of non-hydrocarbon liquids that could be released during routine operations is likely to be small and limited to the volume of individual storage containers. Individual containers stored on the FPSO include process chemicals and lube oil storage tanks (approximately 4.5 m^3).

If the spill is not contained on deck, a release to the marine environment would likely disperse rapidly, with one in 1,000 dilution usually occurring within 30 minutes.

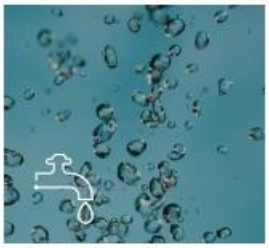
The environment that may be affected for non-hydrocarbon liquids releases resulting in a decrease in water quality is likely to be restricted to the immediate vicinity of the FPSO or support vessel and contained within the OAs.

Potential receptors include the physical environment (e.g. water and sediment quality, benthic habitats), threatened, migratory or local fauna (e.g. marine mammals, marine reptiles, sharks and rays, other fish, and birds) and socioeconomic features of the environment (including cultural features).

How will Santos manage the risk?

Santos has a suite of procedures to manage the selection, storage, handling and clean-up of non-hydrocarbon liquids releases. Vessels also have spill response plans. All chemicals are reviewed and accepted for use, and any chemical that might be discharged to the environment is assessed under the Santos chemical selection procedure to ensure environmental acceptability. These procedures will assist to minimise the likelihood of non-hydrocarbon liquid spills, and subsequent environmental consequences should they occur.

The control measures proposed to be adopted are designed to be consistent with maritime and petroleum industry standards and appropriate to manage the residual risks to as low as reasonably practicable and acceptable levels.



MINOR LIQUID HYRDOCARBON RELEASES

How could a minor liquid hydrocarbon release occur?

Minor releases refer to relatively small volumes of hydrocarbons from storage containers, transfer equipment and pipework on the FPSO or support vessels, that enters the marine environment. Typically, such spills occur as a result of human error during tank filling or storage container transfers. Most of these types of release occur within bunded deck areas, and are less than 1m3, however it remains possible for such spills to enter the marine environment.

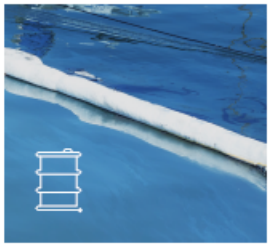
What environmental impacts could occur?

A localised decrease in water quality may occur, however due to the relatively small volumes impacts are expected to be short term as the hydrocarbon would rapidly dilute and dissolve into the ocean. Marine fauna may transit through the OAs and come into contact with the release. However it is expected impacts to fauna would be short term and result in behavioural changes, as they move away from the area where the spill occurred.

How will Santos manage the risk?

A suite of procedures will be in place to manage the handling and transfer of hydrocarbons on both support vessels and the FPSO. Response procedures such as stopping the source of the of the release and cleaning it up on deck to prevent it entering the ocean will be in place to manage minor releases should they occur.

The control measures proposed to be adopted are designed to be consistent with maritime and petroleum industry standards and appropriate to manage the residual risks to as low as reasonably practicable and acceptable levels.



LARGER HYDROCARBON RELEASES

Larger volumes of hydrocarbons may accidentally be released during production operations. These include accidental spills from support vessels or the FPSO, as well as from subsea equipment (e.g. wells and flowlines). A range of different types of hydrocarbons that may be accidentally released are discussed below.

MARINE DIESEL OIL OR MARINE GAS OIL

How could a marine diesel or gas release occur?

Marine vessel fuels (marine diesel oil or marine gas oil) could be released to the environment if there is a collision event between two vessels. An accidental collision could occur due to factors such as human error, poor navigation, vessel equipment failure or poor weather. If a marine vessel collided with the FPSO, the vessel or FPSO hull may rupture and release fuel to the marine environment.

If a vessel fuel tank is ruptured a fuel called marine diesel could be released. The FPSO uses a lighter fuel for some of its power requirements called marine gas oil which could be released if a fuel tank is ruptured.

Although the risk is higher in OA1 than OA2, it should be noted that it is considered unlikely that a vessel collision would occur that would result in releasing fuel to the environment. A sequence of events would need to occur for a vessel collision to escalate to a large volume of fuel released to the environment, including:

1. the vessel must be involved in a collision
2. collision must occur with enough force to rupture a fuel tank
3. rupture must be of such a nature that the fuel can be released into the environment.

What environmental impacts could occur?

Marine diesel oil and marine gas oil fuels are typically characterised by a high percentage of volatile components (typically >95%), which will evaporate when on the sea surface over several days. A small fraction (typically <5%) of persistent hydrocarbons remains, which will not evaporate, and will decay over time. The heavier components of the fuels tend to become entrained in the upper water column as droplets in the presence of waves but can refloat to the surface if wave energies abate. Both marine diesel oil and marine gas oil fuels are expected to weather quickly through evaporation and dispersion and are unlikely to persist in the environment for a significant period.

Such releases will cause a decline in water quality and may cause chemical (e.g. toxicity) and physical impacts to marine species (e.g. ingestion of hydrocarbons). The severity of the impact depends on the magnitude of the release (i.e. extent, duration) and sensitivity of the receptor, however, may include impacts to the physical environment, threatened or migratory marine fauna, protected and significant areas and socioeconomic receptors (fisheries, tourism, recreation, cultural features and other oil and gas operators).

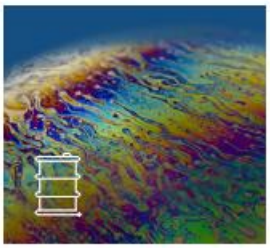
How will Santos manage the risk?

The FPSO in OA1 is fitted with a collision avoidance radar so it appears on the display of the triggering radars, providing range, bearing and identification information, alerting vessels to its presence. Santos has also designed the FPSO hull to be double-sided and double-bottomed, which provides two physical barriers between the fuel tanks and the marine environment for side impact, reducing the likelihood of fuel release in the event of a collision.

A petroleum safety zone (PSZ) will be established alerting other marine users to the presence of the FPSO in OA1 which includes precautions for marine activities (e.g. reduced speed limits, communication protocols and automatic identification systems to aid in their detection at sea). Third party vessels are not permitted to enter a PSZ, thereby reducing the likelihood of other interactions with the FPSO and support vessels. In OA2 during IMMR activities a similar exclusion zone will also be established restricting access to other marine users.

The Production Operations Activity facilities in OA1 & OA2 will be included on navigational charts making other vessels aware of the presence of Barossa facilities. Santos will also provide maritime notifications to relevant departments to ensure marine users are informed of vessel movements.

Santos has also developed response plans which will detail the actions to take to control the release and manage the cleanup activities in the event of a release.



CONDENSATE

How could a condensate release occur?

Barossa condensate has the potential to be released to the marine environment under several scenarios. Of those scenarios, three worst-case events are summarised below.

1. In the event of a vessel collision (e.g. those described above for marine diesel oil or marine gas oil) which ruptures the FPSO condensate storage tank.
2. In the event of an impact to, or failure of the subsea hydrocarbon containing equipment.
3. In the event of an impact to, or failure of multiple production well barriers.

Other scenarios exist that may result in other smaller condensate releases to the marine environment. All scenarios are very low probability of occurring.

What environmental impacts could occur?

Condensate, being a lighter hydrocarbon behaves in a similar fashion to marine diesel when released to the marine environment. The fate of the condensate will depend greatly on the proportion on the surface, which will be transported by prevailing currents and wind and can evaporate readily. Condensate that entrains or dissolves in the water column will be transported by prevailing current and, hence, will follow a different path.

As with the marine diesel oil, the heavier components contained in the condensate will have a strong tendency to physically entrain into the upper water column but can re-float to the surface if these energies abate.

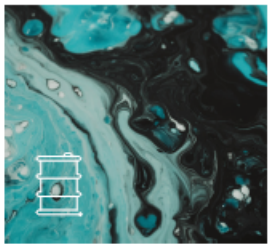
Such releases will impact the marine environment much in the same way as marine diesel oil and marine gas oils, described above. However, in the event of a subsea condensate release, more entrainment of hydrocarbons in the water column could occur, rather than being present on the sea-surface.

How will Santos manage the risk?

In the unlikely event a vessel collision occurs which ruptures an FPSO condensate tank, Santos will manage the risk in accordance with the accepted Production Operations Oil Pollution Emergency Plan.

In the unlikely event of a subsea release in the OA1 area from subsea flowlines or wells, Santos has a range of operating procedures and plans to ensure that the integrity of the subsea infrastructure is maintained and well barriers are in place. Santos will submit a well operations management plan (WOMP) to NOPSEMA that will contain the full details of systems in place to ensure well design and integrity is managed for the well lifecycle. All production wells must be in compliance with the NOPSEMA accepted WOMP at all times. Hydrocarbon containing subsea infrastructure is also within a petroleum safety zone (PSZ), which third party vessels are not permitted to enter, subsequently reducing any interaction with this infrastructure.

Santos is developing response plans which will detail the actions to take to control a release and manage cleanup activities in the unlikely event of a release.



HEAVY FUEL OIL

How could a heavy fuel oil release occur?

Heavy fuel oil is only used as fuel for offtake tankers who enter the Barossa field periodically (approximately once every three months) to load condensate from the FPSO. The only scenario that could lead to a release of heavy fuel oil is in the unlikely event of a vessel collision (described above for marine diesel oil or marine gas oil), where the offtake tanker hull and heavy fuel oil tank is ruptured.

What environmental impacts could occur?

Heavy fuel oil is heavier and more persistent than marine diesel oils, marine gas oils and condensates. The fuel is often characterised by a very high density and a high dynamic viscosity, which does not evaporate as quickly as other lighter fuels. As the fuel has a high residual component, a portion is expected to become semi-solid and can persist in the marine environment for extended periods.

Such releases will cause a decline in water quality and may cause chemical (e.g. toxicity) and physical impacts to marine species (e.g. ingestion of hydrocarbons, physical coating). The severity of the impact depends on the magnitude of the release (i.e. extent, duration) and sensitivity of the receptor, however, may include those to the physical environment, threatened or migratory marine fauna, protected and significant areas and socioeconomic receptors (fisheries, tourism, recreation, cultural features and other oil and gas operators). Given the persistent and sticky nature of heavy fuel oil, there is a higher risk of coating of the physical environment (e.g. shorelines) and marine fauna compared to the lighter fuels such as marine diesel oil and marine gas oil.

How will Santos manage the risk?

Offtake tankers are third-party operated vessels. They are vetted following Santos' marine assurance procedure and international guidelines before acceptance for condensate offtake operations at the Barossa field. The use of tankers with double hulls and fully segregated ballast tanks is not only a requirement of the vetting process; it is a MARPOL requirement that is monitored by way of regular statutory inspections.

All offtake loading events are planned in advance, occur within a petroleum safety zone (PSZ), and are performed under strict operational procedures.

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All offtake loading events are planned in advance, occur within a petroleum safety zone (PSZ), and are performed under strict operational procedures.

CONTINGENCY SPILL RESPONSE OPERATIONS

In the event of a hydrocarbon spill, response strategies will be implemented to reduce environmental impacts to as low as reasonably practicable. The selection of strategies will be undertaken using the Net Environmental Benefits Assessment (NEBA) process. Spill response will be under the direction of the relevant control agency, as defined in the Production Operations Oil Pollution Emergency Plan (OPEP), which may be Santos, another agency or both. In all instances, Santos will undertake a 'first-strike' spill response and will act as the control agency until the designated control agency assumes control. The response strategies considered to be appropriate for the worst-case spill scenarios identified for the activity are detailed in the OPEP and comprise:

- source control (blowout preventer, relief well)
- monitor and evaluate
- mechanical dispersion
- shoreline protection and clean up
- oiled wildlife response
- scientific monitoring
- waste management.

Response strategies are intended to reduce the environmental consequences of a hydrocarbon spill, but poorly planned and coordinated response activities can result in a lack of, or inadequate, information being available, upon which poor decisions can be made, exacerbating or causing further environmental harm.

What impacts are expected?

Spill response operations may be required at any location within the EMBA. Potential environmental impacts include:

- Noise and light emissions – generated by response vessels and equipment which may impact marine fauna, such as fish (including commercial species), marine reptiles and marine mammals.
- Atmospheric emissions – generated from response equipment and vessels are expected to be localised and are not considered to create emissions on a scale where noticeable impacts would be predicted.
- Operational discharges and waste - generated from response equipment and vessels are expected to be consistent with those of normal commercial vessel operations and may create a localised and temporary reduction in marine water quality. Cleaning of hydrocarbon-contaminated equipment, vehicles and vessels has the potential to spread hydrocarbons from contaminated areas to areas not impacted by a spill. Sewage and other waste will be generated from offshore activities at temporary staging/mooring areas, which may include toilet and washing facilities. These wastes have the potential to impact water quality, impact habitats, and reduce the aesthetic value of the environment, which may be within protected areas.
- Physical presence and disturbance - operating vessels during spill response operations has the potential to disturb the physical environment and marine habitats and fauna (e.g. vessel strike, behavioural changes) or cause disruption to other marine users, coastal areas, townships and commercial fishing.

How will Santos manage the risk?

Santos will rely primarily on the implementation of the Production Operations OPEP to manage the potential impacts associated with a spill response event. Other control measures that would be implemented include:

- procedure for interacting with marine fauna
- chemical selection process
- minimum lighting to meet maritime safety and navigation requirements
- air pollution prevention certification
- sewage and oily water treatment systems on vessels
- notify agreed stakeholders.

The implementation of spill response activities to reduce the potential impacts from a spill are required by legislation. The spill response options selected will be demonstrated to show a net environmental benefit, are standard industry practice and are consistent with relevant standards and guidelines, including the National Plan for Maritime Environmental Emergencies. The controls proposed are intended to reduce the consequences of the potential impacts to minor and as low as reasonably practicable and an acceptable level.

SUMMARY OF SANTOS' RISK MANAGEMENT STRATEGY

Santos has a management system that includes specific measures, to be used for the duration of the Production Operations Activity, which seek to confirm that:

- environmental impacts and risks continue to be identified for the duration of the activity and are reduced to as low as reasonably practicable and acceptable levels
- control measures are effective in reducing environmental impacts and risks to as low as reasonably practicable and acceptable levels
- environmental performance outcomes and standards set out in the EP and OEMP are being met
- there will be ongoing appropriate consultation with relevant authorities and other relevant interested persons or organisations
- the roles, accountabilities and responsibilities are defined and understood
- workforce training is completed and competencies assured
- emergency preparedness and response arrangements are in place
- incident reporting, investigation and follow-up is monitored
- audits, inspections, reporting and notifications and document management are appropriately undertaken.

APPROVALS PROCESS

Production Operations Activities detailed in this booklet require a number of regulatory approvals. Primary environmental approvals required for Production Operations Activities are outlined below:

- An Offshore Project Proposal (the Barossa Offshore Project Proposal (OPP)) was developed for the Commonwealth waters component the Barossa Project and was accepted by NOPSEMA in March 2018. The Barossa OPP, at the time of submission, excluded approximately 23 km of GEP in Commonwealth waters which is subject to a separate EPBC Act approval process (refer below).
- A referral under the EPBC Act, covering the installation, operation and decommissioning of the remaining approximately 23 km of GEP in Commonwealth waters and the 100 km section of GEP in NT waters (inclusive of the 8.26 km in NT coastal waters) was submitted to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for assessment. The activity (referred to as the Darwin Pipeline Duplication Project) was determined to be a 'controlled action' under the EPBC Act and is currently being assessed on preliminary documentation.
- A referral under the *NT Environment Protection Act 2019* (EP Act) for the construction, operation and decommissioning of the 100 km section of GEP in NT waters (part of the Darwin Pipeline Duplication Project) was submitted to the NT Environment Protection Authority (EPA) and was subsequently assessed by way of Supplementary Environmental Report. On 22 December 2023, the NT Minister for Environment, Climate Change and Water Security approved the action the subject of the referral, on the recommendation of the NT EPA.

In addition to the primary environmental approvals outlined above, activity-specific Environmental Plans (EPs) meeting the requirements of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (Cth) (OPGGS Environment Regulations) are required. For Production Operations activities, the OPGGS Environment Regulations apply to the activities within OA1 in Commonwealth waters and OA2, spanning both Commonwealth waters (285 km) and coastal waters of the NT (8.26 km).

The OPGGS Environment Regulations set out that an EP must (among other things):

- comprehensively describe the activity to be carried out under the EP
- describe the environment that may be affected by the activity, including the values and sensitivities of that environment
- detail and evaluate the environmental impacts and risks for the relevant activity
- demonstrate that the impacts and risks of the activity will be reduced to as low as reasonably practicable and an acceptable level (and detail the control measures to be used to achieve this)
- demonstrate that Santos has consulted, in accordance with regulatory requirements, with each relevant person, including those whose functions, interests or activities may be affected by the activities to be carried out under the EP
- demonstrate that the measures (if any) that Santos has adopted, or proposes to adopt, because of the consultations are appropriate

Santos is currently preparing the Production Operations EP for submission to NOPSEMA, covering Commonwealth waters Production Operations activities in OA1 and OA2.

Santos is also preparing an Operations Environmental Management Plan (OEMP) to cover the operation of the GEP in NT waters for submission to DITT. The OEMP will also cover the operation of the 8.26km GEP in NT coastal waters, under the PSL Act and OPGGS Environment Regulations and operation of the remaining ~92km GEP covered under the Energy Pipelines Act.

In order to meet its proposed schedule for the Barossa Gas Project, Santos is aiming to submit the Productions Operation EP to NOPSEMA and the OEMP to DITT in 2024 and, subject to regulatory acceptance, commence activities in 2025. The timeline for consultation has been developed by Santos to meet this objective, while still providing a reasonable period for meaningful consultation with relevant persons, having regard to Santos's regulatory obligations and to feedback from relevant persons.

SEEKING INFORMATION AND WHAT'S NEXT

Santos is continuing its Barossa Gas Project consultation efforts to further learn, understand and assess values and sensitivities of the environment that may be affected by our proposed activities, and potential environmental impacts and risks. There may be information Santos is not yet aware of but needs to properly understand to assess potential activity impacts and risks. Consultation may inform this. It may also inform what control measures are to be proposed to reduce environmental impacts and risks to as low as reasonably practicable and to an acceptable level.

Santos is consulting on both the Production Operations EP (Commonwealth waters) and OEMP (NT waters) at the same time.

Scan this QR Code for more information on Barossa Production Operations Activity:

YOUR INPUT IS IMPORTANT TO SANTOS:

In preparing an EP for submission to NOPSEMA, a titleholder must consult with each 'relevant person', including relevant Commonwealth, State and Northern Territory Departments or agencies and persons (or organisations) whose functions, interests or activities may be affected by the activity proposed to be carried out under an EP.

Relevant persons being consulted on EPs under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023* (Cth) (OPGGS Environment Regulations) should note that they:

- are entitled to be given sufficient information to allow them to make an informed assessment of the possible consequences of the activity on their functions, interests or activities;
- are entitled to be allowed a reasonable period for the consultation; and
- may request particular information provided in consultation not be published.

If you request particular information not to be published, Santos will respect and abide by your request. Any information not to be published will be provided to NOPSEMA in a confidential report, separate from the published EP.

Your input is important to Santos:

- so that we can understand the environmental values in the OAs and the environment that may be affected, the environmental impacts and risks associated with the activity, to inform development of the Productions Operations EP (Commonwealth waters) and OEMP (NT waters);
- to inform how consultation processes may need to be adapted for different relevant persons; and
- to ensure that we provide information to relevant persons in an appropriate and accessible manner.

If you think you may be a relevant person for the purposes of one of Santos' proposed activities, please contact Santos on: **1800 267 600** or email **offshore.consultation@santos.com** to seek to be included in consultations and to provide feedback on how you would like to be consulted (if a relevant person).

This can also be done using the form available by scanning the QR Code below:

Visit **www.santos.com/barossa** for more information on the Barossa Gas Project.

Updated email – additional risk

This email, or the content it contains, was sent to relevant entities following the identification of an additional risk.

Since our email to you of 11 March 2024 regarding the consultation Santos is undertaking for the Barossa Gas Project in relation to the proposed Production Operations Environment Plan (EP) and the Gas Export Pipeline Operations Environment Management Plan (OEMP), we advise that the Production Operations information booklet and Gas Export Pipeline Operation factsheet have been updated and that we have extended the consultation period until **21 May 2024.**

In providing this extension of time, we draw your attention to the updated information in the Production Operations information booklet and Gas Export Pipeline Operation factsheet. The information booklet and factsheet have each been updated to account for an additional risk associated with the proposed activity, namely a gas release in the unlikely event of an unplanned pipeline loss of containment. Here is a link to the booklet and a link to the factsheet. This risk, and the measures we propose to manage it, are summarised on page 31 of the updated information booklet and page 6 of the updated factsheet.

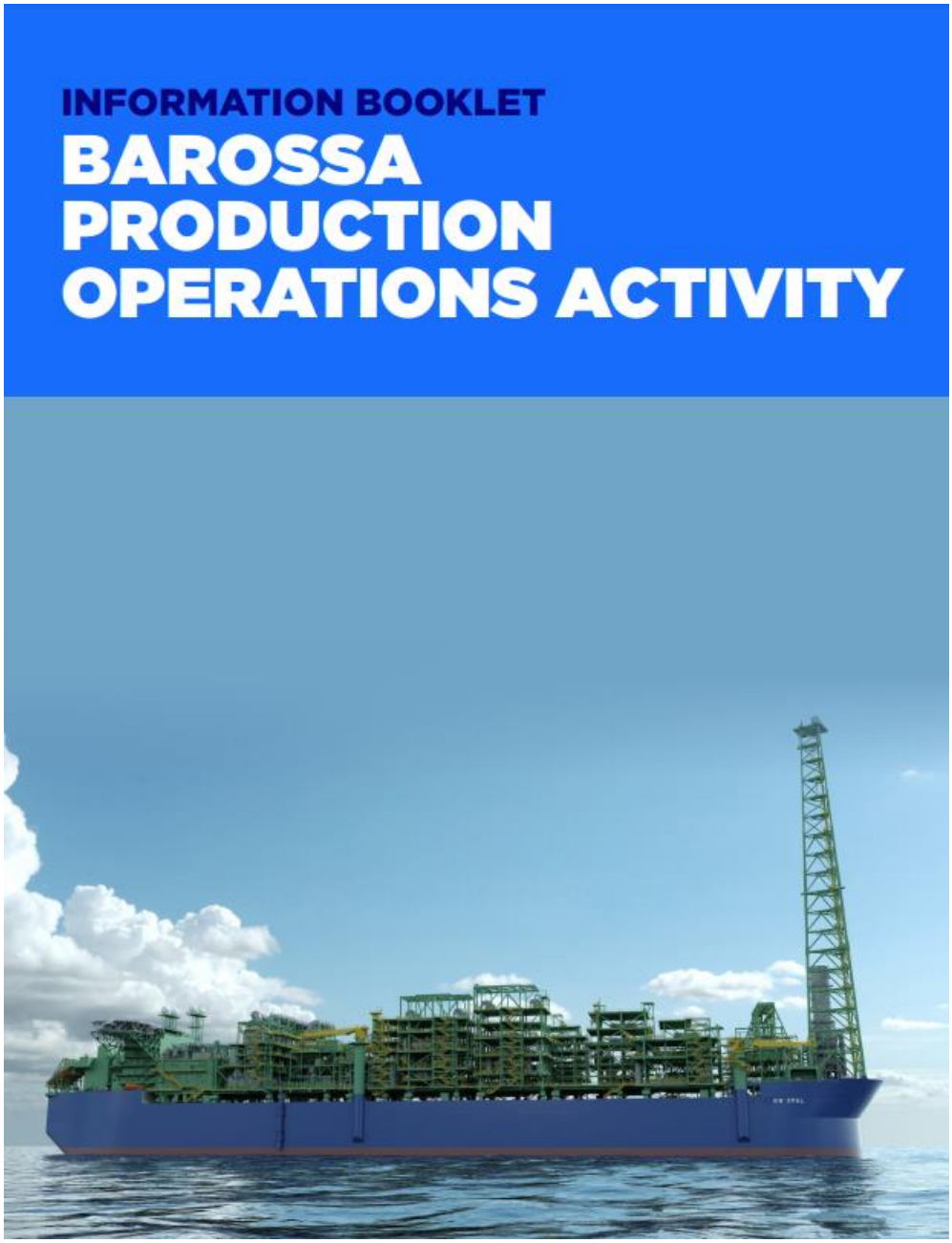
If you wish to provide any further input in light of this update, please call 1800 267 600 or email offshore.consultation@santos.com by the revised consultation closure date of **21 May 2024**. If we do not receive your input by this date, we infer that this means that you do not want Santos to consult with you further on the Productions Operations EP and OEMP.

If and when you provide your input, please let us know if you request particular information you provide during consultation not be published. If you make this request, the information will not be published as part of the plan, in accordance with relevant legislation. Sensitive information we need to give to the regulator to assess our plan will be provided in a separate report, rather than in the published plan. Santos will handle your information in accordance with our *Barossa Gas Project Consultation Privacy Policy.*

Regards,

Santos Offshore Consultation Team

Production operations information booklet – updated version for additional risk



INTRODUCTION

The activities described in this booklet relate to the extraction, processing, and distribution of gas and condensate from the Barossa Field.

The Barossa Development facilities used in these activities consist of a Floating Production Storage and Offloading (FPSO) facility, subsea production wells, supporting in-field subsea infrastructure **(Figure 1)**, a 285 km Gas Export Pipeline (GEP) in Commonwealth waters, and an 8.26 km section of the GEP in Northern Territory (NT) coastal waters; collectively termed in this booklet as "Production Operations Activity".

As part of obtaining authorisation for this activity, Santos is undertaking consultation for the following regulatory approvals:

- The Production Operations Environment Plan (EP) relating to the arrival and operations of the FPSO, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285km section of the GEP located in Commonwealth waters where offshore petroleum activities are regulated under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth)* (OPGGS Act).
- The Operations Environmental Management Plan (OEMP) which includes the:
  - 8.26 km section of the GEP in NT coastal waters covered by the *Petroleum (Submerged Lands Act) 1981 (NT)* (PSL Act); and
  - ~92km section of the GEP inshore of NT waters covered by the *Energy Pipelines Act 1981 (NT)* (Energy Pipelines Act).

The term 'GEP' refers to the Gas Export Pipeline through which Barossa gas will be transported from the Barossa field to Darwin LNG. However, the scope of the GEP covered in this booklet, is limited to the 8.26 km section of the GEP located in NT coastal waters.

The activities, environmental impacts, and risks for the GEP in NT waters (~92km) are broadly similar to those for the GEP in Commonwealth waters (described in this booklet). The activities, environmental impacts and risks specific to the GEP in NT waters, not covered in this booklet, will be provided in a separate factsheet.

The estimated life of the Barossa Development is 25 years, and the Production Operations EP and the OEMP will be reviewed every five years following initial regulator authorisation. This booklet provides a summary of the credible environmental impacts and risks associated with the first five years (also known as Barossa Phase 1) of the Production Operations Activity.

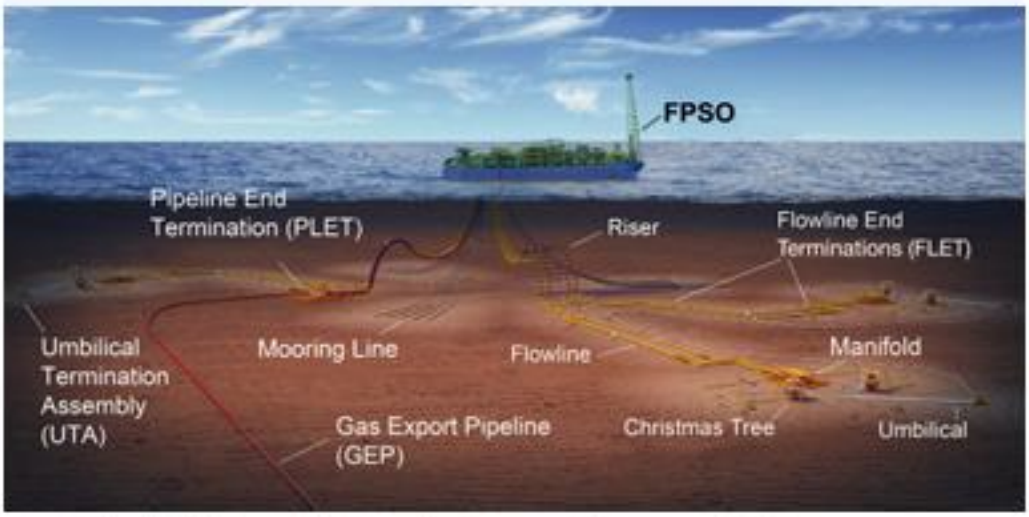


Figure 1: Schematic of the Barossa Field Subsea production system and infrastructure, and FPSO

BAROSSA GAS PROJECT OVERVIEW

The Santos-operated Barossa Gas Project is an offshore gas and condensate project with the purpose of providing a new source of gas to the existing Darwin liquified natural gas (DLNG) facility at Wickham Point in the NT. It is intended that natural gas and condensate would be extracted from the Barossa field, located in Commonwealth waters approximately 285 kilometres offshore north-northwest from Darwin. Initial processing would occur at the FPSO, to separate the natural gas, water and condensate. The dry natural gas would be transported through the GEP for onshore processing at the DLNG facility. The condensate would be transferred from the FPSO facility to purpose-built tankers for international export.

DLNG facility at Wickham Point where Barossa gas will be sent for onshore processing.

ACTIVITY LOCATION

The planned Production Operation Activity is confined to two key operational areas. These areas are simply termed Operational Area 1 (OA1) and Operational Area 2 (OA2) **(Figure 2)**.

OA1: The Barossa field. This is the area in which the FPSO, subsea production system, and supporting subsea infrastructure will be used to process gas and condensate extracted from the Barossa wells. The area is confined to Commonwealth waters, approximately 285 km north-north-west of Darwin (the closest major populated centre), approximately 210 km north-west of the mainland NT coastline, and approximately 130 km north of the Tiwi Islands at the closest point (Seagull Island).

OA2: The 285 km section of the GEP from OA1 to the Commonwealth waters/ NT waters boundary; and the 8.26 km section of the GEP situated in NT coastal waters between the Commonwealth waters/NT coastal waters boundary and the Territorial Sea Baseline (TSB). Not included in this section is the remaining GEP in NT waters (~92 kms). Information on this is covered elsewhere.

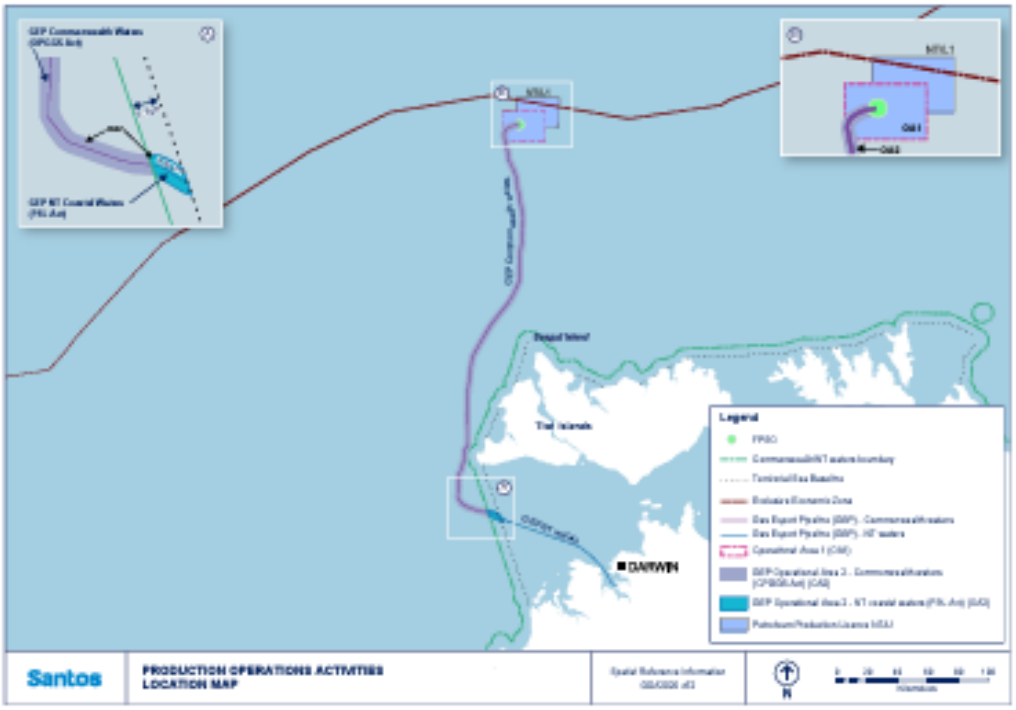


Figure 2: Location of the Barossa Operational Area 1 (OA1) in Commonwealth waters (OPPGS Act) and Operational Area 2 (OA2) in Commonwealth waters and NT coastal waters (PSL Act).

SUMMARY OF ACTIVITIES

The Barossa FPSO, which will be known as BW Opal, is a permanently moored vessel which is able to freely rotate with the strongest wind direction and remain connected to subsea facilities. The operational design life for all Barossa facilities is 25 years. **Figures 3 and 4** depict key features of the FPSO and utilities/marine systems.

Gas and condensate extracted from the Barossa field will be processed on the FPSO to separate the natural gas and condensate (a light liquid hydrocarbon, straw coloured and flammable). The dry gas will be exported to the DLNG facility via the GEP, and the condensate will be transferred from the FPSO to offtake tankers for export approximately four to five times per year. The key activities proposed under the Production Operations EP are detailed below.

Most of the below activities are only applicable to OA1 as this is where the FPSO and subsea infrastructure is located, and the condensate offtakes will occur. The main activity in OA2 will be inspection, maintenance, monitoring, and repair (IMMR) of the GEP.

- **FPSO arrival in the field:** connection of the FPSO to the mooring buoy; equipment and systems testing (also termed commissioning), start-up operations.
- **FPSO operations:** process gas and condensate from the Barossa field. The gas and condensate separation and treatment systems have a gas export capacity of approximately 635 million standard cubic feet per day (a little over 7000 Olympic-size swimming pools) with a condensate processing capacity of approximately 11,000 barrels per day (a little more than half an Olympic-size swimming pool) and a produced water processing maximum capacity of 20,000 barrels per day (over one Olympic-size swimming pool). Under normal operating conditions produced water discharge rates will be approximately a quarter (~5,000 barrels per day) of the maximum discharge capacity (~1/4 of an Olympic-size swimming pool). The FPSO generates its own electricity using Barossa production gas, and potable water supply. Living quarters are provided for the operations workforce.
- **Gas export to DLNG:** dry natural gas will be transported through the GEP for onshore processing at the DLNG facility.
- **Storage and Offtake operations:** storage of condensate onboard the FPSO and offloading of condensate to offtake tankers. Approximately 650,000 barrels (~ 40 Olympic-size swimming pools) will be offloaded approximately once every two to three months (four to five times per year).

- **Support operations:** offshore support vessels periodically visit the FPSO to resupply materials (such as stores, consumables, chemicals and fuel) and return surplus goods and wastes to the Australian mainland for disposal or recycling. Helicopters will be used to transport the operations workforce to and from operations facilities.
- **Subsea system and GEP inspection, maintenance, monitoring and repair (IMMR):** visual inspection of subsea infrastructure and/or the GEP using Remotely Operated Vehicles (a submersible craft used to perform underwater visual inspections operated from a vessel). This activity will be performed according to a planned inspection and maintenance schedule, or at other intervals if unplanned inspections or repairs are required.

1 Engine Room
2 Living Quarters
3 Laydown Areas
4 Seawater Lift Caissons
5 Utilities
6 Gas Treatment A & B
7 Condensate & Produced Water Treatment
8 Production Separation Module
9 Flare Knock Out Drum
10 Flare
11 Electrical-House
12 Central Piperack
13 Power Generation A, B & C
14 Gas Treatment C
15 Flash Gas Compressor
16 Future LP Gas Compressor
17 Export Gas Compressor
18 Turret

Key infrastructure information

A Length 355 m
B Depth 32 m
C Breadth 64 m
D Maximum persons on board - 140

Figure 3: FPSO key features

- Condensate Offloading System
- Aft Service Crane
- Communications & Radar
- Aft Pedestal Crane
- Thermal Oxidiser
- Helideck Parking Area
- Forward Pedestal Crane
- Power Generation Exhaust
- Midship Pedestal Crane
- Helideck Landing Area
- Daughter Craft
- Freefall Lifeboats
- Engine Room Exhaust

Figure 4: FPSO utilities and marine systems

REGIONAL EXISTING ENVIRONMENT SUMMARY

Environment that may be affected (EMBA)

Santos recognises the region's various environmental values and sensitivities. In an EP, although planned activity occurs in OA1 and OA2, it is common to present a geographically defined area of the environment that may be affected (EMBA) by an offshore activity e.g. an unplanned hydrocarbon spill.

In the case of the Production Operations Activity, the broadest extent of the EMBA, is determined by a potential loss of heavy fuel oil from a condensate offtake tanker due to impact from another vessel. Potential loss of heavy fuel oil is a risk associated with any large marine vessel and is managed through established maritime laws and safeguards. Barossa condensate offtake operations are a low frequency activity (four to five times a year) which further reduces the likelihood of such an event, which is already a very low probability of occurring.

Figure 5 depicts operational areas OA1 and OA2 and the EMBA (blue line). The EMBA is generated by modelling and represents the greatest geographical extent that could be affected by 300 individual hydrocarbon spill scenarios occurring simultaneously across the full range of seasonal conditions. It should be noted that an actual spill event is more accurately represented by only one of the 300 simulations from the modelling, meaning a much smaller geographical area would be affected in the event of an actual spill; and the EMBA does not take account of spill response mitigations which would reduce the extent of an unplanned spill. The primary purpose of the EMBA is to assist with spill response planning and preparedness in the unlikely event of a hydrocarbon spill. The EMBA also provides the basis for assessing the range of potential socio-economic impacts and establishes a planning area for scientific monitoring during an unplanned spill event.

The Moderate Exposure Value (MEVA) (pink line) represents the predicted extent of ecological impacts and is used to inform the environmental impact assessment and spill response plans. Beyond the MEVA, impacts to ecological receptors are not expected.

To learn more about spill modelling, exposure values and spill response, see NOPSEMA Spill Modelling Video.

Regional protected and significant areas

Figures 6, 7, and 8 illustrate the boundaries and zonings of regional marine parks and reserves, key ecological features, wetlands, EMBA, the MEVA and the OAs. **Figure 9** illustrates the shoals and banks in relation to the OAs.

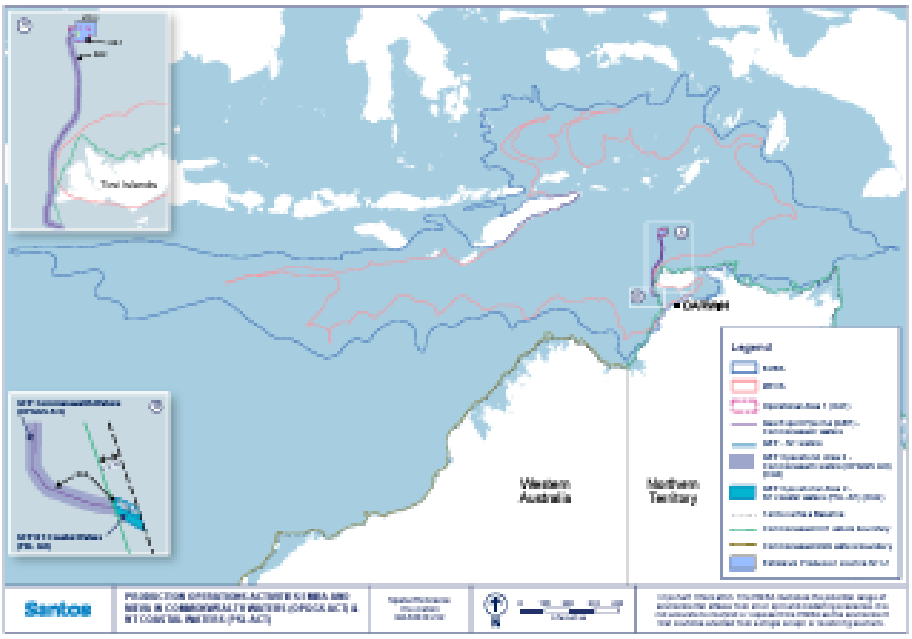


Figure 5: Production Operations Activities EMBA and MEVA in Commonwealth waters (OPGGS Act) and NT coastal waters (PSL Act)

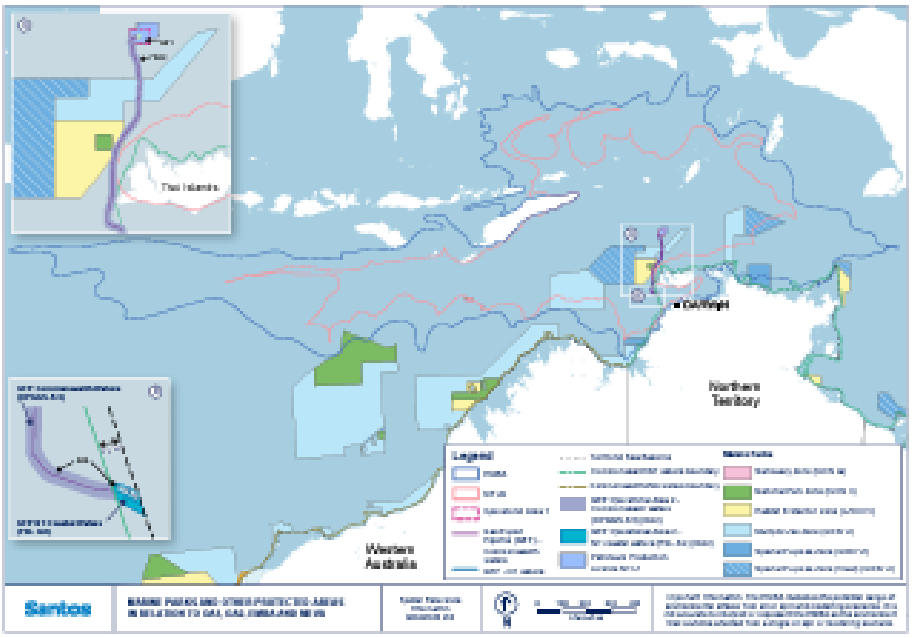


Figure 6: Marine Parks and Other Protected Areas in relation to OA1, OA2, EMBA and MEVA

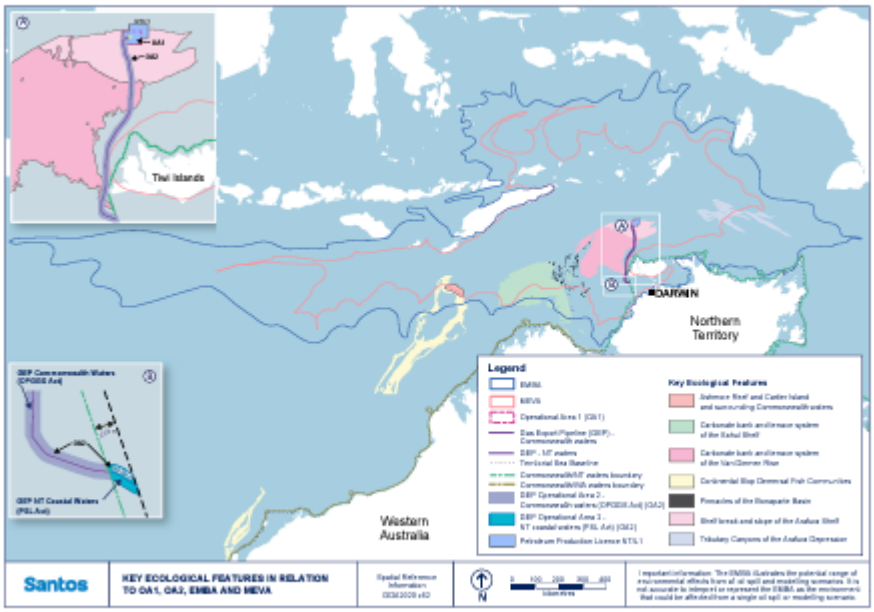


Figure 7: Key Ecological Features in relation to OA1, OA2, EMBA and MEVA

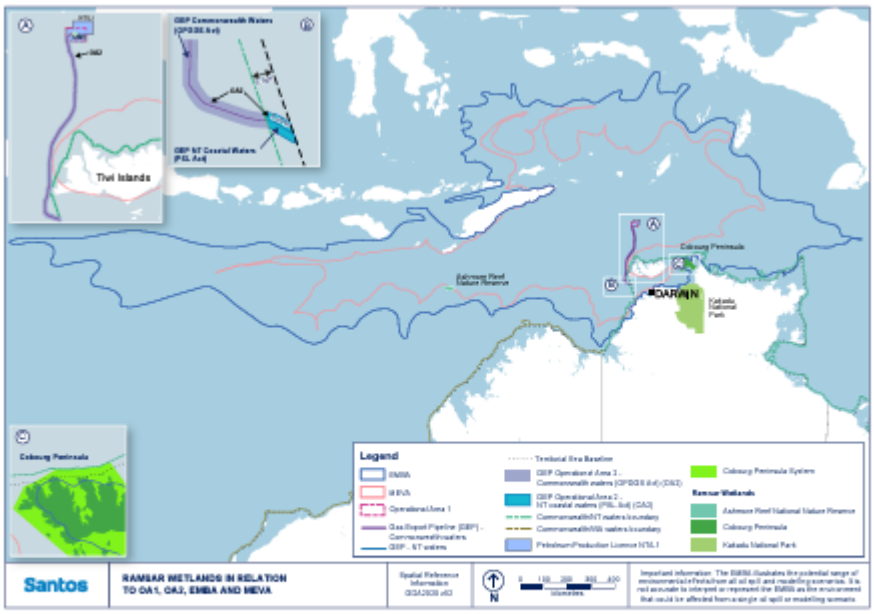


Figure 8: RAMSAR wetlands in relation to OA1, OA2, EMBA and MEVA

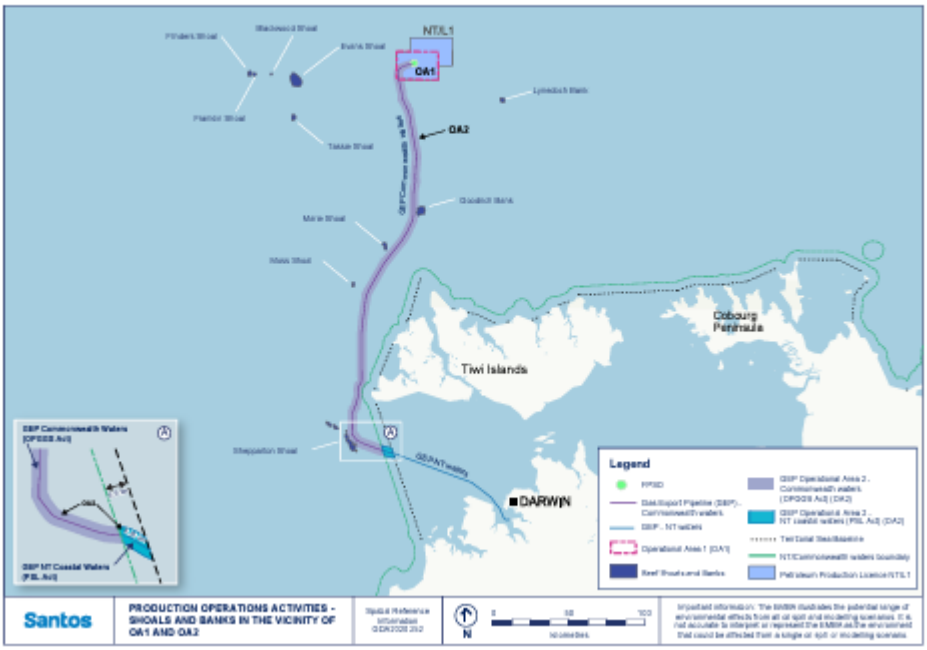


Figure 9: Shoals and Banks in the vicinity of OA1 and OA2

Marine fauna and biologically important areas

Biologically important areas (BIAs) are areas used by protected marine species for carrying out critical life functions, such as reproduction, feeding, migration or resting. BIAs are areas that contain habitat crucial to the survival of protected species and are defined by the Australian Government under the Environment Protection and Biodiversity Conservation Act 2009 (EPBC Act). As shown in Figure 10, some BIAs occur within the EMBA. These areas are known to include protected marine species such as whale sharks, pygmy blue whales, dugongs, olive ridley turtles, loggerhead turtles, green turtles, hawksbill turtles, flatback turtles, and 12 types of seabirds and shorebirds. In addition, the EMBA overlaps the spawning grounds for southern bluefin tuna, a listed species under the EPBC Act, between northern Western Australia and Java.

The BIAs for flatback turtles overlap with OA2. There are no BIAs within OA1. Two turtle species, the flatback turtle and olive ridley turtle, have critical habitat that overlap with OA2.

Activities in OA1 will be conducted in water depths ranging from approximately 220 – 280 m. There are a variety of highly mobile marine fauna that may transit OA1 in low numbers, such as:

- Bryde's, blue, fin, humpback, sperm and sei whales
- orcas, Australian snubfin dolphin and spotted bottlenose dolphin
- dugongs (mostly in shallow waters)
- olive ridley, green, loggerhead, hawksbill, leatherback and flatback turtles
- sea snakes
- whale sharks
- migratory seabirds and shorebirds
- fishes, sharks, rays and sawfish.

An additional three species – the grey nurse shark, Omura's whale and the turtle-headed sea snake have been included as they were observed within or near OA1 and OA2 during the Barossa Marine Studies Program.

Santos recognises the region's various environmental values and sensitivities and has considered government guidance, including protected species management plans, recovery plans, conservation advice and threat abatement plans in the development of the Production Operations and OEMP, and has developed control measures to reduce impacts and risks to marine fauna and biologically important areas to as low as reasonably practicable and acceptable levels.

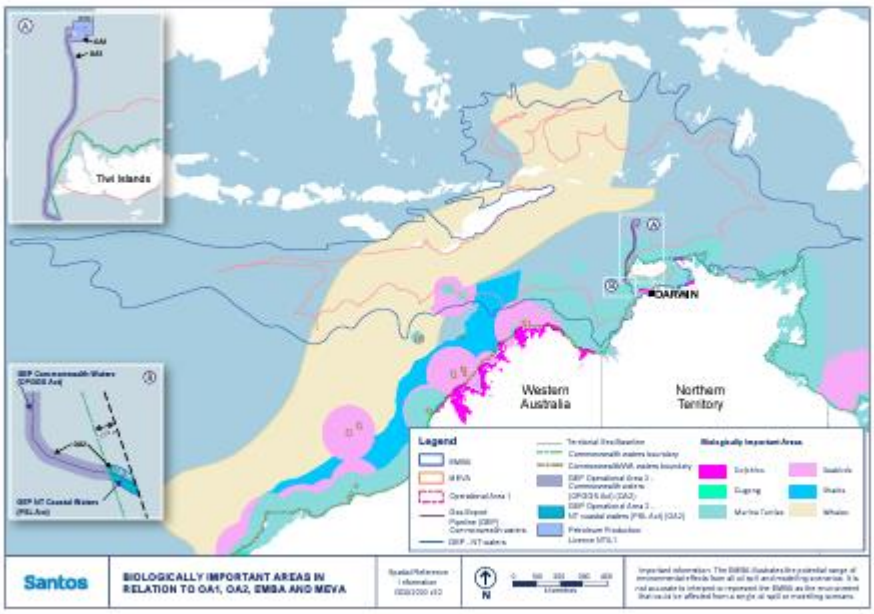


Figure 10: Biologically important areas in relation to OA1, OA2, EMBA and MEVA.

REGIONAL SOCIO-ECONOMIC SUMMARY

Socioeconomic activities that may occur within the OAs or EMBA might include commercial, recreational and traditional (subsistence) fishing, aquaculture, tourism, petroleum industry activities, defence activities, shipping and to a lesser extent in the deeper offshore waters, recreational fishing and tourism.

Underwater cultural heritage and cultural values may also exist across the region. Darwin will be the logistics hub and supply base for the Production Operations Activity bringing employment and economic benefits to the local community.

Nearest population centres

OA2, at its closest point, is located approximately seven kilometres from Bathurst Island, which is part of the Tiwi Islands. Darwin is the closest regional city, which approximately 285 km north-north-west of OA1.

Summary of other uses within the EMBA

Santos' existing understanding of the uses and values of the area and its strategies to reduce impacts or risks to these uses and values, will be supplemented with any new information obtained during consultation. Santos has set out in the list below a summary of the uses and values of the area based on existing information or previous consultation. Santos welcomes further information that may be provided during consultation to inform the Production Operations EP and OEMP.

Commercial fishing

Santos recognises the presence and rights of commercial fishers within the operational area and EMBA. Within the OAs, interaction with some commercial fishing is possible. These fisheries include Northern Prawn, Spanish Mackerel, Pearl Oyster, Offshore Net and Line, and Demersal. Santos has been consulting with the relevant fisheries representative associations, licence-holders and government over many years.

Petroleum industry

Several oil and gas companies hold petroleum permits near the OAs; however, no established oil and gas operations are located within or in the immediate surrounds. The closest operational offshore production facilities and in-field subsea infrastructure are associated with the Santos-operated Bayu-Undan platform, located approximately 400km to the southwest of OA1 and west of OA2.

Tourism, recreational fishing and traditional fishing

The OA1 is located in offshore waters that are not likely to be accessed for tourism activities (e.g. charter boat operations) or recreational fishing, as these tend to be centred around nearshore waters, islands and coastal areas. However, previous consultation on a different Barossa Gas Project EP has identified one fishing charter operator who may on occasions conduct tours near Evans Shoal, approximately 62km west of OA1. Tourism activities may occur within OA2, but they are likely to be limited to vessels transiting the area to access other destinations within the region e.g. islands, shoals, and shipwrecks. Indonesian and Timorese traditional fishers, as well as Australian recreational fishers, are expected to transit and fish in the EMBA. Santos continues to consult regarding recreational and traditional fishing and hunting within the EMBA.

Defence Activities

No designated military and defence exercise areas occur within OA1. OA2 partially intersects the Darwin Air Weapons Range central practice area, which comprises practice and training areas used for offshore naval exercises and onshore weapons-firing training by the Department of Defence. Australian Border Force vessels also undertake civil and maritime surveillance (and enforcement) in Australian offshore waters, therefore they may transit through the operational areas and EMBA.

Telecommunications cables

The North-West Cable System (NWCS) is a submarine telecommunication fibre cable system located within the EMBA and crosses the GEP in the southern portion of OA1. It is located approximately 230 km and 30 km south of OA1 and OA2. Extending 2100 km from Darwin to Port Hedland, the NWCS connects Australia's remote northern and western regions, including offshore oil and gas facilities, with onshore locations.

Listed Heritage

There are no world heritage properties, national heritage places or Commonwealth heritage places within the OAs; however, the EMBA (including the MEVA) overlaps the Ashmore Reef Marine Park, a Commonwealth heritage place. The closest World Heritage Property is the Kakadu National Park, located onshore in the NT. A small portion of the coastal edge overlaps the EMBA. **(Figure 8)**

There are no recorded Aboriginal heritage sites within the OAs. The Tiwi Islands are a declared Aboriginal reserve and a number of protected sacred sites under the Aboriginal Sacred Sites Act 1989 (NT) have been recorded on the Islands.

Under the Commonwealth Underwater Cultural Heritage Act 2018, Australia's underwater cultural heritage is protected in Commonwealth waters, such as shipwrecks, sunken aircraft and other types of underwater cultural heritage including Australia's Aboriginal and Torres Strait Islander underwater cultural heritage. No known shipwrecks are located within the OAs. Multiple known shipwrecks, sunken aircrafts, historic aircrafts and shipwrecks (greater than 75 years old) and other sites occur within the EMBA. Some unlocated wrecks could fall within the boundaries of the OAs or EMBA.

In the course of preparing the Barossa Drilling and Completions EP, SURF EP and commencing works under the GEP EP, Santos engaged independent consultants to investigate potential for underwater cultural heritage within OA1. First Nations underwater cultural heritage is not relevant to OA1 due to its location in water depths beyond the extent of the ancient coastline at the 125 m water depth contour. A 262km section of the GEP within OA2 has been surveyed for both First Nations and other underwater cultural heritage

The results of those surveys concluded there are no specific underwater cultural heritage places along the Barossa GEP to which people, in accordance with Indigenous tradition, may have spiritual and cultural connections that may be affected by the activities covered by the GEP Environment Plan. Further similar surveys are planned for the remainder of OA2 in 2024.

Shipping

The closest port to the OAs is Darwin Port, which is approximately 290km away from OA1 and 116km away from OA2. No designated shipping fairways overlap the OAs, however the southern end of OA2 is an area of high shipping activity.

Cultural Values

Traditional hunting and fishing continue to occur on the Tiwi Islands, although typically these occur within 3 nm of the shoreline.

Mapping exercises and workshops conducted on the Tiwi Islands have identified Aboriginal heritage sites along the northern, western and southern coastlines of the Tiwi Islands, including areas used for food collection, sacred sites, camping sites and a dreaming site. These coastlines are within the EMBA but outside the OAs.

Santos has identified that the Croker Island native title determination (DCD1998/001) partially overlaps the EMBA. The native title holders within the Croker Island native title determination are the Yuwurrumu members of the Mandilarri-Ildugij, the Mangalara, the Murran, the GaduraMinaga and the Ngaynjaharr clans. The Larrakia native title determination (DCD2006/001) also partially overlaps the EMBA. This determination found that native title does not exist within the claim area.

Mapping exercises and workshops conducted on the Tiwi Islands have identified Aboriginal heritage sites along the northern, western and southern coastlines of the Tiwi Islands, including areas used for food collection, sacred sites, camping sites and a dreaming site. These coastlines are within the EMBA but outside the OAs.

Santos acknowledges coastal First Nations peoples' connection with culture through Sea Country and is seeking to improve knowledge and understanding of cultural features within the EMBA, including through consultation with First Nations people and their relevant representative bodies.

SUMMARY OF ENVIRONMENTAL IMPACTS AND RISKS

Environmental impact and risk assessment is the process by which proposed activities are assessed for their impacts (consequences) on the environment (physical, biological, socio-economic and cultural). For the purposes of assessing impacts and risks, proposed activities are divided into planned activities and unplanned events.

Planned activities occur within OA 1 and OA 2 can have unavoidable impacts, such as light, noise and atmospheric emissions, seabed disturbance, discharges to the marine environment, and interactions with other marine users. Unplanned events are not expected to occur but are considered so that contingency measures are in place should they ever eventuate. Unplanned events include dropped objects, introduction of invasive marine species, interactions with marine fauna, accidental discharges, or spills.

Planned activities are assessed based on consequence of impact. Unplanned events are assessed based on their potential impact (consequence) and likelihood of occurrence, which informs the associated risk level.

Santos has conducted an environmental assessment in order to consider the potential environmental impacts and risks associated with activities under this EP. The identification of potential impacts and risks, and the measures proposed to reduce these impacts and risks, may be revised and amended as a result of the consultation process. This includes information obtained during consultation to improve Santos' understanding of potential impacts and risks in regards to cultural values within the EMBA and adoption of any appropriate measures.

PLANNED ACTIVITIES

Santos proposes to adopt a suite of control measures to reduce impacts and risks associated with planned activities to a level that results in a minor or negligible environmental consequence. These consequence levels are considered by Santos to be acceptable and to have been reduced to as low as reasonably practicable (ALARP). **Figure 11** shows several emissions and discharges from planned activities associated with the operation of the FPSO.

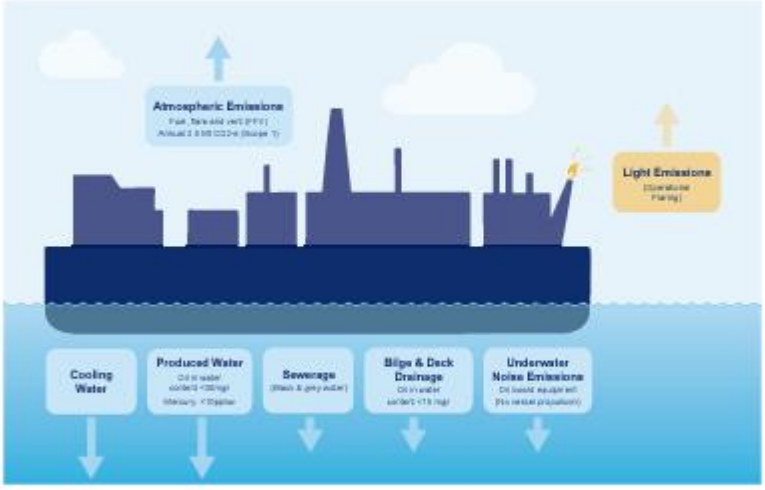


Figure 11: Emissions and discharges from planned activities associated with the operation of the Floating Storage and Offloading (FPSO) facility.

GHG EMISSIONS

The Production Operations EP will consider the contribution of emissions from the Barossa Development to national and global emissions and the potential indirect impacts of climate change on the Australian environment, noting that as a result of the complex nature of the global emissions system, climate change impacts cannot be meaningfully linked to any one activity or emissions source.

GHG emissions can be categorised into Scope 1, Scope 2 and Scope 3.

- Scope 1 - direct emissions from sources that Santos owns or controls, due to fuel combustion, flaring, venting, CO2 removal and fugitive emissions.
- Scope 2 - Indirect emissions from the generation of energy that Santos purchases for its operations including electricity purchased for ancillary activities such as office buildings.
- Scope 3 - includes all indirect emissions not included in Scope 2. The vast majority of Scope 3 emissions from Santos' activities are emissions from the use of sold products.

The Production Operations Activity will not produce scope 2 emissions as it does not consume externally generated electricity or other forms of externally generated energy.

Total annual Barossa Scope 1 emissions are estimated to be 2.5 Mt CO2e (carbon dioxide equivalent), and total annual Scope 3 emissions are estimated to be 12.7 Mt CO2e.

What impacts are expected?

Barossa GHG emissions (Scope 1 and 3) estimates account for approximately 0.86% of annual Australian GHG emissions (Department of Climate Change, Energy, the Environment and Water, 2022).

The GHG emissions attributable to the Barossa Development are not expected to be significant relative to national and international GHG emissions and are considered to be low risk.

How will Santos manage impacts?

Scope 1 emissions from Barossa are managed under Australian regulations and scope 3 emissions are managed using control measures consistent with the UN Paris Agreement, to which the Australian Government is a signatory. Key proposed control measures include:

Scope 1 emissions:

- Barossa will comply with Safeguard Mechanism obligations, including surrendering carbon credit units for any emissions above the Safeguard baseline for the assessment year.
- Barossa will implement a GHG management plan that minimises GHG emissions to ALARP and acceptable levels over the life of the field operations.
- Barossa facilities design has been optimised to reduce fuel, flare and vent (FFV) emissions, and to enable the possibility of future export of reservoir CO2 to a Carbon Capture and Storage (CCS) project.

Scope 3 emissions:

- Products generated from the Barossa Development will only be sold to customers from countries that are signatories to the Paris Agreement (or that have policies for reducing greenhouse gas emissions that are equivalent to policies required by the Paris Agreement), as at the date of the relevant contract of sale.

ATMOSPHERIC EMISSIONS

Fuel consumption, flaring and venting excess gas is required to process gas and condensate which results in the release of air pollutants, such as sulphur oxides (SOX), nitrogen oxides (NOX) and volatile organic compounds (VOCs) to the atmosphere. This mix of continuous and infrequent (e.g. flaring of excess gas) sources of atmospheric emissions associated with operating the Barossa facilities may result in a temporary, localised reduction in air quality.

Intermittent flaring is expected to be of short duration during initial start-up operations and unplanned process trips/upsets during steady-state operations.

Atmospheric emissions will also be generated from support vessel and helicopter operations.

All activities described above that may result in air emissions could be expected within OA1, however only emissions associated with vessel activities would be expected in OA2. In the offshore environment, air emissions quickly dissipate into the surrounding airshed.

What impacts are expected?

Impacts are considered very localised and not significant. Seabirds and migratory shorebirds are unlikely to be impacted by the localised and temporary reduction in air quality.

The potential impact from the release of air emissions includes the decrease in air quality of the local airshed.

Behavioural impacts, such as avoidance, could be expected if seabirds fly in the vicinity of OA1. Impacts to threatened, migratory or local fauna (seabirds) are considered to be minor.

As Barossa's operational activities occur in remote offshore waters, Production Operations Activity emissions will not impact air quality in coastal towns. Atmospheric emissions will quickly dissipate into the surrounding atmosphere and are not considered to be a potential source of impact for protected areas or threatened ecological communities.

How will Santos manage impacts?

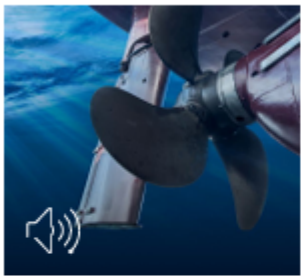
The FPSO power generation system reduces emissions to the atmosphere by primarily using production gas as fuel. Combined-cycle gas turbines (CCGT) will also be used to improve fuel use efficiency. CCGT are highly efficient and best practice resulting in reduced pollution. The steam turbines use low NOx burners, which significantly reduces NOx emissions.

Further FPSO facility design measures to reduce atmospheric emissions include:

- surplus waste gas burned to completely remove methane (minimal flaring)
- vapor recovery instead of releasing to atmosphere
- ozone Depleting Substances (ODS) are not used as refrigerants.

Santos proposes to adopt numerous control measures to manage vessel emissions, including requiring contractor vessels' compliance with MARPOL requirements for low-sulphur fuel and air pollution prevention certifications. ('MARPOL' is a reference to the International Convention for the Prevention of Pollution from Ships).

The control measures to be adopted are designed to be consistent with maritime regulations and petroleum industry standards.



NOISE SOURCES

In OA1 the main FPSO noise sources are intermittent and short-term flaring during initial start-up operations and unplanned process trips/upsets during steady-state operations. FPSO power and processing equipment will also generate a continuous source of noise. Other noise sources include:

- support vessels;
- helicopters;
- ROVs, acoustic positioning systems and survey equipment
- operation of subsea infrastructure such as wellheads, flowlines and valves.

In OA2 the types of noise generated by these activities can be categorised as either: impulsive (brief, high intensity) e.g. from operation of survey equipment or, non-impulsive noises (ongoing or continuous) e.g., from vessel engines. Noise emitted from activities in OA1 and OA2 are expected to be at low levels, similar to ambient noise levels in the region.

What impacts are expected?

Santos has engaged subject matter experts to conduct the underwater noise assessments for the activities.

Noise emissions from the FPSO, helicopters, survey equipment and vessels may result in marine mammals (e.g. whales) changing their behaviour (e.g. avoidance or diving to avoid noise). This change in behaviour is expected to be localised (within the area of the noise source in OA1 or OA2) and short term (e.g. periods of minimal flaring in OA1). Noise emissions are not expected to cause long term population impacts (e.g. distribution & abundance).

Low level noise can occur from the operation of the pipeline which will dissipate to background levels within 100m of the pipeline. The GEP route (OA2) crosses two small areas of important turtle habitat and impacts to marine turtles in these areas are expected to be limited to behavioural (e.g. avoidance). Impacts to marine turtles from any infrequent survey equipment use is also expected to result only in temporary and localised behavioural changes, given the low level of noise. Vessels will be moving when undertaking surveys and it is highly unlikely any individual would remain near the noise source for any length of time.

Other protected species of marine reptiles (such as sea snakes), seabirds and fish (such as sharks and sawfish) are not expected to be affected at the population level, given their wide distribution (in the case of sea snakes and sharks), distances to seabird breeding colonies, and preference for shallow coastal habitats (sawfish).

Noise emissions could result in behavioural changes in marine fauna within the Oceanic Shoals Marine Park, as OA2 is located in this area **(Figure 4)**.

Noise is not expected to impact socio-economic receptors, including commercial fisheries, due to low noise levels and low socio-economic activity levels within and near the Operation Areas. Behavioural impacts to fish of potential commercial value would be restricted to within hundreds of metres of the noise source, a very small portion of the total available fishing area.

How will Santos manage impacts?

A source of significant underwater noise has been eliminated from the FPSO facility by designing the facility to be permanently moored without the use of a propulsion system.

Vapour recovery on the flare system reduces the frequency at which flaring occurs during operations and therefore reduces the amount of noise emitted during routine operations.

Activity vessels are required to comply with Santos's Protected Marine Fauna Interaction and Sighting Procedure to comply with regulatory requirements for managing fauna noise impacts. Marine assurance standards and planned vessel maintenance will minimise noise generated from vessels by ensuring contracted vessels are operated, maintained and crewed in accordance with industry standards and regulatory requirements.

LIGHT SOURCES

Artificial lighting is required for operational and navigational safety during the activity. Light sources include safety and navigational lighting on vessels, campaign-specific lighting when needed, such as deploying or retrieving equipment or when ROVs are working underwater, and intermittent flaring from the FPSO.

What impacts are expected?

Permanent safety and navigational lighting on the FPSO and intermittent flaring will result in light emissions in OA1. Light emissions are not expected to have an effect on adult turtles or hatchlings, given the offshore location and distance from the nearest turtles nesting beaches.

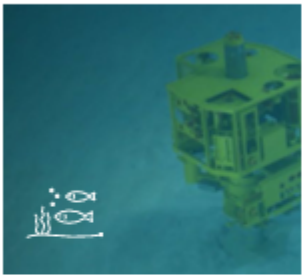
OA2 overlaps BIAs for marine turtles surrounding the Tiwi Islands. The closest turtle nesting beach is Cape Fourcroy, on the Tiwi Islands. Lighting emissions in OA2 will only occur from infrequent vessel inspection and maintenance activities in this location, which are of short durations. Vessel activities in OA2 are expected to produce similar light levels to other marine vessel activities in the region.

Impact to nesting females or hatchlings is not expected to occur. There is potential for hatchlings at sea to be attracted to light emissions if they are carried by currents to within approximately 3.3 km of an IMMR vessel. In the unlikely event hatchlings are attracted to vessel light, the proportion impacted is considered negligible when compared to the total number of hatchlings emerging from Bathurst Island beaches across the year. It will also be a temporary phenomenon, occurring during hours of darkness only. After sunrise, hatchling dispersal behaviour will resume. Displacement of individuals from critical habitat areas is therefore not a credible outcome.

Fish, sharks and birds have been shown to be attracted to artificial light sources, leading to a short-term localised increase in fauna activity, however large-scale changes in species abundance or distribution are unlikely.

How will Santos manage impacts?

The FPSO facility is equipped with a centralised battery system providing an uninterrupted power supply to the FPSO LED lighting which also allows for dimming and controlling in individual areas. Lighting is to be limited to that required for safe operations and navigation and will be compliant with maritime regulations (similar to other commercial vessels operating in the region).



SEABED DISTURBANCE

Seabed disturbance will occur because of:

- physical presence of installed subsea infrastructure and GEP on the seabed
- temporary placement and set down of equipment and subsea infrastructure on the seabed used during IMMR activities

What impacts are expected?

Seabed disturbance resulting from IMMR activities will be confined to the OAs and might result in localised disturbance under the subsea infrastructure and GEP. Seabed disturbance resulting from a subsea repair or replacement will be localised with a potential footprint of approximately 50 m^2 up to 1,600 m^2.

Given the nature and relatively small scale of seabed disturbance, it is not expected to cause a decrease in local population size, area of occupancy of species, loss or disruption of critical habitat, or disruption to the breeding cycle of any protected marine fauna.

Given localised disturbance is restricted to the OAs, which is mostly bare sediment and does not contain any significant habitat features, the consequence level for the physical environment or habitat is negligible. Impacts to the seabed within the Oceanic Shoals Marine Park or overlapping key ecological features (KEFs) (Carbonate bank and terrace system of the Van Diemen Rise KEF and the Shelf break and slope of the Arafura Shelf KEF) are considered to be minor.

While OA1 does not overlap any marine turtle BIAs, the southern end of OA2 traverses internesting buffer habitat critical to survival for flatback and olive ridley turtles, overlaps a portion of the the internesting BIA for flatback turtles, and is adjacent to the internesting BIA for olive ridley turtles. Considering the water depth along the pipeline route in OA2 is greater than the maximum turtle interesting depth of 30 m , it is unlikely the species will be present in significant numbers or for significant periods. Any impact to marine turtles from seabed disturbance or resultant turbidity in both OA1 and OA2 would likely be temporary and negligible, based on the nature and scale of impact.

Seabed disturbance is not expected to impact commercial fisheries, based on the small size of disturbance compared with the total available fishing area.

How will Santos manage impacts?

During IMMR activities Santos' vessels will undertake safe and accurate placement of infrastructure using dynamic positioning to minimise seabed disturbance during placement. Santos will also maintain a comprehensive inventory of all installed equipment to enable recovery of all equipment during decommissioning to limit impacts to the seabed.

INTERACTIONS WITH OTHER MARINE USERS

Other marine users will be displaced from part of OA1 over the life of Barossa operations, and temporarily restricted within parts of OA2 during IMMR. In OA2, the GEP may present a hazard to marine users due to the potential for snagging.

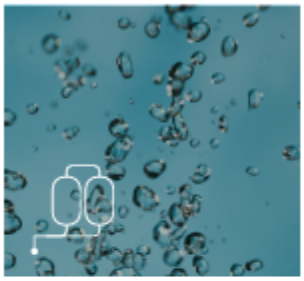
What impacts are expected?

Other marine users will have restricted access within petroleum safety zones (PSZ). A permanent 500m exclusion PSZ will extend around the outer edge of the Barossa Production Operations wells, the subsea infrastructure and mooring system in OA1. During IMMR activities along the GEP IN OA2, a temporary 500m PSZ will be maintained around vessel operations.

Commercial fishing, shipping, military exercises and other incidental marine traffic in the OAs are expected to be low frequency. The area marine users will be excluded from is small when compared to the large area available for their use.

How will Santos manage impacts?

Santos will notify and communicate with other marine users using standard maritime notifications (e.g. Notice to Mariners) before, during and at the end of IMMR activities. Infrastructure locations will be marked on nautical charts. These proposed control measures are consistent with maritime regulations and industry practices.



PRODUCED WATER DISCHARGES

Produced water is naturally occurring water that is extracted from the seabed along with hydrocarbons (condensate and gas in the case of the Barossa field). It is separated from the hydrocarbon components during processing and treated before being discharged to the marine environment from a pipe at least 10 m below the sea surface on the FPSO. This produced water consists of naturally occurring formation water (from the body of rock below the hydrocarbon formation), condensed water (water vapour present within the produced hydrocarbons which condenses when brought to the surface) as well as introduced water-soluble chemicals and other contaminants. While produced water treatment is performed before discharge, the effluent may contain residual inorganic (such as chemicals used for production) and organic (such as oil) contaminants.

The produced water treatment system is divided into two stages - removal of hydrocarbons through a filtration system and designed to handle 20,000 barrels per day (over one Olympic-size swimming pool). During operations the produced water discharge will vary from 3,500 to 5,000 barrels per day (bbl/day), or a quarter to a third of an Olympic-size swimming pool, with a peak rate after 11 years estimated up to 16,500 bbl/day (one Olympic-size swimming pool). Best available technology has been selected to remove oil-in-water concentrations to as low as reasonably practicable (ALARP) and the treatment system will operate well below its design capacity over the majority of the field life.

What impacts are expected?

Water quality may be impacted at the discharge point while the produced water is discharged **(Figure 12)**. Discharge modelling has been undertaken for a conservative maximum discharge rate of 20,000 bbl/day (over one Olympic-size swimming pool). Under normal operating conditions produced water discharge rates will be approximately a quarter (~5,000 bbl/day) of the modelled maximum discharge rate. Modelling results indicated that species protection thresholds for waterborne contaminants is achieved at approximately 6 km from the FPSO. As a result, predicted impacts will be localised and considered minor.

Marine turtles may occur within the produced water mixing zone. It is possible individual turtles may traverse the mixing zone; however significant impacts are not expected to occur, and large numbers of animals are not expected to be exposed. That is because the discharge water depth and discharge location are not within the proximity of internesting turtle habitat, and there is minimal reef habitat in the mixing zone. Given marine turtles are transient through the produced water mixing zone, they will not be exposed to the produced water for enough time for contaminants to accumulate within their body. Behavioural impacts (such as avoidance) may occur to a small proportion (individuals) of a local population close to the produced water discharge.

Like turtles, produced water exposure to plankton, fish, invertebrates and sharks is expected to be brief due to the transient nature of these animals.

Potential impacts to fishery resources are unlikely to result in changes in distribution and abundance of fish species outside the produced water mixing zone.

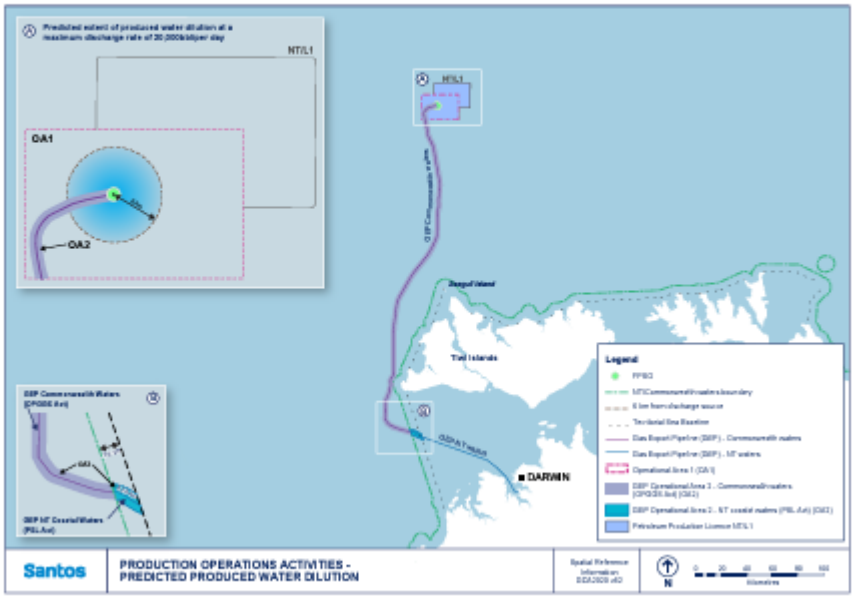


Figure 12: Predicted extent of the produced water dilution at a maximum discharge rate of 20,000 bbl/day.

How will Santos manage impacts?

Activity discharges are to be managed through the application of Santos' Chemical Selection Process, designed so that environmentally acceptable process chemicals (which are likely to be mixed with produced water discharge) are used. Additives have been selected and optimised for biodegradability as well as low aquatic toxicity and bioaccumulation potential.

The produced water discharge will be continuously monitored for oil-in-water content and any reading over the limit of 30 mg/l over any 24-hour period, will be diverted to a dedicated storage tank and returned to the produced water treatment system until suitable for discharge. Strict protocols will be in place for taking regular water samples and perform laboratory testing to ensure the produced water is within acceptable levels before disposing into the marine environment. The Production Operations Environment Plan will include a produced water adaptive management plan that prescribes a water quality monitoring regime which enables the detection of potential impacts of produced water discharge on the marine environment and if remedial actions are necessary to retain the discharge within acceptable limits.

OPERATIONAL DISCHARGES

Operational discharges associated with the activities may cause localised impacts to water quality in the direction of the prevailing current. The environment that may be affected by operational discharges will likely be contained within the OAs. Water quality conditions will return to normal within minutes to hours once discharging stops.

FPSO facility and subsea system discharges

Operational discharges from the FPSO in OA1 will occur each day resulting in localised changes to water quality. Discharges of warm cooling water will include low concentrations of chlorine which break down quickly in the environment and is non-toxic at low concentrations. Minor discharges of water based hydraulic fluid used in the subsea system are classified by the offshore chemical notification scheme as being environmentally acceptable.

Vessel discharges

The types of anticipated discharges in OA1 and OA2 are typical of most offshore commercial vessels and include deck runoff, treated sewage, grey water, machinery cooling water, bilge water (treated via the oily water system), ballast water, macerated food scraps and brine (from water making). These discharges will be small in volume and released into surface waters.

What impacts are expected?

Sensitive receptors that may be impacted include plankton, fish, seabirds, marine turtles and mammals. Impacts to water quality will be localised and temporary occurring only during discharge.

Some fish and oceanic seabirds may be attracted to the FPSO by the discharge of food scraps. However, given the small quantities, intermittent nature of disposal and swift currents, any attraction is likely to be minor and is not anticipated to result in adverse impacts at an ecosystem or population level. Given the controls in place to manage the FPSO discharges in OA1 in accordance with regulatory requirements, impacts to commercial fish species are not predicted.

Operational discharges in OA1 are predicted to quickly dilute and disperse in the offshore environment. Water quality changes will be localised and will occur only when the discharges occur. Given the temporary nature of activities within OA2 (limited to vessel based IMMR) and the relatively deep offshore environment with significant current and tidal action, impacts to water quality will be localised and will occur only for the duration of the discharge.

How will Santos manage impacts?

Vessel discharges are to be managed to acceptable levels as regulated by maritime laws and conventions (e.g. management of sewage treatment systems and oily water systems), such as MARPOL and relevant Marine Orders. Santos also intends to implement management measures including waste management procedures and chemical management and selection procedures.

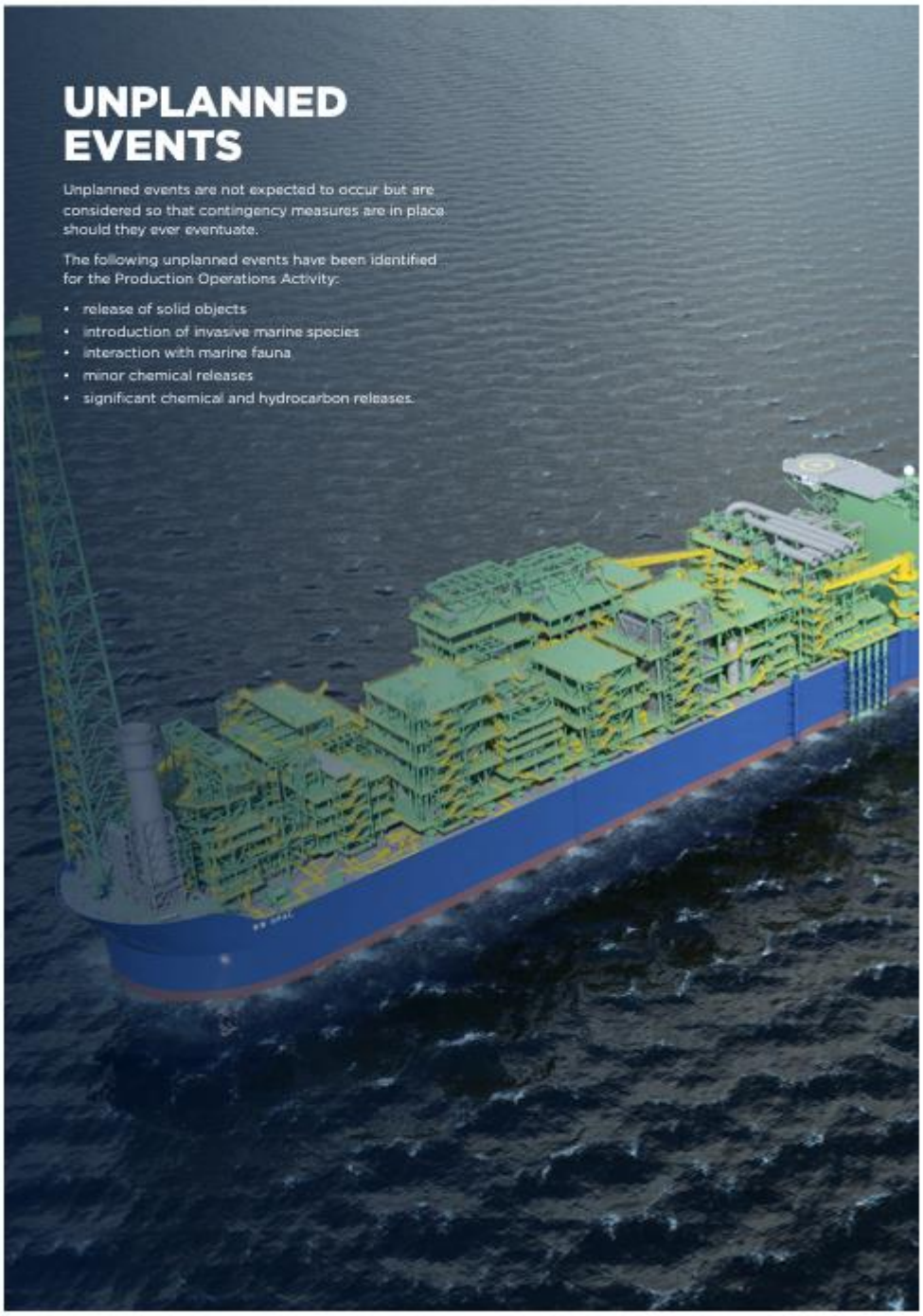
Santos procedures require that all operational chemicals used on the FPSO and chemicals potentially discharged to sea are risk assessed. Santos also implements general chemical management procedures to reduce the risk of accidental discharges.

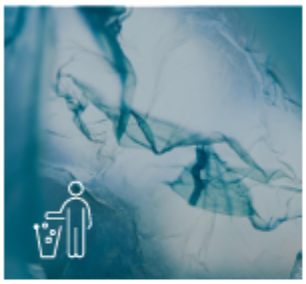
UNPLANNED EVENTS

Unplanned events are not expected to occur but are considered so that contingency measures are in place should they ever eventuate.

The following unplanned events have been identified for the Production Operations Activity:

- release of solid objects
- introduction of invasive marine species
- interaction with marine fauna
- minor chemical releases
- significant chemical and hydrocarbon releases.





DROPPED OBJECTS

How could dropped objects occur?

There is the potential for objects to be accidentally released to the marine environment from support vessels during steady state operations in OA1 or during IMMR activities in OA2. Dropped objects may be non-hazardous solid waste (e.g. paper, packaging materials), hazardous waste (e.g. batteries, aerosol cans etc.). A dropped object event could result from overfilling waste containers, unsecured objects during lifting operations or failed sea fastening.

What environmental impacts could occur?

Objects that float could potentially move beyond the OAs. All non-buoyant objects are expected to sink to the seabed and remain within the OAs. This could cause localised and short-term damage to the seabed.

Marine debris (including plastics and microplastics) is listed as a potential threat to several marine fauna species. Depending on debris size of the dropped object, there is potential for entanglement or ingestion by marine fauna, including turtles and vertebrate wildlife, which could result in injury or death. However, given the limited quantities that might be dropped, impacts to fauna would be limited.

Considering the low frequency of such an unplanned event, even in a worst-case release of a solid object, impacts to fauna would be very localised and limited to individuals, and are not expected to result in impacts to the local population.

How will Santos manage the risk?

Santos has numerous control measures to prevent dropped objects, and to mitigate consequence of impacts of an event does occur. These measures include:

- safety standards and procedures to reduce the likelihood of tools and other equipment being dropped during lifting operations
- waste management procedures to reduce the likelihood of windblown waste entering the marine environment
- implementation of chemical selection processes and the International Maritime Dangerous Goods Code to limit the environmental impact of chemicals if lost overboard
- dropped objects, regardless of size, must be reported and attempts made to recover the object according to safety and environment criteria.

These control measures are designed to comply with maritime legislation. In addition, these control measures are consistent with applicable actions described in the relevant fauna recovery plans and conservation advice, reducing the residual risk to low.

INVASIVE MARINE SPECIES

What are IMS?

Invasive marine species (IMS) are marine flora and fauna that have been introduced into a region that is beyond their natural range but have the ability to survive, and possibly thrive. The majority of climatically compatible IMS to northern Australia are found in south-east Asian countries.

How might IMS be introduced?

Some IMS pose a significant risk to environmental values, biodiversity, ecosystem health, human health, fisheries, aquaculture, shipping, ports and tourism. The risk of introducing IMS is common for all maritime activities. The introduction of IMS may occur due to the following:

- biofouling on FPSO and vessels, external/internal niches (such as sea chests and sea water systems) and routinely submerged equipment
- discharge of FPSO ballast water when the FPSO first transits from the international shipyard to the Barossa field
- discharge of high-risk ballast water where vessels have transited from international destinations.

What environmental impacts could occur?

If successfully established, IMS can:

- outcompete native species for food or space
- prey on native species
- impact fisheries or aquaculture
- impact on human health through released toxins
- reduce coastal aesthetics
- cause damage to marine and industrial equipment and infrastructure.

The above impacts can result in flow-on detrimental effects to marine parks, tourism and recreation.

The ability of invasive marine species to colonise a habitat depends on several environmental conditions. For example, highly disturbed environments (such as marinas) or shallower areas are more susceptible to colonisation than open-water environments (OA2 is 33 metres deep at its shallowest point and not considered sufficiently shallow to be conducive for IMS colonisation). OA1 provides an unfavourable habitat for IMS due to water depth (over 200 metres) and the long distance to the coast. These conditions limit light availability and have low habitat biodiversity with sparse epibiota, therefore, it is highly unlikely that IMS would be able to survive or colonise in OA1.

How will Santos manage the risk?

The pathways and vessel mitigation measures for IMS introduction are well established. The offtake tankers used for condensate export and specialised IMMR vessel(s) (if required) are sourced internationally, whilst the regular support vessels to and from the FPSO are sourced domestically. Vessels contracted to Santos, and vessel ballast, are to be managed according to control measures that comply with maritime regulations, industry practices, and the Biosecurity Act 2015. The FPSO and support vessels will also have ballast water management, vessel biofouling management and anti-fouling systems in place. With these control measures adopted, the residual risk of introducing IMS is assessed as low and reduced to as low as reasonably practicable.

The initial mobilisation of the FPSO out of Singapore to the Barossa gas field will be managed under a quarantine management plan including arrangements for invasive species, biofouling and ballast water exchange.

INTERACTION WITH MARINE FAUNA

How could interactions with marine fauna occur?

During the Production Operations Activity, approximately two vessels per week will travel between the Barossa field and Darwin servicing the FPSO, which is a minor increase relative to the existing levels of regional marine vessel traffic.

The highest potential for interactions with marine fauna, including potential accidental strike or collision resulting in injury or mortality, will be during IMMR vessel operations in OA2 where there is higher likelihood of marine fauna presence. In OA1, where marine fauna presence is of a lower likelihood, the FPSO will remain stationary once on location in position and support vessel movements within the operational area are limited and slow-moving, hence marine fauna interactions are not anticipated and are expected to be minimal.

Marine fauna such as marine mammals (such as whales and dolphins), marine turtles and whale sharks that swim at or near the water surface are most at risk from vessel collisions. Some of these species are threatened, and some marine fauna may have cultural significance.

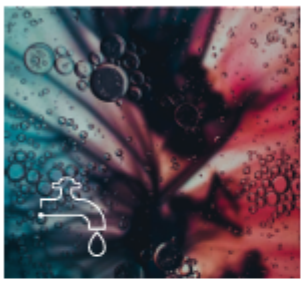
Marine mammals (such as whales and dolphins) and whale sharks may transit through the OAs but are expected to be in low numbers in OA1 **(Figure 10)**. Considering the relatively slow vessel speeds, short duration of activities, and the mobility of these species, it is unlikely that activity vessels will adversely interact with any individuals.

How will Santos manage the risk?

The likelihood of marine fauna interaction resulting in injury or death is considered unlikely given the proposed implementation of the following control measures:

- Santos' Protected Marine Fauna Interaction and Sighting Procedure, which aligns with the *Environment Protection and Biodiversity Conservation Regulations 2000*. This procedure limits marine fauna approach distances and speed, allowing marine fauna to be avoided or to move away.
- Operational area vessel speed restrictions

The control measures are designed to align with management actions outlined in government-published fauna recovery plans and conservation advice. The risk of interactions with marine fauna is assessed as very low and reduced to as low as reasonably practicable and acceptable levels. The risk is no higher than for any other regional maritime activity.



NON-HYDROCARBON LIQUID RELEASE

How could non-hydrocarbon liquids be released?

Non-hydrocarbon liquids including miscellaneous chemicals for use during the Production Operations Activity and waste by-products are transferred to and from supply vessels to the FPSO in OA1. Examples of non-hydrocarbon liquids include chemicals used in the production process, domestic products used in the living quarters for cleaning and general maintenance products such as greases and paints.

An accidental release of non-hydrocarbon liquids into the marine environment has the potential to occur from:

- transferring, storing or using bulk products (e.g. production chemicals)
- mechanical failure of equipment, such as a tank or pipework failure
- handling and storage spills and leaks due to insufficient fastening or inadequate bunding
- floating hose failure or rupture, coupling failure or tank overfilling
- lifting and incorrect handling (e.g. dropped objects damaging storage containers)
- firefighting foam during an emergency response incident.

What environmental impacts could occur?

A release of non-hydrocarbon liquids may result in impacts to water quality and any sensitive environmental receptors.

The maximum volume of non-hydrocarbon liquids that could be released during routine operations is likely to be small and limited to the volume of individual storage containers. Individual containers stored on the FPSO include process chemicals and lube oil storage tanks (approximately 4.5 m^3).

If the spill is not contained on deck, a release to the marine environment would likely disperse rapidly, with one in 1,000 dilution usually occurring within 30 minutes.

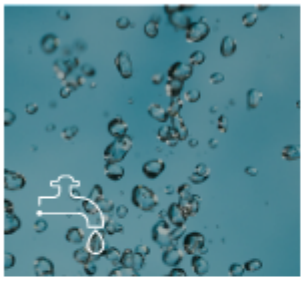
The environment that may be affected for non-hydrocarbon liquids releases resulting in a decrease in water quality is likely to be restricted to the immediate vicinity of the FPSO or support vessel and contained within the OAs.

Potential receptors include the physical environment (e.g. water and sediment quality, benthic habitats), threatened, migratory or local fauna (e.g. marine mammals, marine reptiles, sharks and rays, other fish, and birds) and socioeconomic features of the environment (including cultural features).

How will Santos manage the risk?

Santos has a suite of procedures to manage the selection, storage, handling and clean-up of non-hydrocarbon liquids releases. Vessels also have spill response plans. All chemicals are reviewed and accepted for use, and any chemical that might be discharged to the environment is assessed under the Santos chemical selection procedure to ensure environmental acceptability. These procedures will assist to minimise the likelihood of non-hydrocarbon liquid spills, and subsequent environmental consequences should they occur.

The control measures proposed to be adopted are designed to be consistent with maritime and petroleum industry standards and appropriate to manage the residual risks to as low as reasonably practicable and acceptable levels.



MINOR LIQUID HYRDOCARBON RELEASES

How could a minor liquid hydrocarbon release occur?

Minor releases refer to relatively small volumes of hydrocarbons from storage containers, transfer equipment and pipework on the FPSO or support vessels, that enters the marine environment. Typically, such spills occur as a result of human error during tank filling or storage container transfers. Most of these types of release occur within bunded deck areas, and are less than 1m3, however it remains possible for such spills to enter the marine environment.

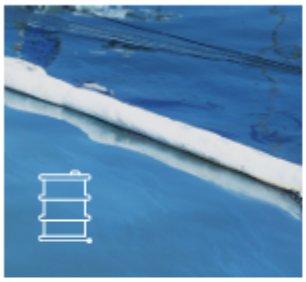
What environmental impacts could occur?

A localised decrease in water quality may occur, however due to the relatively small volumes impacts are expected to be short term as the hydrocarbon would rapidly dilute and dissolve into the ocean. Marine fauna may transit through the OAs and come into contact with the release. However it is expected impacts to fauna would be short term and result in behavioural changes, as they move away from the area where the spill occurred.

How will Santos manage the risk?

A suite of procedures will be in place to manage the handling and transfer of hydrocarbons on both support vessels and the FPSO. Response procedures such as stopping the source of the of the release and cleaning it up on deck to prevent it entering the ocean will be in place to manage minor releases should they occur.

The control measures proposed to be adopted are designed to be consistent with maritime and petroleum industry standards and appropriate to manage the residual risks to as low as reasonably practicable and acceptable levels.



LARGER HYDROCARBON RELEASES

Larger volumes of hydrocarbons may accidentally be released during production operations. These include accidental spills from support vessels or the FPSO, as well as from subsea equipment (e.g. wells and flowlines). A range of different types of hydrocarbons that may be accidentally released are discussed below.

MARINE DIESEL OIL OR MARINE GAS OIL

How could a marine diesel or gas release occur?

Marine vessel fuels (marine diesel oil or marine gas oil) could be released to the environment if there is a collision event between two vessels. An accidental collision could occur due to factors such as human error, poor navigation, vessel equipment failure or poor weather. If a marine vessel collided with the FPSO, the vessel or FPSO hull may rupture and release fuel to the marine environment.

If a vessel fuel tank is ruptured a fuel called marine diesel could be released. The FPSO uses a lighter fuel for some of its power requirements called marine gas oil which could be released if a fuel tank is ruptured.

Although the risk is higher in OA1 than OA2, it should be noted that it is considered unlikely that a vessel collision would occur that would result in releasing fuel to the environment. A sequence of events would need to occur for a vessel collision to escalate to a large volume of fuel released to the environment, including:

1. the vessel must be involved in a collision
2. collision must occur with enough force to rupture a fuel tank
3. rupture must be of such a nature that the fuel can be released into the environment.

What environmental impacts could occur?

Marine diesel oil and marine gas oil fuels are typically characterised by a high percentage of volatile components (typically >95%), which will evaporate when on the sea surface over several days. A small fraction (typically <5%) of persistent hydrocarbons remains, which will not evaporate, and will decay over time. The heavier components of the fuels tend to become entrained in the upper water column as droplets in the presence of waves but can refloat to the surface if wave energies abate. Both marine diesel oil and marine gas oil fuels are expected to weather quickly through evaporation and dispersion and are unlikely to persist in the environment for a significant period.

Such releases will cause a decline in water quality and may cause chemical (e.g. toxicity) and physical impacts to marine species (e.g. ingestion of hydrocarbons). The severity of the impact depends on the magnitude of the release (i.e. extent, duration) and sensitivity of the receptor, however, may include impacts to the physical environment, threatened or migratory marine fauna, protected and significant areas and socioeconomic receptors (fisheries, tourism, recreation, cultural features and other oil and gas operators).

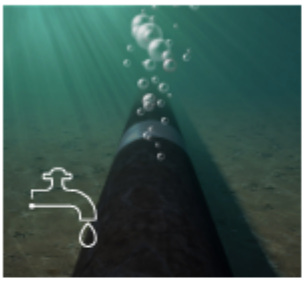
How will Santos manage the risk?

The FPSO in OA1 is fitted with a collision avoidance radar so it appears on the display of the triggering radars, providing range, bearing and identification information, alerting vessels to its presence. Santos has also designed the FPSO hull to be double-sided and double-bottomed, which provides two physical barriers between the fuel tanks and the marine environment for side impact, reducing the likelihood of fuel release in the event of a collision.

A petroleum safety zone (PSZ) will be established alerting other marine users to the presence of the FPSO in OA1 which includes precautions for marine activities (e.g. reduced speed limits, communication protocols and automatic identification systems to aid in their detection at sea). Third party vessels are not permitted to enter a PSZ, thereby reducing the likelihood of other interactions with the FPSO and support vessels. In OA2 during IMMR activities a similar exclusion zone will also be established restricting access to other marine users.

The Production Operations Activity facilities in OA1 & OA2 will be included on navigational charts making other vessels aware of the presence of Barossa facilities. Santos will also provide maritime notifications to relevant departments to ensure marine users are informed of vessel movements.

Santos has also developed response plans which will detail the actions to take to control the release and manage the cleanup activities in the event of a release.



PIPELINE GAS RELEASE

How could a dry natural gas release occur?

Although highly unlikely, dropped objects from vessels (Santos or a third party) may pose a risk of damage to the Barossa GEP. Damage from dropped objects could result in a potential rupture to the GEP that would release dry natural gas into the environment.

What environmental impacts could occur?

Gas would move vertically toward the sea surface resulting in a visible bubble zone at the sea surface and an associated gas cloud before rapidly dispersing into the atmosphere.

Potential receptors include the physical environment (water and air quality); threatened, migratory or local fauna (marine mammals, marine reptiles, sharks and rays, other fish, and birds); socioeconomic (other marine users) and cultural features. Potentially the gas cloud may impact air-breathing fauna, such as marine mammals, marine reptiles and birds. Impacts to marine mammals, turtles and birds are not expected to be significant due to the very localised disturbance area and the rapid dispersion of the gas into the atmosphere. Following the initial gas release, marine fauna are expected to avoid the gas release location limiting the potential for any further impacts.

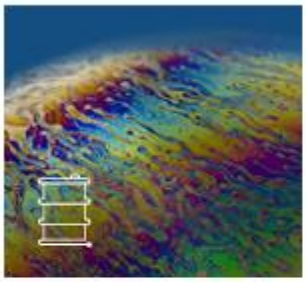
The gas release could also result in a loss of methane, contributing to GHG emissions. The contribution of the gas release to GHG emissions would be temporary and limited to the duration of the release event.

Socio-economic receptors

For the Barossa GEP release, a gas cloud could form an explosive mix that, that if ignited, could result in injury/death of other marine users and property damage. In the highly unlikely event of a Barossa GEP release, safety exclusion zones may be established for the duration of the gas release (weeks) and pipeline repair works (months) which may also temporarily restrict access for fishers (traditional and commercial), tourism and recreational users.

How will Santos manage the risk?

Preventative measures include pipeline design, targeted pipeline protection structures, and pipeline integrity management. Maritime notifications ensure marine users are informed of a gas release event, reducing the likelihood of unplanned interactions. The location of the Barossa GEP will be marked on nautical charts. The risk of impact to subsea infrastructure from dropped objects will be reduced through implementing procedures and standards for lifting equipment, IMMR, and contractor management. Emergency response procedures, pipeline depressurisation procedures (stop gas from flowing into the pipeline) and emergency pipeline repair plans will be implemented to minimise impacts in the event of a loss of containment from the Barossa GEP.



CONDENSATE RELEASE

How could a condensate release occur?

Barossa condensate has the potential to be released to the marine environment under several scenarios. Of those scenarios, three worst-case events are summarised below.

1. In the event of a vessel collision (e.g. those described above for marine diesel oil or marine gas oil) which ruptures the FPSO condensate storage tank.
2. In the event of an impact to, or failure of the subsea hydrocarbon containing equipment.
3. In the event of an impact to, or failure of multiple production well barriers.

Other scenarios exist that may result in other smaller condensate releases to the marine environment. All scenarios are very low probability of occurring.

What environmental impacts could occur?

Condensate, being a lighter hydrocarbon behaves in a similar fashion to marine diesel when released to the marine environment. The fate of the condensate will depend greatly on the proportion on the surface, which will be transported by prevailing currents and wind and can evaporate readily. Condensate that entrains or dissolves in the water column will be transported by prevailing current and, hence, will follow a different path.

As with the marine diesel oil, the heavier components contained in the condensate will have a strong tendency to physically entrain into the upper water column but can re-float to the surface if these energies abate.

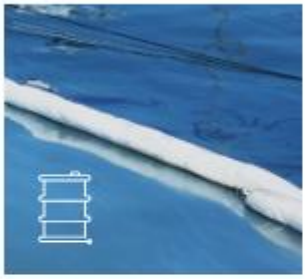
Such releases will impact the marine environment much in the same way as marine diesel oil and marine gas oils, described above. However, in the event of a subsea condensate release, more entrainment of hydrocarbons in the water column could occur, rather than being present on the sea-surface.

How will Santos manage the risk?

In the unlikely event a vessel collision occurs which ruptures an FPSO condensate tank, Santos will manage the risk in accordance with the accepted Production Operations Oil Pollution Emergency Plan.

In the unlikely event of a subsea release in the OA1 area from subsea flowlines or wells, Santos has a range of operating procedures and plans to ensure that the integrity of the subsea infrastructure is maintained and well barriers are in place. Santos will submit a well operations management plan (WOMP) to NOPSEMA that will contain the full details of systems in place to ensure well design and integrity is managed for the well lifecycle. All production wells must be in compliance with the NOPSEMA accepted WOMP at all times. Hydrocarbon containing subsea infrastructure is also within a petroleum safety zone (PSZ), which third party vessels are not permitted to enter, subsequently reducing any interaction with this infrastructure.

Santos is developing response plans which will detail the actions to take to control a release and manage cleanup activities in the unlikely event of a release.



MARINE DIESEL SPILL

What environmental impacts could occur?

Although highly unlikely, a spill from a collision between two vessels could rupture a fuel tank resulting in the release of vessel fuel to the sea. This would impact water quality and may cause chemical/physical impacts to marine species.

How will Santos manage the risk?

The risk of collision is reduced by managing interactions with marine users before and during the activity, with maritime notifications, automatic identification systems, navigational lighting, and exclusion zones in place. Operational procedures are designed to minimise refuelling incidents and spill response plans will be in place.

SPILL RESPONSE OPERATIONS

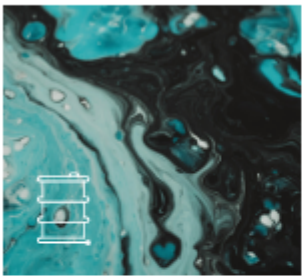
What environmental impacts could occur?

If a spill occurs, response operations may be required at any location surrounding the Operational Area. Potential environmental impacts include those listed in the Planned Activities table.

How will Santos manage the risk?

Santos will rely on its Oil Pollution Emergency Plan (OPEP) to manage the impacts from a spill response event. Control measures would include:

- Procedure for interacting with marine fauna
- Chemical selection process
- Minimum lighting
- Air pollution prevention certification
- Sewage and oily water treatment systems on vessels
- Notification to agreed stakeholders



HEAVY FUEL OIL

How could a heavy fuel oil release occur?

Heavy fuel oil is only used as fuel for offtake tankers who enter the Barossa field periodically (approximately once every three months) to load condensate from the FPSO. The only scenario that could lead to a release of heavy fuel oil is in the unlikely event of a vessel collision (described above for marine diesel oil or marine gas oil), where the offtake tanker hull and heavy fuel oil tank is ruptured.

What environmental impacts could occur?

Heavy fuel oil is heavier and more persistent than marine diesel oils, marine gas oils and condensates. The fuel is often characterised by a very high density and a high dynamic viscosity, which does not evaporate as quickly as other lighter fuels. As the fuel has a high residual component, a portion is expected to become semi-solid and can persist in the marine environment for extended periods.

Such releases will cause a decline in water quality and may cause chemical (e.g. toxicity) and physical impacts to marine species (e.g. ingestion of hydrocarbons, physical coating). The severity of the impact depends on the magnitude of the release (i.e. extent, duration) and sensitivity of the receptor, however, may include those to the physical environment, threatened or migratory marine fauna, protected and significant areas and socioeconomic receptors (fisheries, tourism, recreation, cultural features and other oil and gas operators). Given the persistent and sticky nature of heavy fuel oil, there is a higher risk of coating of the physical environment (e.g. shorelines) and marine fauna compared to the lighter fuels such as marine diesel oil and marine gas oil.

How will Santos manage the risk?

Offtake tankers are third-party operated vessels. They are vetted following Santos' marine assurance procedure and international guidelines before acceptance for condensate offtake operations at the Barossa field. The use of tankers with double hulls and fully segregated ballast tanks is not only a requirement of the vetting process; it is a MARPOL requirement that is monitored by way of regular statutory inspections.

All offtake loading events are planned in advance, occur within a petroleum safety zone (PSZ), and are performed under strict operational procedures.

Offtake tankers are third-party operated vessels. They are vetted following Santos' marine assurance procedure and international guidelines before acceptance for condensate offtake operations at the Barossa field. The use of tankers with double hulls and fully segregated ballast tanks is not only a requirement of the vetting process; it is a MARPOL requirement that is monitored by way of regular statutory inspections.

All offtake loading events are planned in advance, occur within a petroleum safety zone (PSZ), and are performed under strict operational procedures.

CONTINGENCY SPILL RESPONSE OPERATIONS

In the event of a hydrocarbon spill, response strategies will be implemented to reduce environmental impacts to as low as reasonably practicable. The selection of strategies will be undertaken using the Net Environmental Benefits Assessment (NEBA) process. Spill response will be under the direction of the relevant control agency, as defined in the Production Operations Oil Pollution Emergency Plan (OPEP), which may be Santos, another agency or both. In all instances, Santos will undertake a 'first-strike' spill response and will act as the control agency until the designated control agency assumes control. The response strategies considered to be appropriate for the worst-case spill scenarios identified for the activity are detailed in the OPEP and comprise:

- source control (blowout preventer, relief well)
- monitor and evaluate
- mechanical dispersion
- shoreline protection and clean up
- oiled wildlife response
- scientific monitoring
- waste management.

Response strategies are intended to reduce the environmental consequences of a hydrocarbon spill, but poorly planned and coordinated response activities can result in a lack of, or inadequate, information being available, upon which poor decisions can be made, exacerbating or causing further environmental harm.

What impacts are expected?

Spill response operations may be required at any location within the EMBA. Potential environmental impacts include:

- Noise and light emissions – generated by response vessels and equipment which may impact marine fauna, such as fish (including commercial species), marine reptiles and marine mammals.
- Atmospheric emissions – generated from response equipment and vessels are expected to be localised and are not considered to create emissions on a scale where noticeable impacts would be predicted.
- Operational discharges and waste - generated from response equipment and vessels are expected to be consistent with those of normal commercial vessel operations and may create a localised and temporary reduction in marine water quality. Cleaning of hydrocarbon-contaminated equipment, vehicles and vessels has the potential to spread hydrocarbons from contaminated areas to areas not impacted by a spill. Sewage and other waste will be generated from offshore activities at temporary staging/mooring areas, which may include toilet and washing facilities. These wastes have the potential to impact water quality, impact habitats, and reduce the aesthetic value of the environment, which may be within protected areas.
- Physical presence and disturbance - operating vessels during spill response operations has the potential to disturb the physical environment and marine habitats and fauna (e.g. vessel strike, behavioural changes) or cause disruption to other marine users, coastal areas, townships and commercial fishing.

How will Santos manage the risk?

Santos will rely primarily on the implementation of the Production Operations OPEP to manage the potential impacts associated with a spill response event. Other control measures that would be implemented include:

- procedure for interacting with marine fauna
- chemical selection process
- minimum lighting to meet maritime safety and navigation requirements
- air pollution prevention certification
- sewage and oily water treatment systems on vessels
- notify agreed stakeholders.

The implementation of spill response activities to reduce the potential impacts from a spill are required by legislation. The spill response options selected will be demonstrated to show a net environmental benefit, are standard industry practice and are consistent with relevant standards and guidelines, including the National Plan for Maritime Environmental Emergencies. The controls proposed are intended to reduce the consequences of the potential impacts to minor and as low as reasonably practicable and an acceptable level.

SUMMARY OF SANTOS' RISK MANAGEMENT STRATEGY

Santos has a management system that includes specific measures, to be used for the duration of the Production Operations Activity, which seek to confirm that:

- environmental impacts and risks continue to be identified for the duration of the activity and are reduced to as low as reasonably practicable and acceptable levels
- control measures are effective in reducing environmental impacts and risks to as low as reasonably practicable and acceptable levels
- environmental performance outcomes and standards set out in the EP and OEMP are being met
- there will be ongoing appropriate consultation with relevant authorities and other relevant interested persons or organisations
- the roles, accountabilities and responsibilities are defined and understood
- workforce training is completed and competencies assured
- emergency preparedness and response arrangements are in place
- incident reporting, investigation and follow-up is monitored
- audits, inspections, reporting and notifications and document management are appropriately undertaken.

APPROVALS PROCESS

Production Operations Activities detailed in this booklet require a number of regulatory approvals. Primary environmental approvals required for Production Operations Activities are outlined below:

- An Offshore Project Proposal (the Barossa Offshore Project Proposal (OPP)) was developed for the Commonwealth waters component the Barossa Project and was accepted by NOPSEMA in March 2018. The Barossa OPP, at the time of submission, excluded approximately 23 km of GEP in Commonwealth waters which is subject to a separate EPBC Act approval process (refer below).
- A referral under the EPBC Act, covering the installation, operation and decommissioning of the remaining approximately 23 km of GEP in Commonwealth waters and the 100 km section of GEP in NT waters (inclusive of the 8.26 km in NT coastal waters) was submitted to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for assessment. The activity (referred to as the Darwin Pipeline Duplication Project) was determined to be a 'controlled action' under the EPBC Act and is currently being assessed on preliminary documentation.
- A referral under the *NT Environment Protection Act 2019* (EP Act) for the construction, operation and decommissioning of the 100 km section of GEP in NT waters (part of the Darwin Pipeline Duplication Project) was submitted to the NT Environment Protection Authority (EPA) and was subsequently assessed by way of Supplementary Environmental Report. On 22 December 2023, the NT Minister for Environment, Climate Change and Water Security approved the action the subject of the referral, on the recommendation of the NT EPA.

In addition to the primary environmental approvals outlined above, activity-specific Environmental Plans (EPs) meeting the requirements of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (Cth) (OPGGS Environment Regulations) are required. For Production Operations activities, the OPGGS Environment Regulations apply to the activities within OA1 in Commonwealth waters and OA2, spanning both Commonwealth waters (285 km) and coastal waters of the NT (8.26 km).

The OPGGS Environment Regulations set out that an EP must (among other things):

- comprehensively describe the activity to be carried out under the EP
- describe the environment that may be affected by the activity, including the values and sensitivities of that environment
- detail and evaluate the environmental impacts and risks for the relevant activity
- demonstrate that the impacts and risks of the activity will be reduced to as low as reasonably practicable and an acceptable level (and detail the control measures to be used to achieve this)
- demonstrate that Santos has consulted, in accordance with regulatory requirements, with each relevant person, including those whose functions, interests or activities may be affected by the activities to be carried out under the EP
- demonstrate that the measures (if any) that Santos has adopted, or proposes to adopt, because of the consultations are appropriate

Santos is currently preparing the Production Operations EP for submission to NOPSEMA, covering Commonwealth waters Production Operations activities in OA1 and OA2.

Santos is also preparing an Operations Environmental Management Plan (OEMP) to cover the operation of the GEP in NT waters for submission to DITT. The OEMP will also cover the operation of the 8.26km GEP in NT coastal waters, under the PSL Act and OPGGS Environment Regulations and operation of the remaining ~92km GEP covered under the Energy Pipelines Act.

In order to meet its proposed schedule for the Barossa Gas Project, Santos is aiming to submit the Productions Operation EP to NOPSEMA and the OEMP to DITT in 2024 and, subject to regulatory acceptance, commence activities in 2025. The timeline for consultation has been developed by Santos to meet this objective, while still providing a reasonable period for meaningful consultation with relevant persons, having regard to Santos's regulatory obligations and to feedback from relevant persons.

SEEKING INFORMATION AND WHAT'S NEXT

Santos is continuing its Barossa Gas Project consultation efforts to further learn, understand and assess values and sensitivities of the environment that may be affected by our proposed activities, and potential environmental impacts and risks. There may be information Santos is not yet aware of but needs to properly understand to assess potential activity impacts and risks. Consultation may inform this. It may also inform what control measures are to be proposed to reduce environmental impacts and risks to as low as reasonably practicable and to an acceptable level.

Santos is consulting on both the Production Operations EP (Commonwealth waters) and OEMP (NT waters) at the same time.

Scan this QR Code for more information on Barossa Production Operations Activity:

YOUR INPUT IS IMPORTANT TO SANTOS:

In preparing an EP for submission to NOPSEMA, a titleholder must consult with each 'relevant person', including relevant Commonwealth, State and Northern Territory Departments or agencies and persons (or organisations) whose functions, interests or activities may be affected by the activity proposed to be carried out under an EP.

Relevant persons being consulted on EPs under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023* (Cth) (OPGGS Environment Regulations) should note that they:

- are entitled to be given sufficient information to allow them to make an informed assessment of the possible consequences of the activity on their functions, interests or activities;
- are entitled to be allowed a reasonable period for the consultation; and
- may request particular information provided in consultation not be published.

If you request particular information not to be published, Santos will respect and abide by your request. Any information not to be published will be provided to NOPSEMA in a confidential report, separate from the published EP.

Your input is important to Santos:

- so that we can understand the environmental values in the OAs and the environment that may be affected, the environmental impacts and risks associated with the activity, to inform development of the Productions Operations EP (Commonwealth waters) and OEMP (NT waters);
- to inform how consultation processes may need to be adapted for different relevant persons; and
- to ensure that we provide information to relevant persons in an appropriate and accessible manner.

If you think you may be a relevant person for the purposes of one of Santos' proposed activities, please contact Santos on: **1800 267 600** or email **offshore.consultation@santos.com** to seek to be included in consultations and to provide feedback on how you would like to be consulted (if a relevant person).

This can also be done using the form available by scanning the QR Code below:

Visit **www.santos.com/barossa** for more information on the Barossa Gas Project.

Closeout email

This email or the content it contains was sent as appropriate to relevant entities.

Good afternoon,

We refer to our previous correspondence regarding consultation for environment plans for Santos' Barossa Project Operations activities in Commonwealth waters and Northern Territory waters.

Between February and May this year, Santos provided opportunities for your organisation to seek to participate in consultation and provide input regarding these activities, the environment that may be affected by the proposed activities, and the environmental impacts and risks associated with the proposed activities.

Santos would like to thank you for your response and any input provided to date. With the consultation period now complete we consider that consultation has now closed for the purpose of Santos finalising and submitting environment plans for these activities to government regulators for assessment.

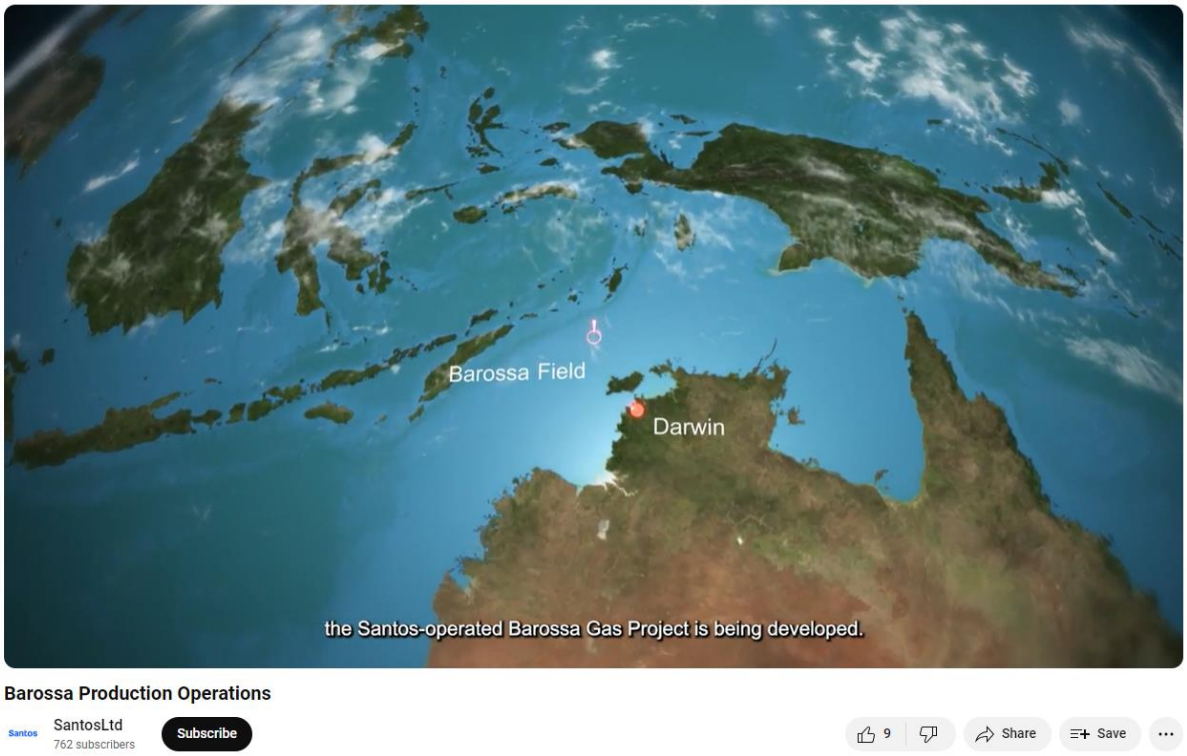
Regards

Barossa Consultation Coordinator
Email: offshore.consultation@santos.com

Phone: 1800 267 600

Santos

Video/Animation



[(Link to video)]

Photos, posters and iPad-based server-documents

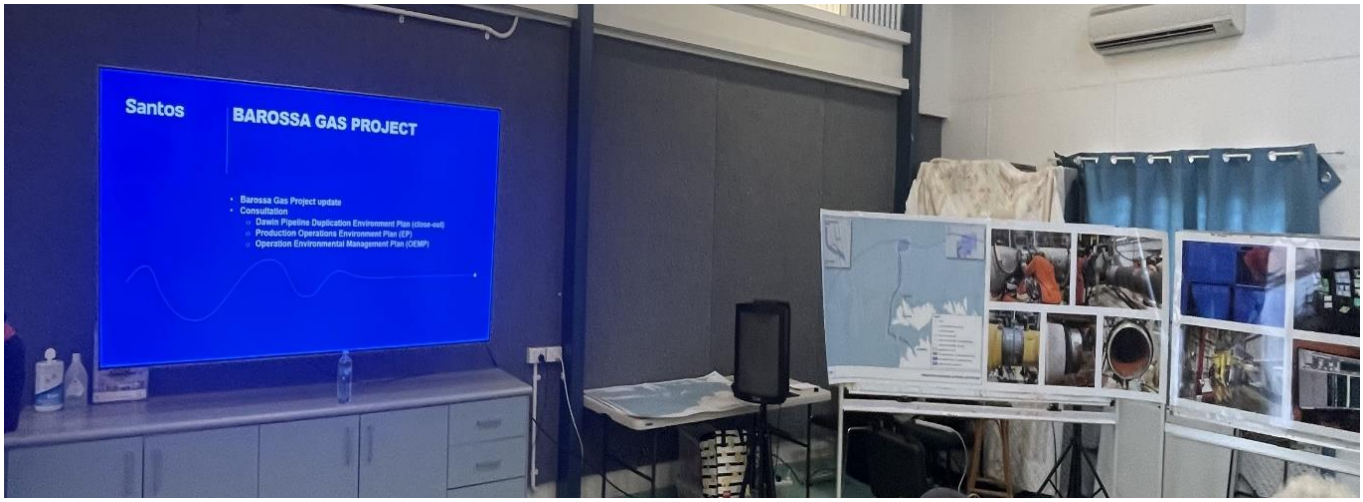
The consultation setup, visual tools (posters) and document tools (iPad server-based documents) made available to relevant persons attending consultation workshops are shown below.

Consultation Session Set Up: 21 May 2024, Pirlangimpi, Sports & Social Club

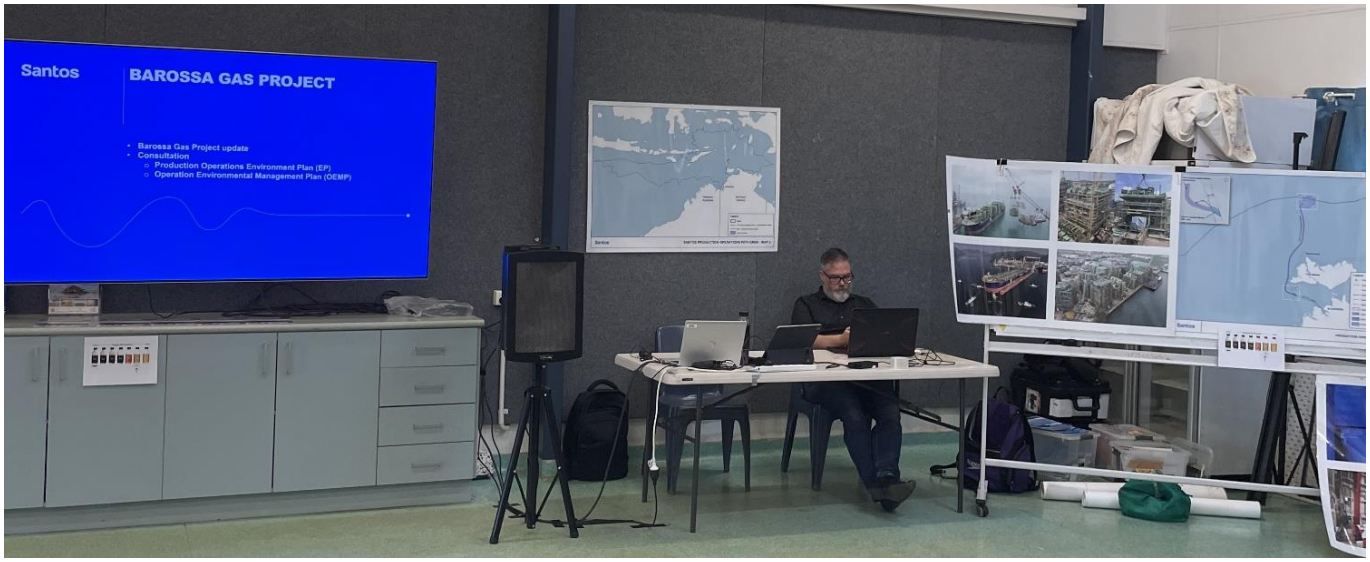
Consultation Session Set Up: 15 May 2024, Wurrumiyanga, Mantiyupwi Motel

Consultation Session Set Up: 15 May 2024, Wurrumiyanga, Mantiyupwi Motel

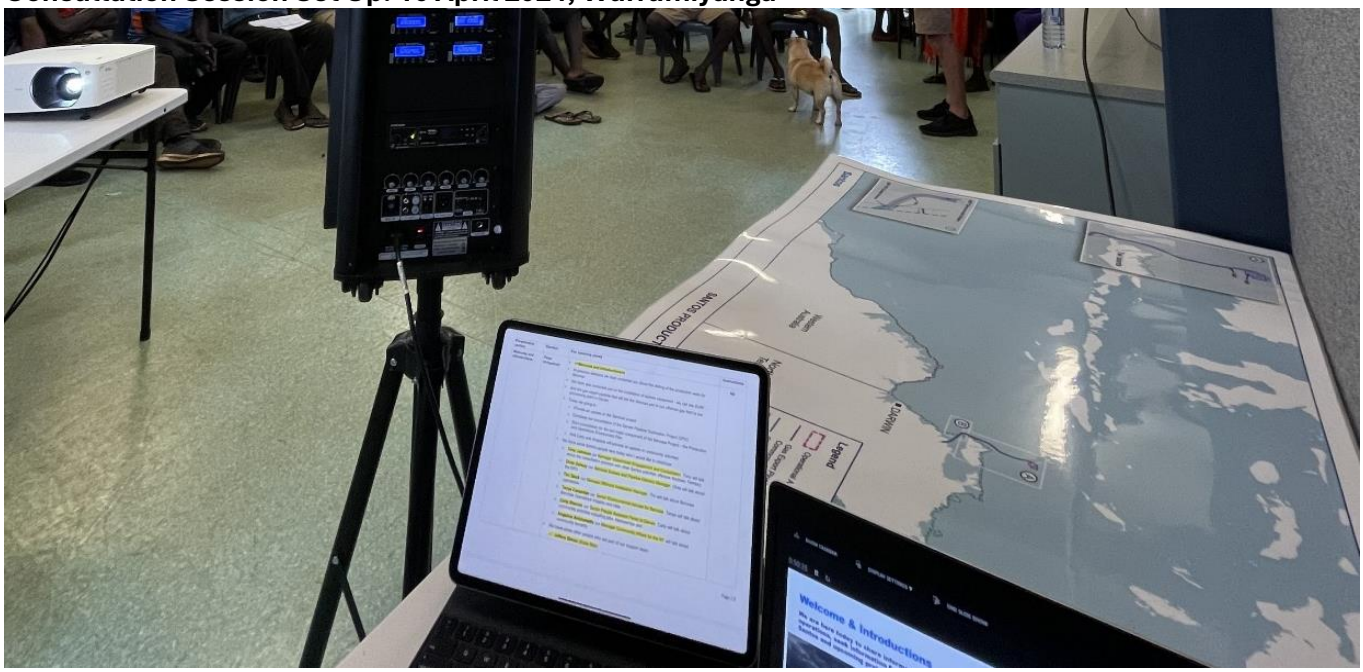
Consultation Session Set Up: 6 March 2024, Wurrumiyanga



Consultation Session Set Up: 7 March 2024, Wurrumiyanga



Consultation Session Set Up: 10 April 2024, Wurrumiyanga



Consultation Session Set Up: 10 April 2024, Wurrumiyanga

Consultation Session Set Up: 5 March 2024, Milikapiti, Sports & Recreation Centre

Consultation Session Set Up: 5 March 2024, Milikapiti, Sports & Recreation Centre

Consultation Session Set Up: 5 March 2024, Milikapiti, Sports & Recreation Centre

Wed 22 May: 10.30am – Wurankuwu Clan & Malawu Clan (came to one joint session), Wurrumiyanga, Mantiyupwi Motel**

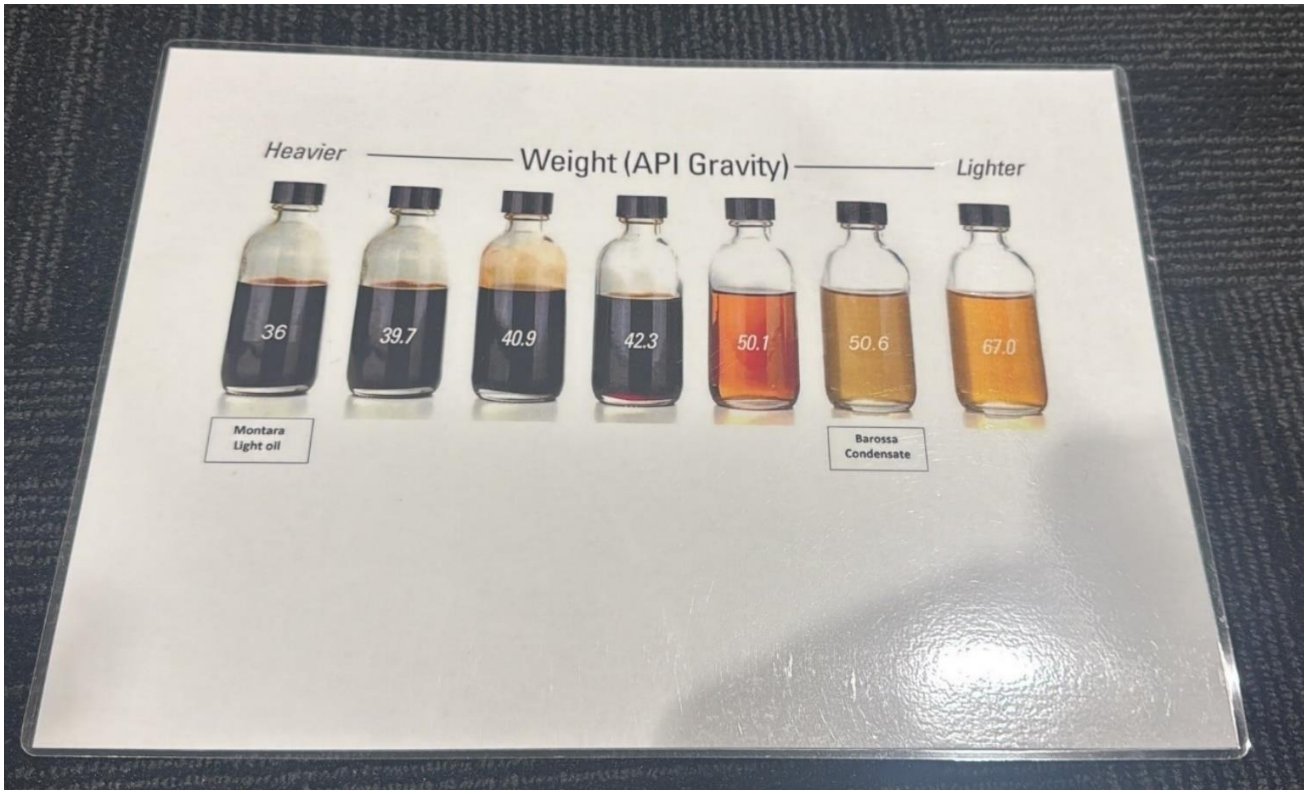
Consultation Visual Tool: Photo of the A0 sized Production Operations Laminated Poster utilised at each consultation session

Consultation Visual Tools: Photo of the A0 sized Barossa Overview Laminated Poster utilised at each consultation session & NOPSEMA Consultation Brochures

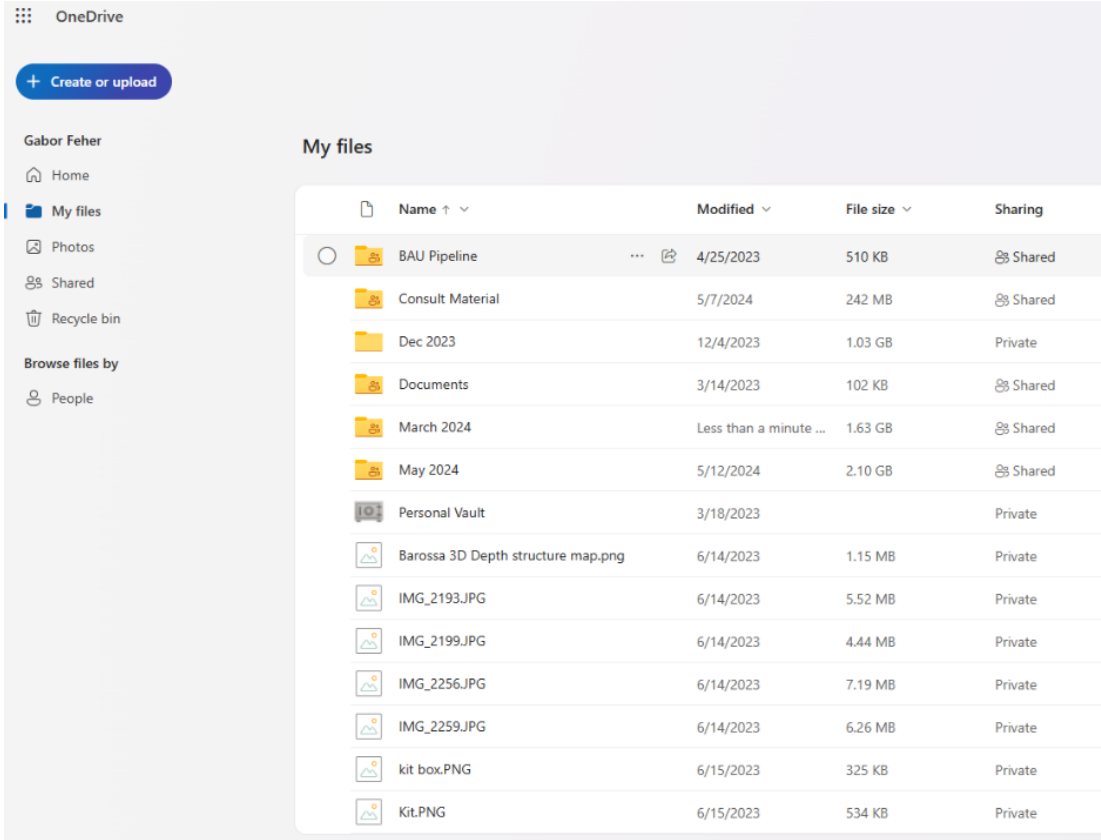
Consultation Visual Tool: Photo of the A0 sized Laminated Poster (Pipe Weld on pipelay vessel) utilised at each consultation session

Consultation Tool: Photo of the A0 sized Laminated Poster (Pipelay Control Room, Underwater Images, ROV) utilised at each consultation session

Consultation Tool: A0 sized FPSO Construction Laminated Poster utilised at each consultation session



Consultation Visual Tool: A4 sized Oil and Condensate Laminated Image



Consultation Tools: Server Based Documents Prepared for IPAD Uploads, 2023 & 2024

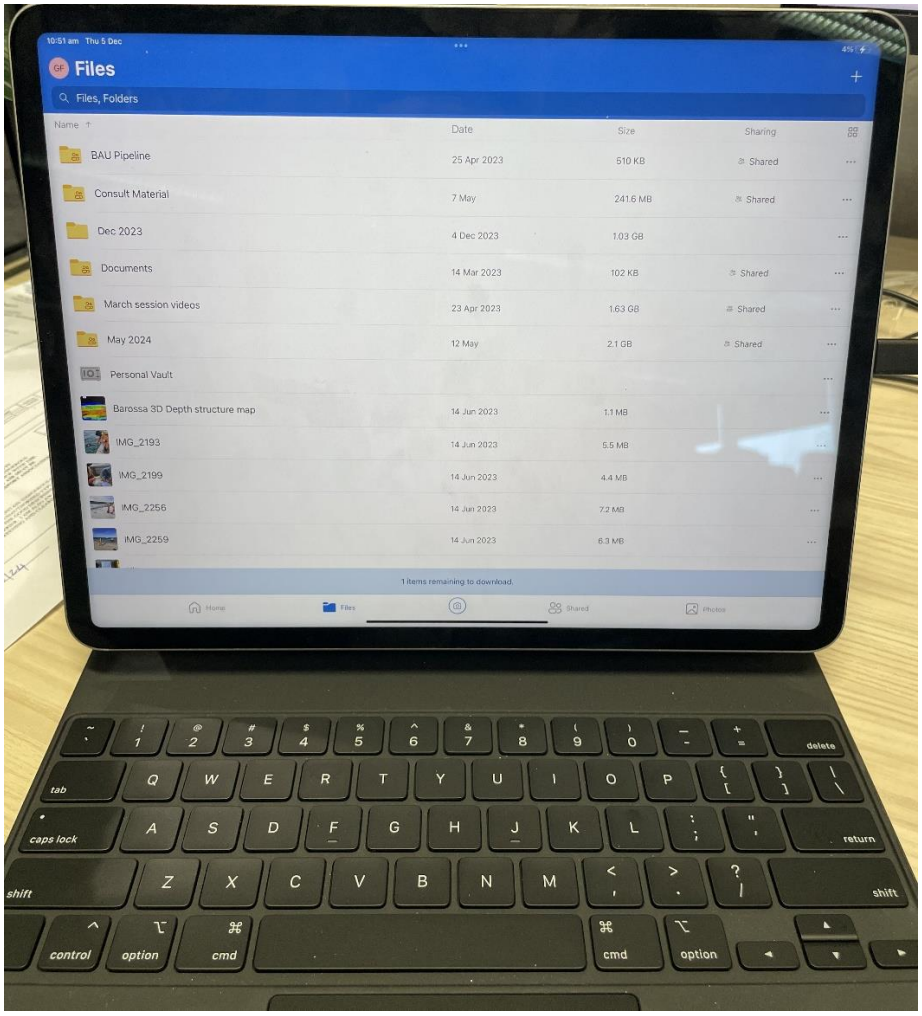
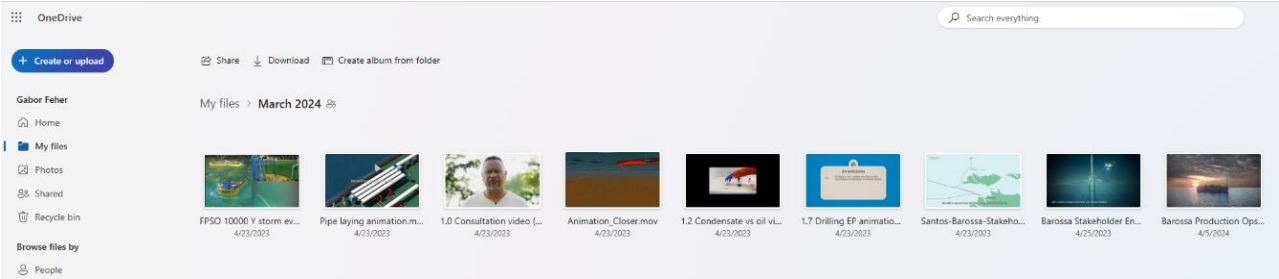
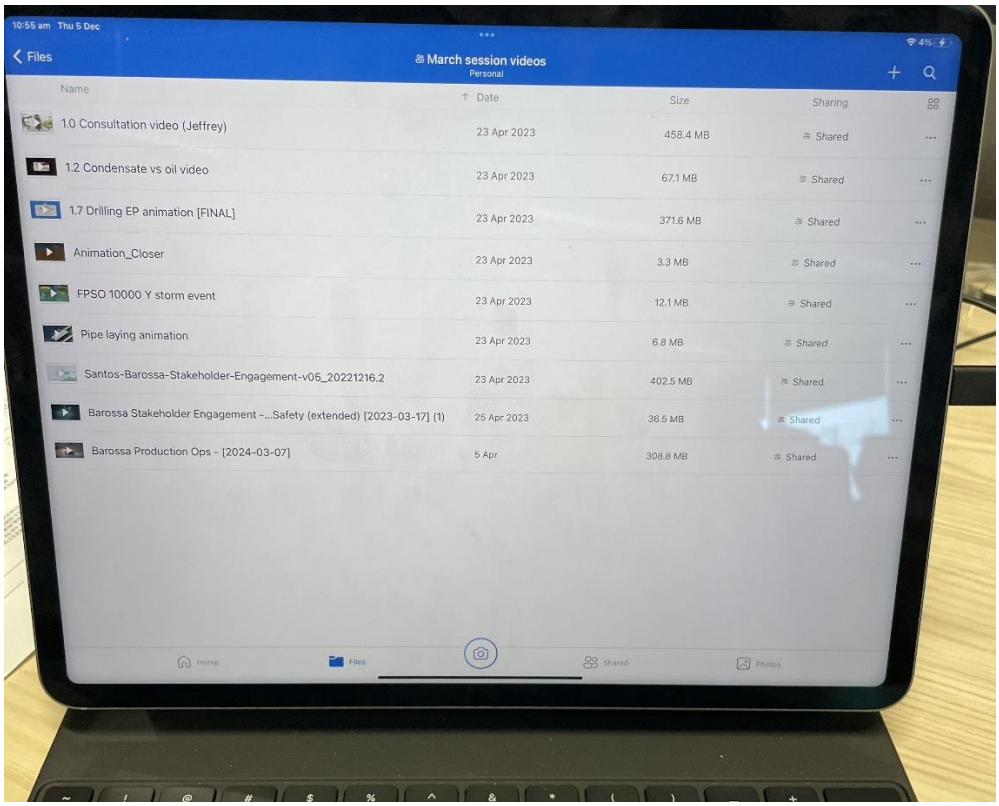


Photo of IPAD with 2023 & 2024 Documents Uploaded



Consultation Tools: Server Based Documents Prepared for IPAD Uploads, March 2024



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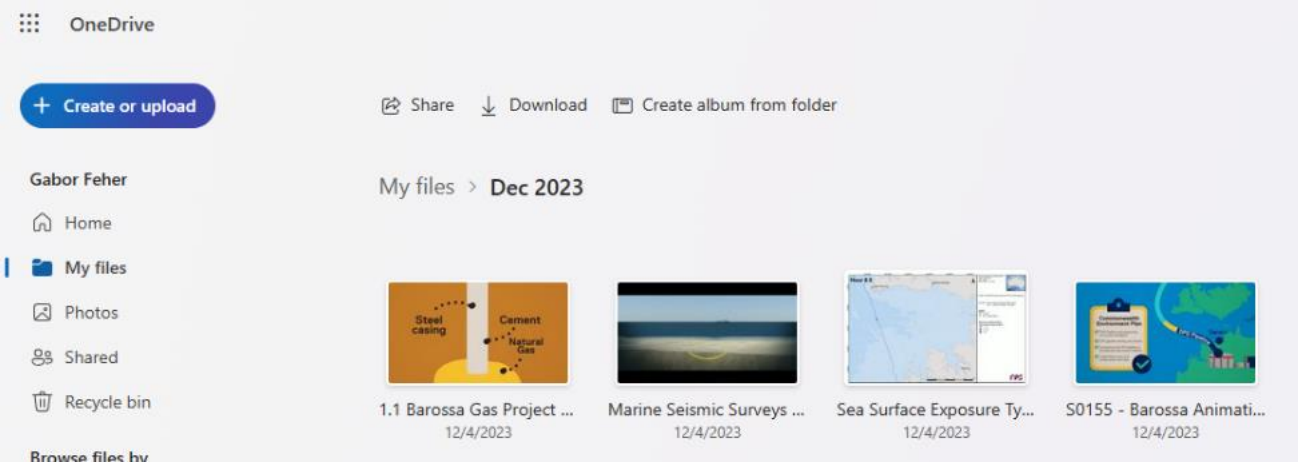


Consultation Tools: Server Based Documents Prepared for IPAD Uploads, December 2023

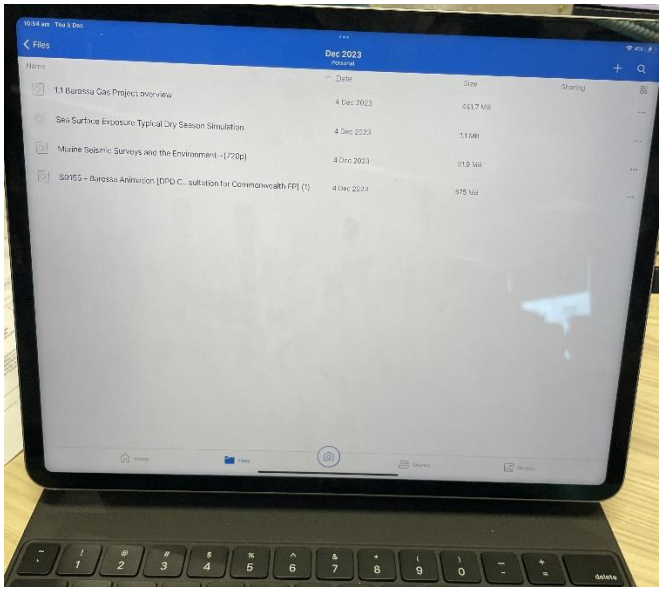
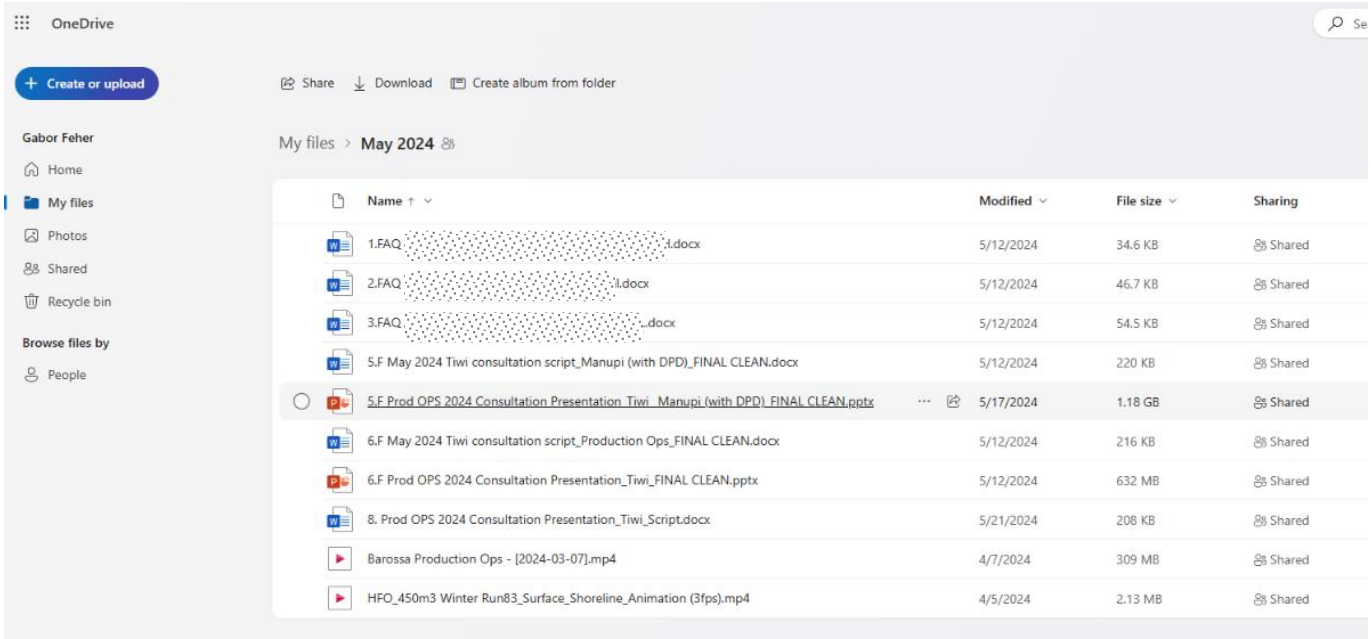


Photo of IPAD with December 2023 Documents Uploaded



Consultation Tools: Server Based Documents Prepared for IPAD Uploads, May 2024

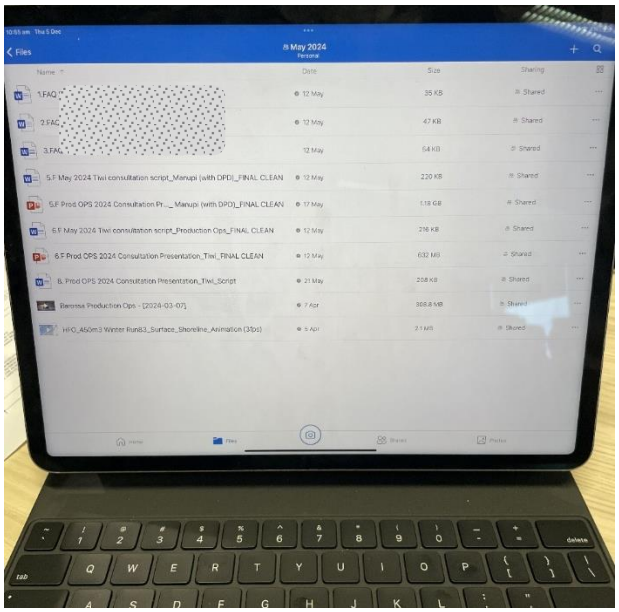
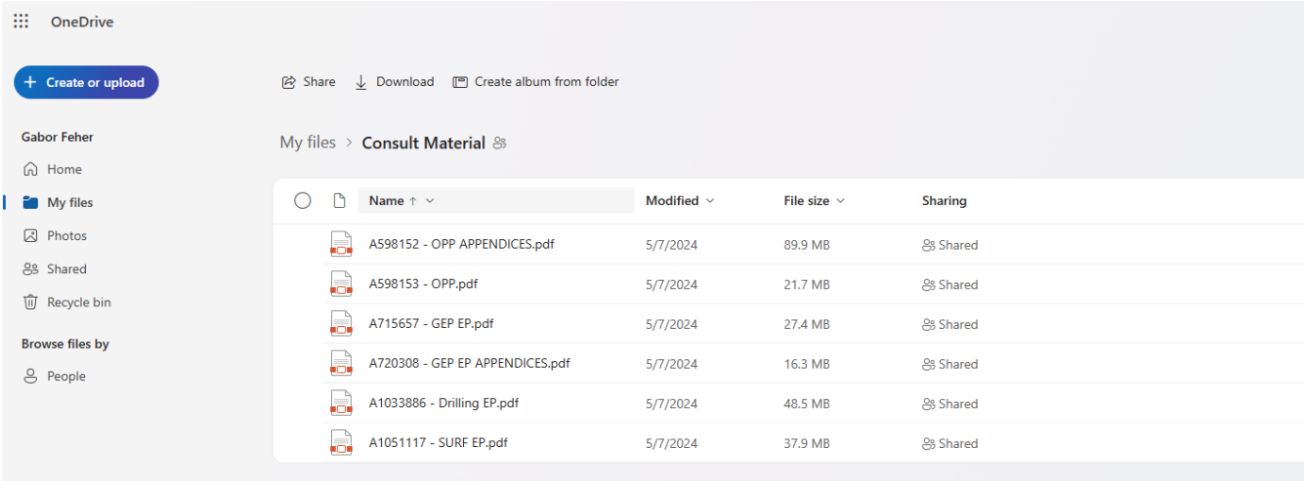
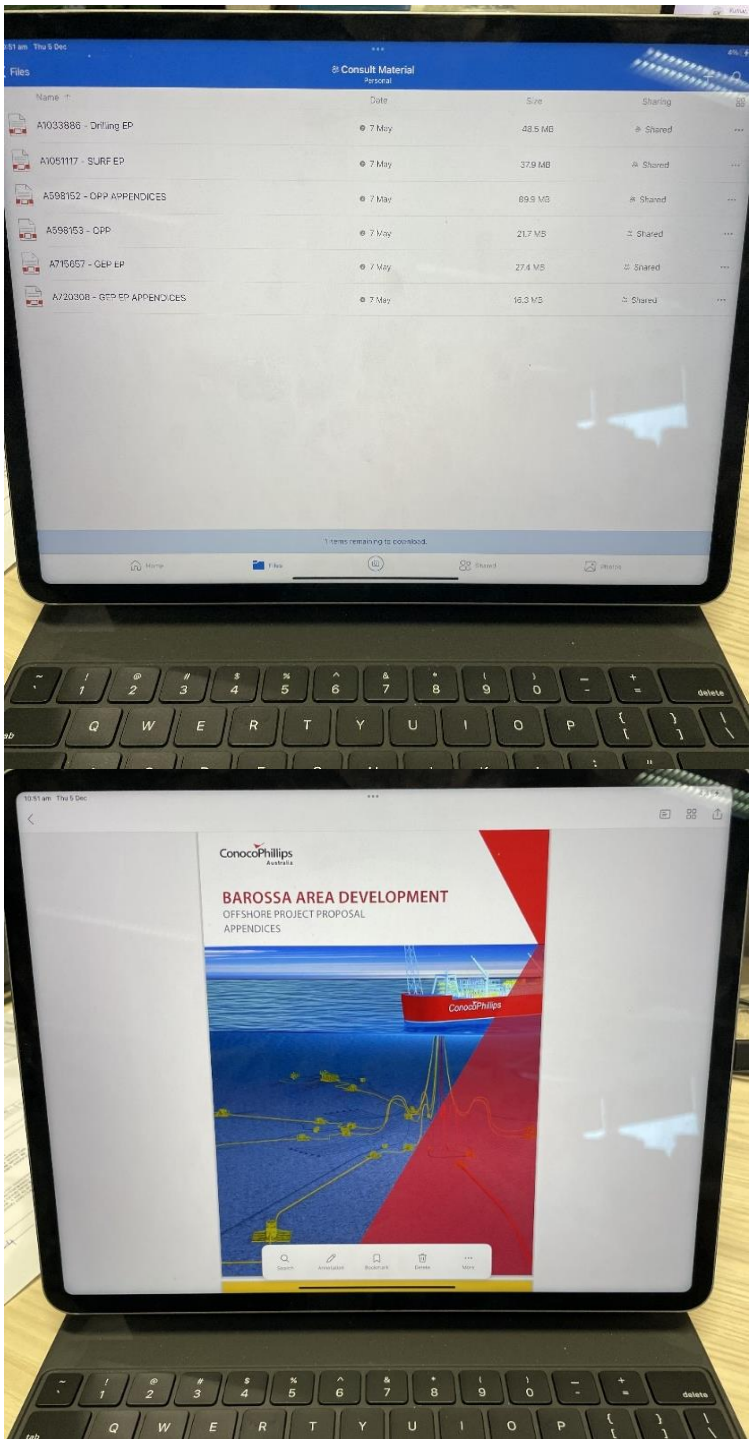


Photo of IPAD with May 2024 Documents Uploaded



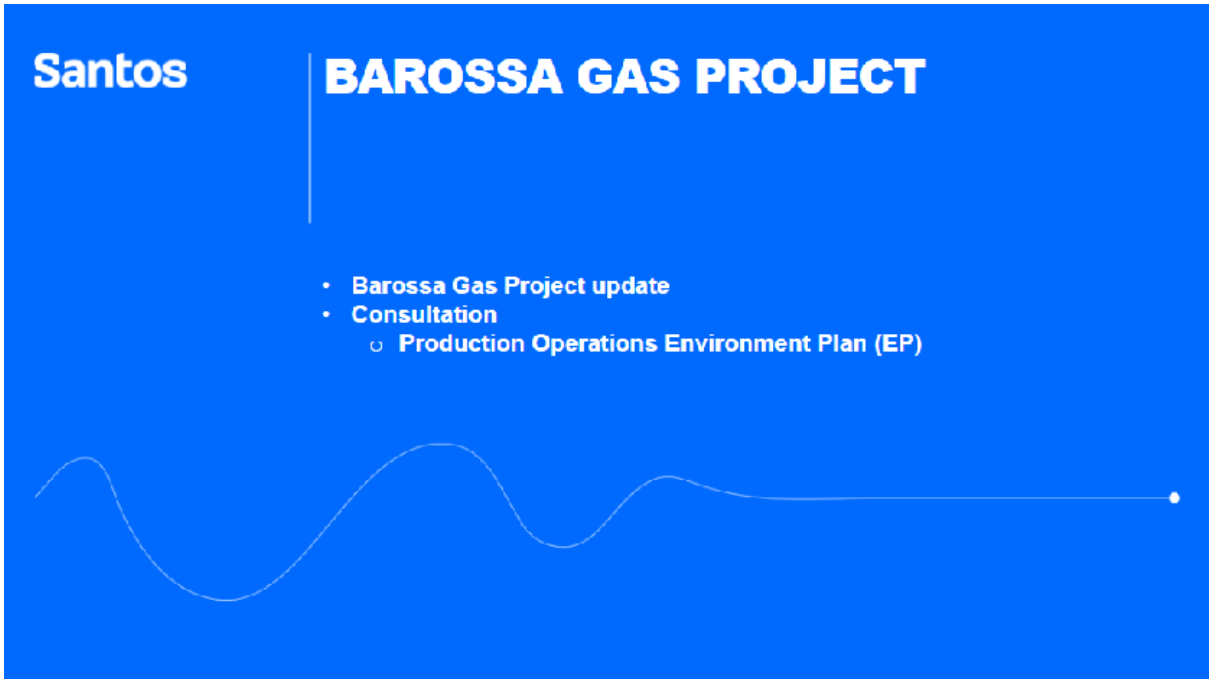
Consultation Tools: Server Based Documents Prepared for IPAD Uploads, May 2024



Photos of IPAD with May 2024 Documents Uploaded

PowerPoint presentation

The content of this presentation was presented to various relevant persons throughout the consultation period.



Santos

Acknowledgement of Country

I would like to begin by acknowledging the Traditional Custodians of the land and water on which work, and where we meet today.

We pay our respects to Elders past, present and emerging, and extend that respect to all Aboriginal and Torres Strait Islander peoples here today.

Santos

WELCOME AND INTRODUCTIONS

Santos

Welcome & Introductions

We are here today to share information about our company and operations, seek information from you and listen to your questions about Santos and upcoming projects.

Tony Johnson (TJ)- *Manager, Stakeholder Engagement & Consultation, Offshore*

Emma Haddon– *Senior Environmental & Consultation Advisor*

Good Advice Cultural Advisors

Santos

SANTOS OPERATIONS & DARWIN LNG

SANTOS - South Australia, Northern Territory Oil Search

Santos is a global energy company committed to increasingly cleaner energy and fuels production, with operations across Australia, Papua New Guinea, Timor-Leste and North America (Alaska).

At Santos, our commitment is to be a global leader in the transition to cleaner energy and clean fuels, by helping the world decarbonise to reach net-zero emissions in an affordable and sustainable way.

For 70 years, Santos has been working in partnership with local communities, providing local jobs and business opportunities, safely developing its natural gas resources, and powering industries and households.

Santos is one of Australia's biggest domestic gas suppliers and a leading LNG supplier in the Asia Pacific region.

We are committed to supplying critical fuels in a more sustainable way through decarbonising projects.

Our business focus: Safe, reliable operations & Minimise our social and environmental impacts.

Darwin LNG Facility & Operations

Santos

- Located in Darwin at Wickham Point, Darwin LNG (DLNG) is a gas liquefaction and storage facility that started production in 2006.
- Gas has been provided to the Darwin LNG from the Bayu-Undan gas field, located in between Australia and Timor Leste. Darwin LNG has shipped its 835th and final LNG cargo from the Bayu-Undan field.
- DLNG generates about $100 million a year in supply and service opportunities for Territory businesses.
- 100% Darwin residential Santos employee workforce and approx 180 local Darwin people work at the LNG Facility.
- DLNG established the NT's first LNG Process Operator Traineeships in 2010. 10% of those who have completed identified as an Aboriginal or Torres Strait Islander.

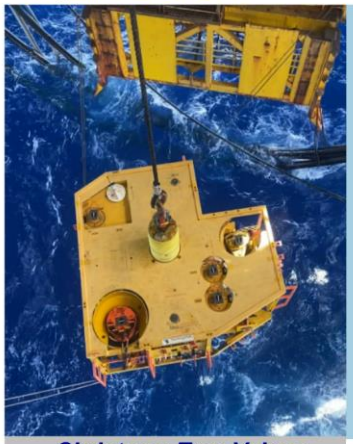
Santos

BAROSSA GAS PROJECT OVERVIEW & UPDATE

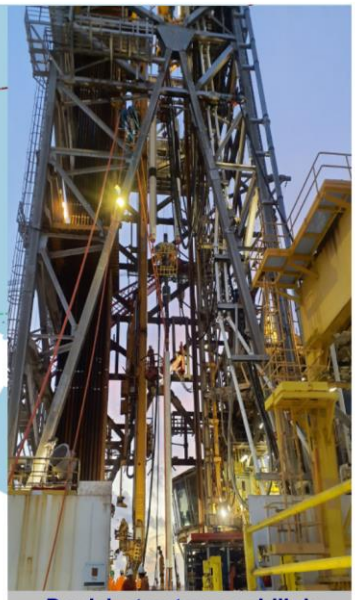
Barossa Project Update

Santos

- The drill rig has finished drilling the second well to just above the reservoir and installed plugs.
- A Tubing Head Spool has been installed on the second well.
- The rig is moving back to the first well to install the Christmas Tree.
- The Christmas tree is series of big valves and it works like a tap to open and close the well.



Christmas Tree Valves



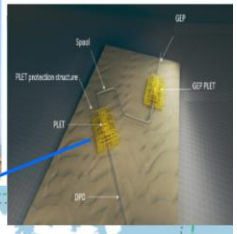
Derrick structure on drill rig

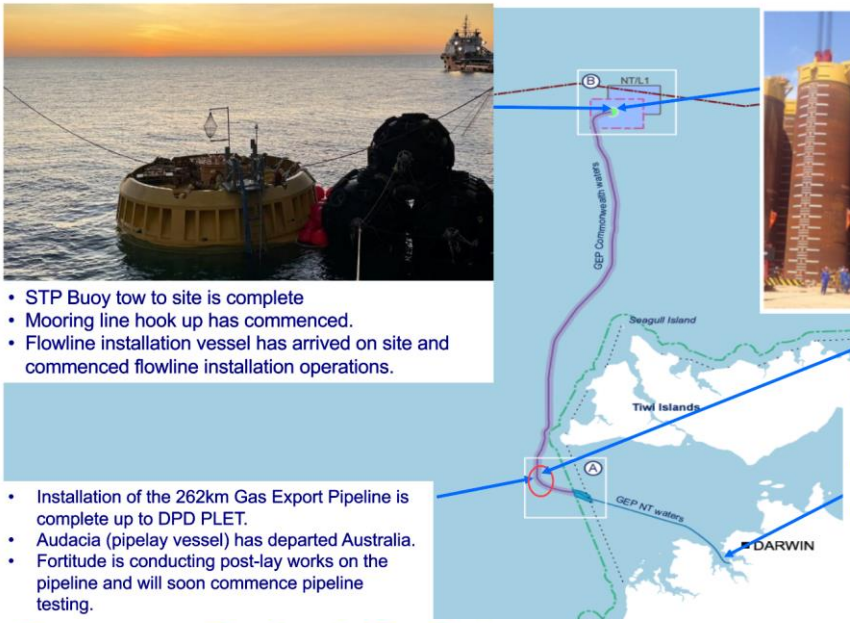
Barossa Project Update

Santos

- STP Buoy tow to site is complete
- Mooring line hook up has commenced.
- Flowline installation vessel has arrived on site and commenced flowline installation operations.

- 15x FPSO mooring anchor/chain installed & tensioning complete
- PLET installed at each end of pipeline





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- Audacia (pipelay vessel) has departed Australia.
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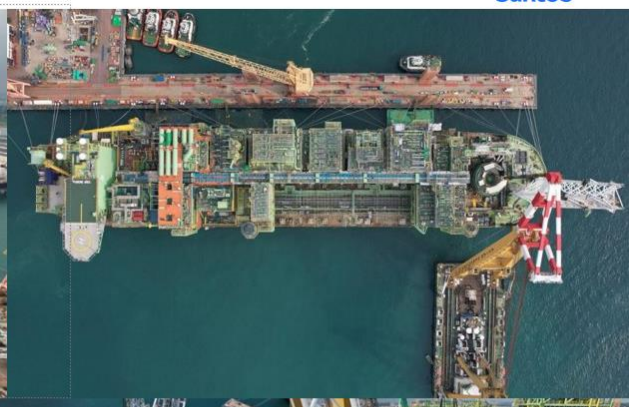
- Baseline environmental monitoring program completed around Darwin harbour.
- Water quality, habitat monitoring & fish surveys
- Joint Program funded by Barossa with the expertise of RPS, Curtin University, focus subsea, Larrakia Rangers.

Barossa Project Update

Santos



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- Ongoing installation of modules and large process equipment on FPSO.
- ROV survey of hull for marine biofouling complete and a report will be prepared with that data.

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CONSULTATION SESSION

Consultation – reg 25, *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023* (Cth)

(previously known as reg 11A, *Offshore Petroleum and Greenhouse Gas (Environment) Regulations 2009* (Cth))

Santos Consultation Introduction

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If you do not provide your personal information, we may not be able to identify you as the person who provided particular information or we may be unable to discuss any information you have provided with you further or respond to your questions. We may disclose your information to other companies within the Santos group, to third parties that help us run our business and to relevant government agencies and government departments.

Due to the global nature of our operations and business, your personal information may be accessed by or disclosed to Santos personnel outside Australia. We may also use overseas third parties to collect, transfer, store and handle your personal information. Some of the overseas countries that your personal information may be accessed from, disclosed or transmitted to or stored in include but are not limited to, Papua New Guinea and the United States of America.

You have a right to request a copy of any personal information that we hold about you, as well as a right to request that we correct any information that we hold about you that is inaccurate, out-of-date, incomplete, irrelevant or misleading. You can also make a complaint about how we have handled your personal information. Our Consultation Privacy Policies explain in more detail how you can exercise these rights, including how we will respond to your access or correction request or to any privacy complaint that you make. The Barossa Gas Project Consultation Privacy Policy is available on our website at www.santos.com/barossa/barossa-gas-project-consultation-privacy-policy, and the Northern Territory Consultation Privacy Policy is available on our website at https://www.santos.com/offshore-wa-and-nt-consultation-privacy-policy/. You can also contact us to request copies be provided to you.

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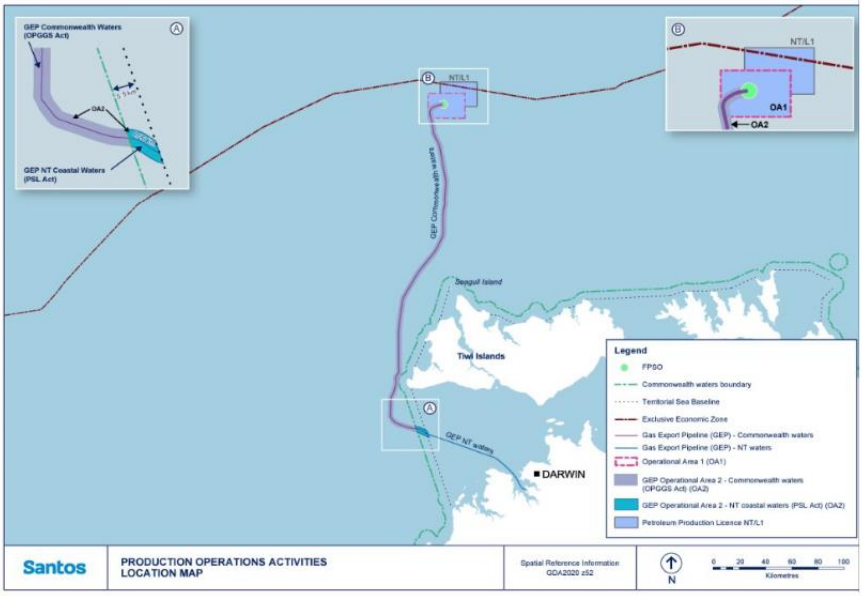
BAROSSA PRODUCTION OPERATIONS ACTIVITY OVERVIEW

Production Operations Activity - Summary

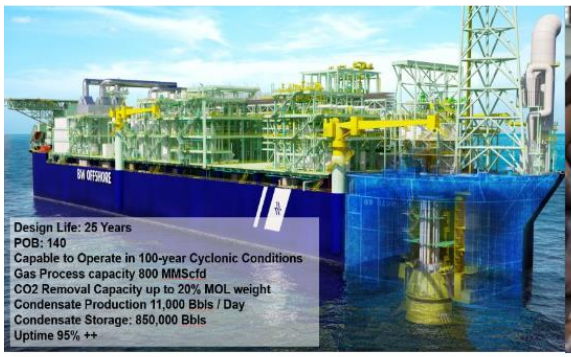
Santo

Key Activities	
Arrival FPSO	arrival & connection to mooring buoy
Hook-up & Commissioning FPSO systems & subsea equipment	Commissioning activities (testing) and prepare for start-up
Production Operations FPSO systems & subsea equipment	gas & condensate is processed on the FPSO
Offtake operations FPSO & tankers	condensate stored on the FPSO is removed 4-5 times a year by offtake tankers
Gas Export Pipeline Operations	dry gas is sent to DLNG via the GEP
Support Operations Vessels	transport food & materials
Support Operations Helicopters	transport people to/from FPSO
Support Operations- IMMR GEP & subsea equipment	planned underwater visual Inspection, Maintenance, Monitoring and Repair activities using remotely operated vehicles



Production Operations Activity - FPSO

Santos



FPSO

- 359m long or approx. 2.5 MCG football fields
- 64 m wide ,
- Houses 140 people

Mooring Line Chains

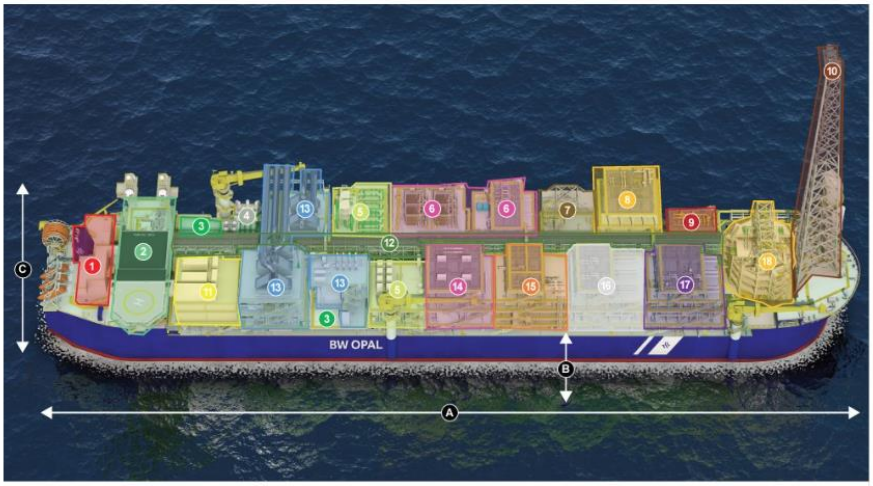
- Chains attach to FPSO mooring buoy & anchor piles
- Total of 11.3 km in length
- Weigh 5500 tonnes or approx. 2200 land cruisers

Anchor piles

- sink into seabed & attach to mooring buoy
- 19m high x 7m round
- Weigh 140 tonne each

Production Operations Activity - FPSO

Santos



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2. Living Quarters
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BAROSSA PRODUCTION OPERATIONS PLANNED ACTIVITIES IMPACTS & RISKS

Presented by Barossa Team

Production Operation Activity Impacts

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Planned Activities	Potential Impact	How we Manage (the rules we follow)
Light emissions	Behavioural impact to marine life (e.g., attraction)	We only use lights where needed for safe operations and to comply with relevant safety rules. We turn off lights when not required.
Noise emissions	Behavioural impact to marine life (e.g., avoidance)	The FPSO has been designed to reduce noise emissions. We follow procedures and look out for marine life (e.g. whales, dolphins, turtles) and we slow down and move away from them where possible if they are too close. Boats and equipment will be maintained to minimise noise.
Seabed disturbance (from inspections, maintenance, monitoring and repair)	Temporary loss of habitat	We will accurately and safely place infrastructure using dynamic positioning to minimise seabed disturbance. Records of all installed equipment will be kept so it can be removed during decommissioning.
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Physical presence (disturbance to other boats)	Exclude other users from activity area	We will communicate to other boats where we are and what we are doing. We mark the location of equipment on charts.

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BAROSSA PRODUCTION OPERATIONS UNPLANNED EVENTS IMPACTS & RISKS

Presented by Barossa Team

Production Operation Activity Impacts

Santos

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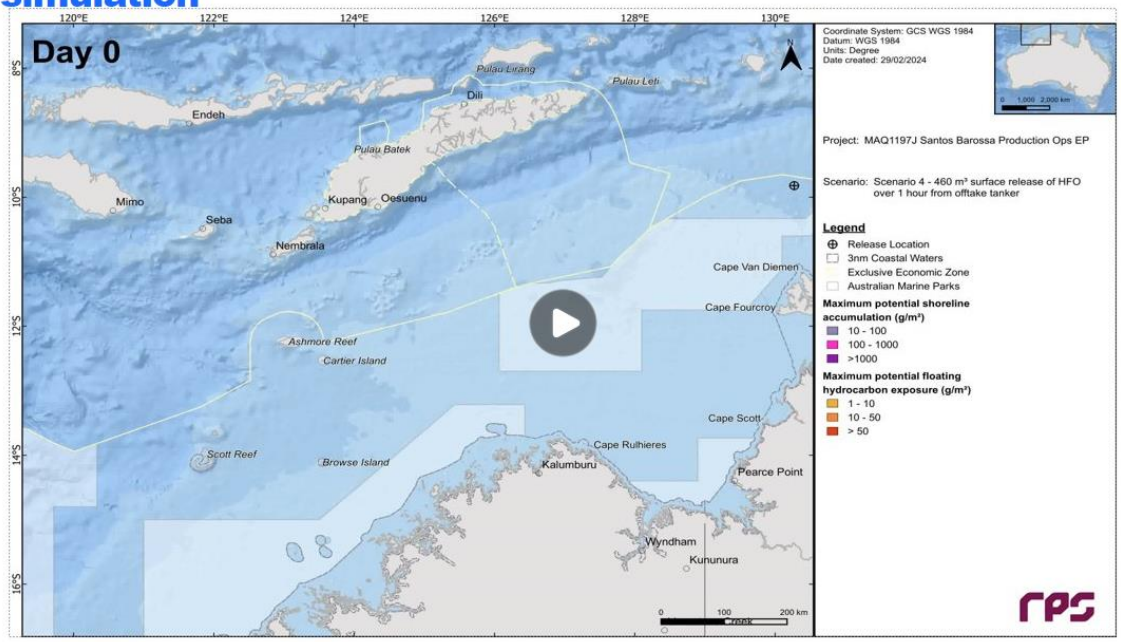
Production Operations Spill Animation – typical dry season simulation



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CLOSE OF CONSULTATION

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COMMUNITY UPDATE

Employment and Training

Follow Up Answers to Questions

Community Update

Santos

Topic	Question
Employment & Training Opportunities	How many First Nations people are employed on the Barossa Gas Project?
	How many First Nations People are employed with Santos altogether?
	How do we find out about any new employment opportunities?
	How do we apply for jobs and traineeships?

Employment Outcomes

Pipelay Cultural Observers & Monitors:

- 5 Tiwi People engaged as Cultural Observers & Monitors on Allseas Pipelay and Survey Vessels.
- Review ROV Footage during surveys and provide support if any finds on seabed while the Barossa pipeline is being laid.

Drilling Rig Assistant Roles:

- 7 First Nations people from Larrakia and Tiwi are employed in entry level offshore roles on the Santos contracted drill rig for Barossa.

Santos Offshore Health, Safety & Environment Advisor Traineeships

- 2 x HSE Advisor Traineeships with Santos, in partnership with Programmed Skilled Workforce to obtain a Certificate IV in HSE (12-18 month program).
- Recruitment process in final stages, with successful candidates on track to commence before July 2024.

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BAROSSA ABORIGINAL FUTURE FUND

Community Benefits

Employment & Training Program Outcomes

Santos-Kaefer (funded by Darwin LNG)

- Support Indigenous peoples by equipping participants with skills and knowledge to prepare them for long-term employment opportunities.
- Onsite training in Darwin at Darwin LNG and Kaefer workshop in Darwin.
- Training areas include scaffolding, HSE Traineeship, University Degree (HR or Mech Engineering), Accounting/ Bookkeeping Traineeship, Trade Apprenticeship
- Successful candidates are employed by Kaefer.
- Applications for 2024 opportunities have now closed.
- If you or a family member would like to register interest for future opportunities, please contact Kaefer via:
- FNrecruitment@kaefer.com.au
- k.thorn@kaefer.com.au
- Kylie Thorn: 0474 159 206

Santos

Santos is committed to supporting the communities where we operate

NT Aboriginal Coastal Communities (including homelands & outstations)

The Barossa Aboriginal Future Fund (BAFF) will invest in areas that provide an enduring legacy for NT Aboriginal Coastal Communities by:

- Improving community infrastructure
- Improving services that improve health, education, housing, community resilience and economic outcomes
- Enabling communities to maintain cultural practices and carry out cultural obligations
- Enabling communities to care for their country
- Building capacity to establish pathways to skilled, well-paying, secure jobs and business development opportunities.

NT Aboriginal Coastal Communities the Barossa projects operates in includes Tiwi Islands, Darwin-Daly-Wagait, West Arnhem, East Arnhem and Victoria River District.

Santos Foundation - Supporting local PNG priorities

Healthcare, Community Development, Family & Sexual Violence, Youth Opportunities

Helping the next generation

"We want to see the children excel in early childhood learning so they can continue to elementary schools equipped with the fundamental tools they need."

Pale Mbipe of Hela Province, PNG

Unlocking barriers to healthcare

"We undertook repairs to the water supply, renovated the maternity ward, and repaired other buildings at the hospital. We will be able to diagnose and treat people very quickly now with these new services available in Koroba."

Dr James Kintwa,
CEO Hela Provincial Health Authority

Bel isi PNG case management and community leadership

"We host events and learning sessions throughout the year aimed at raising awareness and imparting tools to address family violence."

Leon Buskens,
Santos Country Chair PNG

BAROSSA ABORIGINAL FUTURE FUND

Santos wants to listen to NT Aboriginal Coastal Communities about the needs for their communities.

Santos is working with our Barossa Joint Venture Partners to establish legal structures with sound governance

The Santos NT Community Team will continue to visit Tiwi and other NT coastal regions even after consultation is complete.

If you want more information or want to share your ideas, you can visit the NT Community Team at the Santos shop in the Darwin Mall or contact us through:

Email: enquiriesNT@santos.com Phone: +61 8919 1900

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THANK YOU FOR ATTENDING

PowerPoint presentation

These slides were shown as part of close out meetings with Tiwi clans.

Santos

WELCOME AND INTRODUCTIONS

Santos

Welcome & Introductions

We are here today to share information about our company and operations, seek information from you and listen to your questions about Santos and upcoming projects.

Peter Kirkpatrick *– General Manager Darwin*

Tanya Carpenter *– Senior Environmental Adviser*

Angelina Anictomatis *–Manager Government Affairs and Community*

Neil Pomfret *– First Nations Engagement Advisor – NT/WA*

Support Team*–Emma, Khang, Stanley, Kode Blak, Melbourne Minute*

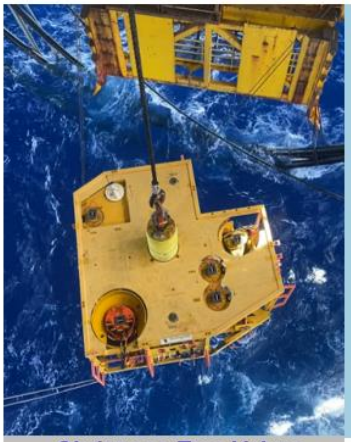
Santos

BAROSSA GAS PROJECT OVERVIEW & UPDATE

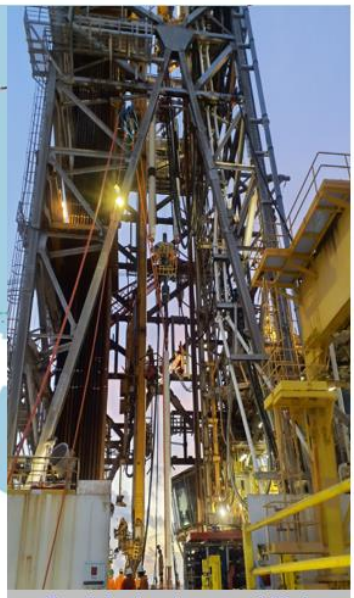
Barossa Project Update

Santos

- The drill rig has finished drilling the second well to just above the reservoir and installed plugs.
- A Tubing Head Spool has been installed on the second well.
- The rig is moving back to the first well to install the Christmas Tree.
- The Christmas tree is series of big valves and it works like a tap to open and close the well.



Christmas Tree Valves



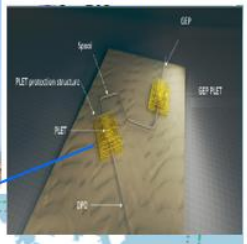
Derrick structure on drill rig

Barossa Project Update

- STP Buoy tow to site is complete
- Mooring line hook up has commenced.
- Flowline installation vessel has arrived on site and commenced flowline installation operations.

Santos

- 15x FPSO mooring anchor/chain installed & tensioning complete
- PLET installed at each end of pipeline



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Barossa Project Update- Anchor Installation

Barossa Project Update

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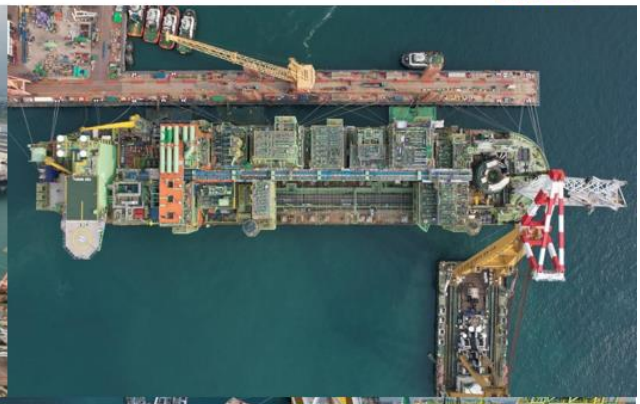

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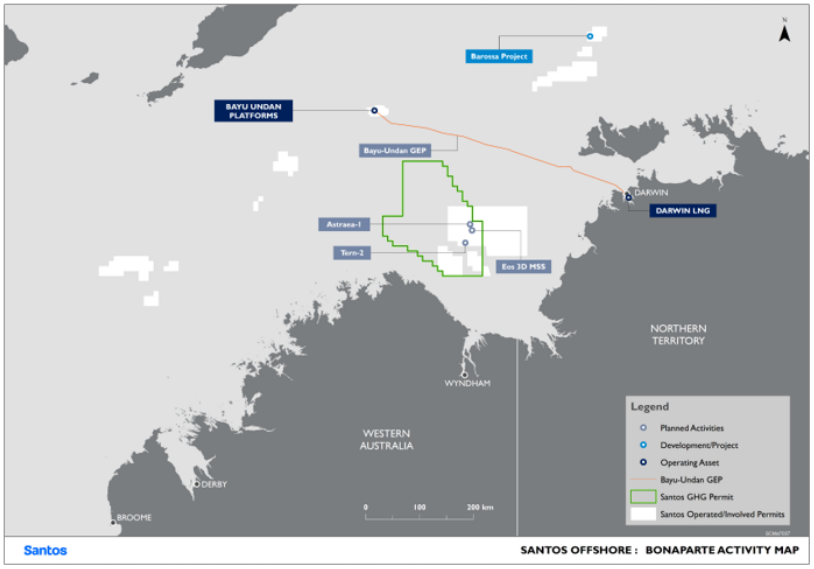
- Ongoing installation of modules and large process equipment on FPSO.
- ROV survey of hull for marine biofouling complete and a report will be prepared with that data.

Other Santos Activity Update 2024

Santos

Planned Activities	Status
Bayu-Undan Gas Export Pipeline Operations (preservation phase)	Consultation closed. EP under assessment by NOPSEMA.
Tern-2 Plug and Abandonment	Consultation closed. EP under assessment by NOPSEMA.
Eos 3D Marine Seismic Survey	Consultation closed. EP to be submitted to NOPSEMA in Q2 2024.
G-11-AP Carbon Capture and Storage Appraisal Well (Astraea-1)	Consultation closed. EP submission to NOPSEMA in Q3 2024.



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BAROSSA PRODUCTION OPERATIONS ACTIVITY OVERVIEW

Production Operations Activity - FPSO

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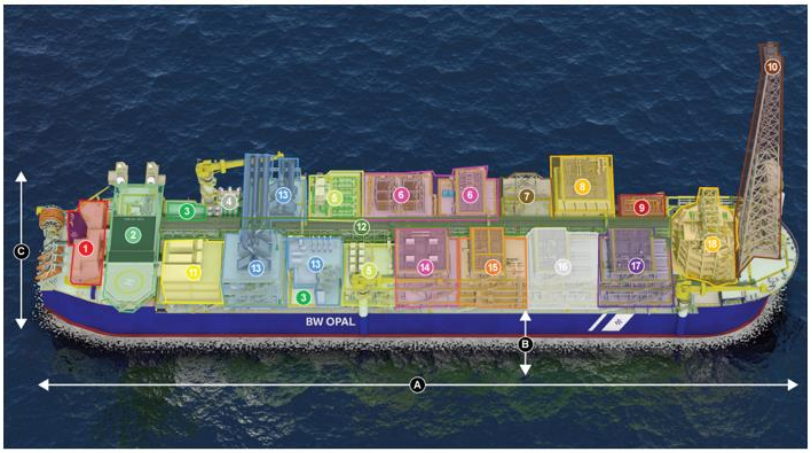

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BAROSSA PRODUCTION OPERATIONS PLANNED ACTIVITIES IMPACTS & RISKS

Presented by Barossa Team

Production Operation Activity Impacts

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Follow Up Answers to Questions

Santos

Planned Activities

Topic	Question
Greenhouse Gas Emissions	Is there a limit on how many times Santos can use the flare on the FPSO? What happens if Santos exceeds the total emissions for the year? Do they shut down?
Environmental Research in the Operational Areas	What baseline studies for the environmental impacts that have been completed? Can Santos provide the environmental baseline studies?
Helicopter Activity	Will helicopters fly over Tiwi

Helicopter Activity

Santos

- Helicopters will fly over Tiwi islands on average 3 times per week to transport people to the FPSO
- To manage any potential noise impacts, Santos intends to:
  - Limit noise impact by fly the Helicopter 1.8 km to 2.4km above Tiwi islands, existing aircraft fly lower than 0.6km. Noise levels at this height are unlikely to be heard any more/differently than other background air traffic.
  - Planned helicopter flight paths are over the eastern end of Melville Island, at its closest point in 22km from Seagull Island
- When helicopters begin flying over Tiwi's, if you do have concerns, you can raise them directly with Santos.

Follow Up Requests

Santos

PLANNED ACTIVITIES

Production Operation

1. Request for a map with the vessel movements and shipping routes
2. Request for a picture of the shipping chart that shows the 500-metre exclusion zone around the FPSO
3. Where is the operational area in relation to biologically important areas (threatened species)?
4. Provide evidence that the operational area is not in a whale migration pathway.

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BAROSSA PRODUCTION OPERATIONS UNPLANNED EVENTS IMPACTS & RISKS

Presented by Barossa Team

Production Operations Unplanned Risks

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Unplanned Events (Accidents)	Unplanned Impact	How we manage (the rules we follow)
Dropped objects	Impacts to water quality, disturbance to seabed and marine life	We follow strict procedures to stop objects dropping overboard and we pick up objects when it is safe to do so.
Disturbing marine animals	Disturbance (e.g. collisions) to marine animals	We look out for marine life (e.g., whales, dolphins, turtles) and we slow down and move away from them where possible if they are too close. We follow rules that outline how we need to interact with marine animals.
Invasive marine life (marine pests)	Impacts to other marine life and industry if pests establish	We ensure boats have low risk for carrying marine pests before they arrive. We have plans and equipment in place on boats to prevent invasive marine species. The Federal government has strict rules we need to follow. The FPSO will have a quarantine management plan.
Chemical spill	Water quality and marine life impacts	We select chemicals that are environmentally friendly where possible and store them carefully. We have procedures for using and cleaning up chemicals.
Dry gas release	Impacts to marine life, water/air quality, other marine users and cultural features	The pipeline is designed to withstand impacts from dropped objects. We follow strict rules for lifting equipment and have emergency response procedures. The infrastructure location is marked on nautical charts. We have operating procedures and a safety case to prevent a loss of gas.
Minor hydrocarbon releases	Impacts to marine life-and water quality	We have procedures in place to manage the handling and transfer of hydrocarbons.
Larger hydrocarbon releases (marine diesel oil, marine gas oil, condensate, heavy fuel oil, well fluids)	Impacts to water quality, habitats and marine life, other marine users and cultural features	We make sure all the boats are following the rules for preventing collisions. We let other boats know where we are and what we are doing. We follow strict procedures for refueling. We will have well operations management plans setting out the systems in place to ensure well safety. We have plans (OPEP) arrangements in place for responding to spills.

Follow Up Answers to Questions

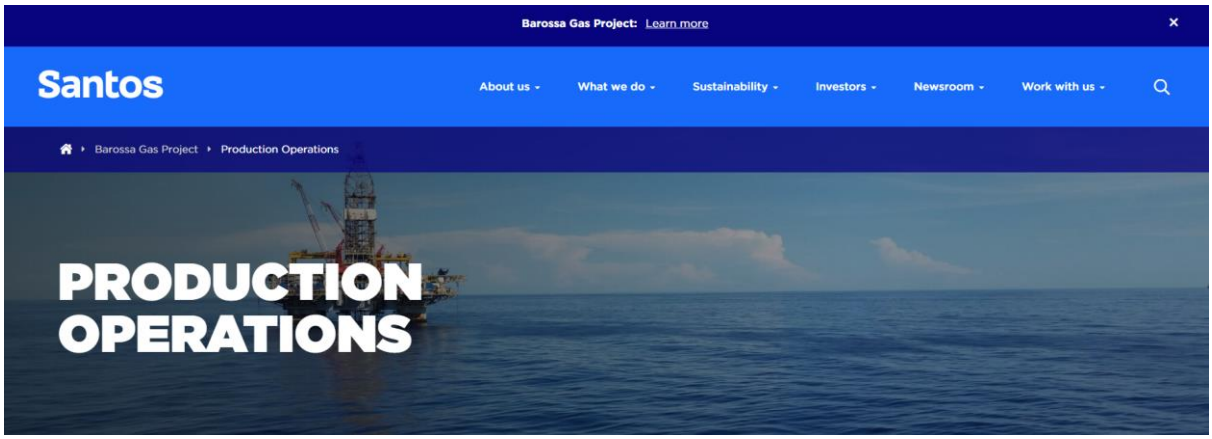
Santos

Unplanned Risks (Accidents)

Topic	Question
Spill Response Training	Who manages the spill response training register?
	Will Santos be doing more spill response training in the Community?
	Is spill response training only for Tiwi people or will other Communities be trained too?
Compensation	If an oil spill were to occur and people were impacted, would there be compensation?

CLOSE OF CONSULTATION

Website



Activity Summary

The Santos-operated Barossa Gas Project is an offshore gas and condensate project with the purpose of providing a new source of gas for the existing Darwin liquified natural gas (DLNG) facility at Wickham Point in the NT. It is intended that natural gas and condensate would be extracted from the Barossa field, located in Commonwealth waters approximately 285 kilometres offshore north-northwest from Darwin. Initial processing would occur at the Floating Production Storage and Offloading (FPSO) facility, to separate the natural gas, water and condensate extracted from the Barossa field. The dry natural gas would be transported through the GEP for onshore processing at the DLNG facility. The condensate would be transferred from the FPSO facility to purpose-built tankers for international export.

As part of obtaining authorisation for this activity, Santos is undertaking consultation for the following regulatory approvals:

- The Production Operations Environment Plan (EP) relating to the arrival and operations of the FPSO, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the GEP located in Commonwealth waters where offshore petroleum activities are regulated under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth) (OPGGS Act).
- The Operations Environmental Management Plan (OEMP) which includes the:
  - 8.26 km section of the GEP in NT coastal waters covered by the *Petroleum (Submerged Lands Act) 1981* (NT) (PSL Act); and
  - ~92 km section of the GEP inshore of NT waters covered by the *Energy Pipelines Act 1981* (NT) (Energy Pipelines Act).

The estimated life of the Barossa Development is 25 years, and the Production Operations EP and the OEMP will be reviewed every five years following initial regulator authorisation. Productions Operations Activity is planned to commence in 2025.

Figure 1: Graphical image of the FPSO

Approvals process

The Commonwealth Government's independent expert regulator for offshore oil and gas development, the National Offshore Petroleum Safety Management Authority (NOPSEMA), accepted the Barossa Offshore Project Proposal (OPP) in March 2018. The OPP is the government's project-level environmental approval for offshore projects, with construction and operations subject to acceptance of activity-level environment plans (EPs). An EP:

- must provide a detailed environmental impact and risk assessment of the proposed offshore activity and demonstrate how those impacts and risks will be reduced to a level that is as low as reasonably practicable and acceptable for the life of the activity; and
- must describe how Santos has identified and consulted with relevant persons whose interests, functions and activities may be affected by the activities to be carried out under the EP.

Santos will be consulting in accordance with section 25 of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023* (Cth) (OPGGS Environment Regulations) as the Production Operations EP is developed.

For Production Operations activity in Northern Territory waters, the OEMP will be submitted to the NT Department of Industry Tourism and Trade (DITT).

Seeking information and what's next

Santos is consulting on both the Production Operations EP (Commonwealth waters) and OEMP (NT waters) at the same time.

Santos is continuing its Barossa Gas Project consultation efforts to further learn, understand and assess values and sensitivities of the environment that may be affected by our proposed activities, and potential environmental impacts and risks. There may be information Santos is not yet aware of but needs to properly understand to assess potential activity impacts and risks. Consultation may inform this. It may also inform what control measures are to be proposed to reduce environmental impacts and risks to as low as reasonably practicable and to an acceptable level.

In preparing an EP for submission to NOPSEMA, a titleholder must consult with each 'relevant person', including relevant Commonwealth, State and Northern Territory Departments or agencies and persons (or organisations) whose functions, interests or activities may be affected by the activity proposed to be carried out under an EP.

Relevant persons being consulted on under the OPGGS Environment Regulations should note that they:

- are entitled to be given sufficient information to allow them to make an informed assessment of the possible consequences of the activity on their functions, interests or activities;
- are entitled to be allowed a reasonable period for the consultation; and
- may request particular information provided in consultation not be published.

If you do ask this, Santos will respect that, and the information will not be published under the OPGGS Environment Regulations. Information we need to give to NOPSEMA to assess our plan will be provided in a separate report (rather than in the published EP).

Your input is important to Santos:

- so that we can understand the environmental values in the operational area and the EMBA, and the environmental impacts and risks associated with the activity;
- to inform how consultation processes may need to be adapted for different relevant persons;
- to ensure that we provide information to people in an appropriate and accessible manner; and
- to assist with Santos' preparation of the EP.

If you consider you may be a relevant person, please contact us as soon as possible via email at offshore.consultation@santos.com or call 1800 267 600 to allow Santos to initiate consultation with you in relation to the proposed activities and so you can tell us how you would like to be consulted. Consultation closes on **Tuesday 9 April 2024.**

Santos is committed to undertaking genuine and meaningful consultation. We want to provide information for people to make informed assessments of the possible consequences of the proposed activities on them. Your input is important to us, and input will be considered in the development of our EP.

Visit santos.com/barossa for more information on the Barossa Development.

Privacy Notice

Santos Limited, Santos NA Barossa Pty Ltd and their related bodies corporate (collectively, we, our, us or Santos) collect personal information about you (which may include sensitive information about your Indigenous heritage or clan group) that you provide in this form and in any consultation with you. We use this information to engage with you, to receive and respond to any feedback that you provide, to include relevant information in any reports that we prepare, and for the purposes otherwise set out in our Barossa Gas Project Consultation Privacy Policy. Santos will handle your information in accordance with our Code of Conduct, our Confidentiality, IP and Privacy Procedure and Barossa Gas Project Consultation Privacy Policy. You can ask us for a copy of any of these documents by contacting us using the details set out below.

The laws that relate to consultation regarding the environment plans may require us to collect personal information about you if your feedback is to be included in any report we prepare (including so that a copy of that report can be provided to you if you request). If you do not provide your personal information, we may not be able to identify you as the person who provided particular feedback (including in any report relating to consultation) or discuss any feedback you have provided with you further.

The information you provide will be collected by or on behalf of us and may be disclosed to other companies in the Santos group, to third parties that help us run our business, or as required by law (including collection and disclosure of information to relevant government agencies and departments to which we are required to provide reports). Your feedback may also be reflected in our environment plans (subject to any non-publication requests, as described below). We may disclose your personal information to recipients that are located outside of Australia, including in Papua New Guinea and the United States of America.

Our Barossa Gas Project Consultation Privacy Policy and related documents described in this Privacy Notice provide further information about how we store and use, and how you may access and correct, your personal information, and how you can lodge a complaint regarding the handling of your personal information (including how we will respond to that complaint). If you would like to request a copy of any personal information that we hold about you or request that we correct any such information that is inaccurate or incomplete, you can contact us in the following ways:

- posting a letter addressed to us at 60 Flinders Street, Adelaide;
- telephoning us on (08) 8116 5000; or
- sending us an email at offshore.consultation@santos.com.

You may request that any information you provide in this form, or during any consultation, not be published (including as part of any environment plan or related reports). You can make this request by selecting the option in the form below. If you select this option, the information will not be published and Santos may contact you to discuss your wishes.

Relevant person nomination form

Production Operations Environment Plan

By completing this form I consent to Santos using the information provided in this form for the purpose of consultation on the Production Operations Environment Plan in accordance with the Privacy Notice on this page and the Barossa Gas Project Privacy Policy.

Start press Enter ↵

Quarterly Update October 2024

Quarterly Update | October 2024

Santos

Stakeholder Consultation

Barossa Gas Project

In this edition

- DPD works continue in Darwin Harbour.
- Subsea infrastructure installation continues.
- FPSO on-track for sail-away in Q1 2025.
- Development wells produce good results.

Work progress highlights

The Barossa Gas Project is now more than 80 per cent complete with first gas expected in the third quarter of 2025.

Offshore works for the Darwin Pipeline Duplication (DPD) will continue within Darwin Harbour for the remainder of 2024.

In remote Commonwealth waters off the Northern Territory (NT), the second phase of subsea infrastructure installation will be undertaken during the next quarter, and we will continue to drill our production wells.

The Floating Production, Storage and Offloading (FPSO) vessel, currently in Singapore, is expected to head to Australia in the first quarter of 2025.

FPSO construction

Installation of all 16 topside modules on the Floating Production Storage and Offloading vessel (FPSO) has been completed in Singapore.

The vessel, one of the largest FPSOs ever built, is now into the commissioning phase during which detailed inspections and testing of systems are being undertaken to ensure they are operating safely and to design parameters.

Once onshore commissioning has been completed, the FPSO will be towed from Singapore to Australia using ocean-going tugs. Sail-away is on track for Q1 in 2025.

Following the FPSO's arrival in the Barossa Field, it will be connected to the mooring system. Equipment and systems will all be tested during this commissioning stage in readiness for start-up operations.

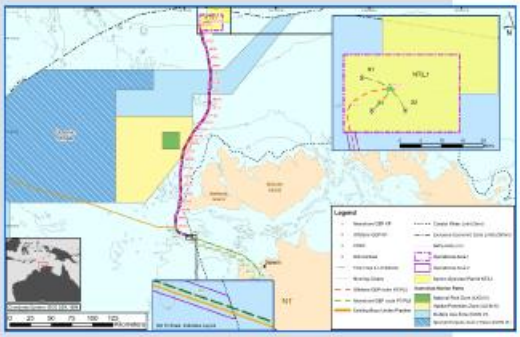
The FPSO, which will be permanently located in the Field, (subject to receipt of the necessary approvals) is 358m long and 64 meters wide and can accommodate up to 140 personnel.

Project Overview

The Barossa Gas Development, located approximately 285km offshore from Darwin in the Northern Territory, comprises a Floating Production Storage and Offloading (FPSO) facility, a subsea production system, supporting in-field subsea infrastructure and a gas export pipeline (GEP).

Once complete, the Barossa Gas Development will transport natural gas from the offshore Barossa field via the GEP to the existing Darwin liquefied natural gas (DLNG) facility.

The development is expected to commence delivering natural gas in 2025. Barossa gas is a critical energy source and will ensure affordable and reliable energy for Santos' customers for decades to come.



The Barossa Gas Development will create and sustain hundreds of jobs in the Northern Territory and will inject billions of dollars into the local economy, supporting the continued regional development of northern Australia.

Subsea Infrastructure Installation

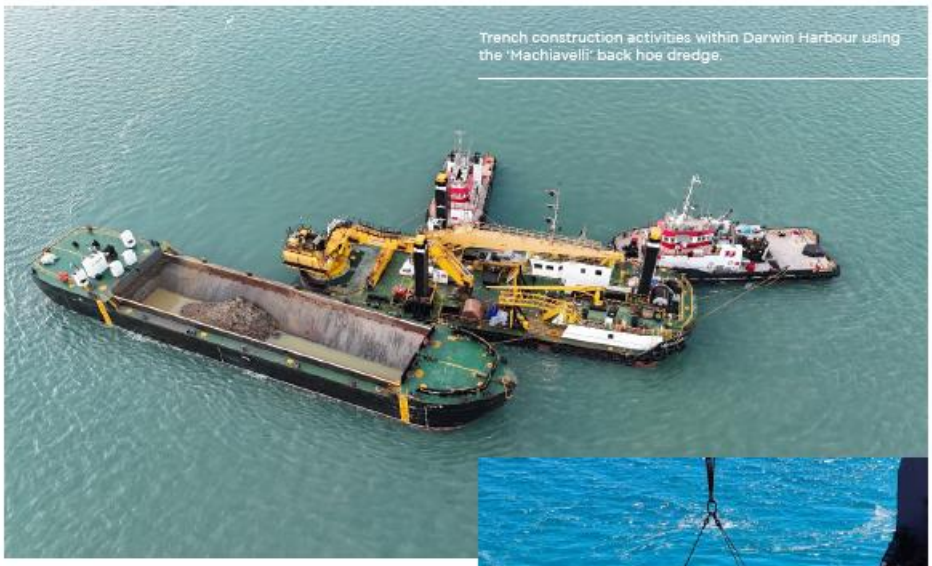
The second campaign for the installation of subsea infrastructure in the Barossa Field, located 285km offshore from Darwin, is due to commence in mid-November and continue until mid-March 2025, subject to weather conditions and operational performance.

During the first campaign, installation of the infield flowlines that connect the drill centres to the FPSO location was completed along with the installation of manifolds, risers and umbilicals. This phase also involved the installation of the suction anchor piles and hook-up of the Submerged Turret Production buoy for the FPSO mooring system. Flowline pre-commissioning activities for two drill centres were also completed.

Campaign 2 will involve the installation of production manifolds, spools, umbilicals, flying leads and jumpers, designed to support the connection of subsea production wells to the FPSO. Further pre-commissioning will be undertaken to test the various connections and systems.

The third campaign will take place in 2025 when the drilling phase is completed.

Once all installation and testing has been completed, a preservation phase will commence that will maintain the integrity of the infrastructure in readiness for future operations expected to start in 2025.



Trench construction activities within Darwin Harbour using the 'Machiavelli' back hoe dredge.

Installation of concrete mattresses for pre-lay span supports within Darwin Harbour.

DPD Project

The DPD Project effectively involves 'duplicating' the existing Bayu-Undan to Darwin pipeline in NT internal waters, NT coastal waters and Commonwealth waters. Once in operation the new pipeline will only be used for transporting natural gas (not oil or condensate) from the Barossa gas field to the Darwin LNG (DLNG) facility.

All work has been completed to date in accordance with an accepted Environment Management Plan. Since the commencement of works in NT internal waters in May 2024, significant progress has been achieved.

Construction of the trench in Darwin Harbour, within which the pipeline will be laid, has been completed along with installation of concrete mattresses for pre-lay span supports, pipeline crossings and cable crossings.

Onshore at Wickham Point, where the existing DLNG facility is located, construction of the shore crossing for the pipeline is nearing completion.

During the next quarter, trench maintenance activities will be undertaken in locations where build-up of sedimentation has occurred.

Installation of the rock bedding layer and pull-in wire at the Wickham Point shore crossing is being undertaken in readiness for shallow water pipelay and associated survey activities to commence in October.

The construction activities occur within a Project area, encompassing the pipeline route with an approximate 2 km buffer either side of the pipeline and the spoil disposal ground.

Other Darwin Harbour users are asked to exercise caution at all times and maintain a distance of at least 500 metres from any vessels undertaking the construction activities.

The activities are managed to ensure that environmental impacts and risks are avoided or mitigated to meet Santos and regulatory requirements.

The DPD Project in NT internal waters has received all primary approvals. The NT Government approved the DPD activity in NT jurisdiction under the *NT Environment Protection Act* following assessment by the NT Environment Protection Authority.

The DPD activity in NT and Commonwealth jurisdictions has also been assessed and approved under the *Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act)*.

Valaris MS-1 MODU (view from support vessel).

Drilling and Completions

Drilling of the six development wells is continuing at the Barossa Field, 285km offshore from Darwin. The moored semisubmersible mobile offshore drilling unit (MODU) is currently positioned at the South 1 (S1) drill centre location, and is working on the fourth well.

All work has been completed to date in accordance with the accepted Environment Plan and without any environmental incidents.

The MODU is planned to move from the S1 to the South-2 (S2) drill centre location in October/November 2024 to complete the remaining work at that location.

Drilling activities occur within a 2.5-km radius of each well. During drilling, a 500-metre exclusion zone (known as a petroleum safety zone) is in place around the MODU. Vessels are prohibited from entering or being present in a petroleum safety zone without authorisation.

Work at the North-1 (N1) drill centre location is planned for subsequent quarters. The entire drilling campaign, including completions and installation of subsea vertical trees, is still expected to take approximately 24 months in total. All schedule estimates are subject to weather and operational performance.

The MODU continues to be supported by helicopters and up to four support vessels which transit between the development area and onshore supply base in Darwin as required.

Valaris MS-1 MODU helicopter deck.

GEP installation

With all testing and pre-commissioning activities completed, the installed 262-kilometre GEP is safely preserved on the seabed in readiness for future operations expected to start in 2025.

The GEP will connect the Barossa field to the DPD and together these pipelines will transport natural gas from the Barossa field to the Darwin LNG (DLNG) facility.

The 'Fortitude' construction support vessel performing pre-commissioning activities on the GEP.

Work Opportunities

We continue to have 11 First Nations people engaged in Santos funded roles/ training programs that work offshore in positions related to the Barossa Gas Project.

These comprise four Tiwi people engaged as Cultural Observers and Monitors on the GEP pipelay and support vessels and seven Larrakia and Tiwi people engaged in offshore roles on the Santos' contracted drilling rig.

Two Santos Offshore Health, Safety and Environment (HSE) Advisor Trainees have been recruited and will undertake a formal 12-18-month traineeship to obtain a Certificate IV in HSE.

One of the trainees, a Tiwi woman, has commenced work on the Santos contracted drill rig while the other trainee will start offshore in October 2024.

Another Tiwi man, one of six indigenous trainees in the MS-1 drill rig training program, has transitioned from offshore assistant to a core roustabout position.

First Nations people represent 55% of Santos' current trainees and apprentices in the NT.

Barossa Aboriginal Future Fund

Santos' Barossa Aboriginal Future Fund (BAFF) aims to invest in projects that will directly benefit NT Aboriginal Coastal Communities.

The Fund will invest in projects and programs that improve community infrastructure, health, education, housing, and economic outcomes and support employment pathways.

The Fund will also support First Nations people to maintain cultural practices, carry out cultural obligations and care for country.

The Barossa Joint Venture Partners initial contribution to the Fund is $10 million, with additional payments to be made into the Fund once Barossa starts producing and selling gas.

Santos is working with our Barossa Joint Venture Partners to finalise the revenue stream for the Fund and establish legal structures with sound governance.

Santos wants to listen to NT Coastal Aboriginal people about the needs for their communities.

If you want more information or want to share your ideas, you can visit the NT Community Team at the Santos shop in the Darwin Mall or contact us via email at **enquiriesNT@santos.com** or phone on **+61 8919 1900**.

Environmental Approvals and Consultation

DPD Project – NT waters

DPD activities in NT internal waters are being undertaken in compliance with the primary environmental approvals received from the NT and Commonwealth governments.

The NT Government approved the DPD Project, following the completion of assessment by the *NT Environment Protection Authority under the Environment Protection Act 2019 (NT).*

The DPD Project was also assessed and approved by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the *Environment Protection and Biodiversity Conservation Act 1999 (Cth).*

DPD Project – Commonwealth and NT coastal waters

Additional environmental approvals are under assessment by the Regulator for the DPD Project activity in each of Commonwealth and NT coastal waters. Santos has submitted the Environment Plan (EP) for DPD installation (~23km section of pipeline) in Commonwealth waters and a Construction Environmental Management Plan (CEMP) for DPD installation (~8km section) in NT coastal waters. Consultation for these plans has been completed.

The Commonwealth waters EP is currently under assessment by NOPSEMA and can be viewed **here** The CEMP has been submitted to the NT Department of Industry, Tourism and Trade (NT-DITT) for assessment and can be viewed at **Published environment plans | NT.GOV.AU**

Barossa Productions Operations – Commonwealth and NT waters

Santos has submitted the Barossa Production Operations EP in Commonwealth waters (~285km section) to NOPSEMA for assessment. The link to the EP is accessible on the NOPSEMA **website**.

The EP covers (among other things) the following activities:

- Arrival, hook-up and commissioning of the FPSO (section 2.5 of the EP);
- Initial start-up of production to a steady state (section 2.6 of the EP);
- Operation of the FPSO and subsea infrastructure and associated activities (section 2.7 of the EP); and
- Inspection, monitoring, maintenance and repair (IMMR) activities for subsea infrastructure and the Gas Export Pipeline (section 2.9 of the EP);

The EP also provides information on (among other things):

- the potential risks and impacts of these proposed activities; and
- the consultation undertaken by Santos on the proposed activities (section 4 of the EP).

If you have any queries about this EP, please contact us by phone or email (see details below).

Operations Environmental Management Plans (OEMPs) for Operational activities along the Barossa pipeline in NT coastal waters (~8km section) and NT internal waters (~92km section) will be submitted to the NT- DITT for assessment and approval.

Contact Us

We are committed to ongoing engagement about our activities. If you require further information or would like to speak to us, please do not hesitate to contact us.

Phone: **1800 267 600**
Email: **offshore.consultation@santos.com**
Website: **santos.com/barossa**

Quarterly Update January 2025

Quarterly Update | January 2025

Santos

Stakeholder Consultation

Barossa Gas Project

In this edition

- NT pipeline installation completed in Darwin Harbour
- SURF Campaign 2 more than 50 percent completed
- FPSO Living Quarters set to be operational
- Drilling of wells continues in Barossa Field

Work progress highlights

The Barossa Gas Project is now more than 88 per cent complete with first gas expected in the third quarter of 2025.

Offshore works for the Darwin Pipeline Duplication (DPD) are nearing completion in NT Waters, to be immediately followed by installation of the final sections of pipeline in Commonwealth and NT Coastal Waters.

In remote Commonwealth waters off the Northern Territory (NT), the second phase of subsea infrastructure installation is continuing along with drilling of the production wells.

The Floating Production, Storage and Offloading (FPSO) vessel, currently in Singapore, is being prepared in readiness for its journey to Australia expected in the first quarter of 2025.

FPSO construction

Commissioning of the various FPSO systems has continued to plan, including the Main Topsides Generators which have all been successfully fired.

Preparations are also being made for the habitation of the Living Quarters by the FPSO crew starting in January.

Once onshore commissioning has been completed, the FPSO will be towed from Singapore to Australia using ocean-going tugs. Sail-away is on track for Q1 in 2025.

Following the FPSO's arrival in the Barossa Field it will be connected to the mooring system. Equipment and systems will all be tested during this commissioning stage in readiness for start-up operations.

The FPSO, which will be permanently located in the Field, (subject to receipt of the necessary approvals) is 358m long and 64 meters wide and can accommodate up to 140 personnel.

Project Overview

The Barossa Gas Development, located approximately 285km offshore from Darwin in the Northern Territory, comprises a Floating Production Storage and Offloading (FPSO) facility, a subsea production system, supporting in-field subsea infrastructure and a gas export pipeline (GEP).

Once complete, the Barossa Gas Development will transport natural gas from the offshore Barossa field via the GEP to the existing Darwin liquefied natural gas (DLNG) facility.

The development is expected to commence delivering natural gas in 2025. Barossa gas is a critical energy source and will ensure affordable and reliable energy for Santos' customers for decades to come.

The Barossa Gas Development will create and sustain hundreds of jobs in the Northern Territory and will inject billions of dollars into the local economy, supporting the continued regional development of northern Australia.

Subsea Infrastructure Installation

The second campaign for the installation of subsea infrastructure in the Barossa Field, located 285km offshore from Darwin, commenced mid-November 2024 and will continue until end-March 2025, subject to weather conditions and operational performance.

Campaign 2 is approximately 50 percent complete with the S1 manifold and umbilicals having been installed, along with the spools, flying leads and jumpers at the S2 Drill Centre.

Pre-commissioning of the riser system and spools is due to commence in the near future, which will test the various connections and systems prior to production. All work has been completed to date in accordance with an accepted Environment Plan.

The third campaign will take place in Q2 / Q3 2025 when the drilling phase at the N1 Drill Centre is completed.

Once all installation and testing has been completed, a preservation phase will commence that will maintain the integrity of the infrastructure in readiness for future operations expected to start in 2025.

'Sandpiper' shallow water barge performing shorepull at DLNG

Installation of rock protection over the pipeline at the shore crossing

Darwin Pipeline Duplication

The DPD Project effectively involves 'duplicating' the existing Bayu-Undan to Darwin pipeline in NT internal waters, NT coastal waters and Commonwealth waters. Once in operation the new pipeline will only be used for transporting natural gas (not oil or condensate) from the Barossa gas field to the Darwin LNG (DLNG) facility.

All work has been completed to date in accordance with an accepted Environmental Management Plan. Since the commencement of works in NT internal waters in May 2024, significant progress has been achieved.

In December the shallow water barge 'Sandpiper' completed installing the first 30kms of the 92 kms section of pipeline in NT internal waters. The Sandpiper commenced with the shore crossing at DLNG and then installed the pipeline through Darwin harbour before handing over to the dynamically positioned pipelay vessel 'Audacia' to complete the section of the pipeline in deeper NT internal waters.

Installation of rock protection over the pipeline at the shore crossing at Wickham Point has been completed and installation of rock protection in deeper water within Darwin harbour continues.

Pipelay will then proceed into NT coastal waters (8 kms) and Commonwealth waters (23 kms) and is expected to be completed in early 2025. Pipeline survey and pre-commissioning will commence on the completion of pipelay activities.

The construction activities occur within a Project area, encompassing the pipeline route with an approximate 2 km buffer either side of the pipeline and the spoil disposal ground.

Other users of the marine environment are asked to exercise caution at all times and maintain a distance of at least 500 metres from any vessels undertaking the construction activities.

The activities are managed to ensure that environmental impacts and risks are avoided or mitigated to meet Santos and regulatory requirements.

The Audacia is now installing the pipeline in the deeper waters outside Darwin Harbour

Welding of pipeline sections aboard the Audacia

Drilling and Completions

Drilling of the six development wells is continuing at the Barossa Field, 285km offshore from Darwin. The moored semisubmersible mobile offshore drilling unit (MODU) is currently positioned at the North 1 (N1) drill centre location.

All work has been completed to date in accordance with the accepted Environment Plan and without any environmental incidents.

Work at the N1 drill centre location is planned to continue during the first half of 2025. The entire drilling campaign, including completions and installation of subsea vertical trees, is still expected to take approximately 24 months in total. All schedule estimates are subject to weather and operational performance.

Drilling activities occur within a 2.5-km radius of each well. During drilling, a 500-metre exclusion zone (known as a petroleum safety zone) is in place around the MODU. Vessels are prohibited from entering or being present in a petroleum safety zone without authorisation.

The Valaris MS-1 mobile offshore drilling unit

The MODU continues to be supported by helicopters and up to four support vessels which transit between the development area and onshore supply base in Darwin as required.

Work Opportunities

Several First Nations people continue to be engaged in Santos' funded roles/ training programs that work offshore in positions related to the Barossa Gas Project.

These comprise five Larrakia and Tiwi people engaged in offshore assistant roles on the Santos' contracted drilling rig, one Tiwi man engaged as a Cultural Monitor on SURF activities and a Larrakia man engaged as a Cultural Monitor on DPD activities.

In addition, two Santos Offshore Health, Safety and Environment (HSE) Advisor Trainees have been recruited and are now undertaking a formal 18-24 month traineeship to obtain a Certificate IV in HSE. Both are currently working offshore on the Santos' contracted drill rig under the leadership of Santos HSE team members.

Another Tiwi man, one of the trainees in the offshore assistant training program on the Santos contracted drill rig, has transitioned from offshore assistant to a core roustabout position, where he continues in his role.

First Nations people represent more than 55% of Santos' current trainees and apprentices in the NT.

Barossa Aboriginal Future Fund

Santos' Barossa Aboriginal Future Fund (BAFF) aims to invest in projects that will directly benefit NT Aboriginal Coastal Communities.

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Santos is working with our Barossa Joint Venture Partners to finalise the revenue stream for the Fund and establish legal structures with sound governance.

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Environmental Approvals and Consultation

DPD Project – NT waters

DPD activities in NT internal waters are being undertaken in compliance with the primary environmental approvals received from the NT and Commonwealth governments.

The NT Government approved the DPD Project, following the completion of assessment by the *NT Environment Protection Authority under the Environment Protection Act 2019 (NT)*.

The DPD Project was also assessed and approved by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*.

DPD Project – Commonwealth and NT coastal waters

DPD activities in NT Coastal Waters are being undertaken in compliance with the primary environmental approvals received from the Commonwealth and NT governments.

The Commonwealth Government approved the activities (~23km section) in Commonwealth Waters following assessment of an Environment Plan under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth)*.

As noted above, the DPD Project was also assessed and approved by DCCEEW under the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*.

The NT Government approved the activities in NT Coastal Waters (~8km section) following assessment of the Offshore Construction Environmental Management Plan (CEMP) under the *Petroleum (Submerged Lands) Act 1981 (NT) and Environment Protection Act 2019 (NT)*.

The DPD EP can be viewed **here** while the CEMP is available **here**

Barossa Productions Operations – Commonwealth and NT waters

Santos submitted the Barossa Production Operations EP in Commonwealth waters (~285km section) to NOPSEMA in August 2024 for assessment. The link to the EP is accessible on the NOPSEMA website **here**

Following a request from NOPSEMA to provide further information, Santos re-submitted the EP with some amendments in December 2024 for further assessment.

The EP covers (among other things) the following activities:

- Arrival, hook-up and commissioning of the FPSO (section 2.5 of the EP);
- Initial start-up of production to a steady state (section 2.6 of the EP);
- Operation of the FPSO and subsea infrastructure and associated activities (section 2.7 of the EP); and
- Inspection, monitoring, maintenance and repair (IMMR) activities for subsea infrastructure and the Gas Export Pipeline (section 2.9 of the EP);

The EP also provides information on (among other things):

- the potential risks and impacts of these proposed activities; and
- the consultation undertaken by Santos on the proposed activities (section 4 of the EP).

If you have any queries about this EP, please contact us by phone or email (see details below).

Operations Environmental Management Plans (OEMPs) for Operational activities along the Barossa pipeline in NT coastal waters (~8km section) and NT internal waters (~92km section) will be submitted to the NT- DME for assessment and approval.

Contact Us

Consultation for all Barossa regulatory approvals has been completed.

We are committed to ongoing engagement about our activities. If you require further information or would like to speak to us, please do not hesitate to contact us.

Phone: **1800 267 600**
Email: **offshore.consultation@santos.com**
Website: **santos.com/barossa**

Appendix F2: Relevant Persons Advertising Material

Table 4-8 (of the EP) Targeted advertising campaign

Preliminary consultation

March 2024 Social Media post

PROYEK GAS BAROSSA DI AUSTRALIA

MENCARI ORANG TERKAIT UNTUK BERKONSULTASI

Santos

RENCANA LINGKUNGAN OPERASI PRODUKSI

Proyek Gas Barossa yang dioperasikan Santos adalah proyek gas dan kondensat, yang melibatkan ekstraksi gas alam dari ladang gas Barossa, yang terletak di perairan Commonwealth Australia, sekitar 285-kilometer lepas pantai utara-barat laut Darwin. Gas alam kemudian akan disalurkan melalui pipa gas ke fasilitas gas alam cair (DLNG) Darwin yang ada. Kondensat akan diturunkan melalui kapal tanker untuk diangkut ke pelanggan di Asia.

Batas wilayah izin produksi kurang lebih 520 kilometer sebelah timur tenggara Dili dan kurang lebih 2.605 kilometer sebelah timur Jakarta, di Laut Arafura.

Sebagai bagian dari Proyek, Santos akan menyiapkan rencana lingkungan untuk proyek operasi produksi untuk diserahkan kepada Otoritas Pengelolaan Lingkungan dan Keselamatan Minyak Lepas Pantai Nasional Australia (NOSPEMA). Konsultasi dengan pihak-pihak terkait merupakan bagian penting dalam mempersiapkan rencana ini.

Santos berupaya mengidentifikasi dan berkonsultasi dengan orang-orang terkait yang fungsi, kepentingan, atau aktivitasnya mungkin terpengaruh oleh aktivitas yang diusulkan berdasarkan Rencana Lingkungan Operasi Produksi yang kami usulkan.

Jika anda menganggap bahwa anda mungkin orang yang relevan dan ingin diajak berkonsultasi mengenai rencana lingkungan ini, silakan hubungi kami paling lambat tanggal 15 Maret agar kami dapat berkonsultasi dengan anda. Konsultasi ditutup pada 9 April 2024.

Informasi lebih lanjut tersedia di santos.com/Barossa tentang siapa yang mungkin menjadi orang yang relevan, usulan kegiatan, lingkungan yang mungkin terkena dampak dari usulan kegiatan, potensi dampak dan risiko lingkungan, dan usulan tindakan pengendalian untuk mengurangi dampak dan risiko. ke tingkat yang serendah mungkin dan dapat dipraktikkan secara wajar.

Untuk informasi lebih lanjut:
Kunjungi santos.com/barossa
Telepon 1800 267 600
Email ke luar offshore.consultation@santos.com

PROJETU GAS BAROSA IHA AUSTRALIA

Santos

BUKA EMA RELEVANTE SIRA ATU HALO KONSULTASAUN

PLANU AMBIENTE BA OPERASAUN PRODUSAUN

Projetu Gas Barossa ne'ebé operadu husi Santos mak projetu gás no kondensadu ida, ne'ebé sei envolve hasai gás naturál husi kampu gás Barossa, ne'ebé lokaliza iha tasi Commonwealth Australia nian, maizumenus kilómetru 285 iha tasi laran parte norte noroeste husi Darwin. Tuirmai gás naturál sei lori liu husi kadoras gás ba instalasaun gás naturál ne'ebé iha Darwin (DLNG). Kondensadu sei deskarega liu husi tanke hodi transporta ba kliente sira iha Ásia.

Fronteira ba área lisensa produsaun nian maizumenus kilómetru 520 iha parte leste sudeste Dili no maizumenus kilómetru 2,605 iha parte leste Jakarta, iha Tasi Arafura.

Hanesan parte husi Projetu ne'e, Santos sei prepara planu ambientál ba operasaun produsaun Projetu refere hodi submete ba Autoridade Nasional Seguransa Petroleu no Jestaun Ambiental Australia (NOPSEMA) nian. Konsultasaun ho ema relevante sira sai parte importante ida hosi preparasaun planu hirak-ne'e.

Santos buka/identifika hela ema relevante sira atu konsulta ho sira ne'ebé nia funsaun, interese ka atividade sira bele afeta husi atividade sira ne'ebé propoin tuir ami-nia Planu Ambiente Operasaun Produsaun nian.

Se ita konsidera katak ita maka ema relevante no hakarak hetan konsulta ba planu ambiente ida-ne'e, favór ida kontaktu ami antes loron 15 fulan Marsu atu ami bele konsulta ho ita. Konsultasan sei taka iha 9 Abril 2024.

Informasaun klaru liu disponivel iha santos.com/Barossa kona-ba se mak bele sai ema relevante, atividade sira ne'ebé propoin, ambiente ne'ebé bele afeta husi atividade sira ne'ebé propoin, impaktu no risku ambientál potensiál sira, no medida kontrolu sira ne'ebé propoin atu buka atu hamenus impaktu no risku sira ba nivel ne'ebé ki'ik liu ho razoavel no aseitavel.

Atu hetan informasaun liután:
Vizita santos.com/barossa
Telefone 1800 267 600
Email offshore.consultation@santos.com

BAROSSA GAS PROJECT

Santos

SEEKING RELEVANT PERSONS FOR CONSULTATION

PRODUCTION OPERATIONS ENVIRONMENT PLAN

The Santos-operated Barossa Gas Project is a gas and condensate project, which would involve extracting natural gas from the Barossa gas field, located in Australian Commonwealth waters, approximately 285 kilometres offshore north-north west from Darwin. Natural gas would then be transported via gas pipeline to the existing Darwin liquified natural gas (DLNG) facility. Condensate will be offloaded via tanker for transport to customers in Asia. As part of the Project, Santos will be preparing an environment plan for the Project's production operations submission to the Australian National Offshore Petroleum Safety and Environmental Management Authority (NOSPEMA). Consultation with relevant persons is an important part of preparing these plans.

Santos is seeking to identify and consult with relevant persons whose functions, interests or activities may be affected by the activities proposed under our proposed Production Operations Environment Plan.

If you consider that you may be a relevant person and would like to be consulted for this environment plan, please contact us to provide your feedback by 9 April 2024.

More information is available at santos.com/Barossa about who may be a relevant person, the proposed activities, the environment that may be affected by the proposed activities, potential environmental impacts and risks, and proposed control measures to seek to reduce impacts and risks to as low as reasonably practicable and an acceptable level.

For more information:
Visit santos.com/barossa
Phone 1800 267 600
Email offshore.consultation@santos.com

Radio January- February - Darwin Hot 100

Script A - Preliminary Consultation 8 Feb- 11 March 2024

Santos is seeking to consult with people whose functions, interests or activities may be affected by the proposed Production Operations Activity for the Barossa Gas Project.
Including Santos's offshore production facility approximately 285 kilometres offshore from Darwin, and a Gas Export Pipeline.
If you consider you may be affected, please contact Santos by 11 March 2024.
For more visit santos.com/barossa,
Phone [1800 267 600] One Eight Hundred, Two Six Seven, Six Hundred
or email: offshore.consultation@santos.com.

17 February 2024 NT News

Iconic resort weighs up sale

Review to explore options

Lisa Allen, Ben Wilmot

The Indigenous-owned Voyages Indigenous Tourism Australia, operators of the Ayers Rock Resort at Yulara in the Red Centre, has started assessing future options for the world-renowned holding, which could see it sold to the private sector.

The resort, which encompasses six sprawling accommodation hubs in the shadow of the rock, including a five-star resort, three and four-star hotels and a campground, has been hampered by a lack of flights since the pandemic given Virgin is not set to recommence flights until mid year.

According to a statement from the Indigenous Land and Sea Corporation (ILSC), which controls Voyages, the key objective is to fulfil its statutory obligations of returning land to First Nations peoples, and in doing so, create Indigenous benefit for traditional owners, and local, regional, and national First Nations peoples.

ILSC has appointed Gilbert + Tobin and Greenhill to assist with the assessment process, including understanding market interest in the Ayers Rock Resort operations.

With this objective in mind, the assessment is focused on exploring potential alternative ownership options for the operations at Ayers Rock Resort.

The ILSC purchased the asset from property company GPT Group in 2011 in one of the largest sales in the hotel sector in a deal worth around $300m.

Back in 2013, the owners of the Ayers Rock Resort wrote down the book value of the resort by $62m after admitting that it faced serious financial challenges and high-profile business figures departed the board.

Prior to Covid-19, about 300,000 people visited Uluru annually via 43 direct flights into Uluru from major capital cities. Annual pre-Covid revenue was between $170-200m, with the resorts enjoying hotel occupancies of more than 85 per cent.

Voyages chief executive Matt Cameron-Smith, who runs the company's hotels and one camping ground could not be reached for comment on Thursday night.

However, in a prepared statement Mr Cameron-Smith said it was business as usual for the Voyages team, which has been offering heavy discounts of late. "Our pipeline of bookings in 2024 and beyond is growing, and we are excited to build on our strong momentum at Ayers Rock Resort, particularly as domestic and international tourism continues to rebound toward pre Covid-19 levels," Mr Cameron-Smith said.

Although British and North American tourists have returned to Uluru at about 70 per cent of pre-Covid-19 levels Japanese visitors are yet to return.

Mossman Gorge Cultural Centre, also owned by Voyages, is not part of the review.

At this stage, there is no certainty as to what the ultimate outcome of the assessment will be, according to the statement from ILSC.

The assessment process involves ongoing consultation and engagement with the local First Nations peoples to understand their aspirations and in particular who should benefit from the land divestment process and how those benefits are to flow.

Visitors began climbing Uluru in the late 1930s and in the lead-up to the rock's closure on October 26, 2019, the Voyages-owned hotels and campgrounds were full to capacity, mainly occupied by Japanese tourists clamouring to climb Uluru in a final rush before it was closed due to the local Anangu people, who had long asked visitors not to climb the sacred site.

Back in 2013, the owners of the Ayers Rock Resort wrote down the book value of the resort by $62m. Picture: Tourism NT

SEEKING RELEVANT PERSONS

Santos

BAROSSA PRODUCTION OPERATIONS ACTIVITY

Santos is seeking to identify and consult with relevant persons whose functions, interests or activities may be affected by our proposed Barossa Production Operations Activity in Commonwealth and Northern Territory waters, north-northwest of Darwin

Santos is currently preparing:

- A Production Operations Environment Plan (EP) relating to the annual and operations of the Floating Production Storage and Offloading facility (FPSO), operation of a subsea production system and supporting subsea infrastructure, and operation of a 285km section of the Gas Export Pipeline (GEP) located in Commonwealth waters where offshore petroleum activities are regulated under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth).
- An Operations Environmental Management Plan (OEMP) which includes the:
  - 8.26 km section of the GEP in Northern Territory (NT) coastal waters covered by the *Petroleum (Submerged Lands) Act 1981* (NT); and
  - 100km section of the GEP inshore of NT waters covered by the *Energy Pipelines Act 1981* (NT).

Summary of activity

The Santos-operated Barossa Gas Project is an offshore gas and condensate project with the purpose of providing a new source of gas to the existing Darwin liquified natural gas (DLNG) facility at Wickham Point in the NT. It is intended that natural gas and condensate would be extracted from the Barossa field, located in Commonwealth waters approximately 265km offshore north-northwest from Darwin. Initial processing would occur at the FPSO facility to separate the natural gas, water and condensate extracted from the Barossa field. The dry natural gas would be transported through the GEP for onshore processing at the DLNG facility. The condensate would be transferred from the FPSO facility to purpose-built tankers for international export.

The estimated life of the Barossa Development is 15 years, and the Production Operations EP and the OEMP will be reviewed every five years. Production Operations activity is expected to commence in 2025, subject to obtaining the required approvals.

Activity location

The Production Operations Activity is confined to two operational areas: Operational Area 1 (OA1) and Operational Area 2 (OA2).

OA1: The Barossa field. This is the area in which the FPSO, subsea production system, and supporting subsea infrastructure will be used to process gas and condensate extracted from the Barossa wells. The area is confined to Commonwealth waters, approximately 265 km north-north-west of Darwin (the closest major populated centre), approximately 200 km north-west of the mainland NT coastline, and approximately 130 km north of the Tiwi Islands at the closest point (Snagull Island).

OA2: The 285 km section of the GEP from OA1 to the Commonwealth waters/ NT waters boundary, and the 8.26 km section of the GEP situated in NT coastal waters between the Commonwealth waters/NT coastal waters boundary and the Territorial Sea Baseline.

The environment that may be affected by the proposed activity

Santos is assessing impacts and risks to the environment from these proposed activities, inclusive of ecosystems (including people and communities), natural and physical resources, the qualities and characteristics of locations, places and areas and the heritage value of places. This will include assessment of the social, economic and cultural features of the environment.

The map depicts OA1 and OA2, and the environment that may be affected (EMBA) by the proposed activities. The EMBA represents the greatest geographical extent that could be affected by an unplanned 'worst case' oil spill scenario, before any measures to reduce the risks are considered.

Santos proposes to implement measures to reduce the impacts and risks of the activity. It is a requirement under relevant environmental legislation that these impacts and risks are reduced to as low as reasonably practicable (ALARP) and to an acceptable level.

Consultation

Under the Offshore Petroleum and Greenhouse Gas Storage Environment Regulations Santos is required to consult with people and organisations who have functions, interests or activities that may be affected by the proposed activities. Functions, interests or activities may include those arising in relation to spiritual or cultural connections to land and sea country in accordance with Indigenous tradition; tourism; recreational and commercial fishing; other commercial or recreational activities; and local communities that might be affected by our proposed activity (these are examples and not an exhaustive list).

Seeking information and what's next

In preparing an EP and OEMP for submission to the regulators, a Stakeholder must consult with each 'relevant person', including relevant Commonwealth, State and Northern Territory Departments or agencies and persons (or organisations) whose functions, interests or activities may be affected by the activity proposed to be carried out under an EP.

Your input is important to Santos:

- so that we can understand the environmental values in the OA1 and the environment that may be affected, the environmental impacts and risks associated with the activity, to inform development of the Production Operations EP (Commonwealth waters) and OEMP (NT waters);
- to inform how consultation processes may need to be adapted for different relevant persons;
- to ensure that we provide information to people in an appropriate and accessible manner; and
- to assist with Santos' preparation of the EP.
- More information on the proposed activities is available on our website.

Contact us

If you consider you may be a relevant person, please contact us as soon as possible to allow Santos to initiate consultation with you in relation to the proposed activity so you can tell us how you would like to be consulted. Consultation closes on **Tuesday 9 April 2024.**

Santos is committed to undertaking genuine and meaningful consultation. We want to provide information for people to make informed assessments of the possible consequences of the proposed activity on them. Your input is important to us, and input will be considered in the development of the EP and OEMP.

Visit **santos.com/barossa/production-operations**, email **offshore.consultation@santos.com** or call **1800 267 600** for more information, to self-identify as relevant person or to provide feedback.

Thursday and they arrested the 29-year-old.

He was charged with one count of failing to comply with a requirement of monitoring conditions. This offence carries a maximum penalty of five years jail and a $93,900 fine.

The man is next expected to appear in court on March 22.

have occurred before the spectacular collapse of her Modco company last August.

Ms Lu, pictured left, did not appear at what was the first hearing of the charges, and neither did her lawyers.

But they did contact the

the firm had 29 homes unfinished on its books.

The couple later issued an apology, months after the company's collapse, through a spokesman.

"It is certainly reasonable to pursue an investigation on Ms

before her scheduled court appearance, Ms Lu posted video of footage from an apparent rooftop party in Perth, that featured UFC champion Jon "Bones" Jones pouring out shots from a $350-per-bottle of tequila.

SEEKING RELEVANT PERSONS

BAROSSA PRODUCTION OPERATIONS ACTIVITY

Santos

Santos is seeking to identify and consult with relevant persons whose functions, interests or activities may be affected by our proposed Barossa Production Operations Activity in Commonwealth and Northern Territory waters, north-northwest of Darwin

Santos is currently preparing:

- A Production Operations Environment Plan (EP) relating to the arrival and operations of the Floating Production Storage and Offloading facility (FPSO), operation of a subsea production system and supporting subsea infrastructure, and operation of a 285km section of the Gas Export Pipeline (GEP) located in Commonwealth waters where offshore petroleum activities are regulated under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth).
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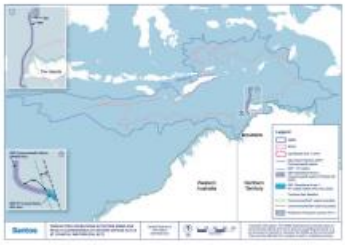
Summary of activity

The Santos-operated Barossa Gas Project is an offshore gas and condensate project with the purpose of providing a new source of gas to the existing Darwin liquified natural gas (DLNG) facility at Wickham Point in the NT. It is intended that natural gas and condensate would be extracted from the Barossa field, located in Commonwealth waters approximately 285km offshore north-northwest from Darwin. Initial processing would occur at the FPSO facility, to separate the natural gas, water and condensate extracted from the Barossa field. The dry natural gas would be transported through the GEP for onshore processing at the DLNG facility. The condensate would be transferred from the FPSO facility to purpose-built tankers for international export.

The estimated life of the Barossa Development is 25 years, and the Production Operations EP and the OEMP will be reviewed every five years. Productions Operations activity is expected to commence in 2025, subject to obtaining the required approvals.



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Researchers have identified an opportunity to reduce infections in people living with cystic fibrosis.

University of Queensland academics discovered a fault in the bacteria-killing function of immune cells in people with CF and a potential way to get around it.

CF is a chronic disease causes a build-up of mucus in the lungs and airways.

raise the incident publicly, in order to protect the identities of the third parties involved, but said it was typical of many incidents in Alice Springs during the 2023-24 summer season.

The incident occurred about 2pm on Sunday, January 21, and ratcheted up when he chased the five youths off the premises.

"They went over the fence again, one was armed with a big metal bar," Mr Yan said.

"I hunted them out again then they came around to the front of the property armed with sticks and rocks and began pelting them at us."

Mr Yan was able to avoid many of the missiles, including fist-sized rocks, but nonetheless was struck three times on the lower body.

"I ducked and weaved out of considered my injuries fairly minor," he said.

"I had a fairly big bruise on the inner-thigh of my right leg and it took a couple of weeks to go away and also a cut on the left calf. One of the other people were grazed by a rock.

"The kids were really very aggressive and confronting. The oldest was 14 and the youngest was 10 or under. I said I'd called the police and about the police. That was the kid wearing the ankle bracelet.

"That's what we're dealing with in the community. Kids with ankle bracelets are prepared to seriously assault somebody who gets in their way."

Mr Yan's comments come as federal Lingiari MP Marion Scrymgour said authorities need to stop "pussyfooting around" on juvenile crime.

the age of criminal responsibility was not working and that parents had to be held accountable for their children's actions.

Ms Scrymgour said her own home had been broken into while she slept last month and youth justice laws needed to be changed.

"There has to be a rethink of how we deal (with youth crime)," she said.

SEEKING RELEVANT PERSONS

BAROSSA PRODUCTION OPERATIONS ACTIVITY

Santos

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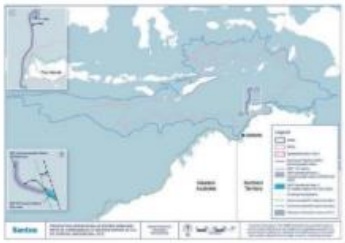

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V1 - NTNE01201MA

Ms Secretary and her partner Darren Nelson had returned to their Coconut Grove home from a trip to Yarralin in 1994, during which the court heard Ms Secretary's partner had driven dangerously, injected himself with amphetamines, and assaulted and threatened to kill her.

She was assaulted and threatened again at their Kulacourt heard a string of domestic violence incidents against Ms Secretary by Mr Nelson, and she was convicted of manslaughter based on provocation in December 1995.

During the retrial that followed, prominent Darwin criminal lawyer John Lawrence said Ms Secretary had been in a state of "chronic terror".

said the party was proud to preselect Ms Secretary and that it was well aware of the 30-year-old incident.

"We understand the challenges around what occurred and she has the real lived experience of a senior Aboriginal woman, and we wholeheartedly endorsed her as our candidate," Mr Stone said. "I think she's fantastic."

CLP Nightcliff candidate Helen Secretary was the accused in a court case where battered woman syndrome was first recognised as a defence to murder. Picture: Che Chorley

multiple fuel thefts, police say.

The youths were allegedly involved in a Jeep Compass, being stolen from a residence in Rapid Creek.

The four youths, aged 13 and 14, have been charged with multiple property offences and remain in custody.

Investigations are ongoing to locate the six additional alleged offenders.

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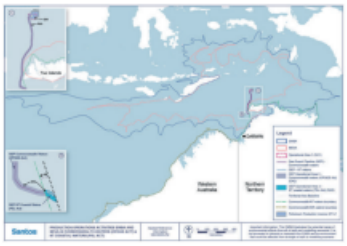

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NTN6012011MA - V1

1 March 2024 NT News

After The Missing Australia podcast broke the story, the daughter of the sportsman – "I just know. I've got a feeling that it's my big brother.

"I'm hoping, even though it's unmarked grave was dug up from Darwin General Cemetery in November.

Currie rejecting the request on the grounds it was not necessary for an investigation.

Now that the baby's DNA profile has been collected it could be compared with records across Australia, meaning a future match could be made.

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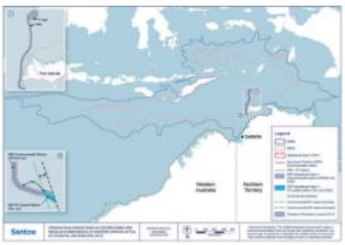

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NTNE01201MA - V1

1 March 2024 The Australian

and federal Labor governments, which provided compensation to industry for loss of resource and retooling to use plantation timber.

Dr Brown said the Albanese government should intervene to

flict when we've had a lot of peace in our forests for a quite a while," Ms White said.

She said the forest industry had benefited from uncontested access to markets and bipartisan

was "an irresponsible gambit" that risked workers' livelihoods.

The Liberals are expected to on Friday promise to extend sawmillers' native forest log contracts beyond 2027.

reconstruction, with Property Council of WA boss Sandra Brewer having already secured the nomination for the seat of Cottesloe and media personality Basil Zempilas facing no internal com-

mann for abandoning them in the wake of 2021 The Chat WhatsApp saga, in which a cache of leaked messages showed how senior party figures including Mr Cormann and upper house MPs Nick

The meeting heard Ms Cormann would have been a "FIFO candidate" between Paris and Perth for the rest of this year, before returning full-time to WA in the new year. Ms Waugh, mean-

trailans their life savings.

He said the Sterling First collapse and Ms Marie's involvement in the Hillarys branch were a major financial scandal and an embarrassment for the party.

minute as a nominee by former councillor Jesse Jacobs, who is facing charges over stealing Mr Hall's promotional signs during the most recent mayoral campaign.

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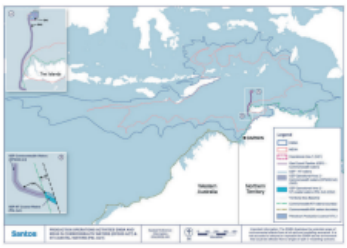

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2 March 2024 The West Australian

were finally able to identify Gus and organise his funeral.

In his victim impact state-

Jackson Pannam, from Slater and Gordon lawyers, said the family's plight had

when the law doesn't take into account someone in Felix's position, it seems like changes

Mr Quigley noted a review of the Criminal Injuries Compensation scheme was tabled in

out to the Kennedy family discuss what options may available to them."

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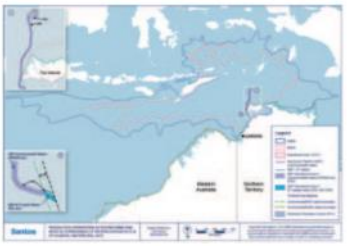

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7 March 2024 Broome Advertiser

travel plans this year — a trip that's even more attractive now with these discounted airfares and other incentives," she said.

unchecked can lead to over tourism in an area," Mr Hall said.

"What we want to see is proper

Mr Hall said new development of resorts, eco retreats, serviced apartments and regional accom-

people who need a place to call home," she said.

Housing Minister John Carey

Incentive Scheme and planning reforms visit the WA Government website's STRA Initiatives page.

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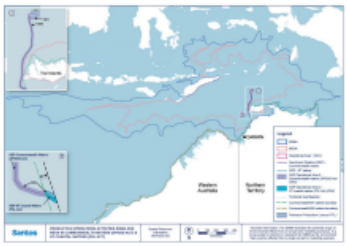

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Santos is committed to undertaking genuine and meaningful consultation. We want to provide information for people to make informed assessments of the possible consequences of the proposed activity on them. Your input is important to us, and input will be considered in the development of the EP and OEMP.

Visit **santos.com/barossa/production-operations**, email **offshore.consultation@santos.com** or call **1800 267 600** for more information, to self-identify as relevant person or to provide feedback.

7 March 2024 Kimberley Echo

acquisition would enable the group to work cruising into an integrated accommodation and hospitality offering in the Kimberley.

Australia, about 60 per cent of local government-operated regional airports operate at a loss due to ageing infrastructure, rising security and regulatory burdens and staffing costs.

across the board, and they can no longer afford to pick up the shortfall," she said.

"Australia's regional airports provide a critical role in border protection, medivac, defence and and our nation's health and security at risk."

It comes as the Australian Federation of Air Pilots went on strike this week with 230 pilots walking off the job and further action set

rely on tightly-run fly-in, fly-out schedules to get workers to site, forcing them to use other providers, reschedule travel or find spare capacity on other Qantas flights.

SEEKING RELEVANT PERSONS

BAROSSA PRODUCTION OPERATIONS ACTIVITY

Santos

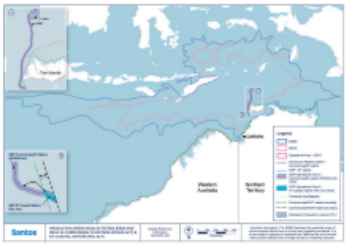
Santos is seeking to identify and consult with relevant persons whose functions, interests or activities may be affected by our proposed Barossa Production Operations Activity in Commonwealth and Northern Territory waters, north-northwest of Darwin

Santos is currently preparing:

- A Production Operations Environment Plan (EP) relating to the arrival and operations of the Floating Production Storage and Offloading facility (FPSO), operation of a subsea production system and supporting subsea infrastructure, and operation of a 285km section of the Gas Export Pipeline (GEP) located in Commonwealth waters where offshore petroleum activities are regulated under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth).
- An Operations Environmental Management Plan (OEMP) which includes the:
  - 8.26 km section of the GEP in Northern Territory (NT) coastal waters covered by the *Petroleum (Submerged Lands Act) 1981* (NT); and
  - ~92km section of the GEP inshore of NT waters covered by the *Energy Pipelines Act 1981* (NT).

Summary of activity

The Santos-operated Barossa Gas Project is an offshore gas and condensate project with the purpose of providing a new source of gas to the existing Darwin liquified natural gas (DLNG) facility at Wickham Point in the NT. It is intended that natural gas and condensate would be extracted from the Barossa field, located in Commonwealth waters approximately 285km offshore north-northwest from Darwin. Initial processing would occur at the FPSO facility, to separate the natural gas, water and condensate extracted



from the Barossa field. The dry natural gas would be transported through the GEP for onshore processing at the DLNG facility. The condensate would be transferred from the FPSO facility to purpose-built tankers for international export.

The estimated life of the Barossa Development is 25 years, and the Production Operations EP and the OEMP will be reviewed every five years. Productions Operations activity is expected to commence in 2025, subject to obtaining the required approvals.

Activity location

The Production Operations Activity is confined to two operational areas: Operational Area 1 (OA1) and Operational Area 2 (OA2).

OA1: The Barossa field. This is the area in which the FPSO, subsea production system, and supporting subsea infrastructure will be used to process gas and condensate extracted from the Barossa wells. The area is confined to Commonwealth waters, approximately 285 km north-north-west of Darwin (the closest major populated centre), approximately 210 km north-west of the mainland NT coastline, and approximately 130 km north of the Tiwi Islands at the closest point (Seagull Island).

OA2: The 285 km section of the GEP from OA1 to the Commonwealth waters/ NT waters boundary; and the 8.26 km section of the GEP situated in NT coastal waters between the Commonwealth waters/NT coastal waters boundary and the Territorial Sea Baseline).

The environment that may be affected by the proposed activity

Santos is assessing impacts and risks to the environment from these proposed activities, inclusive of ecosystems (including people and communities), natural and physical resources, the qualities and characteristics of locations, places and areas and the heritage value of places. This will include assessment of the social, economic and cultural features of the environment.

The map depicts OA1 and OA2, and the environment that may be affected (EMBA) by the proposed activities. The 'EMBA' represents the greatest geographical extent that could be affected by an unplanned 'worst case' oil spill scenario, before any measures to reduce the risks are considered.

Santos proposes to implement measures to reduce the impacts and risks of the activity. It is a requirement under relevant environmental legislation that these impacts and risks are reduced to as low as reasonably practicable (ALARP) and to an acceptable level.

Consultation

Under the Offshore Petroleum and Greenhouse Gas Storage Environment Regulations Santos is required to consult with people and organisations who have functions, interests or activities that may be affected by the proposed activities. Functions, interests or activities may include those arising in relation to spiritual or cultural connections to land and sea country in accordance with Indigenous tradition; tourism; recreational and commercial fishing; other commercial or recreational activities and local communities that might be affected by our proposed activity (these are examples and not an exhaustive list).

Seeking information and what's next

In preparing an EP and OEMP for submission to the regulators, a titleholder must consult with each 'relevant person', including relevant Commonwealth, State and Northern Territory Departments or agencies and persons (or organisations) whose functions, interests or activities may be affected by the activity proposed to be carried out under an EP.

Your input is important to Santos:

- so that we can understand the environmental values in the OAs and the environment that may be affected, the environmental impacts and risks associated with the activity, to inform development of the Productions Operations EP (Commonwealth waters) and OEMP (NT waters);
- to inform how consultation processes may need to be adapted for different relevant persons;
- to ensure that we provide information to people in an appropriate and accessible manner; and
- to assist with Santos' preparation of the EP.
- More information on the proposed activities is available on our website.

Contact us

If you consider you may be a relevant person, please contact us as soon as possible to allow Santos to initiate consultation with you in relation to the proposed activity so you can tell us how you would like to be consulted. Consultation closes on **Tuesday 9 April 2024.**

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9 March 2024 NT News

o enable the city to thrive."
The major projects that are

the 2500sq m complex is set to house a 50m, 25m and resort

$600,000 in total, by the end of the financial year, the

fall and other liquids that gather among waste.

The upgrade included the duplication of Lee Point Rd

Improvements
As part of a $7m program,

SEEKING RELEVANT PERSONS

BAROSSA PRODUCTION OPERATIONS ACTIVITY

Santos

Santos is seeking to identify and consult with relevant persons whose functions, interests or activities may be affected by our proposed Barossa Production Operations Activity in Commonwealth and Northern Territory waters, north-northwest of Darwin

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- A Production Operations Environment Plan (EP) relating to the arrival and operations of the Floating Production Storage and Offloading facility (FPSO), operation of a subsea production system and supporting subsea infrastructure, and operation of a 285km section of the Gas Export Pipeline (GEP) located in Commonwealth waters where offshore petroleum activities are regulated under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth).
- An Operations Environmental Management Plan (OEMP) which includes the:
  - 8.26 km section of the GEP in Northern Territory (NT) coastal waters covered by the *Petroleum (Submerged Lands Act) 1981* (NT); and
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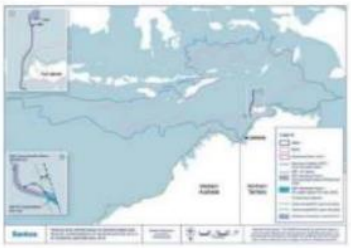
Summary of activity

The Santos-operated Barossa Gas Project is an offshore gas and condensate project with the purpose of providing a new source of gas to the existing Darwin liquified natural gas (DLNG) facility at Wickham Point in the NT. It is intended that natural gas and condensate would be extracted from the Barossa field, located in Commonwealth waters approximately 285km offshore north-northwest from Darwin. Initial processing would occur at the FPSO facility, to separate the natural gas, water and condensate extracted from the Barossa field. The dry natural gas would be transported through the GEP for onshore processing at the DLNG facility. The condensate would be transferred from the FPSO facility to purpose-built tankers for international export.

The estimated life of the Barossa Development is 25 years, and the Production Operations EP and the OEMP will be reviewed every five years. Productions Operations activity is expected to commence in 2025, subject to obtaining the required approvals.



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The environment that may be affected by the proposed activity

Santos is assessing impacts and risks to the environment from these proposed activities, inclusive of ecosystems (including people and communities), natural and physical resources, the qualities and characteristics of locations, places and areas and the heritage value of places. This will include assessment of the social, economic and cultural features of the environment.

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Consultation

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Your input is important to Santos:

- so that we can understand the environmental values in the OAs and the environment that may be affected, the environmental impacts and risks associated with the activity, to inform development of the Productions Operations EP (Commonwealth waters) and OEMP (NT waters);
- to inform how consultation processes may need to be adapted for different relevant persons;
- to ensure that we provide information to people in an appropriate and accessible manner; and
- to assist with Santos' preparation of the EP.
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Contact us

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Visit **santos.com/barossa/production-operations**, email **offshore.consultation@santos.com** or call **1800 267 600** for more information, to self-identify as relevant person or to provide feedback.

NT8101Z01MA - V1

Consultation

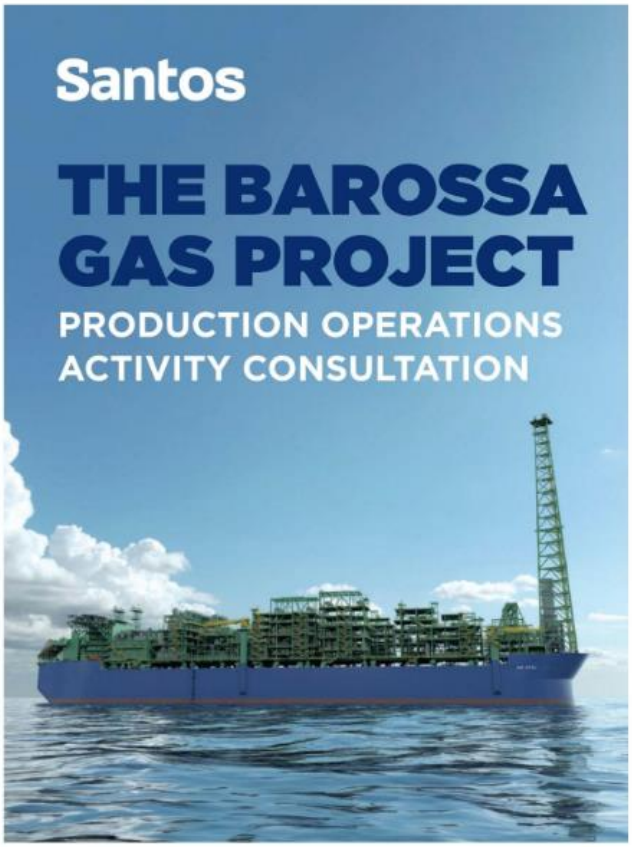
Radio

March-April 2024	**Radio ad - Hit 101.3 Broome**
March-April 2024	**Radio ad - Darwin Mix 1049**
March-April 2024	**Radio ad - Darwin Hot 100**
March-April 2024	**Radio ad - Pilbara and Kimberley Aboriginal Media Radio**

Script B - Consultation 11 March to 9 April

Santos is now consulting with people who maybe affected by the proposed Production Operations Activity for the Barossa Gas Project.
This includes Santos's offshore production facility, approximately 285 kilometres offshore from Darwin, and a Gas Export Pipeline.
If you may be affected by these activities, please contact Santos as soon as possible.
Consultation closes on 9 April 2024
For more visit santos.com/barossa,
Phone [1800 267 600] One Eight Hundred, Two Six Seven, Six Hundred
or email offshore.consultation@santos.com.

16 March 2024 Press ad NT News



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More information is available at santos.com/Barossa about who may be a relevant person for consultation, the proposed activity, potential environmental impacts and risks, and proposed control measures to seek to reduce any impacts and risks to as low as reasonably practicable and an acceptable level.

We are asking relevant persons to provide feedback by **9 April 2024**.

Please contact us via any of the below channels to discuss consultation or provide feedback.

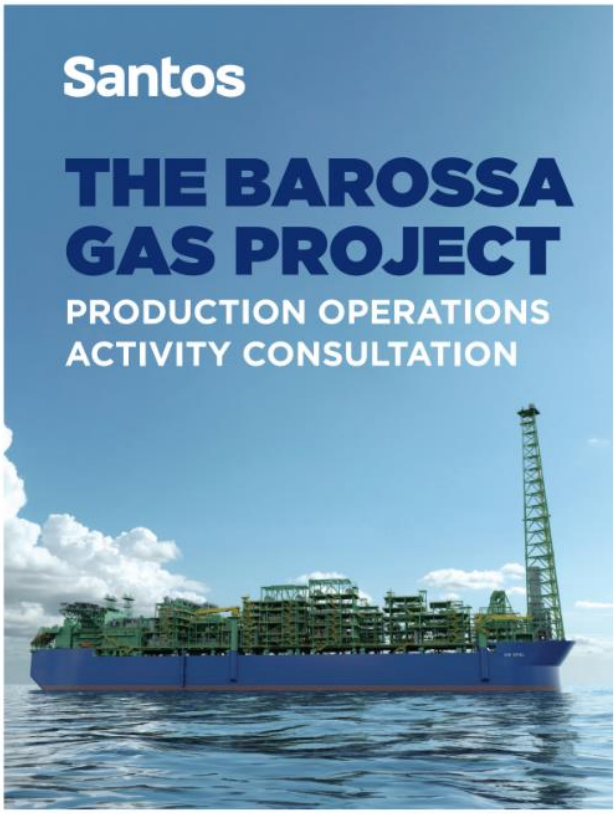
For more information:

Visit **santos.com/barossa**
Phone **1800 267 600**
Email **offshore.consultation@santos.com**
or scan the QR code

NTNE01201MA - V1

16 March 2024 Press ad, The West Australian

leagues at a bar in the nearby ed this. "Perenti categorically lice were responsible for the queries about missing items. 2020 and 2021.



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or scan the QR code

23 March 2024 Press ad NT News

ing sensors in schools, which Ms Thorpe said was "only one solution and a costly one at that".

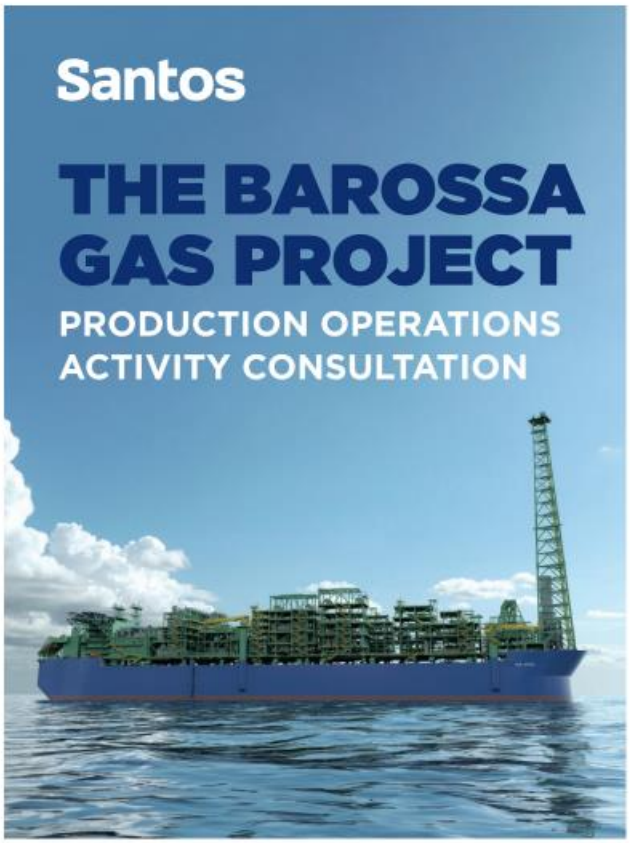
March 1. She said there were "transitional arrangements" in place until July 1 to allow time for vape sponsors and distributed in parliament. There will be no penalties for people who possess limited quantities of vapes for personal use."

Katherine CBD.

Town Council CEO Ingrid Stonhill said a survey last

The hope is to retain past food vendors and attract new ones to a "bigger and

who wish to take part can submit their EOIs at katherine.nt.gov.au/forms.



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Email **offshore.consultation@santos.com**
or scan the QR code

NTN801201MA - V1

Steve Edgington has resigned as the opposition's Domestic Violence spokesman. Picture: Pema Tamang Pakhrin

tered in May 2016 and jointly owned by Mr Edgington and Mr Newman until its deregistration in May last year.

"This afternoon I have notified the Leader of the Opposition that I have resigned from the role of shadow minister for that he is a fierce advocate for the prevention of domestic violence, and the rehabilitation of offenders, representing one

Newman said: "I had to plead guilty to expedite charges after several months, but you might find there's more to the story."

NORTHERN TERRITORY GOVERNMENT | Department of INDUSTRY, TOURISM AND TRADE

EXPRESSIONS OF INTEREST

CHAIRPERSON FOR McARTHUR RIVER MINE INDEPENDENT EXPERT MINE CLOSURE PANEL

The Minister for Mining is seeking expressions of interest from technical experts to be appointed as Chairperson for the independent panel of experts for McArthur River Mine focusing on Mine Closure.

A suitably credentialed individual will be appointed to deliver an independent technical review of action taken to achieve closure of the McArthur River Mine in line with approved plans.

The independent expert will have access to McArthur River Mine operations and performance information focusing on the three-year period following approval of the Overburden Management Project in November 2020.

The Chairperson will play an important role in demonstrating accountability of the mine operator to the wider community.

Prior to applying, please refer to the Terms of Reference and selection criteria at **industry.nt.gov.au/mrm-panels**

Written nominations should be emailed to Andria Handley, Director Mining Operations Policy and Support, **andria.handley@nt.gov.au**

Nominations close at midnight on Sunday 21 April 2024.

V1 - NTN001201MA

Santos

COMMUNITY CONSULTATION DROP-IN SESSIONS

BAROSSA GAS PROJECT ACTIVITY

YOUR VIEWS ARE IMPORTANT TO US.

Santos is preparing environment plans, as required by legislation, regarding activities for the Barossa Gas Project - a project that involves extracting natural gas from the Barossa field in Commonwealth waters approximately 285 kilometres offshore north-north west of Darwin and transporting it to the existing Darwin liquefied natural gas (DLNG) plant.

We are currently consulting with relevant persons whose functions, interests, or activities may be affected by the Production Operations Activity as we prepare a Production Operations Environment Plan and an Operations Environmental Management Plan. Detailed information about these proposed activities is available at **Santos.com/barossa** or by scanning the QR code below. Santos will hold community consultation drop-in sessions for relevant persons to obtain information about these proposed activities, provide feedback and ask any questions.

VENUE:
Santos Shopfront
T14/15, 41 The Mall, Darwin

DATES:
26TH March, Tuesday
27TH March, Wednesday
28TH March, Thursday

TIME:
10.30am - 2.30pm

CONTACT US

T: 1800 267 600
E: offshore.consultation@santos.com

For more information please scan QR codes:

BAROSSA RELEVANT PERSON

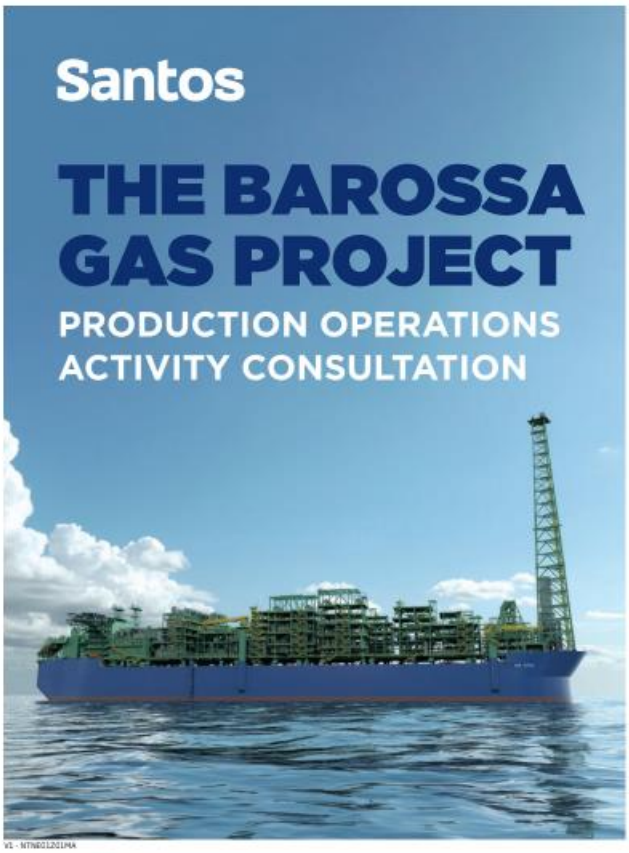
BAROSSA PRODUCTION OPERATIONS

27 March 2024 Press ad NT News

information, and said early evidence supported allegations that awards racist towards First NT Police assistance," Mr Riches said.

Citing a need for the "serious not be referred to NT Police for disciplinary action, and would not be publicly named.

On March 6 NT Police Commissioner Michael Murphy said the police's Professional "We've got a good team. I don't question their integrity or their ethics at all and with the the Northern Territory Police Force is deeply committed to maintaining the public's trust."



v1 - NTN801201MA

Santos is now consulting with relevant persons for its proposed Production Operations activity and is currently preparing:

- **A Production Operations Environment Plan (EP)** relating to the arrival and operations of the Floating Production Storage and Offloading facility (FPSO), operation of a subsea production system and supporting subsea infrastructure, and operation of a 285km section of the Gas Export Pipeline (GEP) located in Commonwealth waters where offshore petroleum activities are regulated under the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth).
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More information is available at santos.com/Barossa about who may be a relevant person for consultation, the proposed activity, potential environmental impacts and risks, and proposed control measures to seek to reduce any impacts and risks to as low as reasonably practicable and an acceptable level.

We are asking relevant persons to provide feedback by **9 April 2024**.

Please contact us via any of the below channels to discuss consultation or provide feedback.

For more information:

Visit **santos.com/barossa**
Phone **1800 267 600**
Email **offshore.consultation@santos.com**
or scan the QR code

Table 4-10 (of the EP) Advertising Tiwi sessions

- **Social media notices**
- **Notice of Consultation - emailed to several independent stakeholders for sharing across their direct networks, in person, and for posting on Tiwi Island notices boards**

March 2024

Santos Ltd
1m ·

Details of our upcoming consultation sessions on the Tiwi Islands are available below. We look forward to chatting with you early next month.

For more information, visit: www.santos.com/barossa

Santos

NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE
BAROSSA GAS PROJECT ACTIVITIES

YOUR VIEWS ARE IMPORTANT TO US.

Santos is preparing Environment Plans (EPs) for the following proposed activities, as required by legislation:

Darwin Pipeline Duplication (DPD) Environment Plan - this relates to the 23 km portion of the underwater DPD pipeline and supporting subsea infrastructure in Commonwealth waters 27 km south-west of the Tiwi Islands.

Production Operations Environment Plan - this relates to the arrival and operations of the Floating Production Storage and Offloading (FPSO) facility, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the Gas Export Pipeline (GEP) located in Commonwealth waters.

Operation Environmental Management Plan (Production Operations) - the OEMP relates to the 100 km portion of the GEP and supporting subsea infrastructure located in Northern Territory Waters and land, extending to the existing Darwin Liquefied Natural Gas (DLNG) facility.

We are currently consulting with Tiwi Islands people whose functions, interests or activities may be affected by activities proposed under the EPs or the OEMP listed above. Based on input from Tiwi Islands people, we will consult with you at the sessions detailed in this notice through Clan group meetings with videos and visual aids available.

At the upcoming sessions we will:

- Continue consulting with relevant persons about our proposed activities under the DPD EP, including:
  - providing responses to information provided and queries raised about the DPD EP by Tiwi Islands people, following previous Clan meetings.
  - updating you about any measures we propose to adopt in the DPD EP as a result of your information and comments before it is submitted to the regulator for assessment.
  - if any input is outstanding, seeking your final input on possible consequences of the proposed DPD activity and any further measures you would like us to consider to reduce impacts and risks.

Please note that this is the final consultation session for the DPD EP.

- Consult with relevant persons about our proposed activities under the Production Operations EP and OEMP, including:
  - providing information and responding to questions about the proposed activities, potential impacts and risks and how we plan to reduce these to as low as reasonably practicable and to an acceptable level.
  - inviting you to consider the information given and tell us if you seek further or different information.

TIMING AND VENUES

Tuesday 5 March 2024, Milikapiti, Sports & Recreation Centre
10.30am - Marrikawuyanga & Yimpinari Clans
1.00pm - Wulirankuwu Clan

Wednesday 6 March 2024, Wurrumiyanga, Mantiyupwi Motel
10.30am - Mantiyupwi Clan
1.00pm - Jikilaruwu Clan

Thursday 7 March 2024, Wurrumiyanga, Mantiyupwi Motel
10.30am - Wurankuwu Clan
1.00pm - Malawu Clan

Friday 8 March 2024, Pirlangimpi, Sports & Social Club
10.30am - Munupi Clan

CONTACT US
T: 1800 267 600
E: offshore.consultation@santos.com
For more information please scan QR codes:

Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

Like Comment Send

April 2024

Santos Ltd
Just now ·

Details of our upcoming consultation sessions on the Tiwi Islands are available below. We look forward to chatting with you in April. For more information, visit www.santos.com/barossa

May 2024

Santos Ltd
Top Contributor · 27m ·

Details of our upcoming consultation sessions on the Tiwi Islands are available below. We look forward to chatting with you in May. For more information, visit www.santos.com/barossa

Santos

NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE
BAROSSA GAS PROJECT ACTIVITIES

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Barossa Gas Export Pipeline Operations Environmental Management Plan (OEMP) - the OEMP relates to the 100 km portion of the GEP and supporting subsea infrastructure located in Northern Territory waters, extending to the onshore termination point at the existing Darwin Liquefied Natural Gas (DLNG) facility.

We are currently consulting with Tiwi Islands people whose functions, interests or activities may be affected by activities proposed under the EP or the OEMP listed above.

At the upcoming sessions we will:

Continue consulting with relevant persons about our proposed activities under the Production Operations EP and OEMP, including:

- providing responses to information provided and queries raised about the EP and OEMP by Tiwi Islands people, following previous Clan meetings.
- updating you about any measures we propose to adopt in the EP and OEMP as a result of your information and comments before it is submitted to the regulator for assessment.
- if any input is outstanding, seeking your final input on possible consequences of the proposed Production Operations activity and any further measures you would like us to consider to reduce impacts and risks.

Based on input from Tiwi Islands people, we will consult with you at the advertised sessions through Clan group meetings with videos and visual aids available.

TIMING AND VENUES

Monday 13 May 2024
Milikapiti, Sports & Recreation Centre
10.30am - Mamkawuyanga & Yimpinari Clans
1.00pm - Wulirankuwu Clan

Wednesday 15 May 2024
Wurrumiyanga, Mantiyupwi Motel
10.30am - Mantiyupwi Clan
1.00pm - Jikilaruwu Clan

Please note that these are the final consultation sessions for Production Operations EP and OEMP.

CONTACT US
T: 1800 267 600
E: offshore.consultation@santos.com
For more information please scan QR codes:

Barossa Relevant Person | Barossa Production Operations

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NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE
BAROSSA GAS PROJECT ACTIVITIES

YOUR VIEWS ARE IMPORTANT TO US.

TIMING AND VENUES

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Reminder today: Santos Munupi Clan Meeting at Pirlangimpi Sports Club at 10:30am.

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NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE

BAROSSA GAS PROJECT ACTIVITIES

YOUR VIEWS ARE IMPORTANT TO US.

Santos is preparing environment plans for the following proposed activities, as required by legislation:

Barossa Production Operations Environment Plan (EP) - this relates to the arrival and operations of the Floating Production Storage and Offloading (FPSO) facility, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the Gas Export Pipeline (GEP) located in Commonwealth waters.

Barossa Gas Export Pipeline Operations Environmental Management Plan (OEMP) - the OEMP relates to the 100 km portion oft he GEP and supporting subsea infrastructure located in Northern Territory waters, extending to the onshore termination point at the existing Darwin Liquefied Natural Gas (DLNG) facility.

We are currently consulting with Tiwi Islands people whose functions, interests or activities may be affected by activities proposed under the EP or the OEMP listed above.

At the upcoming sessions we will:

Continue consulting with relevant persons about our proposed activities under the Production Operations EP and OEMP, including:

- providing responses to information provided and queries raised about the EP and OEMP by Tiwi Islands people, following previous Clan meetings.
- updating you about any measures we propose to adopt in the EP and OEMP as a result of your information and comments before it is submitted to the regulator for assessment.
- if any input is outstanding, seeking your final input on possible consequences of the proposed Production Operations activity and any further measures you would like us to consider to reduce impacts and risks.

Based on input from Tiwi Islands people, we will consult with you at the advertised sessions through Clan group meetings with videos and visual aids available.

Please note that this is the final consultation session for the Production Operations EP and OEMP.

TIMING AND VENUES

Tuesday 21 May 2024

Pirlangimpi, Sports & Social Club

10.30am - Munupi Clan

Wednesday 22 May 2024

Wurrumiyanga, Mantiyupwi Motel

10.30am - Wurankuwu Clan
1.00pm - Malawu Clan

These sessions have been rescheduled to May 21 and 22 at the request of the communities.

CONTACT US

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For more information please scan QR codes:

Barossa Relevant Person

Barossa Production Operations

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NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE

BAROSSA GAS PROJECT ACTIVITIES

YOUR VIEWS ARE IMPORTANT TO US.

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Darwin Pipeline Duplication (DPD) Environment Plan - this relates to the 23 km portion of the underwater DPD pipeline and supporting subsea infrastructure in Commonwealth waters 27 km south-west of the Tiwi Islands.

Production Operations Environment Plan - this relates to the arrival and operations of the Floating Production Storage and Offloading (FPSO) facility, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the Gas Export Pipeline (GEP) located in Commonwealth waters.

Operation Environmental Management Plan (Production Operations) - the OEMP relates to the 100 km portion of the GEP and supporting subsea infrastructure located in Northern Territory Waters and land, extending to the existing Darwin Liquefied Natural Gas (DLNG) facility.

We are currently consulting with Tiwi Islands people whose functions, interests or activities may be affected by activities proposed under the EPs or the OEMP listed above. Based on input from Tiwi Islands people, we will consult with you at the sessions detailed in this notice through Clan group meetings with videos and visual aids available.

At the upcoming sessions we will:

- Continue consulting with relevant persons about our proposed activities under the DPD EP, including:
  - providing responses to information provided and queries raised about the DPD EP by Tiwi Islands people, following previous Clan meetings.
  - updating you about any measures we propose to adopt in the DPD EP as a result of your information and comments before it is submitted to the regulator for assessment.
  - if any input is outstanding, seeking your final input on possible consequences of the proposed DPD activity and any further measures you would like us to consider to reduce impacts and risks.

Please note that this is the final consultation session for the DPD EP.

- Consult with relevant persons about our proposed activities under the Production Operations EP and OEMP, including:
  - providing information and responding to questions about the proposed activities, potential impacts and risks and how we plan to reduce these to as low as reasonably practicable and to an acceptable level.
  - inviting you to consider the information given and tell us if you seek further or different information.

TIMING AND VENUES

Tuesday 5 March 2024, Milikapiti, Sports & Recreation Centre

10.30am - Marrikawuyanga & Yimpinari Clans

1.00pm - Wulirankuwu Clan

Wednesday 6 March 2024, Wurumiyanga, Mantiyupwi Motel

10.30am - Mantiyupwi Clan

1.00pm - Jikilerawu Clan

Thursday 7 March 2024, Wurumiyanga, Mantiyupwi Motel

10.30am - Wurankuwu Clan

1.00pm - Malawu Clan

Friday 8 March 2024, Pirlangimpi, Sports & Social Club

10.30am - Munupi Clan

CONTACT US

T: 1800 267 600

E: offshore.consultation@santos.com

For more information please scan QR codes:

Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

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NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE

BAROSSA GAS PROJECT ACTIVITIES

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At the upcoming sessions we will:

- Continue consulting with relevant persons about our proposed activities under the DPD EP, including:
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TIMING AND VENUES

Tuesday 5 March 2024, Milikapiti, Sports & Recreation Centre

10.30am - Mantikawuyanga & Yirripinari Clans

1.00pm - Wulirankuwu Clan

Wednesday 6 March 2024, Wurumiyanga, Mantiyupwi Motel

10.30am - Mantiyupwi Clan

1.00pm - Jiliaruwu Clan

Thursday 7 March 2024, Wurumiyanga, Mantiyupwi Motel

10.30am - Wurankuwu Clan

1.00pm - Malowu Clan

Friday 8 March 2024, Pirlangimpi, Sports & Social Club

10.30am - Munupi Clan

CONTACT US

T: 1800 267 600

E: offshore.consultation@santos.com

For more information please scan QR codes:

Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

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NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE

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We are currently consulting with Tiwi Islands people whose functions, interests or activities may be affected by activities proposed under the EPs or the OEMP listed above. Based on input from Tiwi Islands people, we will consult with you at the sessions detailed in this notice through Clan group meetings with videos and visual aids available.

At the upcoming sessions we will:

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  - inviting you to consider the information given and tell us if you seek further or different information.

TIMING AND VENUES

Tuesday 5 March 2024, Milikapiti, Sports & Recreation Centre

10.30am – Mamkawuyanga & Yirripinari Clans
1.00pm – Wulirankuwu Clan

Wednesday 6 March 2024, Wurrumiyanga, Mantiyupwi Motel

10.30am – Mantiyupwi Clan
1.00pm – Jilakuwu Clan

Thursday 7 March 2024, Wurrumiyanga, Mantiyupwi Motel

10.30am – Wurankuwu Clan
1.00pm – Malawu Clan

Friday 8 March 2024, Pirlangimpi, Sports & Social Club

10.30am – Munupi Clan

CONTACT US

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For more information please scan QR codes:

Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

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NORTHERN TERRITORY GOVERNMENT | Department of INDUSTRY, TOURISM AND TRADE

EXPRESSIONS OF INTEREST

CHAIRPERSON FOR McARTHUR RIVER MINE INDEPENDENT EXPERT MINE CLOSURE PANEL

The Minister for Mining is seeking expressions of interest from technical experts to be appointed as Chairperson for the independent panel of experts for McArthur River Mine focusing on Mine Closure.

A suitably credentialed individual will be appointed to deliver an independent technical review of action taken to achieve closure of the McArthur River Mine in line with approved plans.

The independent expert will have access to McArthur River Mine operations and performance information focusing on the three-year period following approval of the Overburden Management Project in November 2020.

The Chairperson will play an important role in demonstrating accountability of the mine operator to the wider community.

Prior to applying, please refer to the Terms of Reference and selection criteria at **industry.nt.gov.au/mrm-panels**

Written nominations should be emailed to Andria Handley, Director Mining Operations Policy and Support, **andria.handley@nt.gov.au**

Nominations close at midnight on Sunday 21 April 2024.

V1 - NTNE01Z01MA

Santos

COMMUNITY CONSULTATION DROP-IN SESSIONS

BAROSSA GAS PROJECT ACTIVITY

YOUR VIEWS ARE IMPORTANT TO US.

Santos is preparing environment plans, as required by legislation, regarding activities for the Barossa Gas Project - a project that involves extracting natural gas from the Barossa field in Commonwealth waters approximately 285 kilometres offshore north-north west of Darwin and transporting it to the existing Darwin liquefied natural gas (DLNG) plant.

We are currently consulting with relevant persons whose functions, interests, or activities may be affected by the Production Operations Activity as we prepare a Production Operations Environment Plan and an Operations Environmental Management Plan. Detailed information about these proposed activities is available at **Santos.com/barossa** or by scanning the QR code below. Santos will hold community consultation drop-in sessions for relevant persons to obtain information about these proposed activities, provide feedback and ask any questions.

VENUE:
Santos Shopfront
T14/15, 41 The Mall, Darwin

DATES:
26TH March, Tuesday
27TH March, Wednesday
28TH March, Thursday

TIME:
10.30am - 2.30pm

CONTACT US

T: 1800 267 600
E: offshore.consultation@santos.com
For more information please scan QR codes:

BAROSSA RELEVANT PERSON

BAROSSA PRODUCTION OPERATIONS

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NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE

BAROSSA GAS PROJECT ACTIVITIES

YOUR VIEWS ARE IMPORTANT TO US.

Santos is preparing Environment Plans (EPs) for the following proposed activities, as required by legislation:

Barossa Production Operations Environment Plan (EP) – this relates to the arrival and operations of the Floating Production Storage and Offloading (FPSO) facility, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the Gas Export Pipeline (GEP) located in Commonwealth waters.

Barossa Gas Export Pipeline Operations Environmental Management Plan (OEMP) – the OEMP relates to the 100 km portion of the GEP and supporting subsea infrastructure located in Northern Territory waters, extending to the onshore termination point at the Darwin Liquefied Natural Gas (DLNG) facility.

We are currently consulting with Tiwi Islands people whose functions, interests or activities may be affected by activities proposed under the EP or the OEMP listed above. Based on input from Tiwi Islands people, we will consult with you at the advertised sessions through Clan group meetings with videos and visual aids available.

At the upcoming sessions we will:

- Consult with relevant persons about our proposed activities under the Production Operations EP and OEMP, including:
  - providing information and responding to questions about the proposed activities, potential impacts and risks and how we plan to reduce these to as low as reasonably practicable and to an acceptable level.
  - inviting you to consider the information provided and tell us if you seek further or different information.

TIMING AND VENUES

Monday 8 April 2024, Pirlangimpi, Sports & Social Club

10.30am – Munupi Clan

Please note that in addition to consultation on the Production Operations EP and OEMP, Santos will also be consulting with the Munupi Clan on the Darwin Pipeline Duplication Project EP including:

- providing responses to information provided and queries raised about the DPD EP by Tiwi Islands people, following previous Clan meetings.
- updating you about any measures we propose to adopt in the DPD EP as a result of your information and comments before it is submitted to the regulator for assessment.
- if any input is outstanding, seeking your final input on possible consequences of the proposed DPD activity and any further measures you would like us to consider to reduce impacts and risks.

Tuesday 9 April 2024, Milikapiti, Sports & Recreation Centre

10.30am – Mamikawuyanga & Yirrapinari Clans

1.00pm – Wulirankuwu Clan

Wednesday 10 April 2024, Wurrumiyanga, Mantiyupwi Motel

10.30am – Mantiyupwi Clan

1.00pm – Jilkiaruwu Clan

Thursday 11 April 2024, Wurrumiyanga, Mantiyupwi Motel

10.30am – Wurankuwu Clan

1.00pm – Malawu Clan

CONTACT US

T: 1800 267 600

E: offshore.consultation@santos.com

For more information please scan QR codes:

Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

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NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE

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TIMING AND VENUES

Monday 8 April 2024, Pirlangimpi, Sports & Social Club

10.30am – Munupi Clan

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- providing responses to information provided and queries raised about the DPD EP by Tiwi Islands people, following previous Clan meetings.
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- if any input is outstanding, seeking your final input on possible consequences of the proposed DPD activity and any further measures you would like us to consider to reduce impacts and risks.

Tuesday 9 April 2024, Milikapiti, Sports & Recreation Centre

10.30am – Mamiikawuyanga & Yimpinari Clans

1.00pm – Wulirankuwu Clan

Wednesday 10 April 2024, Wurrumiyanga, Mantiyupwi Motel

10.30am – Mantiyupwi Clan

1.00pm – Jikilaruwu Clan

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10.30am – Wurankuwu Clan

1.00pm – Malowu Clan

CONTACT US

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Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

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NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE

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TIMING AND VENUES

Monday 8 April 2024, Pirlangimpi, Sports & Social Club

10.30am – Munupi Clan

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Tuesday 9 April 2024, Milikapiti, Sports & Recreation Centre

10.30am – Mantikawuyanga & Yirrpinari Clans

1.00pm – Wulirankuwu Clan

Wednesday 10 April 2024, Wurumiyanga, Mantiyupwi Motel

10.30am – Mantiyupwi Clan

1.00pm – Jikilaruwu Clan

Thursday 11 April 2024, Wurumiyanga, Mantiyupwi Motel

10.30am – Wurankuwu Clan

1.00pm – Malawu Clan

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We are currently consulting with Tiwi Islands people whose functions, interests or activities may be affected by activities proposed under the EPs or the OEMP listed above.

At all of the upcoming sessions we will:

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For the Munupi Clan on 17 May 2024: we will also continue consulting with relevant persons about our proposed activities under the DPD EP, including:

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Based on input from Tiwi Islands people, we will consult with you at the advertised sessions through Clan group meetings with videos and visual aids available.

TIMING AND VENUES

Monday 13 May 2024 - Milikapiti, Sports & Recreation Centre

10.30am - Mamkawuyanga & Yimpinari Clans
1.00pm - Wulirankuwu Clan

Wednesday 15 May 2024 - Wurumiyanga, Mantiyupwi Motel

10.30am - Mantiyupwi Clan
1.00pm - Jikilaruwu Clan
Please note that these are the final consultation sessions for the Production Operations EP and OEMP.

Thursday 16 May 2024 - Wurumiyanga, Mantiyupwi Motel

10.30am - Wurankuwu Clan
1.00pm - Malawu Clan

Friday 17 May 2024 - Pirlangimpi, Sports & Social Club

10.30am - Munupi Clan (This session has been rescheduled to May 17 at the request of the community. Note that this is the final Munupi Clan consultation session for the DPD EP.)

Tuesday 21 May 2024 - Pirlangimpi, Sports & Social Club

10.30am - Munupi Clan

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These sessions have been rescheduled to May 21 and 22 at the request of the communities. Please note that these are the final consultation sessions for the Production Operations EP and OEMP.

CONTACT US

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For more information please scan QR codes:

Barossa DPD Project | **Barossa Relevant Person** | **Barossa Production Operations**

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NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE

BAROSSA GAS PROJECT ACTIVITIES

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For the Munupi Clan on 17 May 2024: we will also continue consulting with relevant persons about our proposed activities under the DPD EP, including:

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TIMING AND VENUES

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1.00pm - Wulirankuwu Clan

Wednesday 15 May 2024 - Wurumiyanga, Mantiyupwi Motel

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Please note that these are the final consultation sessions for the Production Operations EP and OEMP.

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10.30am - Munupi Clan (This session has been rescheduled to May 17 at the request of the community. Note that this is the final Munupi Clan consultation session for the DPD EP.)

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10.30am - Munupi Clan

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For more information please scan QR codes:

Barossa DPD Project | **Barossa Relevant Person** | **Barossa Production Operations**

20 May 2024 Press ad NT News

Santos

NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE

BAROSSA GAS PROJECT ACTIVITIES

YOUR VIEWS ARE IMPORTANT TO US.

Santos is preparing environment plans for the following proposed activities, as required by legislation:

Barossa Production Operations Environment Plan (EP) – this relates to the arrival and operations of the Floating Production Storage and Offloading (FPSO) facility, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the Gas Export Pipeline (GEP) located in Commonwealth waters.

Barossa Gas Export Pipeline Operations Environmental Management Plan (OEMP) – the OEMP relates to the 100 km portion of the GEP and supporting subsea infrastructure located in Northern Territory waters, extending to the onshore termination point at the existing Darwin Liquefied Natural Gas (DLNG) facility.

Barossa Darwin Pipeline Duplication (DPD) Environment Plan (EP) – this relates to the 23 km portion of the underwater DPD pipeline and supporting subsea infrastructure in Commonwealth waters 27 km south-west of the Tiwi Islands.

We are currently consulting with Tiwi Islands people whose functions, interests or activities may be affected by activities proposed under the EPs or the OEMP listed above.

At all of the upcoming sessions we will:

Continue consulting with relevant persons about our proposed activities under the Production Operations EP and OEMP, including:

- providing responses to information provided and queries raised about the EP and OEMP by Tiwi Islands people, following previous Clan meetings.
- updating you about any measures we propose to adopt in the EP and OEMP as a result of your information and comments before it is submitted to the regulator for assessment.
- if any input is outstanding, seeking your final input on possible consequences of the proposed Production Operations activity and any further measures you would like us to consider to reduce impacts and risks.

For the Munupi Clan on 17 May 2024: we will also continue consulting with relevant persons about our proposed activities under the DPD EP, including:

- providing responses to information provided and queries raised about the DPD EP by Tiwi Islands people, following previous Clan meetings.
- updating you about any measures we propose to adopt in the DPD EP as a result of your information and comments before it is submitted to the regulator for assessment.
- if any input is outstanding, seeking your final input on possible consequences of the proposed DPD activity and any further measures you would like us to consider to reduce impacts and risks.

Based on input from Tiwi Islands people, we will consult with you at the advertised sessions through Clan group meetings with videos and visual aids available.

TIMING AND VENUES

Monday 13 May 2024 - Milikapiti, Sports & Recreation Centre

10.30am - Mamkawuyanga & Yimpinari Clans
1.00pm - Wulirankuwu Clan

Wednesday 15 May 2024 - Wurrumiyanga, Mantiyupwi Motel

10.30am - Mantiyupwi Clan
1.00pm - Jikilaruwu Clan
Please note that these are the final consultation sessions for the Production Operations EP and OEMP.

Thursday 16 May 2024 - Wurrumiyanga, Mantiyupwi Motel

10.30am - Wurankuwu Clan
1.00pm - Malawu Clan

Friday 17 May 2024 - Pirlangimpi, Sports & Social Club

10.30am - Munupi Clan (This session has been rescheduled to May 17 at the request of the community. Note that this is the final Munupi Clan consultation session for the DPD EP.)

Tuesday 21 May 2024 - Pirlangimpi, Sports & Social Club

10.30am - Munupi Clan

Wednesday 22 May 2024 - Wurrumiyanga, Mantiyupwi Motel

10.30am - Wurankuwu Clan
1.00pm - Malawu Clan
These sessions have been rescheduled to May 21 and 22 at the request of the communities. Please note that these are the final consultation sessions for the Production Operations EP and OEMP.

CONTACT US

T: 1800 267 600
E: offshore.consultation@santos.com
For more information please scan QR codes:

Barossa DPD Project | **Barossa Relevant Person** | **Barossa Production Operations**

Monday May 20, 2024 | NT

Watch

Questions over ship lift project

Camden Smith

Less than a fortnight after the NT government announced US company Pearlson would deliver key infrastructure on the Darwin ship lift development, a leading probity watchdog has delivered a stinging report on the project's governance.

In her May report, auditor general Julie Crisp said that "key decisions" made surrounding the $595m Darwin ship lift project were not subject to governance oversight.

This included a land deal that, in exchange for four land parcels from Paspaley, saw the government transfer 15.8ha of land and sea to the company and lease a further land parcel at nominal value in order to construct a private marine facility to be owned by the company.

The report, tabled in parliament last week, identified that evidence to support key decisions made by the Department of Chief Minister and Cabinet

Table 4-10 (of the EP) Advertising Larrakia sessions

23 March 2024 **Press ad – NT News**

Violence spokesman. Picture: Pema Tamang Pakhrin

tration in May last year.

the role of shadow minister for

of offenders, representing one

find there's more to the story."

NORTHERN TERRITORY GOVERNMENT | Department of INDUSTRY, TOURISM AND TRADE

EXPRESSIONS OF INTEREST

CHAIRPERSON FOR McARTHUR RIVER MINE INDEPENDENT EXPERT MINE CLOSURE PANEL

The Minister for Mining is seeking expressions of interest from technical experts to be appointed as Chairperson for the independent panel of experts for McArthur River Mine focusing on Mine Closure.

A suitably credentialed individual will be appointed to deliver an independent technical review of action taken to achieve closure of the McArthur River Mine in line with approved plans.

The independent expert will have access to McArthur River Mine operations and performance information focusing on the three-year period following approval of the Overburden Management Project in November 2020.

The Chairperson will play an important role in demonstrating accountability of the mine operator to the wider community.

Prior to applying, please refer to the Terms of Reference and selection criteria at **industry.nt.gov.au/mrm-panels**

Written nominations should be emailed to Andria Handley, Director Mining Operations Policy and Support, **andria.handley@nt.gov.au**

Nominations close at midnight on Sunday 21 April 2024.

V1 - NTN0120IMA

Santos

COMMUNITY CONSULTATION DROP-IN SESSIONS

BAROSSA GAS PROJECT ACTIVITY

YOUR VIEWS ARE IMPORTANT TO US.

Santos is preparing environment plans, as required by legislation, regarding activities for the Barossa Gas Project - a project that involves extracting natural gas from the Barossa field in Commonwealth waters approximately 285 kilometres offshore north-north west of Darwin and transporting it to the existing Darwin liquefied natural gas (DLNG) plant.

We are currently consulting with relevant persons whose functions, interests, or activities may be affected by the Production Operations Activity as we prepare a Production Operations Environment Plan and an Operations Environmental Management Plan. Detailed information about these proposed activities is available at **Santos.com/barossa** or by scanning the QR code below. Santos will hold community consultation drop-in sessions for relevant persons to obtain information about these proposed activities, provide feedback and ask any questions.

VENUE:
Santos Shopfront
T14/15, 41 The Mall, Darwin

DATES:
26TH March, Tuesday
27TH March, Wednesday
28TH March, Thursday

TIME:
10.30am - 2.30pm

CONTACT US
T: 1800 267 600
E: offshore.consultation@santos.com
For more information please scan QR codes:

BAROSSA RELEVANT PERSON

BAROSSA PRODUCTION OPERATIONS

April Notice of Consultation

- **Emails to representative organisations for sharing across their direct networks.**
- **Emails and phone calls notifying individual Larrakia family representatives**
- **Promotion via Santos' Darwin shop front Targeted for Larrakia people**

Santos

YOUR VIEWS ARE IMPORTANT TO US.

Santos is preparing environment plans for the following proposed activities, as required by legislation:

Barossa Production Operations Environment Plan (EP) - this relates to the arrival and operations of the Floating Production Storage and Offloading (FPSO) facility, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the Gas Export Pipeline (GEP) located in Commonwealth waters.

Barossa Gas Export Pipeline Operations Environmental Management Plan (OEMP) - the OEMP relates to the 100 km portion of the GEP and supporting subsea infrastructure located in Northern Territory waters, extending to the onshore termination point at the Darwin Liquefied Natural Gas (DLNG) facility.

We are currently consulting with Larrakia people whose functions, interests or activities may be affected by activities proposed under the EP or the OEMP listed above. Videos and visual aids will be available at the advertised sessions.

TIMING AND VENUE

Tuesday 23 April
Session 1: 9.00am - 11.00am
Session 2: 5.30pm - 7.30pm

Hilton Hotel Darwin, 32 Mitchell Street, Darwin

At the upcoming sessions we will:

- Consult with relevant persons about our proposed activities under the Production Operations EP and OEMP, including:
  - providing information and responding to questions about the proposed activities, potential impacts and risks and how we plan to reduce these to as low as reasonably practicable and to an acceptable level.
  - inviting you to consider the information provided and tell us if you seek further or different information.

CONTACT US

T: 1800 267 600
E: offshore.consultation@santos.com
For more information please scan QR codes:

Barossa Relevant Person

Barossa Production Operations

-

Larrakia Nation social media advertising including Facebook and LinkedIn

June Notice of Consultation

- **Emailed to representative organisations for sharing across their direct networks.**
- **Promotion via Santos' Darwin shop front.**
- **Emails and phone calls notifying individual Larrakia family representatives**

Santos

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Santos is preparing environment plans for the following proposed activities, as required by legislation:

Barossa Production Operations Environment Plan (EP) – this relates to the arrival and operations of the Floating Production Storage and Offloading (FPSO) facility, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the Gas Export Pipeline (GEP) located in Commonwealth waters.

Barossa Gas Export Pipeline Operations Environmental Management Plan (OEMP) – the OEMP relates to the 100 km portion of the GEP and supporting subsea infrastructure located in Northern Territory waters, extending to the onshore termination point at the Darwin Liquefied Natural Gas (DLNG) facility.

Barossa Darwin Pipeline Duplication Project Environment Plan (EP) – this relates to the installation and pre-commissioning of the approximately 23 km long section of the Darwin Pipeline Duplication (DPD) and supporting subsea infrastructure, located in Commonwealth waters - 95km north-west of Darwin.

Barossa Darwin Pipeline Duplication Project Offshore Construction Environmental Management Plan (EMP) – this relates to the installation of approximately 8.26 km of the DPD pipeline in an area of Northern Territory (NT) coastal waters between the Commonwealth/NT coastal waters boundary and the Territorial Sea Baseline - 80km north-west of Darwin.

We are currently consulting with Larrakia people whose functions, interests or activities may be affected by activities proposed under the EPs, OEMP, and EMP listed above. Videos and visual aids will be available at the advertised session.

At the upcoming sessions we will:

Continue consultation with Larrakia people about our proposed activities under the EPs, OEMP and EMP including:

- providing responses to information requests and queries previously raised about proposed activities to be managed under the EPs, OEMP and EMP.
- updating you about any measures we propose to adopt in the EPs, OEMP, and EMP as a result of your information and comments before they are submitted to the regulator for assessment.
- if any input is outstanding, seeking your final input on possible consequences of the proposed activities under the EPs, OEMP, and EMP and any further measures you would like us to consider to reduce impacts and risks.

TIMING AND VENUES

Wednesday 12 June
Malak Community Centre
13 Malak Crescent, Malak

Session 1 – 9.30am - 11.30am
Session 2 – 5.00pm - 7.00pm

CONTACT US
T: 1800 267 600
E: offshore.consultation@santos.com
For more information please scan QR codes:

Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

1 June 2024 Press ad – NT News

Santos

NOTICE OF CONSULTATION WITH LARRAKIA PEOPLE

BAROSSA GAS PROJECT ACTIVITIES

YOUR VIEWS ARE IMPORTANT TO US.

Santos is preparing environment plans for the following proposed activities, as required by legislation:

Barossa Production Operations Environment Plan (EP) – this relates to the arrival and operations of the Floating Production Storage and Offloading (FPSO) facility, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the Gas Export Pipeline (GEP) located in Commonwealth waters.

Barossa Gas Export Pipeline Operations Environmental Management Plan (OEMP) – the OEMP relates to the 100 km portion of the GEP and supporting subsea infrastructure located in Northern Territory waters, extending to the onshore termination point at the Darwin Liquefied Natural Gas (DLNG) facility.

Barossa Darwin Pipeline Duplication Project Environment Plan (EP) – this relates to the installation and pre-commissioning of the approximately 23 km long section of the Darwin Pipeline Duplication (DPD) and supporting subsea infrastructure, located in Commonwealth waters - 95km north-west of Darwin.

Barossa Darwin Pipeline Duplication Project Offshore Construction Environmental Management Plan (EMP) – this relates to the installation of approximately 8.26 km of the DPD pipeline in an area of Northern Territory (NT) coastal waters between the Commonwealth/NT coastal waters boundary and the Territorial Sea Baseline - 80km north-west of Darwin.

We are currently consulting with Larrakia people whose functions, interests or activities may be affected by activities proposed under the EPs, OEMP, and EMP listed above. Videos and visual aids will be available at the advertised session.

At the upcoming sessions we will:

Continue consultation with Larrakia people about our proposed activities under the EPs, OEMP and EMP including:

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- updating you about any measures we propose to adopt in the EPs, OEMP, and EMP as a result of your information and comments before they are submitted to the regulator for assessment.
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TIMING AND VENUES

Wednesday 12 June
Malak Community Centre
13 Malak Crescent, Malak

Session 1 – 9.30am - 11.30am
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T: 1800 267 600
E: offshore.consultation@santos.com
For more information please scan QR codes:

Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

Saturday June 1, 2024 NT News

FRA
WHI

"There's so much to be annoyed about. I have a whole list of pet hates"

I have a new pet hate. Oh, I know, judging by your letters, you read this column and you think what a reasonable and level-headed woman I am. And sometimes I am those things.

But the rest of time I am just as much of a seething mass of bitter resentment, simmering anger and passive aggression as the rest of you.

Look, we can't help it, can we? There's just so much to be annoyed about.

I have a whole list of pet hates, including people who say, "Don't take this personally..." at the start of a sentence, signalling that I'm about to take it very, very personally; people who write indignant posts on social media like, "Something crazy just happened to me ... don't ask!" so we all have to ask; people who say "mythink" instead of "anything", and people who are Donald Trump.

I am also very capable of being annoying – just ask my husband, children, friends and co-workers, but mostly my husband.

I am, for example, a fairly regular sender of emails that say, "Hi! Hope you're well! Just wondering if you got my last email." You haven't replied, so I'm just making sure it hasn't gone missing!"

5 June 2024 Press ad – NT News

Santos

NOTICE OF CONSULTATION WITH LARRAKIA PEOPLE

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Barossa Gas Export Pipeline Operations Environmental Management Plan (OEMP) – the OEMP relates to the 100 km portion of the GEP and supporting subsea infrastructure located in Northern Territory waters, extending to the onshore termination point at the Darwin Liquefied Natural Gas (DLNG) facility.

Barossa Darwin Pipeline Duplication Project Environment Plan (EP) – this relates to the installation and pre-commissioning of the approximately 23 km long section of the Darwin Pipeline Duplication (DPD) and supporting subsea infrastructure, located in Commonwealth waters – 95km north-west of Darwin.

Barossa Darwin Pipeline Duplication Project Offshore Construction Environmental Management Plan (EMP) – this relates to the installation of approximately 8.26 km of the DPD pipeline in an area of Northern Territory (NT) coastal waters between the Commonwealth/NT coastal waters boundary and the Territorial Sea Baseline – 80km north-west of Darwin.

We are currently consulting with Larrakia people whose functions, interests or activities may be affected by activities proposed under the EPs, OEMP, and EMP listed above. Videos and visual aids will be available at the advertised session.

At the upcoming sessions we will:

Continue consultation with Larrakia people about our proposed activities under the EPs, OEMP and EMP including:

- providing responses to information requests and queries previously raised about proposed activities to be managed under the EPs, OEMP and EMP;
- updating you about any measures we propose to adopt in the EPs, OEMP, and EMP as a result of your information and comments before they are submitted to the regulator for assessment;
- if any input is outstanding, seeking your final input on possible consequences of the proposed activities under the EPs, OEMP, and EMP and any further measures you would like us to consider to reduce impacts and risks.

TIMING AND VENUES

Wednesday 12 June
Malak Community Centre
13 Malak Crescent, Malak

Session 1 – 9.30am – 11.30am
Session 2 – 5.00pm – 7.00pm

CONTACT US
T: 1800 267 600
E: offshore.consultation@santos.com
For more information please scan QR codes:

Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

8 June 2024 Press ad – NT News

NOTICE OF CONSULTATION WITH LARRAKIA PEOPLE

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Barossa Darwin Pipeline Duplication Project Environment Plan (EP) - this relates to the installation and pre-commissioning of the approximately 23 km long section of the Darwin Pipeline Duplication (DPD) and supporting subsea infrastructure, located in Commonwealth waters - 95km north-west of Darwin.

Barossa Darwin Pipeline Duplication Project Offshore Construction Environmental Management Plan (EMP) - this relates to the installation of approximately 8.26 km of the DPD pipeline in an area of Northern Territory (NT) coastal waters between the Commonwealth/NT coastal waters boundary and the Territorial Sea Baseline - 80km north-west of Darwin.

We are currently consulting with Larrakia people whose functions, interests or activities may be affected by activities proposed under the EPs, OEMP, and EMP listed above. Videos and visual aids will be available at the advertised session.

At the upcoming sessions we will:

Continue consultation with Larrakia people about our proposed activities under the EPs, OEMP and EMP including:

- providing responses to information requests and queries previously raised about proposed activities to be managed under the EPs, OEMP and EMP.
- updating you about any measures we propose to adopt in the EPs, OEMP, and EMP as a result of your information and comments before they are submitted to the regulator for assessment.
- if any input is outstanding, seeking your final input on possible consequences of the proposed activities under the EPs, OEMP, and EMP and any further measures you would like us to consider to reduce impacts and risks.

TIMING AND VENUES

Wednesday 12 June
Malak Community Centre
13 Malak Crescent, Malak

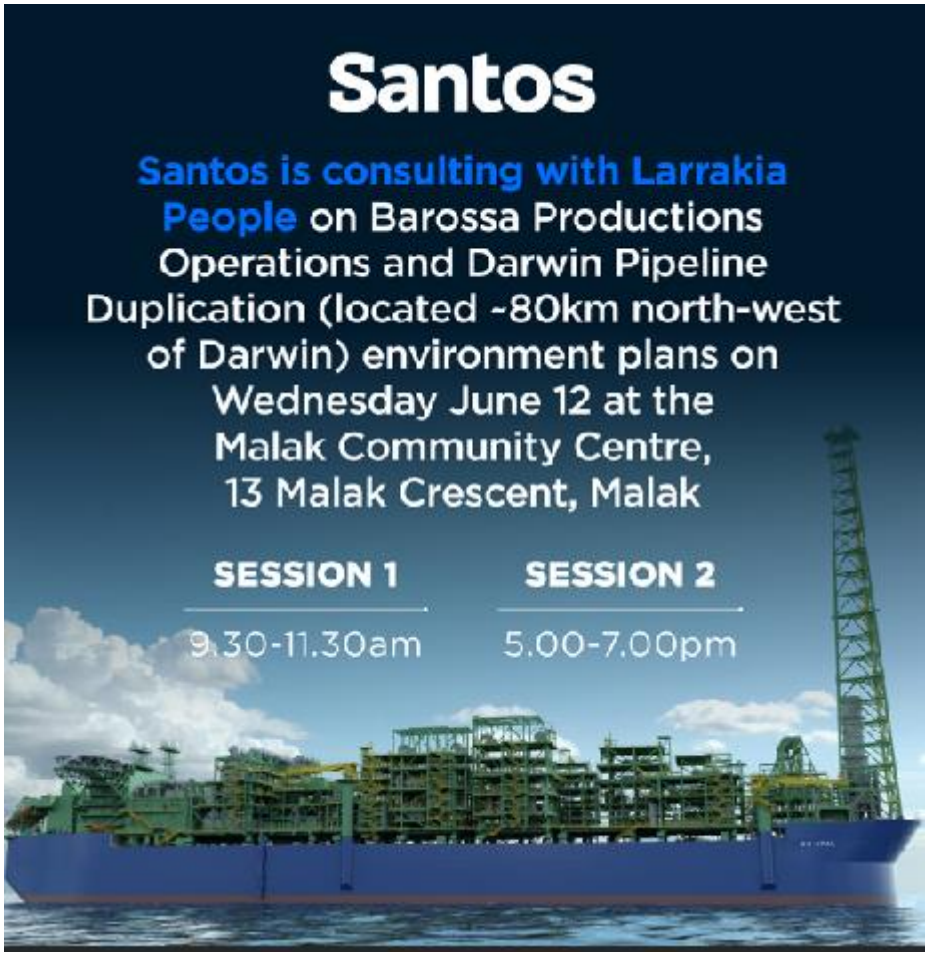
Session 1 - 9.30am - 11.30am
Session 2 - 5.00pm - 7.00pm

CONTACT US

T: 1800 267 600
E: offshore.consultation@santos.com
For more information please scan QR codes:

Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

June Social media advertising including Facebook and LinkedIn


Santos
Santos is consulting with Larrakia People on Barossa Productions Operations and Darwin Pipeline Duplication (located ~80km north-west of Darwin) environment plans on Wednesday June 12 at the Malak Community Centre, 13 Malak Crescent, Malak
SESSION 1
9.30-11.30am
SESSION 2
5.00-7.00pm

Appendix G Santos' Environment Consequence Descriptors

Excerpt from Santos *Environmental Hazard Identification and Assessment Guideline* (EA 91 IG 00004), Revision 5 (issued October 2020).

Consequence level		I	II	III	IV	V	VI
Acceptability		Acceptable	Acceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable
Severity description		**Negligible** **No impact or negligible impact**	**Minor** **Detectable but insignificant change to local population, industry or ecosystem factors. Localised effect**	**Moderate** **Significant impact to local population, industry or ecosystem factors**	**Major** **Major long-term effect on local population, industry or ecosystem factors**	**Severe** **Complete loss of local population, industry or ecosystem factors AND/OR extensive regional impacts with slow recovery**	**Critical** **Irreversible impact to regional population, industry or ecosystem factors**
Environmental Receptors	Fauna In particular, EPBC Act listed threatened/migratory fauna or Territory Parks and Wildlife Conservation Act 1976 (NT) specially protected fauna	Short-term behavioural impacts only to small proportion of local population and not during critical lifecycle activity. No decrease in local population size. No reduction in area of occupancy of species. No loss/disruption of habitat critical to survival of a species. No disruption to the breeding cycle of any individual. No introduction of disease likely to cause a detectable population decline.	Detectable but insignificant decrease in local population size. Insignificant reduction in area of occupancy of species. Insignificant loss/disruption of habitat critical to survival of a species. Insignificant disruption to the breeding cycle of local population.	Significant decrease in local population size but no threat to overall population viability. Significant behavioural disruption to local population. Significant disruption to the breeding cycle of a local population. Significant reduction in area of occupancy of species. Significant loss of habitat critical to survival of a species. Modify, destroy, remove, isolate or decrease availability of quality of habitat to the extent that a significant decline in local population is likely. Introduce disease likely to cause a significant population decline.	Long-term decrease in local population size and threat to local population viability. Major disruption to the breeding cycle of local population. Major reduction in area of occupancy of species. Fragmentation of existing population. Major loss of habitat critical to survival of a species. Modify, destroy, remove, isolate or decrease availability of quality of habitat to the extent that a long-term decline in local population is likely. Introduce disease likely to cause a long-term population decline.	Complete loss of local population. Complete loss of habitat critical to survival of local population. Widespread (regional) decline in population size or habitat critical to regional population.	Complete loss of regional population. Complete loss of habitat critical to survival of regional population.
	Physical Environment/Habitat Includes: air quality; water quality; benthic habitat (biotic/abiotic), particularly habitats that are rare or unique; habitat that represents a Key Ecological Feature[60]; habitat within a protected area; habitats that include benthic primary producers[61] and/or epi-fauna[62]	No or negligible reduction in physical environment/habitat area/function.	Detectable but localised and insignificant loss of area/function of physical environment/habitat. Rapid recovery evident within approximately two years (two season recovery).	Significant loss of area and/or function of local physical environment/habitat. Recovery over medium term (2–10 years).	Major, large-scale loss of area and/or function of physical environment/local habitat. Slow recovery over decades.	Extensive destruction of local physical environment/habitat with no recovery. Long-term (decades) and widespread loss of area or function of primary producers on a regional scale.	Complete destruction of regional physical environment/habitat with no recovery. Complete loss of area or function of primary producers on a regional scale.
	Threatened ecological communities (EPBC Act listed ecological communities)	No decline in threatened ecological community population size, diversity or function. No reduction in area of threatened ecological community. No introduction of disease likely to cause decline in threatened ecological community population size, diversity or function.	Detectable but insignificant decline in threatened ecological community population size, diversity or function; Insignificant reduction in area of threatened ecological community.	Significant decline in threatened ecological community population size, diversity or function. Significant reduction in area of threatened ecological community. Introduction of disease likely to cause significant decline in threatened ecological community population size, diversity or function.	Major, long-term decline in threatened ecological community population size, diversity or function. Major reduction in area of threatened ecological community. Fragmentation of threatened ecological community. Introduce disease likely to cause long-term decline in threatened ecological community population size, diversity or function.	Extensive, long-term decline in threatened ecological community population size, diversity or function. Complete loss of threatened ecological community.	Complete loss of threatened ecological community with no recovery.
	Protected Areas Includes: World Heritage Properties; Ramsar wetlands; Commonwealth/National Heritage Areas; Land/Marine Conservation Reserves.	No or negligible impact on protected area values. No decline in species population within protected area. No or negligible alteration, modification, obscuring or diminishing of protected area values.*	Detectable but insignificant impact on one of more of protected area's values. Detectable but insignificant decline in species population within protected area. Detectable but insignificant alteration, modification, obscuring or diminishing of protected area values.*	Significant impact on one of more of protected area's values. Significant decrease in population within protected area. Significant alteration, modification, obscuring or diminishing of protected area values.	Major long-term effect on one of more of protected area's values; Long-term decrease in species population contained within protected area and threat to that population's viability. Major alteration, modification, obscuring or diminishing of protected area values.	Extensive loss of one or more of protected area's values. Extensive loss of species population contained within protected area.	Complete loss of one or more of protected area's values with no recovery. Complete loss of species population contained within protected area with no recovery.

[60] *As defined by the Department of Agriculture, Water and Environment*
[61] *Benthic photosynthetic organisms such as seagrass, algae, hard corals and mangroves*
[62] *Fauna attached to the substrate including sponges, soft corals and crinoids.*

Consequence level	I	II	III	IV	V	VI
Acceptability	Acceptable	Acceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable
Severity description	**Negligible** **No impact or negligible impact**	**Minor** **Detectable but insignificant change to local population, industry or ecosystem factors. Localised effect**	**Moderate** **Significant impact to local population, industry or ecosystem factors**	**Major** **Major long-term effect on local population, industry or ecosystem factors**	**Severe** **Complete loss of local population, industry or ecosystem factors AND/OR extensive regional impacts with slow recovery**	**Critical** **Irreversible impact to regional population, industry or ecosystem factors**
Socio-economic receptors Includes: fisheries (commercial and recreational); tourism; oil and gas; defence; commercial shipping.	No or negligible loss of value of the local industry. No or negligible reduction in key natural features or populations supporting the activity.	Detectable but insignificant short-term loss of value of the local industry. Detectable but insignificant reduction in key natural features or population supporting the local activity.	Significant loss of value of the local industry. Significant medium-term reduction of key natural features or populations supporting the local activity.	Major long-term loss of value of the local industry and threat to viability. Major reduction of key natural features or populations supporting the local activity.	Shutdown of local industry or widespread major damage to regional industry. Extensive loss of key natural features or populations supporting the local industry.	Permanent shutdown of local or regional industry. Permanent loss of key natural features or populations supporting the local or regional industry.

Appendix H Spill Modelling Results Summary

APPENDIX H– SPILL MODELLING RESULTS SUMMARY (MAXIMUM VALUES ACROSS ALL SEASONS AND WATER DEPTHS)

1.0: Scenario 1 – 1,383 m³ subsea leak of condensate from the FPSO over 181 days, as a result of an internal influence at S2 Drill Centre: Surface, dissolved and entrained impact oil spill modelling results (maximum values across all seasons and water depths)

Environmental Value Area	Probability of exposure (percent)					Minimum time before exposure on the sea surface (hours)					Maximum dissolved hydrocarbon exposure (ppb)	Maximum entrained hydrocarbon exposure (ppb)
	Moderate exposure values			High exposure values		Moderate exposure values			High exposure values			
	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)		
Sunrise Bank	-	<0.67	-	-	<0.67	-	NC	-	-	NC	-	15

1.1: Scenario 1 – 1,383 m³ subsea leak of condensate from the FPSO over 181 days, as a result of an internal influence at S2 Drill Centre: Shoreline impact oil spill modelling results (maximum values across all seasons)

No shoreline accumulation was observed for this scenario at or above the moderate exposure threshold for any Environmental Value Area.

NC: No contact to receptor predicted for specified threshold.

*: This receptor is not an Environmental Value Area defined by Santos.

<: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

2.0: Scenario 2 – 16,700 m³ surface release of condensate from the FPSO over 1 hour, as a result of an external impact: Surface, dissolved and entrained impact oil spill modelling results (maximum values across all seasons and water depths)

Environmental Value Area	Probability of exposure (percent)					Minimum time before exposure on the sea surface (hours)					Maximum dissolved hydrocarbon exposure (ppb)	Maximum entrained hydrocarbon exposure (ppb)
	Moderate exposure values			High exposure values		Moderate exposure values			High exposure values			
	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)		
Afghan Shoal	-	<0.33	-	-	<0.33	-	NC	-	-	NC	35	-
Ashmore Reef AMP	-	<0.33	<0.33	-	<0.33	-	NC	NC	-	NC	39	100
Ashmore-Cartier - Outer	-	0.33	0.33	-	<0.33	-	710	723	-	NC	125	212
Barracouta Shoals	-	<0.33	0.33	-	<0.33	-	NC	844	-	NC	31	217
Cartier Island AMP	-	-	0.33	-	-	-	-	933	-	-	-	232
Echo Shoals	<0.33	3.33	8	<0.33	0.33	NC	225	215	NC	255	568	2,912
Eugene McDermott Shoal	-	-	<0. 33	-	-	-	-	NC	-	-	-	12
Fantome Shoals	-	0.67	0.67	-	<0.33	-	481	588	-	NC	171	384
Flat Top Bank	<0.33	0.33	1.33	<0.33	<0.33	NC	545	626	NC	NC	78	454
Gale Bank	-	<0.33	-	-	<0.33	-	NC	-	-	NC	21	-
Hibernia Reef	-	<0.33	<0.33	-	<0.33	-	NC	NC	-	NC	24	84
Indonesia East and Timor Leste	0.33	3	4.33	<0.33	0.33	703	202	209	NC	210	964	2,443
Johnson Bank	-	-	<0.33	-	-	-	-	NC	-	-	-	50
Joseph Bonaparte Gulf AMP	-	-	<0.33	-	-	-	-	NC	-	-	-	14
Margaret Harries Bank	1	7.33	11.33	<0.33	1.33	232	116	112	NC	121	1,815	5,548
Minor Indonesian Islands	<0.33	1.67	3	<0.33	0.33	NC	304	291	NC	309	615	1,317
Newby Shoal	<0.33	0.67	1.67	<0.33	<0.33	NC	433	400	NC	NC	97	532
Northern Arafura AMP	<0.33	0.67	0.67	<0.33	<0. 3	NC	340	306	NC	NC	336	635
NT Waters*	-	0.33	<0.33	-	<0.33	-	917	NC	-	NC	54	82
Outer Argo-Rowley Terrace AMP	-	-	<0.33	-	-	-	-	NC	-	-	-	33
Outer Oceanic Shoals AMP	0.67	7.33	10	0.33	1.67	84	63	62	86	64	2,633	12,777
Sahul Banks	<0.33	1.33	2.67	<0.33	0.33	NC	332	329	NC	353	409	1,429
Shepparton Shoal	-	<0.33	2.33	-	<0.33	-	NC	726	-	NC	22	383

NC: No contact to receptor predicted for specified threshold.

*: This receptor is not an Environmental Value Area defined by Santos.

<: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

Environmental Value Area	Probability of exposure (percent)					Minimum time before exposure on the sea surface (hours)					Maximum dissolved hydrocarbon exposure (ppb)	Maximum entrained hydrocarbon exposure (ppb)
	Moderate exposure values			High exposure values		Moderate exposure values			High exposure values			
	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)		
Southern Arafura AMP	-	<0.33	0.33	-	<0.33	-	NC	438	-	NC	14	129
State Waters – WA*	-	<0.33	0.33	-	<0.33	-	NC	932	-	NC	39	232
Sunrise Bank	1.67	15.67	21.67	0.67	4.67	50	35	34	53	36	13,235	44,778
The Boxers Area	0.33	3.67	5.33	0.33	1	111	133	115	115	134	1,876	5,444
Tiwi Islands	-	<0.33	-	-	<0.33	-	NC	-	-	NC	42	-
Van Cloon-Deep Shoals	-	0.67	2	-	<0.33	-	513	514	-	NC	182	607
Vulcan Shoals	-	-	1.33	-	-	-	-	NC	-	-	-	3
Western Sahul Bank Shoals	<0.33	1	<0.33	<0.33	<0.33	NC	427	417	NC	NC	167	775
Woodbine Bank	-	-	<0.33	-	-	-	-	NC	-	-	-	33

2.1 Scenario 2 - 16,700 m³ surface release of condensate from the FPSO over 1 hour, as a result of an external impact: Shoreline impact oil spill modelling results (maximum values across all seasons)

Environmental Value Area	Probability of exposure (%)		Minimum time before exposure on the sea surface (days)		Maximum length of shoreline impacted (km)		Maximum accumulated concentration along shoreline (g/m²)	Maximum accumulated volume along shoreline (m³)
	Moderate exposure values	High exposure values	Moderate exposure values	High exposure values	Moderate exposure values	High exposure values		
	Shoreline oil accumulation (≥ 100g/m²)	Shoreline oil accumulation (≥ 1000g/m²)	Shoreline oil concentration (≥ 100g/m²)	Shoreline oil concentration (≥ 1000g/m²)	Shoreline oil concentration (≥ 100g/m2)	Shoreline oil concentration (≥ 1000g/m²)		
Cartier Island AMP	0.33	<0.33	959	NC	1	NC	108	8
Cobourg Peninsula-Nhulunbuy	<0.33	<0.33	NC	NC	NC	NC	17	2
Indonesia East and Timor Leste	1.67	0.67	271	432	28	2	3,718	156
Minor Indonesian Islands	1.00	<0.33	447	NC	7	NC	731	41

NC: No contact to receptor predicted for specified threshold.

*: This receptor is not an Environmental Value Area defined by Santos.

<: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

3.0: Scenario 3 - 460 m³ surface release of HFO from the offtake tanker over 1 hour, as a result of external impact: Surface, dissolved and entrained impact oil spill modelling results (maximum values across all seasons and water depths)

Environmental Value Area	Probability of exposure (percent)					Minimum time before exposure on the sea surface (hours)					Maximum dissolved hydrocarbon exposure (ppb)	Maximum entrained hydrocarbon exposure (ppb)
	Moderate exposure values			High exposure values		Moderate exposure values			High exposure values			
	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)		
Arnhem AMP	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Ashmore Reef AMP	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Ashmore-Cartier - Outer	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Britomart Shoal	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Central Arnhem AMP	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Cobourg Peninsula-Nhulunbuy	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Djukbinj NP	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Echo Shoals	0.67	-	-	<0.33	-	191	-	-	NC	-	-	-
Fantome Shoals	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Flat Top Bank	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Hancox Shoal	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Hibernia Reef	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Indonesia East and Timor Leste	0.33	-	-	<0.33	-	209	-	-	NC	-	-	-
Johnson Bank	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Lowry Shoal	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Margaret Harries Bank	2	-	-	<0.33	-	83	-	-	NC	-	-	-
Marsh Shoal	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Minor Indonesian Islands	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Moresby Shoals	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Newby Shoal	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Northern Arafura AMP	0.33	-	-	<0.33	-	179	-	-	NC	-	-	-
Orontes Reef	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Outer Oceanic Shoals AMP	2	-	0.67	<0.33	-	53	-	69	NC	-	-	260
Sahul Banks	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Shepparton Shoal	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Skottowe Shoal	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-

NC: No contact to receptor predicted for specified threshold.

*: This receptor is not an Environmental Value Area defined by Santos.

<: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

Environmental Value Area	Probability of exposure (percent)					Minimum time before exposure on the sea surface (hours)					Maximum dissolved hydrocarbon exposure (ppb)	Maximum entrained hydrocarbon exposure (ppb)
	Moderate exposure values			High exposure values		Moderate exposure values			High exposure values			
	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)		
Southern Arafura AMP	0.33	-	-	<0.33	-	454	-	-	NC	-	-	-
State Waters - NT*	0.33	-	-	<0.33	-	459	-	-	NC	-	-	-
State Waters - WA*	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Sunrise Bank	7.67	-	0.33	0.33	-	30	-	76	37	-	-	183
The Boxers Area	0.67	-	0.33	<0.33	-	94	-	197	NC	-	-	106
Tiwi Islands	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Van Cloon-Deep Shoals	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Van Dieman Gulf Coast	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Van Diemen Gulf Shoals	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Vernon Islands CR	0.33	-	-	<0.33	-	879	-	-	NC	-	-	-
Western Sahul Bank Shoals	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-

3.1: Scenario 3 - 460 m³ surface release of HFO from the offtake tanker over 1 hour, as a result of external impact: Shoreline impact oil spill modelling results (maximum values across all seasons)

Environmental Value Area	Probability of exposure (%)		Minimum time before exposure on the sea surface (days)		Maximum length of shoreline impacted (km)		Maximum accumulated concentration along shoreline (g/m²)	Maximum accumulated volume along shoreline (m³)
	Moderate exposure values	High exposure values	Moderate exposure values	High exposure values	Moderate exposure values	High exposure values		
	Shoreline oil accumulation (≥ 100g/m²)	Shoreline oil accumulation (≥ 1000g/m²)	Shoreline oil concentration (≥ 100g/m²)	Shoreline oil concentration (≥ 1000g/m²)	Shoreline oil concentration (≥ 100g/m2)	Shoreline oil concentration (≥ 1000g/m²)		
Ashmore Reef AMP	1.67	1.00	702	717	28	8	2,918	195
Beagle Gulf-Darwin Coast	<0.33	<0.33	NC	NC	NC	NC	17	<1
Cobourg Peninsula-Nhulunbuy	1.33	0.67	731	740	75	9	5,261	298
Djukbinj NP	0.67	0.33	883	896	6	1	1,139	29
Indonesia East and Timor Leste	4.66	1.67	222	224	93	12	9,156	367
Minor Indonesian Islands	1.67	0.33	333	409	40	7	1,459	174
Tiwi Islands	0.33	0.33	897	922	61	4	1,476	278
Van Dieman Gulf Coast	0.67	<0.33	895	NC	11	NC	928	46
Vernon Islands CR	0.67	0.67	862	871	17	5	7,869	227

NC: No contact to receptor predicted for specified threshold.

*: This receptor is not an Environmental Value Area defined by Santos.

<: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

4.0: Scenario 4 – 2,418 m³ surface release of MGO from the FPSO over 1 hour, as a result of external impact: Surface, dissolved and entrained impact oil spill modelling results (maximum values across all seasons and water depths)

Environmental Value Area	Probability of exposure (percent)					Minimum time before exposure on the sea surface (hours)					Maximum dissolved hydrocarbon exposure (ppb)	Maximum entrained hydrocarbon exposure (ppb)
	Moderate exposure values			High exposure values		Moderate exposure values			High exposure values			
	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)		
Ashmore Reef AMP	-	-	0.33	-	-	-	-	846	-	-	-	118
Ashmore-Cartier - Outer	-	-	0.33	-	-	-	-	628	-	-	-	145
Echo Shoals	-	<0.33	4.33	-	<0.33	-	NC	193	-	NC	26	1,721
Fantome Shoals	-	-	0.33	-	-	-	-	677	-	-	-	285
Flat Top Bank	-	-	1.33	-	-	-	-	475	-	-	-	279
Hibernia Reef	-	-	0.33	-	-	-	-	771	-	-	-	127
Indonesia East	<0.33	-	-	<0.33	-	NC	-	-	NC	-	-	-
Indonesia East and Timor Leste	-	<0.33	2.67	-	<0.33	-	NC	200	-	NC	19	1,211
JBG East Coast	-	-	0.33	-	-	-	-	878	-	-	-	157
Johnson Bank	-	-	<0.33	-	-	-	-	NC	-	-	-	92
Margaret Harries Bank	0.33	<0.33	13.33	<0.33	<0.33	149	NC	130	NC	NC	43	2,225
Minor Indonesian Islands	-	-	1	-	-	-	-	330	-	-	-	583
Newby Shoal	-	-	<0.33	-	-	-	-	NC	-	-	-	100
Northern Arafura AMP	-	-	0.33	-	-	-	-	454	-	-	-	219
Outer Oceanic Shoals AMP	0.67	0.33	9.67	0.33	<0.33	75	78	64	83	NC	159	4,903
Sahul Banks	-	-	1.67	-	-	-	-	375	-	-	-	275
Shepparton Shoal	-	-	<0.33	-	-	-	-	NC	-	-	-	21
Southern Arafura AMP	-	-	<0.33	-	-	-	-	NC	-	-	-	22
NT Waters*	-	-	<0.33	-	-	-	-	NC	-	-	-	93
State Waters – WA*	-	-	0.33	-	-	-	-	910	-	-	-	118
Sunrise Bank	2	2.67	21.67	0.33	<0.33	43	34	31	45	NC	250	10,647
The Boxers Area	0.33	<0.33	3.33	<0.33	<0.33	86	NC	99	NC	NC	29	1,409
Tiwi Islands	-	-	<0.33	-	-	-	-	NC	-	-	-	63
Van Cloon-Deep Shoals	-	-	0.67	-	-	-	-	744	-	-	-	155
Western Sahul Bank Shoals	-	-	0.67	-	-	-	-	608	-	-	-	371
Woodbine Bank	-	-	<0.33	-	-	-	-	NC	-	-	-	31

NC: No contact to receptor predicted for specified threshold.

*: This receptor is not an Environmental Value Area defined by Santos.

<: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

4.1: Scenario 4 – 2,418 m³ surface release of MGO from the FPSO over 1 hour, as a result of external impact: Shoreline impact oil spill modelling results (maximum values across all seasons)

Environmental Value Area	Probability of exposure (%)		Minimum time before exposure on the sea surface (days)		Maximum length of shoreline impacted (km)		Maximum accumulated concentration along shoreline (g/m²)	Maximum accumulated volume along shoreline (m³)
	Moderate exposure values	High exposure values	Moderate exposure values	High exposure values	Moderate exposure values	High exposure values		
	Shoreline oil accumulation (≥ 100g/m²)	Shoreline oil accumulation (≥ 1000g/m²)	Shoreline oil concentration (≥ 100g/m²)	Shoreline oil concentration (≥ 1000g/m²)	Shoreline oil concentration (≥ 100g/m2)	Shoreline oil concentration (≥ 1000g/m²)		
Ashmore Reef AMP	<0.33	<0.33	NC	NC	NC	NC	35	4
Indonesia East and Timor Leste	0.67	<0.33	244	NC	5	NC	174	25
Minor Indonesian Islands	<0.33	<0.33	NC	NC	NC	NC	90	3
Tiwi Islands	<0.33	<0.33	NC	NC	NC	NC	28	<1

NC: No contact to receptor predicted for specified threshold.

*: This receptor is not an Environmental Value Area defined by Santos.

<: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

5.0: Scenario 5 – 500 m³ surface release of MDO from a vessel over 1 hour, as a result of external impact: Surface, dissolved and entrained impact oil spill modelling results (maximum values across all seasons and water depths)

Environmental Value Area	Probability of exposure (percent)					Minimum time before exposure on the sea surface (hours)					Maximum dissolved hydrocarbon exposure (ppb)	Maximum entrained hydrocarbon exposure (ppb)
	Moderate exposure values			High exposure values		Moderate exposure values			High exposure values			
	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)	Surface hydrocarbons (≥10 g/m²)	Dissolved hydrocarbons (≥50 ppb)	Entrained hydrocarbons (≥100 ppb)	Surface hydrocarbons (≥50 g/m²)	Dissolved hydrocarbons (≥400 ppb)		
Afghan Shoal	<0.33	0.33	7.67	<0.33	<0.33	NC	47	23	NC	NC	72	1,660
Beagle Gulf-Darwin Coast	<0.33	-	4.33	<0.33	-	NC	-	102	NC	-	-	510
Cobourg Peninsula-Nhulunbuy	-	-	<0.33	-	-	-	-	NC	-	-	-	93
Djukbinj NP	-	-	2.67	-	-	-	-	144	-	-	-	338
Flat Top Bank	-	<0.33	6.33	-	<0.33	-	NC	94	-	NC	14	647
Hancox Shoal	-	-	8	-	-	-	-	110	-	-	-	313
Harris Reef	-	-	5.67	-	-	-	-	119	-	-	-	374
JBG East Coast	-	-	3.33	-	-	-	-	127	-	-	-	512
JBG South Coast	-	-	<0.33	-	-	-	-	NC	-	-	-	15
Jones Shoal	-	-	<0.33	-	-	-	-	NC	-	-	-	11
Joseph Bonaparte Gulf AMP	-	-	0.67	-	-	-	-	374	-	-	-	116
Lowry Shoal	-	-	7	-	-	-	-	96	-	-	-	438
Marsh Shoal	-	-	5	-	-	-	-	132	-	-	-	331
Moresby Shoals	-	<0.33	9	-	<0.33	-	NC	98	-	NC	12	450
Newby Shoal	-	-	2.33	-	-	-	-	224	-	-	-	223
Outer Oceanic Shoals AMP	-	-	2.33	-	-	-	-	190	-	-	-	250
Shepparton Shoal	2	0.33	24	<0.33	<0.33	16	20	7	NC	NC	68	5,032
NT Waters*	43	3.67	52.33	27.33	<0.33	1	1	1	1	NC	251	20,273
Skottowe Shoal	-	-	8.33	-	-	-	-	96	-	-	-	404
The Boxers Area	<0.33	<0.33	4.33	<0.33	<0.33	NC	NC	68	NC	NC	11	644
Tiwi Islands	<0.33	<0.33	7.33	<0.33	<0.33	NC	NC	63	NC	NC	15	877
Van Cloon-Deep Shoals	-	-	0.33	-	-	-	-	614	-	-	-	106
Van Dieman Gulf Coast	-	-	0.67	-	-	-	-	199	-	-	-	112
Van Diemen Gulf Shoals	-	-	4.33	-	-	-	-	137	-	-	-	245
Vernon Islands CR	-	<0.33	9.67	-	<0.33	-	NC	111	-	NC	11	431

NC: No contact to receptor predicted for specified threshold.

*: This receptor is not an Environmental Value Area defined by Santos.

<: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

5.1: Scenario 5 – 500 m³ surface release of MDO from a vessel over 1 hour, as a result of external impact: Shoreline impact oil spill modelling results (maximum values across all seasons)

Environmental Value Area	Probability of exposure (%)		Minimum time before exposure on the sea surface (days)		Maximum length of shoreline impacted (km)		Maximum accumulated concentration along shoreline (g/m^2)	Maximum accumulated volume along shoreline (m^3)
	Moderate exposure values	High exposure values	Moderate exposure values	High exposure values	Moderate exposure values	High exposure values		
	Shoreline oil accumulation (≥ 100g/m²)	Shoreline oil accumulation (≥ 1000g/m²)	Shoreline oil concentration (≥ 100g/m²)	Shoreline oil concentration (≥ 1000g/m²)	Shoreline oil concentration (≥ 100g/m2)	Shoreline oil concentration (≥ 1000g/m²)		
Beagle Gulf-Darwin Coast	<0.33	<0.33	NC	NC	NC	NC	91	4
Djukbinj NP	<0.33	<0.33	NC	NC	NC	NC	15	<1
JBG East Coast	<0.33	<0.33	NC	NC	NC	NC	15	2
Tiwi Islands	0.33	<0.33	99	NC	5	NC	366	16
Vernon Islands CR	<0.33	<0.33	NC	NC	NC	NC	26	9

NC: No contact to receptor predicted for specified threshold.

*: This receptor is not an Environmental Value Area defined by Santos.

<: If exposure is predicted for a receptor at the low threshold but not at the moderate and/or high threshold, then the probability presented is <0.33%.

Appendix I Produced Water Adaptive Management Plan

Produced Water Adaptive Management Plan

Produced Water (PW) will be treated and discharged to the marine environment during the Activity, as described in Section 6.8 of the EP. The PW treatment system has a design guarantee to treat PW to the following specifications, at a flowrate of up to 20,000 bbl/d, as considered in the Barossa OPP (ConocoPhillips, 2018) (the primary environmental approval for the Barossa Development):

+ Oil in water (OIW) content of not greater than 30 mg/L average over a 24-hour period
+ Maximum mercury content of 10 ppbw
+ Discharge temperature of <60°C

OIW and mercury are predicted to be key constituents within the Barossa PW in terms of the potential for toxicity effects within the marine environment and will not be discharged above these design specification limits. These limits have been used to assess the scale of impacts from the PW discharge over the life of the Activity.

In consideration of PW treatment system performance data, the following additional limits for OIW and mercury have been set for steady state operations which will require PW to be diverted inboard and not discharged until the limits can be met:

+ OIW content <25 mg/L average over a 24-hour rolling period when the PW flowrate is between 3,000 bbl/d and 10,000 bbl/d.
+ Mercury content <8 ppbw

For PW flowrates of 10,000 and 20,000 bbl/d the design specification limit of no greater than 30 mg/L average over a rolling 24- hour period applies.

If PW does not meet the OIW or mercury content specifications and additional limits listed above (referred to as off-specification PW), the PW stream will be automatically (in the case of OIW monitoring through the OIW Analyser) or manually (in the case of mercury monitoring or when the OIW Analyser is offline) diverted to the PW off-specification storage tank in the Floating Production Storage and Offloading facility (FPSO) hull, which has a capacity of 26,256 m^3. Off-specification PW will be routed from the off-specification storage tank back to the PW treatment system for further treatment.

In addition to the limits set out above, performance targets for PW treatment have been set for OIW and mercury during steady state operations for the purpose of reducing impacts associated with PW discharges to ALARP. These performance targets also act as triggers for adaptive management. The performance targets are aligned with expected design performance of the PW treatment equipment (e.g. the induced gas flotation (IGF) unit and macro-porous polymer extraction (MPPE)). Deviations from performance targets will be managed through adaptive management response actions to be implemented. The performance targets for OIW and mercury are:

+ OIW discharge performance target of <15 mg/L average over a 3-day (72-hour) rolling period when the PW production rate is between 3,000 and 10,000 bbl/d
+ OIW discharge performance target of <25 mg/L average over a 3-day (72-hour) rolling period when the PW production rate is between 10,000 and 20,000 bbl/d
+ >80% mercury removal through the PW treatment system

This adaptive management plan sets out the monitoring and adaptive management approach for the performance targets for PW discharge and also sets out the PW characterisation and field verification regime (including PW chemical characterisation, ecotoxicity testing, and field water and sediment quality sampling) to verify PW composition and toxicity and ensure the PW discharge complies with acceptable levels of impact and environmental performance outcomes (EPO-13).

1.1 Monitoring of Produced Water

Monitoring of PW OIW concentration, mercury, physio-chemical stressors, toxicants and whole of effluent (WET) toxicity is important to verify that targets and limits of PW discharge are met and that impacts from the PW discharge are within acceptable levels and comply with environmental performance outcomes (EPO-13). Required routine monitoring of PW during the Activity is presented in Table 1-1.

Table 1-1: Routine PW Monitoring

Parameter	Method	Summary	Frequency
OIW concentration	Online OIW analyser	Provides continuous reading of PW OIW concentrations	Continuous online reading *If unavailable – manual sampling will occur every ~6 hours
	Onboard laboratory manual sampling of PW	Verifies PW OIW concentrations taken from the online OIW analyser. In accordance with ASTM D7066-04 (Standard Test Method for dimer/trimer of chlorotrifluoroethylene (S-316) Recoverable Oil and Grease and Nonpolar Material by Infrared Determination)	Sample is collected and analysed every ~24 hours.
Mercury concentrations	Onboard laboratory manual sampling of PW	PW samples will be taken prior to the PW treatment system (IGF and MPPE) and post treatment system (adjacent to the online OIW analyser). PW samples to be stored in suitable sample containers (which may require acid spiking for preservation) and analysed for mercury content in the BWO Opal laboratory.	Sample is collected and analysed every ~24 hours during the start-up period. During steady state operations sampling will be undertaken weekly until 12 months of mercury data is collected. A review of the mercury data (including an assessment of the rate of change) will be done at this time, following which mercury sampling and analysis may be adjusted to a less frequent rate, up to a maximum interval of 28 days between sampling/analysis events. Sampling may be conducted more frequently than the routine rate if required to inform an adaptive management response.
Temperature	Online temperature indicator	Measures continuous PW temperature.	Continuous.

Parameter	Method	Summary	Frequency
Flow rate	PW flowmeter	Totalising flowmeter is included to measure continuous PW flowrates.	Continuous.
PW chemical characterisation[1]	NATA laboratory analysis of sample	Monitors physio-chemical stressors such as metals, ammonia, OIW, residual process chemicals in the PW. Verifies PW OIW concentrations from the online OIW analyser and onboard laboratory sampling of OIW and mercury in PW. Parameters tested are summarised in **Table 1-2**	Within one month of commencement of steady state operations, i.e. acceptance of Final Performance Test, and then every 12 months while discharging. Additional PW chemical characterisation may occur if triggered as part of adaptive management response (refer Section 1.2 of this Adaptive Management Plan.). Annual sampling shall be coordinated with annual sampling of PW for ecotoxicity testing to provide data to support investigation of ecotoxicology results. Sampling shall also be coordinated with water quality monitoring to provide data to support investigation of water quality monitoring results.
PW ecotoxicity[1]	Laboratory sampling of PW for ecotoxicity in accordance with ANZG (2018).	Monitors toxicity to marine species. Ecotoxicity testing in accordance with ANZG (2018).	Within one month of commencement of steady state operations, i.e. acceptance of Final Performance Test, and then every 12 months while discharging PW. The initial ecotoxicity test (within one month of commencement of steady state operations) will be a multi-species test (indicatively 8 test species) which is then repeated every three years (36 months) thereafter (i.e. on years 1, 4, 7 and so on). Surrogate toxicity tests (indicatively 1 or 2 species) will represent the 12-monthly test on years where a multi-species test is not required (i.e. on years 2, 3, 5, 6 and so on). Additional ecotoxicity testing may be undertaken as triggered through adaptive

Parameter	Method	Summary	Frequency
			management response (refer Section 1.2). Sampling shall be coordinated with chemical characterisation so that PW composition data can assist with interpretation of ecotoxicology results.
PW discharge modelling	Modelling software (MUDMAP model or equivalent)	PW modelling predicts the spatial extent of dilution of the PW plume. From this information, the concentration of PW constituents and the level of dilution of the discharge (corresponding to 99% species protection) can be determined at varying distances from the discharge point and compared to the PW Mixing Zone.	When the outcomes of PW sampling, characterisation and ecotoxicity test results are above adaptive management triggers and remodelling is required to support further investigation.
Water quality field monitoring [1]	Field water quality monitoring	Water quality monitoring will take direct measurements of physio-chemical parameters from water samples (refer **Appendix J**). This sampling will validate modelled dilution factors and the predicted PW Mixing Zone[2] and confirm compliance with EPO-13 by sampling water within and outside of the PW Mixing Zone[2].	Within six months after reaching produced water rates of 3,000 bbl/d then every five years thereafter. Additional water quality field monitoring may occur if triggered through an adaptive management response (refer Section 1.2)
Sediment quality monitoring [1]	Field sediment quality monitoring	Sediment quality monitoring will take direct measurements of physio-chemical parameters from sediment samples (refer **Appendix J**). This sampling will determine if there are exceedances beyond ANZG (2018) sediment quality guideline levels attributable to PW discharge and confirm compliance with EPO-13.	Within six months after reaching produced water rates of 3,000 bbl/d production then every five years thereafter. Additional sediment quality field monitoring may occur if triggered through an adaptive management response (refer Section 1.2)

PW samples should be taken during representative routine operations. Where possible samples are taken at a time when all PW-producing wells are online.

1 The monitoring program for water and sediment quality is presented in Appendix J.

2 PW Mixing Zone is detailed within Section 6.8 of the EP

1.1.1 Parameters Measured During PW characterisation

Table 1-2 presents the parameters to be measured during PW characterisation (NATA laboratory sampling).

Table 1-2: Parameters measured during PW characterisation (NATA laboratory sampling)

Parameters	
Organics	
Hydrocarbons C 6–9	Anthracene
Hydrocarbons C 10–14	Fluorene
Hydrocarbons C 15–28	Naphthalene
Hydrocarbons C 29–36	Phenanthrene
Hydrocarbons > C36	Low Molecular Weight polycyclic aromatic hydrocarbons (PAHs)[1]
Total Hydrocarbons C6–36	Benzo(a)anthracene
Oil and Grease	Benzo(a)pyrene
Benzene	Dibenzo(a,h)anthracene
Toluene	Chrysene
Ethyl-Benzene	Fluoranthene
Xylene	Pyrene
Sum of Benzene, Toluene, Ethyl-Benzene, Xylene (BTEX)	High Molecular Weight PAHs [2]
Acenaphthene	Total PAHs
Acenaphthylene	
Production chemicals[3]	
Biocide	Methanol
Defoamer	Monoethylene glycol (MEG)
Demulsifier	Scale inhibitors
Corrosion Inhibitor	Wax inhibitor
H2S scavenger	
Metals	
Total and dissolved Arsenic	Total and dissolved Iron
Total and dissolved Barium	Total and dissolved Lead
Total and dissolved Cadmium	Total and dissolved Manganese
Total and dissolved Chromium	Total and dissolved Mercury
Total and dissolved Copper	Total and dissolved Nickel
Total and dissolved Silver	Total and dissolved Selenium
Total and dissolved Strontium	Total and dissolved Zinc
Other	

Parameters	
Total Organic Carbon	Tertiary Amines – N
Chemical Oxygen Demand	Total Phosphorous
Ammonia – N	Total Dissolved Solids
Nitrate – N	Total Suspended Solids
Total Kjeldahl Nitrogen – N	pH
Total Nitrogen – N	NORMs (^{226}Ra and ^{228}Ra)

[1] Low molecular weight PAHs are the sum of concentrations of acenaphthene, acenaphthylene, anthracene, fluorene, 2-methylnaphthalene, naphthalene and phenanthrene.

[2] High molecular weight PAHs are the sum of concentrations of benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h) anthracene, fluoranthene and pyrene.

[3] Chemicals presented are examples. Chemicals are added to the production process and may be present within the PW. Production chemicals are soluble in PW to varying extents and the dissolved fractions may be present within the PW.

1.2 Adaptive Management Measures

The PW discharge is managed through the adaptive management process, including defined triggers values/ events and resultant investigation and management response measures, to provide a mechanism to ensure the PW discharge is within limits and the PW treatment meets expected levels of performance (ALARP and acceptable). The adaptive management process also provides the framework for the implementation of appropriate response measures to ensure any potential non-compliance with EPO-13 is prevented or rectified.

Table 1-3 details the adaptive management trigger values/ events applied to the results of routine PW monitoring (as outlined in Table 1-1) and the resultant investigation and adaptive management response measures that will be applied.

With respect to PW OIW and mercury content monitoring, the triggers are aligned with the performance targets of the PW treatment system such that managing the PW stream to these targets will ensure the PW discharge remains within the required discharge limits.

For characterisation of PW (chemical characterisation and ecotoxicity) triggers requiring investigation are set at levels that allow response to be enacted prior to acceptable levels of impact being exceeded outside of the PW Mixing Zone (i.e. prior to a non-compliance with EPO-13).

As a new facility, assumptions that have been made about the facility's performance (such as performance of the produced water treatment system) will require validation following commencement of the Activity. Section 8.2.5.1 of the Environment Plan details the PW target setting/ review process that will be followed following one year of steady state production data and repeated annually.

As an outcome of this process, revised PW targets may be set for the following 12 months of operations and may result in revision to triggers and monitoring requirements as outlined within this PW Adaptive Management Plan.

If following the investigation and implementation of corrective actions to meet ALARP, it is determined that achieving acceptable levels of impact as per EPO-13 is not possible, the EP management of change (MoC) process (Section 1.3) will be implemented.

Figure 1-1 provides a summary overview of the adaptive management triggers, response actions and outcomes, performance target review and EP MoC process for steady state operations.

Table 1-3: Adaptive management measures for discharge of PW to the marine environment

Item	Parameter	Trigger values / events	Investigation and/or adaptive management response measures
1	OIW	Steady state PW production rate is within 3,000 to 10,000 bbl/d and the OIW concentration exceeds 15 mg/L average over rolling 3-day (72 h) period	Root cause of exceedance is investigated (e.g. performance of MPPE or IGF, change to production chemical use) and corrective actions applied. Response measures may include diverting PW to the off-spec tank and re-treating to lower OIW concentration to below performance target. The tracking of OIW concentration against the performance target and the application of corrective actions to reduce OIW concentration should OIW concentration exceed the target, will be summarised and reported monthly as part of Operations Governance Forums (Section 8.2.3.1 of the EP), which will include representation from both Asset leadership and Regional Business Unit leadership. PW treatment equipment will be assigned an appropriate maintenance criticality rating as per Section 8.3.2.3 given its role in achieving EPOs. Monthly reporting through Operations Governance Forums will track any expected changes to operating conditions or equipment performance relevant to PW management.
		Steady state PW production rate is within 10,000 to 20,000 bbl/d and the OIW concentration exceeds 25 mg/L average over rolling 3-day (72 h) period	Root cause of exceedance is investigated (e.g. performance of MPPE or IGF, change to production chemical use) and corrective actions applied. Response measures may include diverting PW to the off-spec tank and re-treating to lower OIW concentration to below performance target. The tracking and reporting of OIW concentrations against the target and application of any corrective actions, as applicable, and maintenance of PW treatment equipment will be undertaken in accordance with the Operations Governance Forum processes outlined above.
		Loss of OIW online analyser signal (e.g., maintenance)	On loss of the OIW online analyser signal frequency, onboard manual laboratory measurements for OIW concentration are increased to approximately every 6 hours (4 samples taken within every 24-hour period) until the online analyser is returned to service, to ensure OIW performance targets and limits can be verified.

Item	Parameter	Trigger values / events	Investigation and/or adaptive management response measures
		Trends in OIW concentration between the OIW analyser and the onboard manual sampling show readings trending away from each other	Should trends in OIW concentration between the OIW analyser and the onboard manual sampling show readings trending away from each other the following tiered response occurs: 1. Clean the OIW analyser to correct the deviation. If the OIW analyser readings still deviate from the onboard sampler: 2. Remedial actions will occur on the OIW analyser in accordance with manufacturers recommendations to correct the deviation. 3. Onboard manual sampling will be increased (every 6 hours). 4. Onboard manual sampling calibration will be reviewed.
		NATA accredited laboratory OIW concentration exceeds the manual laboratory results	The OIW analyser is re-calibrated in accordance with manufacturers recommendations to meet the NATA accredited laboratory values.
2	PW flow rate	PW flowrate exceeds 16,000 bbl/d.	1. The predicted peak flowrate for PW is 16,000 bbl/d. Annual PW flowrate forecasting will be undertaken as part of the PW target review/ setting cycle (Section 8.2.5.1 of the EP). The tracking of PW production against forecast rates and limits will be reported monthly as part of Operations Governance Forums (Section 8.2.3.1 of the EP), which will include representation from both Asset leadership and Regional Business Unit leadership. 2. If flowrate forecasts or flowrate data show that the expected peak flowrate of 16,000 bbl/d has been or will be exceeded, proactive measures will be applied (e.g. field/well management) to ensure PW production remains below the limit of 20,000 bbl/d. 3. If following the investigation and implementation of corrective actions to meet ALARP, it is determined that the PW flowrate limit of 20,000 bbl/d is not possible, Engineering Change Management (Section 8.5.5 of the EP) and the EP Management of Change (MoC) process (Section 1.3) will be implemented.

Item	Parameter	Trigger values / events	Investigation and/or adaptive management response measures
3	Mercury	Mercury removal efficiency from PW during steady state is less than the 80% performance target as determined from sampling of PW before and after treatment (IGF and MPPE)	Investigate root cause of lower mercury removal performance (e.g. Underperformance of MPPE) and corrective actions applied to increase mercury removal efficiency to >80%. The tracking of mercury removal efficiency against the performance target and the application of corrective actions to increase mercury removal efficiency when mercury removal efficiency falls below the target, will be summarised and reported monthly as part of Operations Governance Forums (Section 8.2.5.1 of the EP), which will include representation from both Asset leadership and Regional Business Unit leadership. PW treatment equipment will be assigned an appropriate maintenance criticality rating as per Section 8.3.2.3 given its role in achieving EPOs. Monthly reporting through Operations Governance Forums will track any expected changes to operating conditions or equipment performance relevant to PW management.
4	PW chemical characterisation	Concentrations of potential contaminants in PW exceed ANZG (2018) 99% species protection (SP) default guideline values (DGVs) for marine water quality (where they exist) and previous chemical characterisation results. Parameters (i.e. potential contaminants) tested for will include, but are not limited to those in **Table 1-2.**	1 An assessment of the PW chemical characterisation results is undertaken to determine if trigger is met by: a. Comparing against the previous PW chemical characterisation results; and b. Comparing against ANZG (2018) 99% SP DGVs 2 For those contaminants that exceed ANZG (2018) 99% SP DGVs and exceed previous chemical characterisation results, the expected scale of dilution within the marine environment is predicted through PW dilution modelling (existing or new) representative of the current PW discharge rate and credible future discharge rates. 3 If, after dilution, the contaminant is predicted to exceed the ANZG (2018) 99% SP DGV beyond the PW Mixing Zone[1] or could potentially exceed the DGV beyond the mixing zone under credible increased PW discharge rates, the root cause and applicable management actions are to be investigated to prevent a future exceedance. This may include the following: • A review of chemical dosing rates and types of chemicals that could be attributable to the observed increased contaminant concentration. A change to dosing rates and/or chemical selection to reduce the concentration of the contaminant of concern to achieve the EPO may be implemented.

Item	Parameter	Trigger values / events	Investigation and/or adaptive management response measures
			• A review of the performance of the produced water system (MPPE or IGF) to determine and rectify possible underperformance • Undertake more frequent sampling of the PW for the contaminant of concern 4 Where modelling review predicts there is a current exceedance of a ANZG (2018) 99% SP DGV beyond the PW Mixing Zone (i.e. non-compliance with EPO-13), regulatory reporting (Recordable Incident reporting, Section 8.4.9 of the EP) will be undertaken, including reporting of the corrective actions implemented and proposed to ensure the PW discharge achieves the EPO. 5 If following the investigation and implementation of corrective actions to meet ALARP, it is determined that achieving acceptable levels of impact as per EPO-13 is not possible, the EP management of change (MoC) process (Section 1.3) will be implemented.
5	Production chemical usage	New chemical used in the process	1. New chemicals will be subject to Santos' chemical selection process and assessed for acceptability for use in consideration of achievement of the EPO. 2. The addition of a new production chemical to the process will trigger PW chemical characterisation testing and modelling, if required, to confirm achievement of the EPO.
6	PW ecotoxicity	New ecotoxicity testing results	1. New ecotoxicity results (99% species protection (SP) safe dilution factor) will be investigated by way of PW modelling (new modelling or interrogation of existing modelling), using the current PW discharge rate and credible future discharge rates, to determine the spatial extent of the safe dilution factor and allow comparison to the accepted PW Mixing Zone. 2. Where toxicity testing indicates the accepted PW Mixing Zone is exceeded or could be exceeded based on credible future discharge rates, the root cause and applicable management actions are to be investigated to rectify the exceedance or prevent a future exceedance. This may include the following: • Concurrent chemical characterisation testing to assist with a determination of which constituent/s are likely to be driving the increased toxicity. • A review of chemical dosing rates and types of chemicals that could be attributable to the observed increased PW toxicity. A change to dosing rates and/or chemical

Item	Parameter	Trigger values / events	Investigation and/or adaptive management response measures
			selection to reduce the concentration of the contaminant of concern to achieve the EPO may be implemented. • A review of the performance of the produced water system (MPPE or IGF) to determine and rectify possible underperformance • Undertake more frequent small-scale ecotoxicity testing (for example using a reduced number of test species 3. Where modelling review predicts there is a current exceedance of 99% SP safe dilution beyond the PW Mixing Zone (i.e. non-compliance with EPO-13), regulatory reporting (Recordable Incident reporting, Section 8.4.9 of the EP) will be undertaken, including reporting of the corrective actions implemented and proposed to bring the PW discharge in compliance with the EPO. 4. If following the investigation and implementation of corrective actions to meet ALARP, it is determined that achieving acceptable levels of impact as per EPO-13 is not possible, the EP management of change (MoC) process (Section 1.3) will be implemented.
7	Water quality field sampling [1]	Field sampling indicates an increase in contaminant levels from pre-PW discharge levels or baseline reference sites (refer Water and Sediment Quality Monitoring Plan, Appendix J)	1. Where contaminant levels exceed pre-discharge or baseline reference levels beyond the PW Mixing Zone a review against ANZG (2018) 99% SP DGVs will be undertaken to determine compliance with EPO-13. 2. Where contaminant concentrations attributable to PW discharge beyond the accepted PW Mixing Zone indicate a non-compliance with EPO-13 or potential non-compliance based on credible future discharge rates, the root cause and applicable management actions are to be investigated to rectify the exceedance or prevent a future exceedance. This may include the following: • A review of chemical dosing rates and types of chemicals that could be attributable to the observed increased contaminant concentration. A change to dosing rates and/or chemical selection to reduce the concentration of the contaminant of concern to achieve the EPO may be implemented.

Item	Parameter	Trigger values / events	Investigation and/or adaptive management response measures
			• A review of the performance of the produced water system (MPPE or IGF) to determine and rectify possible underperformance 3. Where contaminant concentrations attributable to PW discharge exceed ANZG (2018) 99% SP DGVs beyond the accepted PW Mixing Zone (i.e. non-compliance with EPO-13), regulatory reporting (Recordable Incident reporting, Section 8.4.9 of the EP) will be undertaken, including reporting of the corrective actions undertaken and proposed to ensure the PW discharge achieves the EPO. 4. If following the investigation and implementation of corrective actions to meet ALARP, it is determined that achieving acceptable levels of impact as per EPO-13 is not possible, the EP management of change (MoC) process (Section 1.3) will be implemented.
8	Sediment quality field sampling [1]	Field sampling indicates that an increase in contaminant levels from pre-PW discharge levels or baseline reference sites (refer Water and Sediment Quality Monitoring Plan, Appendix J)	1. Where contaminant levels exceed pre-discharge or baseline reference levels a review of contaminant levels against ANZG (2018) sediment quality levels will be undertaken to determine compliance with EPO-13. 2. Where contaminant concentrations attributable to PW discharge indicate a non-compliance with EPO-13 or is trending towards non-compliance, an investigation of the root cause of increased contaminant concentration and resultant corrective actions to reduce further sediment contamination above guideline levels, will be applied, if applicable, and will consider the following options: • A review of chemical dosing rates and types of chemicals that could be attributable to the observed increased contaminant concentration increase. A change to dosing rates and/or chemical selection to reduce the concentration of the contaminant of concern to achieve the EPO may be implemented. • A review of the performance of the produced water system (MPPE or IGF) to determine and rectify possible underperformance 3. Where contaminant concentrations attributable to PW discharge exceed ANZG (2018) sediment quality levels (i.e. non-compliance with EPO-13), regulatory reporting (Recordable

Item	Parameter	Trigger values / events	Investigation and/or adaptive management response measures
			Incident reporting, Section 8.4.9 of the EP) will be undertaken, including reporting of the corrective actions undertaken and proposed to ensure the PW discharge achieves the EPO. 4. If following the investigation and implementation of corrective actions to meet ALARP, it is determined that achieving acceptable levels of impact as per EPO-13 is not possible, the EP management of change (MoC) process (Section 1.3) will be implemented.

1 PW Mixing Zone is detailed within Section 6.8 of the EP.

2 The monitoring program for water and sediment quality is described in **Appendix J** (Water and Sediment Quality Monitoring Plan)

1.3 Environment Plan management of change

Should ongoing compliance with the PW discharge limits or the acceptable levels of impact within the PW Mixing Zone (compliance with EPO-13) not be possible, reassessment of the PW discharge risk and impacts will be undertaken in compliance with the Santos Environment Plan (EP) management of change (MoC) process (Section 8.5.2 of the EP) and with EP revision/resubmission requirements under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023*. The assessment process applied will follow the Santos risk assessment process outlined in Section 5 of the EP (including reassessment of PW impacts and re-evaluation of acceptable and ALARP levels) and will consider available information collected during PW discharge such as:

- Expected nature and scale of the PW discharge.
- PW ecotoxicity testing results and dilution factors.
- PW chemical characterisation testing results
- Water and sediments sampling results
- Validated PW discharge modelling.

The EP MoC process will be informed by the investigations and application of ALARP response measures that have been applied through the adaptive management approach.

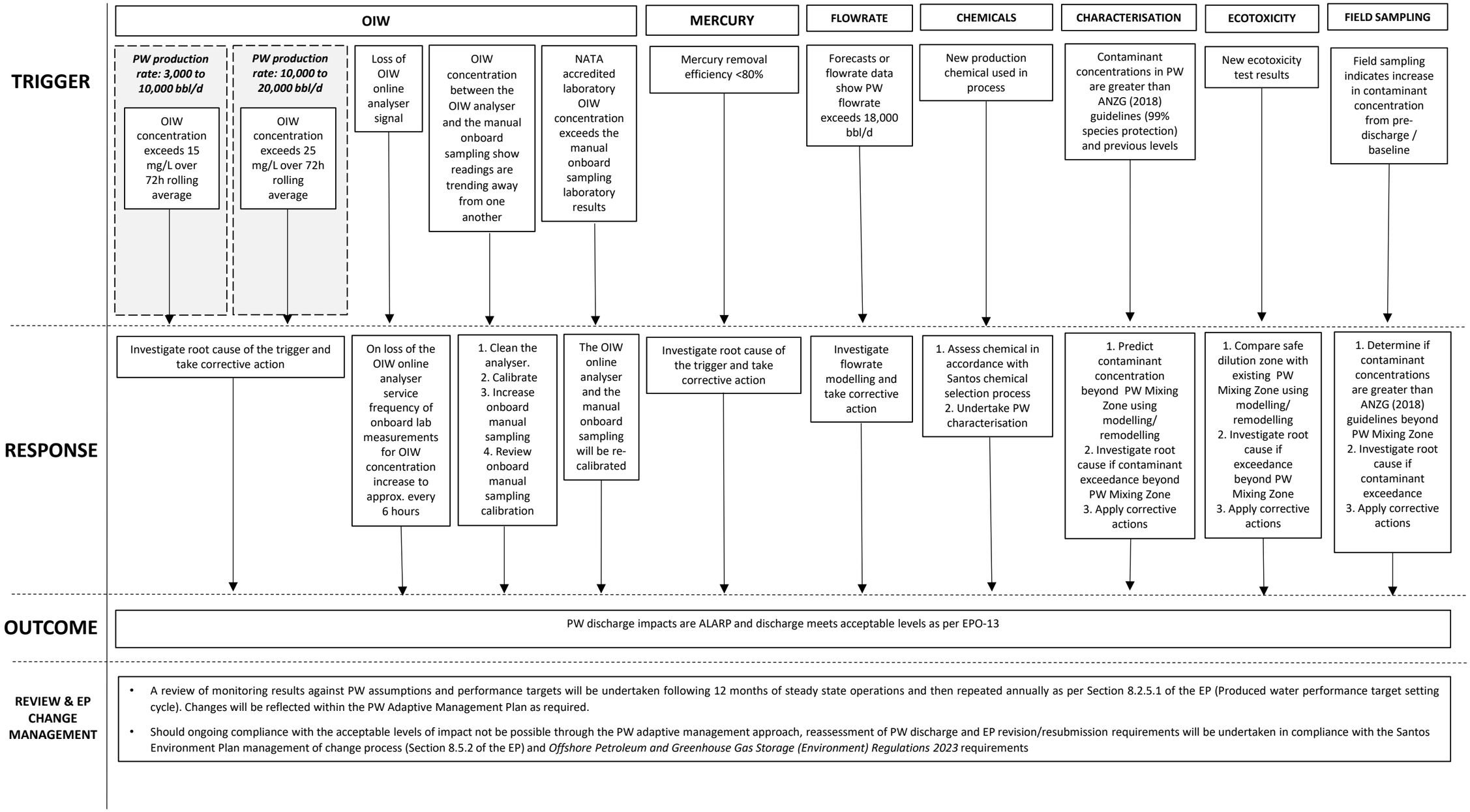


Figure 1-1: Overview summary of adaptive management measures for discharge of PW to the marine environment during steady state operations

Appendix J Water and Sediment Quality Monitoring and Sampling Plan

Water and Sediment Quality Monitoring and Sampling Plan

1 Objective

The objectives of this Water and Sediment Quality Monitoring and Sampling Plan (the Plan) is to provide the framework for the ongoing monitoring program that supports the implementation of the Produced Water (PW) Adaptive Management Plan (Appendix I of the EP) for the PW discharge from the Floating Production Storage and Offloading (FPSO) facility.

As set out in the PW Adaptive Management Plan, results from sampling and analysis will be used to compare concentrations of contaminants in the receiving environment with ANZG (2018) guideline values for the marine environment to ensure Environmental Performance Outcome (EPO) 13 is achieved. Both water quality and sediment quality guidelines will be used.

This plan may be revised based on new information, such as further details on the PW properties and / or new PW modelling outputs.

2 Scope

The scope of work required to address the objectives will consist of a water quality monitoring program, a sediment quality monitoring program and a benthic infauna monitoring program. The benthic infauna monitoring has been included as soft sediment habitat is the dominant habitat inside the operational area and within the PW Mixing Zone (as defined in Section 6.8 of the EP).

3 Timing

A water and sediment monitoring program as per the requirements of the PW Adaptive Management Plan (Appendix I of the EP).

Water quality monitoring will be undertaken within six months after reaching produced water rates of 3,000 bbl/d (and undertaken at 5-year intervals thereafter) based on the criteria presented in the PW Adaptive Management Plan (Appendix I of the EP).

Sediment quality monitoring will also be undertaken within six months after reaching produced water rates of 3,000 bbl/d (then every five years thereafter) based on the criteria presented in the PW Adaptive Management Plan (Appendix I of the EP).

4 Water Quality Monitoring

4.1 Objective

The objective of water quality monitoring is to determine whether PW discharge is meeting EPO -13 and to confirm through monitoring data the spatial extent of the PW Mixing Zone (see Section 6.8 of the EP).

4.2 Sampling Design

Proposed sample sites are located along prevailing current vectors radiating out from the FPSO. This approach enables measurement of changes in water quality due to PW discharges, with increasing distance from the facility. Baseline data was collected during preparation of the OPP. The gradient design will provide post commissioning data for comparison.

The water quality sampling locations will be determined by the current direction at the time of sampling.

4.3 Sampling Locations

For water quality monitoring, sampling vectors on the maps will be nominally based on prevailing currents, existing data (e.g., Fugro, 2015) and plume modelling.

Water samples will typically be collected at 24 sites around the FPSO, to determine the extent of nearfield mixing. Samples will typically be collected along transects parallel and perpendicular to the prevailing current at a range of water depths through the water column and distances of 20 m, 40 m, 70 m, 100 m and 250 m away from the FPSO, as shown in **Figure 1**. Additional replicate samples (3) are to be taken at a site at the boundary of the field Operational Area (OA1) (refer Section 2.2.3 of the EP) to ensure there are samples that do not have the potential to be affected by any other operational discharges or activities. The sample locations at the boundary of OA1 and at 250 m from the FPSO are expected to act as baseline reference sites. Additional samples may be collected closer to the discharge point (from the FPSO) depending on access between sampling points shown in **Figure 1**.

Samples at 20 m, 40 m and 70 m (70 m being the boundary of the PW Mixing Zone) are selected to monitor any effect of the PW discharge within the modelled plume extents (refer to Section 6.8 of the EP).

Samples collected from 70 m out to 250 m will be used to determine if there is any change to water quality beyond the (PW mixing zone) from a PW discharge.

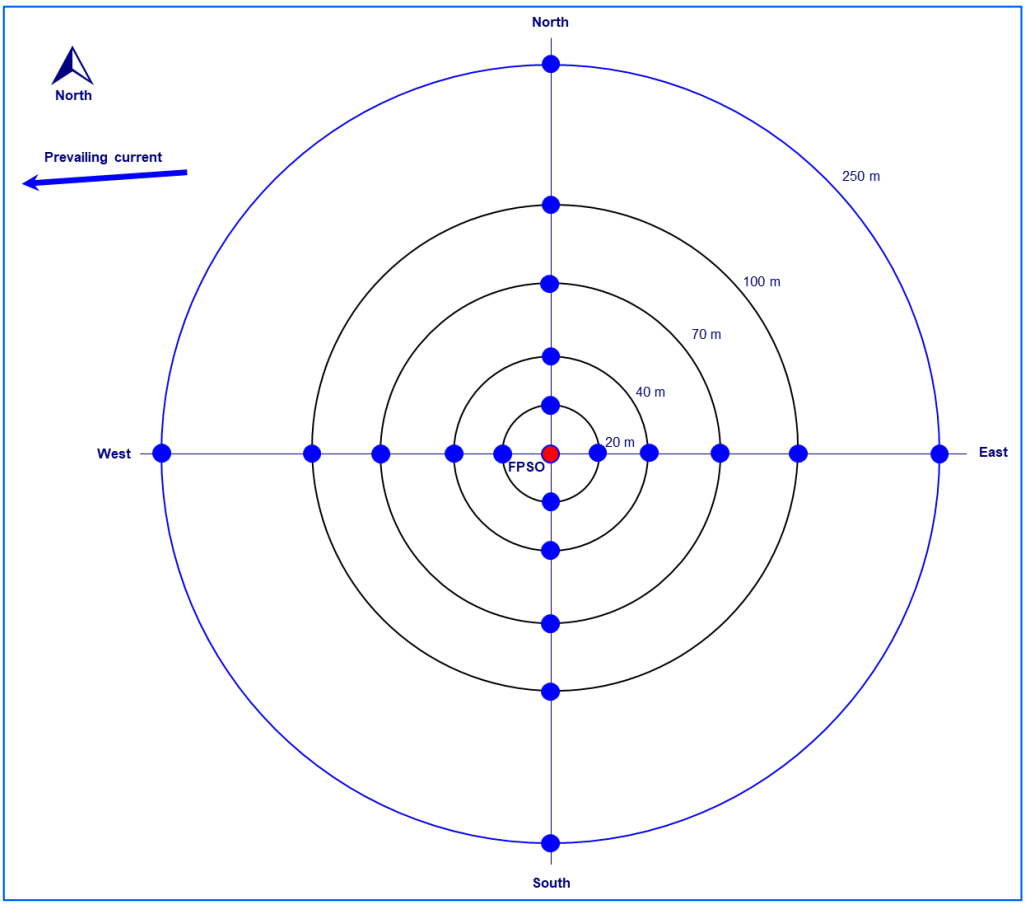


Figure 1: Indicative sampling design

4.3.1 Verification of Plume

Once PW discharge commences, a dye tracer study will be implemented to understand the plume movement for water sampling and to assist in verification of the plume modelling using Rhodamine or

another suitable dye. Rhodamine is a conservative tracer and concentrations in the water column are regularly used for comparing modelled estimates of dilution with in-situ measurements.

4.4 Sampling Method

4.4.1 Water Quality Profiles

Vertical profiles will be taken at a range of water depths through the water column, using a suitable profiler, that is capable of measuring conductivity, temperature and depth (CTD) as a minimum (e.g. Seabird Electronics SBE19 Seacat profiler or YSI EXO 2). In addition, water samples will also be collected sub-surface (see Section 4.4.2).

Profile measurements should be recorded at 4Hz (every 0.25 seconds) from 0 m to approximately 35 m water depth and at each of the water quality sampling locations. Either one or two depth profiles are recorded at each sampling site to ensure high quality data capture. The water quality profiler should be lowered / raised at a speed of approximately 1 m per second. At each location, the profiler should be lowered to approximately -1 m BSL and allowed to equilibrate for 30 seconds before profiling begins to ensure that all parameters have stabilised.

4.4.2 Water Quality Sampling

At each sampling location, a surface sample will be collected using either a 5 L Niskin water sampler or a 10 L (hydrocarbon safe) plastic bucket. The samples will be collected from approximately -1.0 m BSL to prevent contamination from any floating detritus for surface locations or from approximately -5 m BSL for mid-water samples (Niskin use only). However, this should be validated during the survey based on results from the plume verification (see Section 4.3.1) and CTD casts (see Section 4.4.1) to identify the location of the PW plume in the profile. Samples will be taken on the upwind side of the survey vessel, to minimise the risk of contamination from hydrocarbons from the vessel. Samples may need to be collected from the facility if the sites are in a vessel exclusion zone unless express permission is granted by the Offshore Installation Manager (OIM).

Further details regarding sample collection, sample processing and quality control should be detailed in a sampling and analysis plan that is prepared prior to undertaking the monitoring program. Sample collection, processing, transportation, storage, preservation and labelling will be conducted in accordance with the ANZG (2018) guideline.

Samples will be sent to NATA accredited laboratories capable of achieving Limits of Reporting to meet the ANZG (2018) PQLs for the proposed analyte listed in **Table 1**. These parameters will be confirmed based on the constituents identified during PW characterisation as per the PW Adaptive Management Plan (Appendix I to the EP).

Table 1: Proposed Test Parameters and Recommended PQLs

Analyte	Target Practical Quantification Limit	Method
Ammonium (NH4-N)	<5 µg.N/L (0.005 mg/L)	APHA 4500BFG
Nitrite (NO2-N)	<2 µg.N/L (0.002 mg/L)	APHA 4500BFG
Nitrate (NO3-N)	<2 µg.N/L (0.002 mg/L)	APHA 4500BFG
Total Nitrogen (TN-Persulphate)	<50 µg.N/L (0.050 mg/L)	APHA 4500BFG
Orthophosphate (PO4-P)	<2 µg.N/L (0.002 mg/L)	APHA 4500BFG
Total Phosphorus (TP-Persulphate)	<5 µg.N/L (0.002 mg/L)	APHA 4500BFG

Analyte	Target Practical Quantification Limit	Method
Total Dissolved Solids (TDS)	1 mg/L	APHA 4500BFG
Total Suspended Solids (TSS)	2 mg/L	APHA 4500BFG
Biochemical Oxygen Demand (BOD)	2 mg/L	APHA 4500BFG
Chemical Oxygen Demand (COD)	5 mg/L	APHA 4500BFG
Total Petroleum Hydrocarbon (TPH) (C_6-C_{36})	25/50/100/100 µg/L	USEPA 8260 / P&T GCMS
Benzene, Toluene, Ethyl Benzene and Xylenes (BTEX)	1 µg/L	USEPA 8260 / P&T GCMS
Poly-Aromatic Hydrocarbons (PAH)	1 µg/L	USEPA 3500C / 8270D GCMS
Phenols	1 µg/L	USEPA 3500C / 8270D GCMS
Aliphatic Speciation Aliphatic Hydrocarbons (C_{16}-C_{35})	100 µg/L	USEPA 3500C / 8270D GCMS
Cations (Ca, Mg, K, Na)	1 mg/L	USEPA 200.8 ICP/MS
Radium-226 Radium-228	0.1 Bq/L 0.1 Bq/L	Gamma Spectrometry Gamma Spectrometry
Trace Metals – dissolved		
Arsenic	0.5 µg/L	USEPA 200.8 ICP/MS
Barium	1 µg/L	
Boron	100 µg/L	
Cadmium	0.2 µg/L	
Chromium	1 µg/L	
Cobalt	0.1 µg/L	
Copper	0.2 µg/L	
Iron	5 µg/L	
Manganese	0.6 µg/L	
Mercury	0.1 µg/L	
Nickel	0.5 µg/L	
Lead	0.2 µg/L	

Analyte	Target Practical Quantification Limit	Method
Silver	0.1 µg/L	
Strontium	10 µg/L	
Zinc	5 µg/L	

4.4.3 Data Analysis

Results from the laboratory analysis will be presented in summary tables with comparisons to ANZG (2018) 99% and 95% species protection guidelines values and available pre-PW discharge (refer Section 3.3.3.5 of the EP) and post-PW discharge results. Analysis of data will also include a description of physical-chemical water quality characteristics, including presence and concentration of hydrocarbons and heavy metals.

The key objective is to assess the presence of a gradient from the PW discharge point outwards towards any of the cardinal sampling points or targeted sampling points. A range of statistical tests are available for determining the presence of gradient effects including:

- Linear regressions to assess for a relationship between distance from discharge and concentrations of selected contaminants.
- Multivariate statistical analysis using Distance Based Linear Model (DistLM) to determine if there is a gradient impact in the suite of water quality parameters tested (where present above the limit of reporting).

5 Sediment Monitoring Program

5.1 Objective

The objective of the sediment monitoring is to determine whether PW discharge is meeting EPO -13 (see Section 6.8 of the EP).

5.2 Sampling Design

Proposed sample sites are located along prevailing current vectors radiating out from the FPSO. This provides an approach to identify changes in sediment quality due to PW discharges, with increasing distance from the facility. The gradient design will provide baseline and post commissioning data for comparison.

Sediment sample sites will be determined based on the prevailing currents and information from the metocean data (Fugro, 2015) collected between July 2014 and March 2015 in the vicinity of the Barossa field.

5.3 Sampling Locations

The sampling design will follow the gradient approach presented in Section 4.2 and 4.3 of this plan. (including **Figure 1**).

Sediment samples will typically be collected at 24 sites around the FPSO, to determine the extent of nearfield mixing, with each site consisting of three replicates (adjusted for suitable clearances from subsea infrastructure to avoid damaging these). Replicate samples (3) will also be taken at a representative soft sediment site at the boundary of the field Operational Area (OA1) (refer Section 2.2.3 of the EP) away from any subsea infrastructure. Samples sites around the FPSO will typically be collected along transects parallel and perpendicular to the prevailing current at a depth range from 220

to 280 m below sea level (BSL) and distances of 20 m, 40 m, 70 m, 100 m and 250 m away from the FPSO, as shown in **Figure** 1.

Sampling locations will be confirmed using a positioning system of high accuracy (e.g., marine surveyor on board with USBL tracking of box corer).

5.4 Sampling Method

Sediment samples will be collected either using vessel-based methods that involve operation of a grab/corer (described in Section 5.4.1) or remote methods via operation of a remote operated vehicle (ROV, described in Section 5.4.2).

The sampling method will depend on the water depth, locations of sampling with respect to the FPSO facility status and other duties for the vessel used for sampling. The selection of sampling method should also consider the ability to safely deploy and retrieve the samples without impacting existing subsea infrastructure on the seabed (e.g. pipelines).

5.4.1 Box Corer

Given the known water depths of the Barossa field, the sampling is most likely to be performed with a box corer. Box corer samples will be collected using a corer deployed with the deck crane and winch ensuring there is sufficient cable for the water depths being sampled. The box corer will be operated according to appropriate lifting plans and deployment and recovery procedures.

5.4.2 Remote Methodology - Push Cores

As an alternative to operation of a grab/corer), samples can be collected using an Elkin push corer (or similar) operated by ROV under the guidance of qualified environmental scientists/engineers. The proposed method of sampling provides the ability to collect sediment samples close to existing subsea equipment with a high degree of accuracy. The main disadvantage with the ROV method is the limited volume of samples that can be collected at each time.

5.4.3 Sediment Quality Sampling

The following parameters will be tested within the sediments (**Table 2**).

Table 2: Proposed Typical Test Parameters and Recommended Limits of Reporting

Analyte	Limit of Reporting*	Method
Moisture content	0.1%	Gravimetric
Particle Size Distribution	0.01 mg/kg	Sieve and Sedigraph
Total Organic Carbon	0.02%	-
Arsenic	0.4 mg/kg	USEPA 3050/200.7 ICP/AES
Barium	0.1 mg/kg	USEPA 3050/200.7 ICP/AES
Boron	5 mg/kg	USEPA 3050/200.7 ICP/AES
Cadmium	0.1 mg/kg	USEPA 3050/200.7 ICP/AES
Chromium	0.1 mg/kg	USEPA 3050/200.7 ICP/AES
Cobalt	0.5 mg/kg	USEPA 3050/200.7 ICP/AES
Copper	0.1 mg/kg	USEPA 3050/200.7 ICP/AES
Iron	5 mg/kg	USEPA 3050/200.7 ICP/AES

Analyte	Limit of Reporting*	Method
Lead	0.5 mg/kg	USEPA 3050/200.7 ICP/AES
Magnesium	5 mg/kg	USEPA 3050/200.7 ICP/AES
Manganese	0.5 mg/kg	USEPA 3050/200.7 ICP/AES
Nickel	0.1 mg/kg	USEPA 3050/200.7 ICP/AES
Strontium	1.0 mg/kg	USEPA 3050/200.7 ICP/AES
Zinc	0.5 mg/kg	USEPA 3050/200.7 ICP/AES
Mercury	0.01 mg/kg	USEPA 3050/7471A CVAAS
BTEX	0.2 – 1.2 mg/kg	USEPA 8260/P&T GCMS
TPH (C6-C9)	10 mg/kg	USEPA 8260/P&T GCMS
TPH (C10-C36)	10-50 mg/kg	USEPA 3550B/8015B GC/FID
PAH	5-10, total PAH 100	USEPA 3550B/8270 GCMS

*ANZG (2018) guideline values for sediment quality

5.4.4 Data Analysis

All results are to be compared with sediment quality criteria (where available) from ANZG (2018) https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/sediment-quality-toxicants (**Table 3**) and available pre-PW discharge (refer Section 3.3.3.6 of the EP) and available post-PW discharge sediment quality results.

Table 3: Proposed Test Parameters and Recommended Levels of Reporting

	Toxicant	Default Guideline Value (DGV)	DGV - High
Metals (mg/kg, dry wt)	Cadmium	1.5	10
	Chromium	80	370
	Copper	65	270
	Lead	50	220
	Mercury	0.15	1.0
	Nickel	21	52
	Zinc	200	410
Metalloids (mg/kg)	Arsenic	20	70
Organics (µg/kg dry weight,)*	Total PAH	10,000	50,000
Organics (mg/kg dry weight)*	TPH	280	550

* Normalised to 1% organic carbon (OC) content within the limits of 0.2 to 10%

Where possible, the data will be tested statistically using ANOVA (Analysis of Variance) to determine if there were differences in the sediment quality results of individual variables with regards to distance and direction.

6 Benthic Infauna Monitoring

6.1 Objective

The objective of this monitoring is to assess the abundance and diversity of infauna at selected locations proximal to the FPSO which may assist in assessing the effect of any observed changes to sediment quality on infaunal community structure.

6.2 Sampling Design

Proposed sample sites are located along prevailing current vectors radiating out from the FPSO. This provides an approach to identify changes in infauna due to PW discharges, with increasing distance from the facility. The gradient design will provide baseline and post commissioning data for comparison.

Infauna sample sites will be determined based on the prevailing currents and information from the metocean data (Fugro, 2015) collected between July 2014 and March 2015 in the vicinity of the Barossa field. Where practical sites should be aligned with sediment quality sampling sites.

A sample site (representative soft sediment site) will also be located outside of the field Operational Area (OA1) (refer Section 2.2.3 of the EP).

6.3 Sampling Locations

Infauna sampling should be undertaken at the same sites as those targeted for sediment sampling (see Section 5.4) so that representative samples are collected simultaneously. At each survey location, three replicate sediment samples from each location should be collected.

6.4 Sampling Method

6.4.1 Sample collection

Infauna samples will be collected using apparatus deployed as part of the sediment monitoring program.

Once on board the vessel, samples should be sieved through a 1 mm mesh sieve and then transferred into suitable sample containers. The sieve shall be examined after removal of the sample, with any animals trapped in the mesh added to separate infauna containers for separate analysis. All material in the containers should be covered in a solution of 10% formalin and seawater or ethanol. The formalin solution should be buffered with borax to ensure that calcium carbonate structures (e.g. molluscs) in the samples remained intact.

The sieve is then rinsed with ionised water to avoid any cross-contamination.

Sample containers are to be labelled internally and externally with project details, time, date, site, location and replicate sample number and placed in a sealed and labelled poly-drum. Three replicate samples are to be collected per location. Global Positioning System (GPS) coordinates and times are to be recorded at the start and finish of sampling at each replicated sample site.

Decontamination of all sampling equipment (including sieves, grab sampler, bowls etc.), should be undertaken between sampling locations via a decontamination procedure involving a wash with ambient sea water and a laboratory grade detergent, and successive rinsing with deionised water; or by a similarly acceptable method.

6.4.2 Laboratory Procedure

Upon arrival at the laboratory, the infauna samples are washed in clean water and rinsed through a 1 mm mesh sieve. Bengal Rose dye can be added to the sample to assist with sorting.

Fauna are removed from the sediment using a binocular microscope and forceps and stored according to their higher taxonomic group. Samples should be labelled with the project details and sample information (as per Section 6.4.1).

Samples are to be identified at least to family level and to species level where possible. Identification to family level has been established as adequate for the detection of impacts on infauna communities (Warwick, 1988).

6.4.3 Data Analysis

Taxa abundance, richness and diversity will be calculated for the infauna data. A brief definition of each of these is provided below:

Taxa abundance: Relates to how common or rare taxa are relative to other taxa in a defined location or community.

Taxa richness: A measure related to the total number of different taxa present within a sample.

Taxa diversity: Taxa diversity accounts for the number of taxa and the evenness of taxa giving a measure of the biodiversity and complexity of a population. Taxa diversity consists of two components, taxa richness and taxa evenness. Taxa richness is a simple count of taxa, whereas taxa evenness quantifies how equal the abundances of the taxa are.

Taxa diversity was calculated using the Shannon Weiner diversity index as follows:

$H = \Sigma - (Pi * \ln Pi)$

$i = 1$

Where:

H = the Shannon diversity index

Pi = fraction of the entire population made up of taxa i

Σ = sum from taxa 1 to taxa S (number of taxa encountered)

Both univariate statistical analyses (using Statistica Version 7 or equivalent) and multivariate analyses (using PRIMER) will be undertaken to compare differences between sites.

Appendix K Toxicity Assessment of Barossa-3 Condensate

Barossa Environmental Studies

ConocoPhillips

Toxicity Assessment of Barossa-3 Condensate

IW021200-NMS-RP-0028 | Rev 1

30 May 2017

Barossa Environmental Studies

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Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to assess the toxicity of the Barossa-3 condensate in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from toxicity tests undertaken by Ecotox Services Australasia (ESA) and information sourced from the Client (including client provision of condensate samples to ESA for testing) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

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Abbreviations and Glossary

ACR	acute to chronic ratio
Acute toxicity	A lethal or adverse sub-lethal effect that occurs after a short exposure period relative to the organism's life span.
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
Chronic toxicity	An adverse effect that occurs after exposure for a substantial proportion of the organism's life span or an adverse sub-lethal effect on a sensitive early life stage.
Contaminant	A substance, inorganic or organic, at or near levels that could be toxic to some organisms.
BTEX	Benzene, toluene, ethylbenzene, and xylenes (meta-, para- and ortho-xylene)
EC_{50}	The concentration of a given contaminant that will cause a sub-lethal effect in 50% of a collection of organisms over a given period of time. Effects can be larval abnormalities, reproductive impairment, and growth inhibition or fertilisation success.
ESA	Ecotox Services Australasia
FSW	Filtered seawater
IC_{10}	The concentration of a given contaminant that will cause the inhibition of growth or reproduction in 10% of a collection of organisms over a given period of time.
IC_{50}	The concentration of a given contaminant that will cause the inhibition of growth or reproduction in 50% of a collection of organisms over a given period of time.
Larva(e)	The early free-living, immature form of any animal that changes structurally when it becomes an adult.
LC_{50}	The concentration of a given contaminant that will cause a lethal effect in 50% of a collection of organisms over a given period of time.
LOEC	(Lowest Observed Effect Concentration). The lowest concentration of a material used in a toxicity test that has a statistically significant adverse effect on the exposed population of test organisms as compared with the controls.
MAH	Monocyclic aromatic hydrocarbons
NATA	National Association of Testing Authorities
NOEC	(No Observed Effect Concentration). The highest concentration of a toxicant at which no statistically significant effect is observable, compared to the controls; the statistical significance is measured at the 95% confidence level.
PAH	Polycyclic aromatic hydrocarbons
PQL	Practical quantitation limit
QA	Quality assurance
SSD	Species sensitivity distribution
Toxicity	The quality or degree of being poisonous or harmful, to humans or biota.

TRH	Total recoverable hydrocarbons
WAF	Water accommodated fraction

Executive Summary

ConocoPhillips Australia Exploration Pty Ltd (ConocoPhillips) are proposing to develop natural gas resources as part of the Barossa area development, located in waters up to 300 m deep in the Bonaparte Basin, in Commonwealth waters offshore of northern Australia. Numerous shoals (submerged calcareous banks or 'seamounts') exist in the broader region around the Barossa area development; the closest being Evans Shoal, 60 km to the west, Tassie Shoal, 70 km south-west and Lynedoch Bank, 40 km to the south-east. In addition, the new Oceanic Shoals Commonwealth marine reserve (multiple use zone) lies to the south and south-east of the permit area.

ConocoPhillips intends to derive threshold concentrations of un-weathered and weathered Barossa-3 condensate to inform the assessment of the potential for toxicity impacts from hydrocarbon from the Barossa field to sensitive marine biota. The aim of this study is to assess the toxicity of the following:

1. Un-weathered Barossa-3 condensate (full suite of toxicants)
2. Weathered Barossa-3 condensate (limited tests involving fish only).

The toxicity tests were undertaken on a broad range of taxa of ecological relevance for which accepted standard test protocols are well established. These ecotoxicology tests are mainly focused on the early life stages of test organisms, when organisms are typically at their most sensitive to hydrocarbons. For the un-weathered condensate, static toxicity tests were conducted on seven mainly tropical species, representing seven taxonomic groups. It was considered that fish would be the more likely receptor to be exposed to the weathered condensate during a hydrocarbons spill, and consequently fish were the focus species for the weathered condensate study.

The moderate guideline value for 95% species protection of un-weathered Barossa-3 condensate was 1146 µg/L and the moderate guideline value for 99% species protection was 456 µg/L. The IC_{10} values for the un-weathered Barossa-3 condensate ranged from 1,051 to 15,875 µg/L. According to the GESAMP (2002) classification, un-weathered Barossa-3 condensate has almost negligible chronic aquatic toxicity.

Neither the un-weathered nor weathered Barossa-3 condensate was particularly toxic to fish larvae. A lower concentration of un-weathered condensate was required to affect the balance of 10% of fish larvae compared with the weathered condensate while a lower concentration of weathered condensate was required to affect the biomass of 10% of fish larvae compared to the un-weathered condensate.

The un-weathered Barossa-3 condensate was more toxic to copepod development and macroalgal growth and less toxic to fish larvae and oyster larval development. Neff (1979) also found that toxicity was most pronounced among crustaceans and least among telesost or ray finned fishes.

From the chemical analysis of the Barossa-3 condensate the most obvious difference between the un-weathered and weathered condensate was in the benzene, toluene, ethylbenzene, and xylenes (BTEX) results. BTEX falls into the class of monocyclic aromatic hydrocarbons (MAHs). The weathered Barossa-3 condensate had much lower concentrations than the un-weathered Barossa-3 condensate, particularly benzene and toluene. BTEX compounds are acutely toxic to aquatic organisms if exposure is sustained. Because of the volatility of BTEX, aquatic organisms typically only experience short exposure times in the order of 12 hours which may circumvent toxic effects.

Of the polycyclic aromatic hydrocarbons (PAH's) analysed for this study, naphthalene was the only chemical that was higher in the weathered condensate compared to the un-weathered condensate. All other PAHs

measured were below the laboratory detection limit or in the case of fluorene and phenanthrene was similar between weathered and un-weathered condensate. However, the myriad of other chemicals present in the condensate were not required to be measured for the purposes of this exercise. Neff et al. (2000) demonstrated that the MAHs are the most important contributors to the acute toxicity of the water accommodated fractions (WAFs) of fresh oils, while the contribution of PAHs to WAF toxicity increases with weathering. However it is generally not well understood which of the many components of oil are responsible for the many toxicity effects induced by oil.

1. Introduction

1.1 Background

ConocoPhillips Australia Exploration Pty Ltd (ConocoPhillips), as proponent on behalf of the current and future joint ventures, are proposing to develop natural gas resources as part of the Barossa area development, located approximately 300 kilometres (km) north of Darwin, Northern Territory (**Figure 1-1**). The Barossa field is situated in petroleum retention lease permit NT/RL5 (referred to as the 'permit area' in this report).

1.2 Overview of existing regional environment

The Barossa area is located in the Northern Marine Region, which comprises the Commonwealth waters of the Gulf of Carpentaria, Arafura Sea and Timor Sea as far west as the Northern Territory and Western Australian border. The Northern Marine Region contains internationally significant breeding and/or feeding grounds for a number of listed threatened and migratory marine species, including nearshore dolphins, turtles, dugongs, seabirds and migratory shorebirds afforded protection under national legislation and international conventions.

The Timor and Arafura Seas support a variety of shark, pelagic finfish and crustacean species of commercial and recreational game-fishing importance, e.g. trawl and various finfish fisheries. The shelf break and slope of the Arafura Shelf is characterised by patch reefs and hard substrate pinnacles that support a diverse array of invertebrate groups, with polychaetes and crustaceans being the most prolific (Heyward et al. 1997, CEE 2002). Surveys indicate that between 50 m and 200 m depth, the seabed consists of predominantly soft, easily resuspended sediments (Heyward et al. 1997, URS 2005, 2007). The diversity and coverage of epibenthos is low and organisms present are predominantly sponges, gorgonians and soft corals (Heyward et al. 1997, URS 2005, 2007).

Numerous shoals (submerged calcareous banks or 'seamounts') exist in the broader region around the permit area; the closest being Evans Shoal, 60 km to the west, Tassie Shoal, 70 km south-west and Lynedoch Bank, 40 km to the south-east. In addition, the new Oceanic Shoals Commonwealth marine reserve (multiple use zone) lies to the south and south-east of the permit area.

1.3 Scope of work

ConocoPhillips intends to derive species sensitivity guideline values (99%, 95% etc.) of un-weathered and weathered Barossa-3 condensate, which have toxic effects on sensitive marine biota, to inform the assessment of the potential for toxicity impacts from hydrocarbons from the Barossa field. The scope consisted of the following components:

Definition of Scope of Ecotoxicity Testing

- Jacobs provided advice on ecotoxicity testing methods including sample collection and numbers of species to test, and liaised with the NATA accredited laboratory that undertook the testing. For this study, Jacobs used the services of Ecotox Services Australasia (ESA).

Interpretation of the Ecotoxicological Data

- Following the ecotoxicity assessment, Jacobs interpreted the ecotoxicity data to inform definition of species protection guideline values as relevant to the Barossa field.

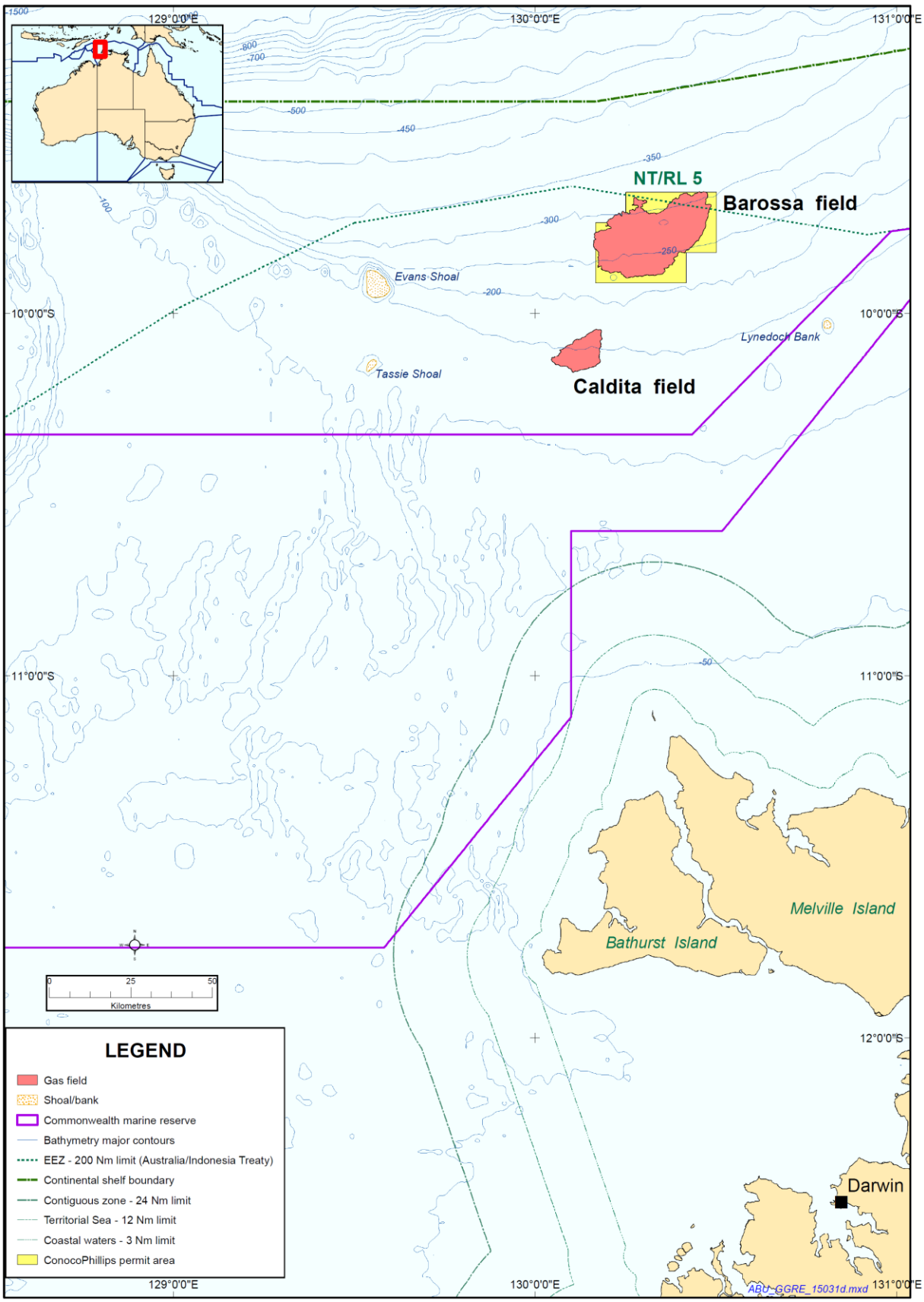

Figure 1-1: Barossa field location

2. Methods

ConocoPhillips sent samples of Barossa-3 condensate to the ESA laboratory in September 2015 for detailed ecotoxicological studies and hydrocarbon chemical analysis. The laboratory-based toxicity tests used a range of Water Accommodated Fraction (WAF) concentrations of weathered and un-weathered condensate to expose the different test organisms.

The toxicity tests were undertaken on a broad range of taxa of ecological relevance for which accepted standard test protocols are well-established. These ecotoxicology tests are mainly focused on the early life stages of test organisms, when organisms are typically at their most sensitive to hydrocarbons. For the un-weathered condensate, static toxicity tests were conducted on seven mainly tropical species, representing seven taxonomic groups demonstrating different levels if the food chain (**Table 2-1**).

Table 2-1: Analytical methods, test species, life stages, durations and test end-points for ecotoxicology

Test Species	Life Stage	Test Duration and End-Point	Type*	Protocol
Microalga (*Isochrysis aff. galbana*)	-	72-hour Growth inhibition (cell yield)	Chronic	ESA SOP 110 (ESA, 2014a). Based on Stauber *et al*. (1994)
Macroalage (*Ecklonia radiata)*	Gametophyte	14-day Growth rate	Chronic	ESA SOP 116 (ESA, 2014f). Based on Bidwell *et al*. (1998) and Burridge et al. (1999)
Sea Urchin (*Heliocidaris tuberculata)*	Gamete	1-hour Fertilisation rate	Chronic	ESA SOP 104 (ESA, 2014b). Based on USEPA (2002a), Simon and Laginestra (1997)
Sea Urchin (*Heliocidaris tuberculata)*	Larvae	72-hour Development rate	Chronic	ESA SOP 105 (ESA, 2014c). Based on APHA (1998), Simon and Laginestra (1997) and Doyle *et. al.* (2003)
Milky Oyster (*Saccostrea echinata)*	Embryo	48-hour Development rate	Chronic	ESA SOP 106 (ESA, 2014d). Based on APHA (1998) and Krassoi (1995)
Copepod (*Parvocalanus crassirostris*)	Juveniles	5-day Development rate	Acute	ESA SOP 124 (ESA, 2014e).
Sea anemone (*Aiptasia pulchella*)	Pedal lacerate	8-day Development rate	Chronic	ESA SOP 128 (ESA, 2014g) based on Howe et al. (2014)
Fish (Barramundi) (*Lates calcarifer*)	Larvae	7-day Biomass	Chronic	ESA SOP 122 (ESA, 2012). Based on USEPA (2002a)
Fish (Barramundi) (*Lates calcarifer*)	Larvae	7-day Imbalance	Chronic	ESA SOP 122 (ESA, 2012). Based on USEPA (2002a)

*Based on test classification according to Warne et al. (2014) guidelines

Based on stochastic modelling results from the RPS APASA (2015) hydrocarbon spill modelling study, the minimum contact time of moderate dissolved aromatic hydrocarbon exposure from a subsea well blowout to the nearest submerged receptors of Evans Shoal, Tassie Shoal and Lynedoch Bank (all less than 100 km from the Barossa Field) was greater than 24 hours in all seasons. Due mainly to the evaporative loss of volatiles, less than 20% of the original volume of condensate would remain after this time. However, the open waters of the Timor Reef Fishery could be affected during a well blowout event during any season, given the Barossa Field is located within this fishery. The times to contact with dissolved aromatic hydrocarbons (90 - 100 m depth layer) were 2.4 hrs for all seasons, with the probability of exposure ranging between 14% and 37%. Considering the predicted exposure to the nearest submerged receptors and the Timor Reef Fishery, it was decided that fish

would be the most likely receptor to be exposed to the weathered condensate, and consequently were the focus species for the weathered condensate study.

Aliquots of the Barossa-3 condensate sample were weathered by ESA using the Mackay Chamber Testing techniques for a 12 hour weathering period, with a wind speed of 5.5 m/s (10.7 knots) and water temperature of 28.8°C. The weathering information was based upon the season in which spawning occurs for goldband snapper (*Pristipomoides multidens*), which is the key target species of the Timor Reef Fishery. The most vulnerable life stages for fish are their egg and larval life stages, therefore goldband snapper are most susceptible to hydrocarbons during the spawning period, which is January to April with a peak during March (Newman 2003).

ESA prepared the WAF by combining a prescribed quality of weathered or un-weathered condensate to 0.45 µm filtered seawater in a 1:9 ratio. The combined samples were mixed for 24 hrs using a magnetic stirrer. The WAF and condensate mixture was allowed to settle for 1 hour before the WAF was siphoned off into clean amber glass reagent bottles until required for toxicity testing and total recoverable hydrocarbon (TRH) analysis. The WAFs were serially diluted with filtered seawater (FSW) to prepare the remaining test concentrations.

For each toxicity test, sub-samples of the WAF were sent to Envirolab Services Pty Ltd to be analysed for the determination of TRH, polycyclic aromatic hydrocarbons (PAHs) and benzene, toluene, ethylbenzene and xylenes (BTEX) concentrations of the solution. Total recoverable hydrocarbon concentration is representative of the sum of the hydrocarbons in each test solution for C_6–C_{40}.

ESA performed a full suite of toxicity testing (nine tests with seven test species as detailed in **Table 2-1**) on the un-weathered Barossa-3 condensate and a limited number of tests (7-day fish imbalance and biomass toxicity test) on the weathered Barossa-3 condensate.

Toxicity test results for the WAF are expressed in terms of loading rate of condensate (grams of oil per litre of seawater; **Table 2-2**) and TRH concentrations (µg/L).

Table 2-2: Test dilutions used in toxicity tests

Dilution Factor	1X	2X	4X	8X	16X	32X	64X	128X	Filtered Seawater
% of treatment	100%	50%	25%	12.5%	6.25%	3.125%	1.56%	0.78%	0%
Loading Rate (g/L)-Barossa-3	77.2	38.6	19.3	9.7	4.8	2.4	1.2	0.6	0
Loading Rate (g/L)-Barossa-3 weathered	79.5	39.8	19.9	9.9	5	2.5	1.2	0.6	0

2.1 Quality assurance

Specific quality assurance (QA) procedures for undertaking toxicity testing, procurement and culturing of test organisms, maintenance and calibration of instrument, cleaning, chain of custody and sample handling procedures were in accordance with ESA standard laboratory procedures. ESA is the only National Association of Testing Authorities (NATA) accredited laboratory undertaking toxicity testing in Australia and five of the nine toxicity tests conducted for this study were NATA certified. The 8-day sea anemone pedal lacerate development test using *Aiptasia pulchella*, the 5-day copepod development toxicity test using *Parvocalanus crassirostris*, the

7-day fish imbalance and 7-day fish biomass tests involving barramundi (*Lates calcarifer*) are not NATA certified but only because these are new tests developed by ESA; the quality assurance procedures for these tests are similar to the certified tests.

The pH, salinity and dissolved oxygen concentration of a representative sample from each concentration/treatment was measured. A FSW control and a WAF control were tested concurrently with each test. The WAF control is a way of determining if the process of creating a WAF causes toxicity to test animals. **Appendix A** gives specific quality assurance controls for each of the toxicity tests. The acceptance criteria for each of these measures had to be met in order for the tests to be considered valid. Tests that were invalid were repeated with un-weathered treatment and test organisms, therefore the results presented here represent the final tests in which all acceptance criteria were met.

2.2 Chemical analyses

A total of 39 sub-samples of the WAF were sent by ESA to Envirolab Services for testing in three separate batches. **Table 2-3** lists the practical quantitation limits (PQLs) for the hydrocarbons analysed during this study. The laboratory used for analysis is NATA certified for the parameters measured. As part of their procedures the Envirolab undertakes the required blanks, testing of standards and replicate tests to the satisfaction of NATA requirements.

Table 2-3: Laboratory practical quantitation limits for each of the hydrocarbons analysed

Analyte	PQL (µg/L)
BTEX	
Benzene	1
Toluene	1
Ethylbenzene	1
m+p xylene	2
o-xylene	1
Total Recoverable Hydrocarbons	
C_6-C_{10}	10
>C_{10}-C_{16}	50
>C_{16}-C_{34}	100
>C_{34}-C_{40}	100
Polycyclic Aromatic Hydrocarbons	
Naphthalene	1
Acenaphthylene	1
Acenaphthene	1
Fluorene	1
Phenanthrene	1
Anthracene	1
Fluoranthene	1
Pyrene	1
Benzo(a)anthracene	1
Chrysene	1
Benzo(b,j+k)fluoranthene	2
Benzo(a)pyrene	1
Indeno(1,2,3-c,d)pyrene	1
Dibenzo(a,h)anthracene	1
Benzo(g,h,i)perylene	1

2.3 Data presentation and statistical analysis

The toxicity test data are presented in several ways. Firstly the concentration at which no observed effects are noted (no observed effect concentration, NOEC) is generally used as the most conservative measure of toxicity in that it is the lowest concentration at which no test organisms are affected. The lowest observed effects concentration (LOEC) is the concentration where the first statistically detectable toxicity is observed. The concentration that causes one or more specified effects in 50% of the test organisms in the prescribed test duration (EC_{50}) or which inhibits growth or reproduction of 50% of the test organisms in the prescribed test duration (IC_{50}) are statistically calculated. Similarly IC/EC_{10} values are statistically calculated.

Burrlioz 2.0 is a statistical software package for use in environmental management of species with regard to understanding the effects of levels of toxins in an environment. Depending on the number of observations, Burrlioz 2.0 uses either the log-logistic ($n < 8$) or the Burr Type III ($n \geq 8$) model, to estimate the greatest concentration of a toxin at which no observed effect to a species will be detected. The ANZECC/ARMCANZ (2000) guidelines recommend using the Burrlioz program and stipulate that:

The program determines by statistical means the distribution that best fits the available toxicity data and calculates the 95% protection level (with median confidence) or any other nominated protection level.

For this assessment, the Burrlioz 2.0 program was used to analyse the toxicity results and to plot species sensitivity distributions (SSD) to derive the concentration that protects 80%, 90%, 95% and 99% of species with 50% confidence (PC80(50), PC90(50), PC95(50) and PC99(50) respectively). Analysis by the Burrlioz 2.0

program is designed to utilise EC/IC_{10} values derived from chronic toxicity tests to provide high reliability guideline values. Warne et al (2014) recommend:

EC/IC/LCx where x≤10 are to be used in preference to NOEC and then NOEC estimated values derived from LOEC and LC_{50} values.

In cases where there are insufficient chronic data to derive a guideline value, acute toxicity data can be converted to provide an estimate of chronic toxicity. ANZECC/ARMCANZ (2000) guidelines use LC_{50} or EC_{50} data derived from acute tests in the Burrlioz 2.0 program; however, a chemical-specific acute to chronic ratio (ACR) must be applied to convert the data to a chronic equivalent. A chemical-specific ACR is derived from chronic and acute tests performed on a given species for a test chemical or solution. If this has not been undertaken, the ANZECC/ARMCANZ (2000) guidelines suggest the use of a default value of 10 be applied, meaning that the LC_{50} or EC_{50} data are divided by ten (10) before they are entered into the Burrlioz 2.0 program. The default ACR value of ten was applied to the EC_{50} result for the Acute Copepod Development Test.

It is also worth noting that the Burrlioz 2.0 program is a distribution-fitting application and the more ecotoxicity tests used, the more reliable the guideline values calculated. As a minimum, Warne et al. (2014) state:

The minimum data requirements for using a SSD have not changed from the ANZECC/ARMCANZ (2000) Guidelines i.e. toxicity data for at least five species that belong to at least four taxonomic groups, but using toxicity data from at least 8 species is strongly encouraged and from more than 15 species is considered optimal.

For this investigation, nine tests comprised of seven different taxonomic groups (microalga, macroalga, echinoderm, crustacean, mollusc, cnidarian and fish) were used. As a number of the tests used the same species (e.g. sea urchin *Heliocidaris tuberculata*) a single toxicity value needed to be obtained for each species. At this point in time the laboratory has a limit on the number of tropical test species available, as the new guidelines become more prevalent this will likely change. The lowest value for all combinations of a species and endpoint is adopted as the toxicity value to represent the sensitivity of the species in the SSD calculations (Warne et al. 2014). Therefore, from the nine tests used in the assessment, seven values were used to derive the species protection guideline values. Of the input values, six were derived from chronic tests and one from an acute test.

Burrlioz 2.0 calculates the species protection levels (99%, 95%, etc) based on toxicity data, which are either an EC/IC_{10} or an EC/IC_{50} divided by a factor of ten (10). For a 99% species protection value the Burrlioz 2.0 program assimilates all the test data to derive a value that protects an even higher proportion of the species (i.e. where only one species is affected rather than 10% or 50% of individuals); hence, the values derived will routinely be much lower than the input values from the toxicity testing.

3. Results

The laboratory reports from ESA for each of the toxicity tests are presented in **Appendix B** for un-weathered and weathered treatments of Barossa-3 condensate.

The statistical outputs for the Barossa-3 condensate un-weathered and weathered toxicity tests are summarised in **Table 3-1** and **Table 3-2** respectively. Note that for the chronic tests the IC/EC_{10} values were used as inputs to the Burrlioz 2.0 program, whereas for the Acute Copepod Development Test the EC_{50} value was divided by 10. This factor is applied to ensure that a conservative approach is taken to derive PC95 and PC99 percentages and dilutions in the absence of sufficient chronic toxicity data. The Burrlioz distribution fitting for 95% and 99% species protection of un-weathered Barossa-3 condensate are graphed in **Figure 3-1** to **Figure 3-2**; however, guideline values for all species protection levels (80, 90, 95 and 99%) are highlighted in **Table 3-3**. The Burrlioz output reports are located in **Appendix C.**

Microalga Growth Inhibition Test (72 hour)

For the un-weathered Barossa-3 condensate, algal cell yield was significantly inhibited in the WAF with a loading density corresponding to a TRH concentration of 12,850 µg/L. There was zero cell yield in higher concentrations of the un-weathered condensate (**Appendix B**). The IC_{10} value for the un-weathered condensate was 4,355 µg/L (**Table 3-1**).

Macroalgal Growth Test (14 day)

The WAF of un-weathered Barossa-3 condensate caused significantly lower gametophyte length of the macroalgae *Ecklonia radiata* at a TRH concentration of 3180 µg/L (**Appendix B**). The IC_{10} value for the un-weathered condensate was 1,873 µg/L (**Table 3-1**).

Sea Urchin Fertilisation Success Test (1 hour)

The un-weathered Barossa-3 condensate caused a significantly lower percentage of sea urchin eggs to be fertilised at a TRH concentration of 720 µg/L and no eggs were fertilised at concentrations of 30,860 µg/L or higher (**Appendix B**). The EC_{10} value for the un-weathered condensate was 9,206 µg/L (**Table 3-1**).

Sea Urchin Larval Development Test (72 hour)

The WAF of un-weathered Barossa-3 condensate caused a significant decrease in the number of normally developed sea urchin larvae. No normally developed larvae were observed in the WAF with the highest loading density (corresponding to a TRH concentration of 69,620 µg/L) and a TRH of concentration of 30,860 µg/L caused significantly fewer normally developed larvae (**Appendix B**). The EC_{10} value for the un-weathered condensate was 15,481 µg/L (**Table 3-1**).

Oyster Larval Development Test (48 hour)

Significantly fewer normally developed milky oyster larvae were observed in the WAF's containing a TRH of 14,060 µg/L of un-weathered Barossa-3 condensate and no larvae developed normally with higher concentrations of un-weathered condensate (**Appendix B**). The IC_{10} value for the un-weathered condensate was 11,478 µg/L (**Table 3-1**).

Copepod Acute Development Toxicity Test (5 day)

There was a significant change to the number of healthy copepods affected by un-weathered Barossa-3 at a TPH concentration of 15,830 µg/L compared with the WAF control and at this and higher concentrations of un-weathered condensate all copepods were affected (**Appendix B**). The IC_{10} value for the un-weathered condensate was 27.2 µg/L (**Table 3-1**).

Sea Anemone Pedal Lacerate Development Test (8 day)

The WAF of un-weathered Barossa-3 condensate caused a significant decrease in the number of normally developed sea anemone pedal lacerates. No normally developed larvae were observed in the WAF with the highest loading density (corresponding to a TRH concentration of 63,990 µg/L; **Appendix B**). The IC_{10} value for the un-weathered condensate was 8,862 µg/L (**Table 3-1**).

Fish Imbalance Test (7 day)

The number of healthy fish larvae (unhealthy larvae measured as a loss of balance or equilibrium when swimming and inability to catch prey) in the WAF of un-weathered Barossa-3 condensate was significantly less at a TRH concentration of 29,770 µg/L and there were no healthy fish larvae at higher concentrations (**Appendix B**). The number of healthy fish larvae exposed to weathered Barossa-3 condensate at the highest loading density was not significantly different compared to the FSW control (i.e. 0%; **Appendix B**). The IC_{10} values for the un-weathered and weathered condensate were 15,875 and 19,596 µg/L respectively (**Table 3-1** and **Table 3-2**).

Fish Biomass Toxicity Test (7 day)

The biomass of fish larvae in the WAF of un-weathered Barossa-3 condensate was significantly lower at a TRH concentration of 29,770 µg/L and there were no unaffected fish larvae at higher concentrations (**Appendix B**). The biomass of the fish larvae exposed to weathered Barossa-3 condensate at the highest loading density was not significantly different compared to the FSW control (i.e. 0%; **Appendix B**). The IC_{10} values for the un-weathered and weathered condensate were 17,016 and 13,908 µg/L respectively (**Table 3-1** and **Table 3-2**).

99 and 95% Species Protection

The 95% species protection guideline value of un-weathered Barossa-3 condensate was 456 µg/L (**Figure 3-1** and **Table 3-3**), while the 99% species protection guideline values of un-weathered Barossa-3 condensate was 1146 µg/L (**Figure 3-2** and **Table 3-3**). The IC_{10} values for the un-weathered Barossa-3 condensate ranged from 1,051 to 15,875 µg/L. The reliability of the guideline value was moderate based on the classification scheme outlined in Warne et al. (2014) based on the number of species in which toxicity data are available (n=7), type of toxicity data (mixture of chronic and estimated chronic) and visual assessment of the goodness of fit of the SSD to the toxicity data (good).

Neither the un-weathered nor weathered Barossa-3 condensate was particularly toxic to fish larvae. A lower concentration of un-weathered condensate was required to affect the balance of 10% of fish larvae compared with the weathered condensate (**Table 3-1** and **Table 3-2**) while a lower concentration of weathered condensate was required to affect the biomass of 10% of fish larvae compared to the un-weathered condensate (**Table 3-1** and **Table 3-2**).

Hydrocarbon Concentrations of Weathered and Un-weathered Condensate

The major difference between the hydrocarbon components of the Barosssa-3 weathered and un-weathered condensate was the large reduction in benzene and toluene after 12 hours of weathering (**Table 3-4**). Ethylbenzene and xylenes also decreased but to a much smaller degree. The aliphatic fraction C_{16}-C_{34} and naphthalene increased in weathered condensate but the other PAHs remained unchanged, with most being below the detection limit of the laboratory in both weathered and un-weathered condensates.

Table 3-1: Summary of toxicity tests for un-weathered Barossa-3 condensate (concentrations in µg/L)

Test	NOEC	EC_{10} or IC_{10}	EC_{50} or IC_{50}	Burrlioz Input Values
Microalgal Growth	6670	4355.2	8529.3	4355.2
Macroalgal Germination Success	1673	1873.9	57196.9	1873.9
Sea Urchin Fertilisation	350	9206.2	13202.7	9206.2
Sea Urchin Larval Development	14060	15481.6	20104.4	-
Milky Oyster Larval Development	7160	11478.4	18747.2	11478.4
Copepod Development	8560	27.2	10506.9	1050.7*
Sea Anemone Pedal Lacerate Development	28040	8862.4	30720.0	8862.4
Fish Imbalance	15830	15875.5	23182.2	15875.5
Fish Growth (Biomass)	15830	17016.3	24006.3	-

- indicates that the lowest value for the species was used
* indicates a default acute to chronic ratio was applied to the EC_{50} value

Table 3-2: Summary of toxicity tests for weathered Barossa-3 condensate (concentrations in µg/L)

Test	NOEC	EC_{10} or IC_{10}	EC_{50} or IC_{50}
Fish Imbalance	22480	19596.3	>22480
Fish Growth (Biomass)	22480	13908.1	>22480

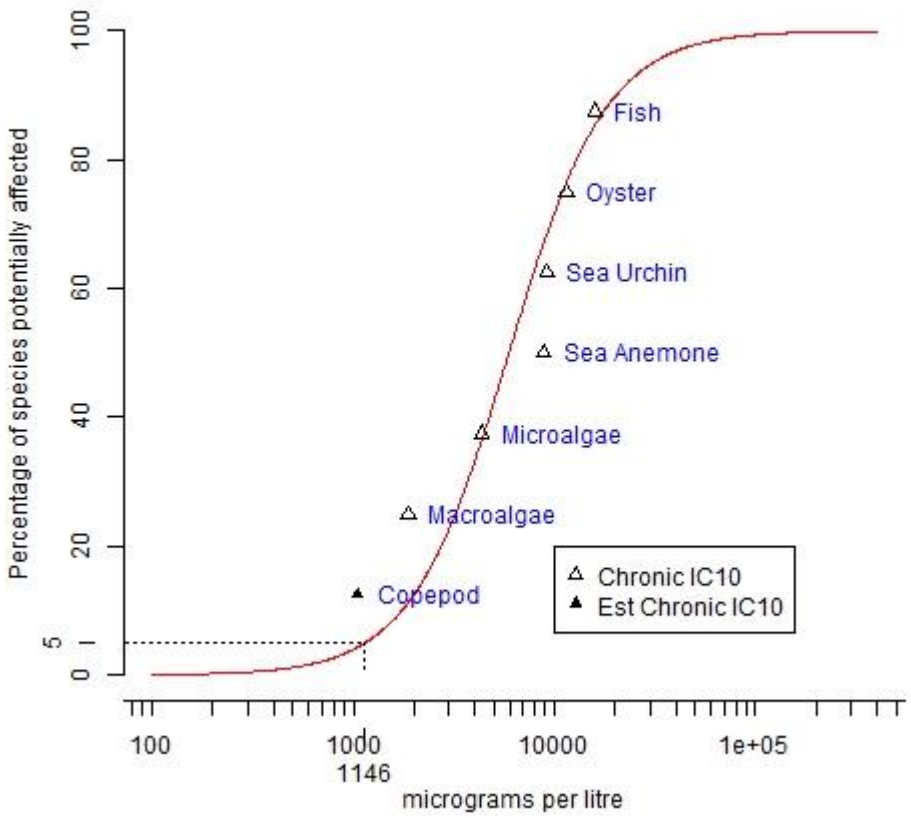

Figure 3-1: Burrlioz distribution fitting for 95% species protection of un-weathered Barossa-3 condensate

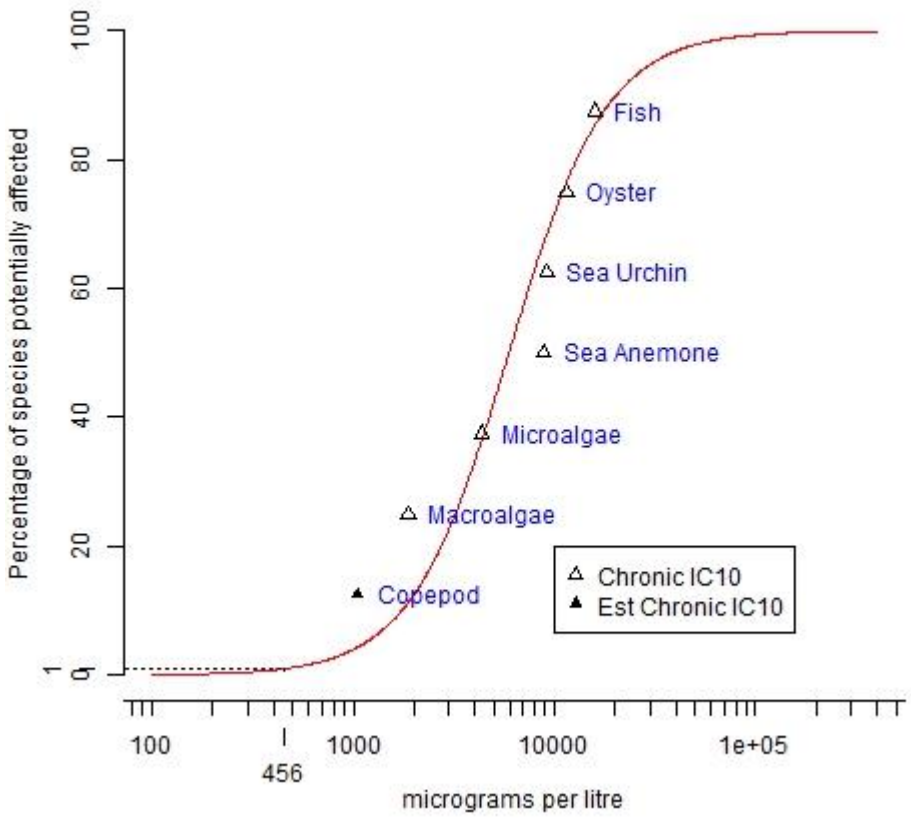

Figure 3-2: Burrlioz distribution fitting for 99% species protection of un-weathered Barossa-3 condensate

Table 3-3: Moderate reliability guideline values derived from Burrlioz species sensitivity distribution curve for un-weathered Barossa-3 condensate

Treatment	Level of Species Protection	Derived Guideline Value for TRH concentration (µg/L)
Un-weathered Barossa-3 condensate	99%	456
	95%	1146
	90%	1739
	80%	2735

Table 3-4: Hydrocarbon concentrations of weathered and un-weathered Barossa-3 condensate

Analyte	100% Un-weathered Condensate (µg/L)	100% Weathered Condensate (µg/L)
BTEX		
Benzene	27000	630
Toluene	21000	7400
Ethylbenzene	490	400
m+*p* xylene	5000	4000
o-xylene	1500	1400
Total Recoverable Hydrocarbons		
C_6-C_{10} (less BTEX)	7000	5200
>C_{10}-C_{16} (less naphthalene)	1200	800
>C_{16}-C_{34}	1900	2600
>C_{34}-C_{40}	140	<100
Polycyclic Aromatic Hydrocarbons		
Naphthalene	250	400
Acenaphthylene	<1	<1
Acenaphthene	<1	<1
Fluorene	3	4
Phenanthrene	2	2
Anthracene	<1	<1
Fluoranthene	<1	<1
Pyrene	<1	<1
Benzo(a)anthracene	<1	<1
Chrysene	<1	<1
Benzo(b,j+k)fluoranthene	<2	<1
Benzo(a)pyrene	<1	<1
Indeno(1,2,3-c,d)pyrene	<1	<1
Dibenzo(a,h)anthracene	<1	<1
Benzo(g,h,i)perylene	<1	<1

4. Conclusions

A large number of studies have been published describing the toxicity of total petroleum hydrocarbon and hydrocarbon components (including French-McCay, 2002; Lewis and Pryor, 2013; Neff et al. 2000). The common theme in the findings is that the observed toxicity of crude and refined hydrocarbons is primarily attributable to volatile and water-soluble aromatic hydrocarbons (MAHs) including BTEX, low molecular weight PAHs such as naphthalene and phenanthrene and higher molecular weight PAHs).

The moderate reliability guideline value for 95% species protection of un-weathered Barossa-3 condensate was 1,146 µg/L and the moderate guideline value for 99% species protection was 456 µg/L. The IC_{10} values for the un-weathered Barossa-3 condensate ranged from 1,051 to 15,875 µg/L. According to the GESAMP (2002) classification, un-weathered Barossa-3 condensate has almost negligible chronic aquatic toxicity.

Neither the un-weathered nor weathered Barossa-3 condensate was particularly toxic to fish larvae. A lower concentration of un-weathered condensate was required to affect the balance of 10% of fish larvae compared with the weathered condensate while a lower concentration of weathered condensate was required to affect the biomass of 10% of fish larvae compared to the un-weathered condensate.

The un-weathered Barossa-3 condensate was more toxic to copepod development and macroalgal growth and less toxic to fish larvae and oyster larvae development. Neff (1979) also found that toxicity was most pronounced among crustaceans and least among teleost or ray-finned fishes.

From the chemical analysis of the Barossa-3 condensate undertaken by Envirolab Services (**Appendix B**), the most obvious difference between the un-weathered and weathered condensate was in the BTEX results. BTEX is the collective name for benzene, toluene, ethylbenzene, and xylenes and falls into the class of MAH. The weathered Barossa-3 condensate had much lower concentrations than the un-weathered Barossa-3 condensate, particularly of benzene and toluene. BTEX compounds are acutely toxic to aquatic organisms if exposure is sustained. Because of the volatility of BTEX, aquatic organisms typically only experience short exposure times in the order of 12 hours which may circumvent toxic effects.

Of the PAHs analysed for this study, naphthalene was the only one measured by Envirolab Services that was higher in the weathered condensate compared to the un-weathered condensate. All other PAHs measured were below the laboratory detection limit or in the case of fluorene and phenanthrene were similar between weathered and un-weathered condensate. However, the myriad of other chemicals present in the condensate were not required to be measured for the purposes of this exercise. Neff et al. (2000) demonstrated that the MAHs are the most important contributors to the acute toxicity of the WAFs of fresh oils, while the contribution of PAHs to WAF toxicity increases with weathering. However it is generally not well understood which of the many components of oil are responsible for the many toxicity effects induced by oil.

5. References

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Appendix A. Summary of Quality Assurance for Ecotox Tests

Table A.1: Specific quality assurance (QA) criteria for the Microalga Growth Test

QA Measure	Acceptance Criteria	This Test	Criterion Met?
FSW control mean cell density	≥ 160,000 cells/mL	202,000 ± 32,000 cells/mL	Yes
Control coefficient of variation	< 20%	16.0%	Yes
Reference toxicant test within Cusum chart limits	15.1-46.7 µg/L Cu/L	19.0 µg/L Cu/L	Yes

Table A.2: Specific quality assurance (QA) criteria for the Macroalgal Growth Test

QA Measure	Acceptance Criteria	This Test	Criterion Met?
FSW control mean % germination @ 72 hrs	≥ 70%	90.3 ± 1.12	Yes
Reference toxicant test	86.0-1262.1 µg/L Cu/L	408.5 µg/L Cu/L	Yes

Table A.3: Specific quality assurance (QA) criteria for the Sea Urchin Fertilisation Success Test

QA Measure	Acceptance Criteria	This Test	Criterion Met?
FSW control mean % fertilised eggs	≥ 70%	78.8 ± 3.2%	Yes
Reference toxicant test within Cusum chart limits	23.7-105.6 µg/L Cu/L	26.7 µg/L Cu/L	Yes

Table A.4: Specific quality assurance (QA) criteria for the Sea Urchin Larval Development Test

QA Measure	Acceptance Criteria	This Test	Criterion Met?
FSW control mean % normal larvae	≥ 70%	80.8 ± 5.0%	Yes
Reference toxicant test within Cusum chart limits	10.5-23.1 µg/L Cu/L	12.2 µg/L Cu/L	Yes

Table A.5: Specific quality assurance (QA) criteria for the Milky Oyster Larval Development Test

QA Measure	Acceptance Criteria	This Test	Criterion Met?
FSW control mean % normal larvae	≥ 70%	74.5 ± 4.8%	Yes
Reference toxicant test within Cusum chart limits	10.2-20.0 µg/L Cu/L	14.5 µg/L Cu/L	Yes

Table A.6: Specific quality assurance (QA) criteria for the Acute Copepod Development Toxicity Test

QA Measure	Acceptance Criteria	This Test	Criterion Met?
FSW control mean % unaffected larvae	≥ 70%	70 0 ± 10.7%	Yes
Reference toxicant test within Cusum chart limits*	n/a	2.8 µg/L Cu/L	n/a

* Cusum chart data unavailable due to insufficient tests conducted to build database

Table A.7: Specific quality assurance (QA) criteria for the Sea Anemone Pedal Lacerate Development Test

FSW control mean % normal pedal lacerates	≥ 90%	100 ± 0.0%	Yes
Reference toxicant test within Cusum chart limits*	n/a	11.5 µg/L Cu/L	n/a

* Cusum chart data unavailable due to insufficient tests conducted to build database

Table A.8: Specific quality assurance (QA) criteria for the Larval Fish Imbalance and Growth (Biomass) Test

FSW control mean % unaffected larvae	≥ 80%	100.0 ± 0.0%	Yes
Control Mean Growth	≥ 20% of initial weight	52.6%	Yes
Reference toxicant test within Cusum chart limits	n/a	17.3 mg NH_4^+/L	n/a

* Cusum chart data unavailable due to insufficient tests conducted to build database

Appendix B. Laboratory Reports

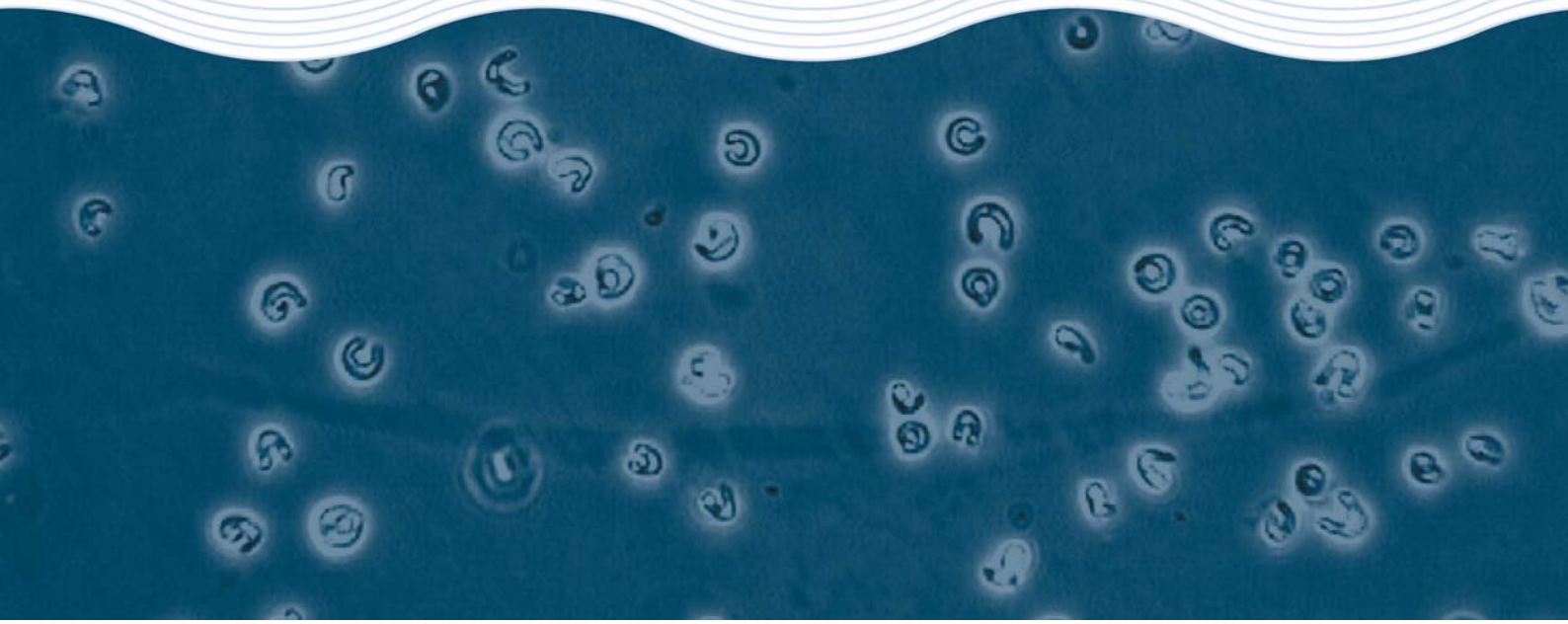
ecotox
SERVICES AUSTRALASIA

Toxicity Assessment of Fresh and Weathered Barossa Field Condensate

Jacobs SKM

Comprehensive Test Report

November 2015



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SERVICES AUSTRALASIA

Toxicity Assessment of Fresh and Weathered Barossa Field Condensate

Jacobs SKM

Comprehensive Test Report

November 2015

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1. Executive Summary

1.1 Executive Summary

Ecotox Services Australasia Pty Ltd (ESA) was commissioned by Jacobs Group (Australia) Pty Ltd to undertake marine toxicity tests with a condensate sample from the Barossa field development site.

The following toxicity tests were undertaken on Water Accommodated Fractions (WAFs) of Barossa Field Condensate:

- 1-hr fertilisation test using the sea urchin *Heliocidaris tuberculata* (based on USEPA Method 1008 and Environment Canada (1992), modified for use with *H. tuberculata* by Simon and Laginestra 1997, and Doyle *et al*. 2003).
- 72-hr larval development test using the sea urchin *Heliocidaris tuberculata* (based on APHA Method 8810D, modified for use with *H. tuberculata* by Simon and Laginestra 1997)
- 48-hr larval abnormality test using the milky oyster *Saccostrea echinata* (based on APHA Method 8610 and USEPA OPPTS 850.1055, Krassoi 1995)
- 72-hr growth (cell-yield) test using the marine micro-alga *Isochrysis aff. galbana* (based on Stauber *et al*., 1994 for *N. closterium.*)
- 14-day macroalgal growth test using *Ecklonia radiata* (based on Bidwell *et al.* 1998 and Burridge *et al.* 1999).
- 8-day sea anemone pedal lacerate development toxicity test using *Aiptasia pulchella* (based on Howe *et al.* 2014)
- 5-day copepodid development toxicity test using the juvenile calanoid copepod *Parvocalanus crassiostris* (based on Rose *et al* 2006).
- 7-d fish imbalance and growth test with barramundi *Lates calcarifer* (based on USEPA 2002b).

All eight toxicity tests were performed on WAFs generated from either the fresh or weathered Barossa Field Condensate (ESA identification number 7323). Sub-samples of the WAFs and individual dilution treatments were shipped to Envirolab Services Pty Ltd for Total Recoverable Hydrocarbons (TRH, C6-C36), Total Petroleum Hydrocarbons (TPHs) and BTEX. The TRH data, in addition to loading rate of condensate in the WAF generation systems, were used to determine toxicity test end-points.

Test data for the Barossa Field Condensate, based on loading rates, are summarised in **Table 1.1**. The bioassays were performed at the ESA laboratory in Lane Cove. This report describes the results of each of the toxicity tests performed. Test reports for each of the tests are given in **Appendices C to J.** Statistical printouts for each test are given in **Appendices K** to **R**. The analytical reports for TRH analysis of the WAF samples are provided in **Appendix B** of this report.

Test results indicated the following:

- ***1-hr Sea Urchin Fertilisation Test*:**
  Based on the loading rate, the WAF of the Barossa Field Condensate had an EL10, EL50, NOEL and LOEL of 14.6, 18.6 (8.97-19.12), 0.6 and 1.2g/L, respectively. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 9206.2 (7702.42-10203.00), 13202.7 (12495.20-13763.40)µg/L, 350 and 720µg/L, respectively.

- ***72-hr Sea Urchin Larval Development Test*:**
  Based on the loading rate, the WAF of the Barossa Field Condensate had an EL10, EL50, NOEL and LOEL of 21.0 (18.90-2276), 26.5 (24.67-28.01), 19.3 and 38.6g/L, respectively. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 15481.6 (13727.10-16947.80), 20104.4 (18575.70-21450.10), 14060 and 30860µg/L, respectively.

- ***48-hr Milky Oyster Larval Development Test*:**
  Based on the loading rate, the WAF of the Barossa Field Condensate sample had an EL10, EL50, NOEL and LOEL 15.7 (11.78-18.35), 24.7 (24.11-25.32), 9.7 and 19.3g/L, respectively. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 11478.4 (9026.54-13230.50), 18747.2 (18266.80-19240.30), 7160 and 14060µg/L, respectively.

- ***72-hr Micro-algal Growth Inhibition Test*:**
  Based on the loading rate, the WAF of the Barossa Field Condensate had an IL10, IL50, NOEL and LOEL of 6.4 (2.18-10.68), 12.6 (7.45-15.09), 9.7 and 19.3g/L, respectively. Expressed as TRH concentration, the corresponding IC10, IC50, NOEC and LOEC were 4355.2 (1641.13-7401.38), 8529.3 (5094.77-10126.00), 6670 and 12850µg/L, respectively.

- ***14-d Macroalgal Growth Test:***
  Based on the loading rate, the WAF of the Barossa Field Condensate had an IL10, IL50, NOEL and LOEL of 2.7, 64.8, 2.4 and 4.8g/L, respectively. Expressed as TRH concentration, the corresponding IC10, IC50, NOEC and LOEC were 1873.9, 57196.9, 1673 and 3180µg/L, respectively.

- ***8-dSea Anemone Development Test:***
  Based on the loading rate, the WAF of the Barossa Field Condensate had an EL10, EL50, NOEL and LOEL of 11.2, 40.1 (31.78-50.60), 38.6 and 77.2g/L, respectively. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 8862.4, 30720.0 (23961.00-39385.50), 28040, 63990µg/L, respectively.

- ***5-d Copepodid development Test***
  Based on the loading rate, the WAF of the Barossa Field Condensate had an EL10, EL50, NOEL and LOEL of 1.0, 12.2 (10.84-13.73), 9.7 and 19.3g/L, respectively. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 27.2, 10506.9 (9451.82-11679.80), 8560 and 15830µg/L, respectively.

- ***7-d Fish Imbalance and Growth Test*:**
  Based on the loading rate, the WAF of the fresh Barossa Field Condensate had an EL10, EL50, NOEL and LOEL of 19.4 (13.58-23.28), 29.3 (24.71-34.66),

19.3 and 38.6g/L, respectively, for the imbalance endpoint. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 15875.5 (11275.40-18756.60). 23182.2 (19851.60-27226.80), 15830 and 29770µg/L, respectively. The EL10, EL50, NOEL and LOEL for the biomass endpoint were 20.9 (8.44-22.09), 30.6 (27.79-31.44), 19.3 and 38.6g/L, respectively expressed as loading rate, and 17016.3 (7373.18-18757.60), 24006.3 (21800.80-24621.00), 15830 and 29770µg/L, respectively, expressed as TRH concentration.

Based on the loading rate, the WAF of the Weathered Barossa Field Condensate had an EL10, EL50, NOEL and LOEL of 69.1, >79.5, 79.5 and >79.5g/L, respectively, for the imbalance endpoint. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 19596.3, >22480, 22480 and >22480µg/L, respectively. The EL10, EL50, NOEL and LOEL for the biomass endpoint were 48.6, >79.5, 79.5 and >79.5g/L, respectively expressed as loading rate, and 13908.1, >22480.0, 22480 and >22480µg/L, respectively, expressed as TRH concentration.

Table 1.1. Summary of toxicity test data for the Barossa Field Condensate

		Barossa Field Condensate		Weathered Barossa Field Condensate	
Toxicity Test	**Endpoint**	**Loading Rate (g/L)**	**TRH Concentration (µg/L)**	**Loading Rate (g/L)**	**TRH Concentration (µg/L)**
1-hr sea urchin fertilisation	1-hr EL10	14.6*	9206.2 (7702.42-10203.00)	-	-
	1-hr EL50	18.6 (8.97-19.12)	13202.7 (12495.20-13763.40)	-	-
	NOEL	0.6	350	-	-
	LOEL	1.2	720	-	-
72-hr sea urchin larval development	72-hr EL10	21.0 (18.90-22.76)	15481.6 (13727.10-16947.80)	-	-
	72-hr EL50	26.5 (24.67-28.01)	20104.4 (18575.70-21450.10)	-	-
	NOEL	19.3	14060	-	-
	LOEL	38.6	30860	-	-
48-hr milky oyster larval development	48-hr EL10	15.7 (11.78-18.35)	11478.4 (9026.54-13230.50)	-	-
	48-hr EL50	24.7 (24.11-25.32)	18747.2 (18266.80-19240.30)	-	-
	NOEL	9.7	7160	-	-
	LOEL	19.3	14060	-	-
72-hr micro-algal growth	72-hr IL10	6.4 (2.18-10.68)	4355.2 (1641.13-7401.38)	-	-
	72-hr IL50	12.6 (7.45-15.09)	8529.3 (5094.77-10126.00)	-	-
	NOEL	9.7	6670	-	-
	LOEL	19.3	12850	-	-
14-d macroalgal growth	14-d IL10	2.7*	1873.9*	-	-
	14-d IL50	64.8*	57196.9*	-	-
	NOEL	2.4	1673	-	-
	LOEL	4.8	3180	-	-

		Barossa Field Condensate		Weathered Barossa Field Condensate	
Toxicity Test	**Endpoint**	**Loading Rate (g/L)**	**TRH Concentration (µg/L)**	**Loading Rate (g/L)**	**TRH Concentration (µg/L)**
8-d sea anemone development	8-d EL10	11.2*	8862.4*	-	-
	8-d EL50	40.1 (31.78-50.60)	30720.0 (23961.00-39385.50)	-	-
	NOEL	38.6	28040	-	-
	LOEL	77.2	63990	-	-
5-d copepodid development	5-d EL10	1.0**	27.2*	-	-
	5-d EL50	12.2 (10.84-13.73)	10506.9 (9451.82-11679.80)	-	-
	NOEL	9.7	8560	-	-
	LOEL	19.3	15830	-	-
7-d fish imbalance	7-d EL10	19.4 (13.58-23.28)	15875.5 (11275.40-18756.60)	69.1*	19596.3*
	7-d EL50	29.3 (24.71-34.66)	23182.2 (19851.60-27226.80)	>79.5	>22480.0
	NOEL	19.3	15830	79.5	22480
	LOEL	38.6	29770	>79.5	>22480
7-d fish biomass	7-d EL10	20.9 (8.44-22.09)	17016.3 (7373.18-18757.6)	48.6*	13908.1
	7-d EL50	30.6 (27.79-31.44)	24006.3 (21800.80-24621.00)	>79.5	>22480.0
	NOEL	19.3	15830	79.5	22480
	LOEL	38.6	29770	>79.5	>22480

*95% confidence limits are not available/reliable
** Based on extrapolated data

1.2 Glossary of Terms

The following glossary is based on that provided by Environment Canada (1997)

Acute toxicity is an adverse effect (lethal or sub-lethal) induced in the test organisms within a short period of exposure to a test material, usually a few days.

Bioassay is a test (=assay) in which the strength or potency of a substance is measured by the response of living organisms or living system. ***Toxicity test*** is a more specific and preferred term for environmental work.

Chronic toxicity implies long-term effects that are related to changes in metabolism, growth, reproduction, or ability to survive

Control is a treatment in an investigation that duplicates all the factors that might affect results, except the specific condition being studied. In toxicity tests, the control must duplicate all the conditions in the exposure treatment(s) but must contain no test material. The control is used as a check for toxicity due to basic conditions such as quality of dilution water or health and handling of the test organisms. Control is synonymous with ***negative control***. See also ***positive control***.

ECx is the median effective concentration. That is the concentration of material in water that is estimated to cause a specified percent effect (eg. EC10, EC50) of the test organisms. In most instances the EC50 and its 95% confidence limits are statistically derived by analysing the percentages of organisms affected at various test concentrations, after a fixed period of exposure. The duration of exposure must be specified (eg. 48h).

ELx is the median effective loading rate. That is the loading rate of material in water (eg. mg/L) that is estimated to cause cause a specified percent effect (eg. EC10, EC50) of the test organisms. In most instances the EL50 and its 95% confidence limits are statistically derived by analysing the percentages of organisms affected at various test loading densities, after a fixed period of exposure. The duration of exposure must be specified (eg. 48h).

Endpoint means the measurement(s) or value(s) that characterise the results of a test (LL50, EL50, IL50). It also means the reaction of the organism to show the effect which is intended to mark completion of the test (eg. death, number of shell abnormalities).

ILx is the inhibiting loading rate for a specified percent effect (eg. IL50). It represents a point estimate of a loading rate of test material that causes a designated percent inhibition (*p*) compared to the control, in a quantitative biological measurement such as microalgal cell yield attained at the end of a test.

ICx is the inhibiting concentrations for a specified percent effect (eg. IC50). It represents a point estimate of a concentration of test material that causes a designated percent inhibition (*p*) compared to the control, in a quantitative biological measurement such as microalgal cell yield attained at the end of a test.

LOEC is the lowest-observed-effect concentration. This represents the lowest concentration of a test material for which a statistically significant effect on the test organisms was observed, relative to the control.

LOEL is the lowest-observed-effect loading rate. This represents the lowest loading densities of a test material for which a statistically significant effect on the test organisms was observed, relative to the control.

NOEC is the no-observed-effect concentration. This represents the highest test concentration of a test material for which no statistically significant effect on the test organisms was observed, relative to the control.

NOEL is the no-observed-effect loading rate. This represents the highest test loading rate of a test material for which no statistically significant effect on the test organisms was observed, relative to the control.

Positive Control is a toxicity test with a reference toxicant, used to assess the sensitivity of the organisms at the time of the test material is evaluated and the precision of the results obtained by the laboratory for that chemical.

Reference toxicant is a standard chemical used to measure the sensitivity of the test organisms to establish confidence in the toxicity data obtained for a test material. In most instances, a toxicity test with a reference toxicant is performed to assess the sensitivity of the organisms at the time the test material is evaluated and the precision of the results obtained by the laboratory for that chemical.

Replicate is a single test chamber containing a prescribed number of test organisms in either one loading rate of test solution or in dilution water as a control. In a toxicity test comprising five test concentrations and a control, and using four replicates, 24 test chambers would be used. For each loading rate or control, there would be 4 test chambers or replicates. A replicate must be an independent unit, and therefore, any transfer of test material or organisms from one replicate to another would invalidate a statistical analysis based on replication.

Static describes toxicity tests in which test solutions are not renewed during the test.

Sub-lethal means detrimental to the organism, but below the level that directly causes death within the test period.

Toxic means poisonous. A toxic material can cause adverse effects on living organisms, if present in sufficient amount at the right location.

Toxicant is a toxic material.

2. Introduction

Ecotox Services Australasia Pty Ltd (ESA) was commissioned by Jacobs Group (Australia) Pty Ltd to undertake marine toxicity tests with a condensate sample from the Barossa field development site.

The following toxicity tests were undertaken on Water Accommodated Fractions (WAFs) of Barossa Field condensate:

- 1-hr fertilisation test using the sea urchin *Heliocidaris tuberculata* (based on USEPA Method 1008 and Environment Canada (1992), modified for use with *H. tuberculata* by Simon and Laginestra 1997, and Doyle *et al*. 2003).
- 72-hr larval development test using the sea urchin *Heliocidaris tuberculata* (based on APHA Method 8810D, modified for use with *H. tuberculata* by Simon and Laginestra 1997)
- 48-hr larval abnormality test using the milky oyster *Saccostrea echinata* (based on APHA Method 8610C and USEPA OPPTS 850.1055, Krassoi 1995)
- 72-hr growth (cell-yield) test using the marine micro-alga *Isochrysis aff. galbana* (based on Stauber *et al*., 1994 for *N. closterium.*)
- 14-day macroalgal growth test using *Ecklonia radiata* (based on Bidwell *et al.* 1998 and Burridge *et al.* 1999).
- 8-day sea anemone pedal lacerate development toxicity test using *Aiptasia pulchella* (based on Howe *et al.* 2014)
- 5-day copepodid development toxicity test using the juvenile calanoid copepod *Parvocalanus crassiostris* (based on Rose *et al* 2006).
- 7-d fish imbalance and growth test with barramundi *Lates calcarifer* (based on USEPA 2002b).

The condensate sample was shipped to ESA in 20L steel cans and was received in good condition (**Appendices A**). The Barossa Field Condensate was assigned ESA identification number 7323. The condensate sample was stored at room temperature until used for preparing Water Accommodated Fractions (WAFs).

WAFs of the condensate sample were prepared by adding a prescribed quantity of condensate to 0.45μm filtered seawater (FSW) in 2 litre glass bottles in general accordance with CONSERF procedures (Singer *et al*., 2000). The mixing ratio was 1 part condensate: 9 parts filtered seawater. The preparations were stirred for 24 hours using a magnetic stirrer in such a manner as to avoid the formation of a vortex that may form dispersed droplets. The WAF and the overlying condensate layer were allowed to settle for 1 hour before the underlying WAF was siphoned off into clean glass bottles and tested on the day of preparation.

The WAFs were prepared in general accordance with CONSERF procedures (Singer *et al*., 2000), the principal departure being the individual WAFs were not prepared for each test treatment. After consideration, it was determined that a dilution of a single or combined WAF was to be undertaken to prepare test solutions for each toxicity test. The results reported herein are for toxicity tests where dilutions were prepared from a WAF at a mixing ratio of 1 part condensate: 9 parts filtered seawater.

The bioassays were performed at the ESA laboratory in Lane Cove, NSW. This report describes the results of each of the toxicity tests performed. Test reports for each test performed are given in **Appendices C to J**. The statistical printouts from the Toxcalc

analytical software for each test are given in **Appendices K** to **R**. Toxicity tests reported herein were undertaken in September to October 2015.

The toxicity test endpoints reported herein are expressed as loading rate of condensate (expressed in terms of grams of condensate/L), and as Total Recoverable Hydrocarbon (TRH, total of C6-C36) determined by subcontracted chemical analyses of each test treatment. Sub-samples of the test treatments (ie dilutions of each WAF) were sent by same-day express courier to Envirolab Services Pty Ltd, Chatswood NSW. The analytical report for the TRH analyses is provided in **Appendix B** of this report.

3. 1-hr Sea Urchin Fertilisation Test

3.1 Summary of Test Methodology

The 1-hr sea urchin fertilisation test using the gametes of *Heliocidaris tuberculata* was undertaken in accordance with ESA Standard Operating Procedure 104, which is based on methods described by USEPA method 1008 (2002) and Environment Canada (1992), ASRM (1995) and APGHA (1998), modified for use by Simon and Langistera (1996) and adapted for use with *H. tuberculata* by Simon and Laginestra (1997). Tests were performed in a constant temperature chamber of 20±1°C with a 16:8h light: dark photoperiod for the entire exposure. Clean seawater was collected from the Sydney region and filtered to 0.45µm on return to the laboratory. Sea urchins used for the tests were obtained by field collection from South Maroubra, NSW and spawned within 6-hr of collection.

The definitive test reported here was initiated on 10 September 2015. The tests were undertaken in 9mL borosilicate glass tissue culture tubes, with four replicate tubes per treatment. A filtered seawater (FSW) control and a Water Accommodated Fraction (WAF) control were tested concurrently with the prepared WAF.

The pH, salinity and dissolved oxygen concentration of a representative sample from each concentration/treatment was measured. Salinity was measured using a WTW Cond330 salinity/conductivity meter with a WTW Tetracon 325 probe. The pH was measured using a WTW pH330 meter with a WTW SenTix 41 electrode. Dissolved oxygen was measured using a WTW Oxi 330 Oximeter, with a WTW CellOx 325 probe. Sub-samples for TRH (Total Recoverable Hydrocarbons, C6-C36), PAHs (Polycyclic aromatic hydrocarbons) and BTEX (benzene, toluene, ethylbenzene, and xylenes) were collected for each WAF dilution and controls and stored at 4°C in the dark until it was determined that the corresponding toxicity tests met QA criteria, upon which samples were forwarded to Envirolab Services Pty Ltd by same-day express courier.

Sperm were exposed to each of the test treatments for 1 hour, after which eggs were added to the test solutions and incubated with the sperm for 20 minutes. The test was then terminated by the addition of buffered formalin. One milliliter of test solution was drawn directly from the bottom of each test vessel and placed in a Sedgwick-Rafter counting chamber. The first 100 eggs were examined and the number of fertilised eggs was recorded. Toxicity test end-points were determined using loading rates and TRH concentrations. The loading rate and TRH concentration of WAF resulting in reductions in fertilisation to 10% and 50% of the test population (1-hr EL and EC values) was determined by either Maximum Liklihood Probit or Trimmed Spearman Karber or Probit Method using Toxcalc v5.0 software. The loading rate and TRH concentration causing no significant toxicity (No Observed Effect Loading Rate/Concentration – NOEL/NOEC), and the lowest loading rate causing significant toxicity (Lowest Observed Effect Loading Rate/Concentration – LOEL/LOEC) were determined by performing a Dunnett's or non-parametric test, depending on the data being normally distributed and homoscedastic.

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Table 3.1. Summary of test conditions for the sea urchin fertilisation test

Test species	Sea urchin *Heliocidaris tuberculata*
Test type	Static, non-renewal
Test duration	1-hour
Test end-point	Fertilisation
Test temperature	20±1°C
Test salinity	35±1‰
Test chamber size / volume	5mL in 9 mL tissue culture tube
Source of test organisms	Field collection, Sydney coastal region
Test concentrations	WAF dilutions of 100, 50, 25, 12.5 and 6.3% or lower
Test acceptability criteria	≥70% fertilisation in controls, reference toxicant results within prescribed range

To test the relative sensitivity of the test organisms and the proficiency of the Laboratory Technician, a separate positive control test was conducted using copper. The test was performed in the same manner as the test with the WAF. The results of the reference toxicant test were compared with the results from previous testing using a control chart.

3.2 Results

The results for the WAF of the Barossa Field Condensate using the sea urchin fertilisation test are summarised in **Table 3.2** below. The mean and standard deviation of the responses of test organisms to each test treatment are given in the summary reports given in **Appendix C**. The statistical output from the Toxcalc statistical analyses are given in **Appendix K**.

Table 3.2. The 1-hr EL/EC10 and EL/EC50 (with 95% confidence limits), NOEL/NOEC and LOEL/NOEC (based on loading rates and TRH concentrations) for Water Accommodated Fractions (WAFs) of the Barossa Field Condensate sample using the sea urchin fertilisation success test.

Sample	1-hr EL/EC10	1-hr EL/EC50	NOEL/ NOEC	LOEL/ LOEC
Barossa Field Condensate – Loading rate (g/L)	14.6*	18.6 (8.97-19.12)	0.6	1.2
Barossa Field Condensate – TRH concentration (µg/L)	9206.2 (7702.42-10203.00)	13202.7 (12495.20-13763.40)	350	720

*95% confidence limits are not reliable

Based on the loading rate, the WAF of the Barossa Field Condensate had an EL10, EL50, NOEL and LOEL of 14.6, 18.6 (8.97-19.12), 0.6 and 1.2g/L, respectively. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 9206.2 (7702.42-10203.00), 13202.7 (12495.20-13763.40), 350 and 720µg/L, respectively.

The WAF control was not toxic to sea urchin fertilisation.

3.3 Quality Assurance

The sea urchin fertilisation test undertaken with the pepared WAF met all quality assurance criteria. The mean percentage of fertilised eggs in the laboratory control in the test was 78.8%, exceeding the minimum control criteria of 70%. Water quality parameters were also within test acceptability ranges.

The 1-hr EC50 estimate for the copper reference toxicant tests run concurrently with the WAF sample fell within the reference toxicant cusum chart control limits (**Table 3.3**). This indicated that the toxicity test was within the expected range with respect to performance and sensitivity.

Table 3.3 The Quality Assurance limits for the sea urchin fertilisation test.

QA Measure	Criterion	This Test
Control % normally developed	$\geq$ 70%	78.8%
Reference toxicant EC50	23.7-105.6µg Cu/L	26.7µg Cu/L

4. 72-hr Sea Urchin Larval Development Test

4.1 Summary of Test Methodology

The 72-hr sea urchin larval development test using the fertilised eggs of *Heliocidaris tuberculata* was undertaken in accordance with ESA Standard Operating Procedure 105, which is based on methods described by ASTM (1995) and APHA (1998), and adapted for use with *H. tuberculata* by Simon and Laginestra (1997) and Doyle *et al*. (2002). Tests were performed in a constant temperature chamber of 20±1°C with a 16:8h light: dark photoperiod for the entire 72-hr exposure. Clean seawater was collected from the Sydney region and filtered to 0.45μm on return to the laboratory. Sea urchins used for the tests were obtained by field collection from South Maroubra, NSW and spawned within 6-hr of collection.

The definitive test reported here was initiated on 10 September 2015. The tests were undertaken in 9mL borosilicate glass tissue culture tubes, with four replicate tubes per treatment. A filtered seawater (FSW) control and a Water Accommodated Fraction (WAF) control were tested concurrently with the prepared WAF.

The pH, salinity and dissolved oxygen concentration of a representative sample from each concentration/treatment was measured. Salinity was measured using a WTW Cond330 salinity/conductivity meter with a WTW Tetracon 325 probe. The pH was measured using a WTW pH330 meter with a WTW SenTix 41 electrode. Dissolved oxygen was measured using a WTW Oxi 330 Oximeter, with a WTW CellOx 325 probe. Sub-samples for TRH (Total Recoverable Hydrocarbons, C6-C36), PAHs (Polycyclic aromatic hydrocarbons) and BTEX (benzene, toluene, ethylbenzene, and xylenes) were collected for each WAF dilution and controls and stored at 4°C in the dark until it was determined that the corresponding toxicity tests met QA criteria, upon which samples were forwarded to Envirolab Services Pty Ltd by same-day express courier.

Fertilised eggs were exposed to each of the test treatments for 72 hours, after which the test was terminated by the addition of buffered formalin. One milliliter of test solution was drawn directly from the bottom of each test vessel and placed in a Sedgwick-Rafter counting chamber. The first 100 larvae were examined and the number of normally developed larvae was recorded. Toxicity test end-points were determined using loading rates and TRH concentrations. The loading rate and TRH concentration of WAF resulting in reductions in normal development to 10% and 50% of the test population (72-hr EL and EC values) was determined by either Maximum Liklihood Probit or Trimmed Spearman Karber or Probit Method using Toxcalc v5.0 software. The loading rate and TRH concentration causing no significant toxicity (No Observed Effect Loading Rate/Concentration – NOEL/NOEC), and the lowest loading rate causing significant toxicity (Lowest Observed Effect Loading Rate/Concentration – LOEL/LOEC) were determined by performing a Dunnett's or non-parametric test, depending on the data being normally distributed and homoscedastic.

Table 4.1. Summary of test conditions for the sea urchin larval development test

Test species	Sea urchin *Heliocidaris tuberculata*
Test type	Static, non-renewal
Test duration	72-hour
Test end-point	Normal pluteus larvae
Test temperature	20±1°C
Test salinity	35±1‰
Test chamber size / volume	5mL in 9 mL tissue culture tube
Source of test organisms	Field collection, Sydney coastal region
Test concentrations	WAF dilutions of 100, 50, 25, 12.5 and 6.3% or lower
Test acceptability criteria	≥70% normal larvae in controls, reference toxicant results within prescribed range

To test the relative sensitivity of the test organisms and the proficiency of the Laboratory Technician, a separate positive control test was conducted using copper. The test was performed in the same manner as the test with the WAF. The results of the reference toxicant test were compared with the results from previous testing using a control chart.

4.2 Results

The results for the WAF of the Barossa Field Condensate using the sea urchin larval development test are summarised in **Table 4.2** below. The mean and standard deviation of the responses of test organisms to each test treatment are given in the summary reports given in **Appendix D**. The statistical output from the Toxcalc statistical analyses are given in **Appendix L**.

Table 4.2. The 72-hr EL/EC10 and EL/EC50 (with 95% confidence limits), NOEL/NOEC and LOEL/NOEC (based on loading rates and TRH concentrations) for Water Accommodated Fractions (WAFs) of the Barossa Field Condensate sample using the sea urchin larval development test.

Sample	72-hr EL/EC10	72-hr EL/EC50	NOEL/ NOEC	LOEL/ LOEC
Barossa field condensate – Loading rate (g/L)	21.0 (18.90-22.76)	26.5 (24.67-28.01)	19.3	38.6
Barossa field condensate – TRH concentration (µg/L)	15481.6 (13727.10-16947.80)	20104.4 (18575.70-21450.10)	14060	30860

Based on the loading rate, the WAF of the Barossa Field Condensate had an EL10, EL50, NOEL and LOEL of 21.0 (18.90-2276), 26.5 (24.67-28.01), 19.3 and 38.6g/L, respectively. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 15481.6 (13727.10-16947.80), 20104.4 (18575.70-21450.10), 14060 and 30860µg/L, respectively.

The WAF control was not toxic to sea urchin larvae.

4.3 Quality Assurance

The sea urchin larval development test undertaken with the prepared WAF met all quality assurance criteria. The mean percentage of normal pluteus larvae in the laboratory control in the test was 80.8%, exceeding the minimum control criteria of 70%. Water quality parameters were also within test acceptability ranges.

The 72-hr EC50 estimate for the copper reference toxicant tests run concurrently with the WAF sample fell within the reference toxicant cusum chart control limits (**Table 4.3**). This indicated that the toxicity test was within the expected range with respect to performance and sensitivity.

Table 4.3 The Quality Assurance limits for the sea urchin larval development test.

QA Measure	Criterion	This Test
Control % normally developed	≥ 70%	80.8%
Reference toxicant EC50	10.5-23.1µg Cu/L	12.2µg Cu/L

5. 48-hr Oyster Larval Development Test

5.1 Summary of Test Methodology

The 48-hr larval development toxicity test using the larvae of the milky oyster *Saccostrea echinata* was undertaken in accordance with ESA Standard Operating Procedure 106, which is based on methods described by USEPA (1996) and APHA (1998), with *S. glomerata* by Krassoi (1995). Tests were performed in a constant temperature chamber of 29±1°C with a 16:8h light: dark photoperiod for the entire 48-hr exposure. Clean seawater was collected from the Sydney region and filtered to 0.45μm on return to the laboratory. Oysters used for the tests were obtained from a rocky shore oyster lease in Mackay, QLD.

The definitive test reported here was initiated on 10 September 2015. The tests were undertaken in 9mL borosilicate glass tissue culture vials, with four replicate vials per treatment. A filtered seawater (FSW) control and a Water Accommodated Fraction (WAF) control were tested concurrently with the prepared WAF.

Oysters were spawned by gonad stripping. Viable gametes were selected on the basis of fertilisation success trials and visual examination of gamete maturity. The eggs were fertilised by adding spermatozoa to the egg suspension.

The pH, salinity and dissolved oxygen concentration of a representative sample from each concentration/treatment was measured. Salinity was measured using a WTW Cond330 salinity/conductivity meter with a WTW Tetracon 325 probe. The pH was measured using a WTW pH330 meter with a WTW SenTix 41 electrode. Dissolved oxygen was measured using a WTW Oxi 330 Oximeter, with a WTW CellOx 325 probe. Sub-samples for TRH (Total Recoverable Hydrocarbons, C6-C36), PAHs (Polycyclic aromatic hydrocarbons) and BTEX (benzene, toluene, ethylbenzene, and xylenes) were collected for each WAF dilution and controls and stored at 4°C in the dark until it was determined that the corresponding toxicity tests met QA criteria, upon which samples were forwarded to Envirolab Services Pty Ltd by same-day express courier.

Fertilised eggs were exposed to each test treatment for 48 hours after which a formalin solution was added to each vessel. One mL of test solution was drawn directly from the bottom of each test vessel and placed in a Sedgwick-Rafter counting chamber. The first 100 oyster larvae were examined and the number of normal and abnormal D-veliger larvae was recorded. Toxicity test end-points were determined using loading rates and TRH concentrations. The loading rate and TRH concentration of WAF resulting in reductions in normal development to 10% and 50% of the test population (48-hr EL and EC values) was determined by either Maximum Liklihood Probit or Trimmed Spearman Karber or Probit Method using Toxcalc v5.0 software. The loading rate and TRH concentration causing no significant toxicity (No Observed Effect Loading Rate/Concentration – NOEL/NOEC), and the lowest loading rate causing significant toxicity (Lowest Observed Effect Loading Rate/Concentration – LOEL/LOEC) were determined by performing a Dunnett's or non-parametric test, depending on the data being normally distributed and homoscedastic.

Table 5.1. Summary of test conditions for the milky oyster larval development test

Test species	Milky oyster *Saccostrea echinata*
Test type	Static, non-renewal
Test duration	48 hours
Test end-point	Larval development to D-veliger stage
Test temperature	29±1°C
Test salinity	35±1‰
Test chamber size / volume	5mL in 9 mL tissue culture tube
Source of test organisms	Oyster farms, Mackay QLD
Test concentrations	WAF dilutions of 100, 50, 25, 12.5 and 6.3% or lower
Test acceptability criteria	>70% normally developed larvae in controls, reference toxicant results within prescribed range

To test the relative sensitivity of the test organisms and the proficiency of the Laboratory Technician, a separate positive control test was conducted, using copper. The test was performed in the same manner as for the test with the WAF. The results of this test were compared with the results from previous testing using a control chart.

5.2 Results

The results for the WAF of the Barossa Field Condensate using the milky oyster larval development test are summarised in **Table 5.2** below. The mean and standard deviation of the responses of test organisms to each test treatment are given in the summary reports given in **Appendix E**. The statistical output from the Toxcalc statistical analyses are given in **Appendix M**.

Table 5.2. The 48-hr EL/EC10 and EL/EC50 (with 95% confidence limits), NOEL/NOEC and LOEL/NOEC (based on loading rates and TRH concentrations) for Water Accommodated Fractions (WAFs) of the Barossa Field Condensate sample using the sea urchin larval development test.

Sample	48-hr EL/EC10	48-hr EL/EC50	NOEL/ NOEC	LOEL/ LOEC
Barossa Field Condensate – Loading rate (g/L)	15.7 (11.78-18.35)	24.7 (24.11-25.32)	9.7	19.3
Barossa Field Condensate – TRH concentration (µg/L)	11478.4 (9026.54-13230.50)	18747.2 (18266.80-19240.30)	7160	14060

Based on the loading rate, the WAF of the Barossa Field Condensate sample had an EL10, EL50, NOEL and LOEL 15.7 (11.78-18.35), 24.7 (24.11-25.32), 9.7 and 19.3g/L, respectively. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 11478.4 (9026.54-13230.50), 18747.2 (18266.80-19240.30), 7160 and 14060µg/L, respectively.

The WAF control was not toxic to the oyster larvae.

5.3 Quality Assurance

The milky oyster larval development toxicity test met all quality assurance criteria. The mean percentage of normally developed D-veliger larvae in the filtered seawater controls in the test was 74.5%, which exceeded the minimum control criteria of 70%. Water quality parameters for control samples were also within test acceptability ranges.

The 48-hr EC50 estimates for the copper reference toxicant tests run concurrently with the prepared WAF fell within the reference toxicant cusum chart control limits (**Table 5.3**). This indicated that the toxicity tests were within the expected range with respect to performance and sensitivity.

Table 5.3. Quality Assurance limits for the 48-hr milky oyster larval development test.

QA Measure	Criterion	This Test
Control % normally developed	≥ 70%	74.5%
Reference toxicant EC50	10.2-20.0µg Cu/L	14.5µg Cu/L

6. 72-hr Micro-Algal Growth Inhibition Test

6.1 Summary of Test Methodology

The 72-hr micro-algal growth inhibition (cell yield) test using Isochrysis *aff. galbana* was undertaken in accordance with ESA Standard Operating Procedure 110 which is based on methods described by Stauber *et al*. (1994). Tests were performed in a constant temperature of 29±1°C. Clean seawater was collected from the Sydney region and filtered to 0.45μm on return to the laboratory. *Isochrysis* used for the tests were obtained from the CSIRO Marine Algal Supply Service, Hobart and cultured in the ESA laboratory using Guillards F/2 culture media.

The definitive test reported here was initiated on 11 September 2015. Guillards F/2 nutrient stock solutions were added to each of the WAF treatments and control treatment at a quarter of the usual concentration added to algal culture media so as to provide the minimum nutrients required for micro-algal growth. The tests were undertaken in 20mL borosilicate glass scintillation vials containing 10mL of test solution, with four replicate vials per treatment. A filtered seawater (FSW) control and a Water Accommodated Fraction (WAF) control were tested concurrently with the prepared WAF.

Micro-algae used to inoculate the test vessels were first concentrated from cultures in log-growth phase by centrifugation, and then re-suspended using dilution water. This process was repeated a second time to remove all traces of original culture medium. The density of the micro-algae was determined using a haemocytometer, and test vessels were inoculated with the micro-algae such that the final concentration at t=0 was 10,000 cells/ml. The test vessels were incubated for 72-hr in a constant temperature cabinet equipped with cool-white fluorescent tubes to provide 4440-8880 Lux lighting on a 12:12 light:dark cycle.

The pH and salinity of a representative sample from each concentration/treatment was measured. Salinity was measured using a WTW Cond330 salinity/conductivity meter with a WTW Tetracon 325 probe. The pH was measured using a WTW pH330 meter with a WTW SenTix 41 electrode. Sub-samples for TRH (Total Recoverable Hydrocarbons, C6-C36), PAHs (Polycyclic aromatic hydrocarbons) and BTEX (benzene, toluene, ethylbenzene, and xylenes) were collected for each WAF dilution and controls and stored at 4°C in the dark until it was determined that the corresponding toxicity tests met QA criteria, upon which samples were forwarded to Envirolab Services Pty Ltd by same-day express courier

At the end of the incubation period, algal density for each replicate vial was determined by measuring absorbance at 750nm using a spectrophotometer. The algal counts were recorded as the number of cells per mL based on a standard curve of cell density against absorbance at 750nm. Toxicity test end-points were determined using loading rates and TRH concentrations. The loading rate and TRH concentration of WAF resulting in inhibition of growth to 10% and 50% of the test population (72-hr IL and IC values) was determined by the Non-Linear Interpolation Method using Toxcalc v5.0 software. The loading rate and TRH concentration causing no significant toxicity (No Observed Effect Loading Rate/Concentration – NOEL/NOEC), and the lowest loading rate causing significant toxicity (Lowest Observed Effect Loading Rate/Concentration – LOEL/LOEC) were determined by performing a Dunnett's or non-parametric test, depending on the data being normally distributed and homoscedastic.

Table 6.1 Summary of test conditions for the micro-algal growth inhibition test

Test species	*Isochrysis aff. galbana* (Tahitian isolate)
Test type	Static, non-renewal
Test duration	72-hour
Test end-point	Cell yield (density)
Test temperature	29 ± 1°C
Test salinity	35 ± 1‰
Test chamber size / volume	10mL in 20mL scintillation vials
Source of test organisms	Laboratory culture
Test concentrations	WAF dilutions of 100, 50, 25, 12.5 and 6.3% or lower
Test acceptability criteria	>160,000 cells/mL in controls, reference toxicant results within prescribed range, CV <20% for control replicates

To test the relative sensitivity of the test organisms and the proficiency of the Laboratory Technician, a positive (toxic) control test was conducted using copper. The test was performed in the same manner as the WAF test. The results of this test were compared with the results from previous testing using a control chart.

6.2 Results

The results for the WAF of the Barossa Field condensate using the micro-algal growth inhibition assay are summarised in **Table 6.2** below. The mean and standard deviation of the responses of test organisms to each test treatment are given in the summary reports given in **Appendix F**. The statistical output from the Toxcalc statistical analyses are given in **Appendix N.**

Table 6.2. The 72-hr IL/IC10 and IL/IC50 (with 95% confidence limits), NOEL/NOEC and LOEL/NOEC (based on loading rates and TRH concentrations) for Water Accommodated Fractions (WAFs) of the Barossa Field Condensate sample using the micro-algal growth inhibition test.

Sample	72-hr IL/IC10	72-hr IL/IC50	NOEL/ NOEC	LOEL/ LOEC
Barossa Field Condensate – Loading rate (g/L)	6.4 (2.18-10.68)	12.6 (7.45-15.09)	9.7	19.3
Barossa Field Condensate – TRH concentration (µg/L)	4355.2 (1641.13-7401.38)	8529.3 (5094.77-10126.00)	6670	12850

Based on the loading rate, the WAF of the Barossa Field Condensate had an IL10, IL50, NOEL and LOEL of 6.4 (2.18-10.68), 12.6 (7.45-15.09), 9.7 and 19.3g/L,

respectively. Expressed as TRH concentration, the corresponding IC10, IC50, NOEC and LOEC were 4355.2 (1641.13-7401.38), 8529.3 (5094.77-10126.00), 6670 and 12850µg/L, respectively.

The WAF control was not toxic to the micro-alga.

6.3 Quality Assurance

The microalgal growth inhibition test undertaken with the prepared WAF met all quality assurance criteria for the test. The mean cell density per 1mL in the filtered seawater control treatment in the test was 212 000, exceeding the minimum control criteria of 160,000 cells/mL. The coefficient of variation was 16.0% and below the criteria of ≤20%. Water quality parameters for control samples were also within test acceptability ranges.

The 72-hr IC50 estimate for the copper reference toxicant test run concurrently with the WAF test fell within the reference toxicant cusum chart control limits (**Table 6.3**). This indicated that the toxicity test was within the expected range with respect to performance and sensitivity.

Table 6.3 The Quality Assurance limits for the marine microalga *I.galbana* growth inhibition test.

QA Measure	Criterion	This Test
Control density x 10^4 cells/mL	16.0	21.2
Control coefficient of variation	<20%	16.0%
Reference toxicant Cusum limits	15.1-46.7µg Cu/L	19.0µg Cu/L

7. 14-d Macro-Alagl Growth Toxicity Test

7.1 Summary of Test Methodology

The 14-day growth toxicity test using the zoospores of the brown kelp *Ecklonia radiata* was undertaken in accordance with ESA Standard Operating Procedure 116, which is based on methods described by Bidwell *et al*. (1998) and Burridge *et al*. (1999). The test was extended to 14 days to encompass the growth endpoint. Tests were performed in a constant temperature chamber of 18±1°C with ambient laboratory lumination for the entire 14-d exposure. Clean seawater was collected from the Sydney region and filtered to 0.45μm on return to the laboratory.

The definitive test reported here was initiated on 10 September 2015. The test was undertaken in 9mL borosilicate glass tissue culture petri dishes, with four replicate vials per treatment. A filtered seawater (FSW) control and a Water Accommodated Fraction (WAF) control were tested concurrently with the prepared WAF.

Kelp used for the test was obtained from Mercury Passage, Tasmania and shipped via overnight freight to the ESA laboratory. The kelp was induced to spawn using temperature shock. A concentrated suspension of motile zoospores a density of 20,000 – 75,000 zoospores/mL was prepared in FSW, using a haemocytometer. The zoospore suspension was added to the test vessels and allowed to settle on to cover slips placed on the bottom of the test vessels for 1 hour, before the excess FSW was pipetted from the dishes, and the WAF sample and controls pipetted in. After the sample had been added to the test vessels, the petri dishes were arranged randomly in a temperature controlled chamber for the duration of the test.

The pH, salinity and dissolved oxygen concentration of a representative sample from each concentration/treatment was measured. Salinity was measured using a WTW Cond330 salinity/conductivity meter with a WTW Tetracon 325 probe. The pH was measured using a WTW pH330 meter with a WTW SenTix 41 electrode. Dissolved oxygen was measured using a WTW Oxi 330 Oximeter, with a WTW CellOx 325 probe. Sub-samples for TRH (Total Recoverable Hydrocarbons, C6-C36), PAHs (Polycyclic aromatic hydrocarbons) and BTEX (benzene, toluene, ethylbenzene, and xylenes) were collected for each WAF dilution and controls and stored at 4°C in the dark until it was determined that the corresponding toxicity tests met QA criteria, upon which samples were forwarded to Envirolab Services Pty Ltd by same-day express courier.

After 14 days exposure, each cover slip containing the settled zoospores was drawn directly from the bottom of each petri dish and placed on a clean microscope slide. The first 10 individuals were examined under 400x magnification and photographed. The length of the gametophyte was recorded. The average length of the 10 gaemetophyte were calculated for each replicate. Toxicity test end-points were determined using loading rates and TRH concentrations. The loading rate and TRH concentration of WAF resulting in reductions in growth to 10% and 50% of the test population (14-d IL and IC values) was determined by the Non-Linear Interpolation Method using Toxcalc v5.0 software. The loading rate and TRH concentration causing no significant toxicity (No Observed Effect Loading Rate/Concentration – NOEL/NOEC), and the lowest loading rate causing significant toxicity (Lowest Observed Effect Loading Rate/Concentration – LOEL/LOEC) were determined by performing a Dunnett's or non-parametric test, depending on the data being normally distributed and homoscedastic.

Table 7.1. Summary of test conditions for the macro-algal growth germination test

Test species	Brown kelp *Ecklonia Radiata*
Test type	Static, non-renewal
Test duration	14 days
Test end-point	Growth of gametophyte
Test temperature	18 ± 1ºC
Test salinity	35±1‰.
Test chamber size / volume	5mL in 9 mL petri dish
Source of test organisms	Mercury Passage, Tasmania
Test concentrations	WAF dilutions of 100, 50, 25, 12.5 and 6.3% or lower
Test acceptability criteria	>70% of zoospores germinated in controls after 72 hours, reference toxicant results within prescribed range

To test the relative sensitivity of the test organisms and the proficiency of the Laboratory Technician, a separate positive (toxic) control test was conducted, using copper. The test was performed in the same manner as for the test with the WAF. The results of this test were compared with the results from previous testing using a control chart.

7.2 Results

The results for the WAF of the Barossa Field Condensate using the macro-algal growth test are summarised in **Table 7.2** below. The mean and standard deviation of the responses of test organisms to each test treatment are given in the summary reports given in **Appendix G**. The statistical output from the Toxcalc statistical analyses are given in **Appendix O**.

Table 7.2. The 14-d IL/IC10 and IL/IC50 (with 95% confidence limits), NOEL/NOEC and LOEL/NOEC (based on loading rates and TRH concentrations) for Water Accommodated Fractions (WAFs) of the Barossa Field Condensate sample using the macro-algal growth test.

Sample	14-d IL/IC10	14-d IL/IC50	NOEL/ NOEC	LOEL/ LOEC
Barossa Field Condensate – Loading rate (g/L)	2.7*	64.8*	2.4	4.8
Barossa Field Condensate – TRH concentration (µg/L)	1873.9*	57196.9*	1673	3180

*95% confidence limits are not reliable

Based on the loading rate, the WAF of the Barossa Field Condensate had an IL10, IL50, NOEL and LOEL of 2.7, 64.8, 2.4 and 4.8g/L, respectively. Expressed as TRH

concentration, the corresponding IC10, IC50, NOEC and LOEC were 1873.9, 57196.9, 1673 and 3180µg/L, respectively.

The WAF control was not toxic to the zoospores.

7.3 Quality Assurance

The macro-algal growth toxicity test met all quality assurance criteria. The mean percentage of germinated zoospores after 72 hours in the filtered seawater controls was 90.3%, which exceeded the minimum control criteria of 70.0%. Water quality parameters for the control sample were also within test acceptability ranges.

The 72-hr EC50 estimate for the copper reference toxicant test run concurrently with the WAF sample fell within the reference toxicant cusum chart control limits (**Table 7.3**). This indicated that the toxicity test was within the expected range with respect to performance and sensitivity.

Table 7.3. Quality Assurance limits for the 72-hr macro-algal germination test.

QA Measure	Criterion	This Test
Control % spore germination	≥ 70%	90.3%
Reference toxicant EC50	86.0-1262.1µg Cu/L	408.5µg Cu/L

8. 8-day Sea Anemone Toxicity Test

8.1 Summary of Test Methodology

The 8-day toxicity test using the sea anemone *Aiptasia pulchella* was undertaken in accordance with ESA Standard Operating Procedure 128, which is based on general methods described by the Howe *et al.* (2014). Tests were performed in a constant temperature chamber at m25±1°C with a 16:8h light: dark photoperiod for the entire 96-hr exposure. Clean seawater was collected from the Sydney region and filtered to 0.45μm on return to the laboratory. Pedal lacerates were sourced from in-house laboratory cultures.

The definitive tests reported here were initiated on 27 October 2015. The tests were undertaken in 100 mL borosilicate glass beakers containing 80mL of test solution. WAFs were prepared for the condensate sample and tested using 3 replicate beakers. A filtered seawater (FSW) control and a Water Accommodated Fraction (WAF) control were tested concurrently with the prepared WAF.

The pH, salinity and dissolved oxygen concentration of a representative sample from each concentration/treatment was measured. Salinity was measured using a WTW Cond330 salinity/conductivity meter with a WTW Tetracon 325 probe. The pH was measured using a WTW pH330 meter with a WTW SenTix 41 electrode. Dissolved oxygen was measured using a WTW Oxi 330 Oximeter, with a WTW CellOx 325 probe. Sub-samples for TRH (Total Recoverable Hydrocarbons, C6-C36), PAHs (Polycyclic aromatic hydrocarbons) and BTEX (benzene, toluene, ethylbenzene, and xylenes) were collected for each WAF dilution and controls and stored at 4°C in the dark until it was determined that the corresponding toxicity tests met QA criteria, upon which samples were forwarded to Envirolab Services Pty Ltd by same-day express courier.

A. pulchella pedal lacerates were isolated from in-house laboratory cultures at random and 5 lacerates were placed into each test vessel containing FSW using a Pasteur pipette. Lacerates were allowed to acclimate and re-attach to the test vessel before test solutions were placed in each beaker. The beakers were covered with cling-wrap film to minimise evaporation of test solutions. The sea anemones were observed at on three occasions during the test period and the number of surviving sea anemones were recorded.

After 8 days, the number of surviving and normally developed juvenile sea anemones and physico-chemical parameters recorded. Toxicity test end-points were determined using loading rates and TRH concentrations. The loading rate and TRH concentration of WAF resulting in reductions in normal development to 10% and 50% of the test population (48-hr EL and EC values) was determined by either Maximum Liklihood Probit or Trimmed Spearman Karber or Probit Method using Toxcalc v5.0 software. The loading rate and TRH concentration causing no significant toxicity (No Observed Effect Loading Rate/Concentration – NOEL/NOEC), and the lowest loading rate causing significant toxicity (Lowest Observed Effect Loading Rate/Concentration – LOEL/LOEC) were determined by performing a Dunnett's or non-parametric test, depending on the data being normally distributed and homoscedastic.

Table 8.1. Summary of test conditions for the 8-d sea anemone toxicity test

Test species	Sea anemone *Aptasia pulchella*
Test type	Static, non-renewal
Test duration	8 days
Test end-point	Normally developed juveniles
Test temperature	25±1°C
Test salinity	35±1‰
Test chamber size / volume	80mL in 100mL borosilicate glass beakers
Source of test organisms	In-house laboratory culture
Test concentrations	WAF dilutions of 100, 50, 25, 12.5 and 6.3% or lower
Test acceptability criteria	>90% developed in controls, reference toxicant results within prescribed range

To test the relative sensitivity of the test organisms and the proficiency of the Laboratory Technician, a separate positive control test was conducted using copper. The test was performed in the same manner as for the test conducted with the WAF sample. The results of this test were compared with the results from previous testing using a control chart.

8.2 Results

The results for the WAF of the Barossa Field Condensate using the sea anemone development toxicity tests are summarised in **Table 8.2** below. The mean and standard deviation of the responses of test organisms to the test treatment are given in the summary reports given in **Appendix H**. The statistical output from the Toxcalc statistical analyses are given in **Appendix P**.

Table 8.2. The 8-d EL/EC10 and EL/EC50 (with 95% confidence limits), NOEL/NOEC and LOEL/NOEC (based on loading rates and TRH concentrations) for Water Accommodated Fractions (WAFs) of the Barossa Field Condensate sample using the sea anemone *A. pulchella* toxicity test.

Sample	8-d EL/EC10	8-d EL/EC50	NOEL/ NOEC	LOEL/ LOEC
Barossa Field Condensate – Loading rate (g/L)	11.2*	40.1 (31.78-50.60)	38.6	77.2
Barossa Field Condensate – TRH concentration (µg/L)	8862.4*	30720.0 (23961.00-39385.50)	28040	63990

*95% confidence limits are not reliable

Based on the loading rate, the WAF of the Barossa Field Condensate had an EL10, EL50, NOEL and LOEL of 11.2, 40.1 (31.78-50.60), 38.6 and 77.2g/L, respectively. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 8862.4, 30720.0 (23961.00-39385.50), 28040, 63990µg/L, respectively.

The WAF control was not toxic to the sea anemone.

8.3 Quality Assurance

The 8-d sea anemone development test undertaken with the WAF sample met all quality assurance criteria. The mean percentage normally developed in the laboratory controls in the test was 100%, meeting the minimum control normally developed criteria of ≥90%. Water quality parameters for control samples were also within test acceptability ranges (**Table 8.3**).

Table 8.3. Quality Assurance limits for the 8-d sea anemone *A. pulchella* test.

QA Measure	Criterion	This Test
Control % normally developed	≥ 90%	100%
Reference toxicant Cusum limits	n/a*	11.5µg Cu/L

* Reference toxicant cusum chart limits are not available due to limited testing

9. 5-d Juvenile Copepodid Development Test

9.1 Summary of Test Methodology

The 5-day chronic toxicity test using the juvenile tropical copepod *Parvocalanus crassiostris* was undertaken in accordance with ESA Standard Operating Procedure 124, which is based on general methods described by the USEPA (2002) for marine crustaceans, and also following the methods described for the Australian copepod *Acartia sinjiensis* (Rose *et al.*, 2006) . Tests were performed in a constant temperature chamber of 28±1°C with a 16:8h light: dark photoperiod for the entire 5-d exposure. Clean seawater was collected from the Sydney region and filtered to 0.45µm on return to the laboratory. Freshly fertilised eggs used for testing were obtained from in-house laboratory cultures, originally sourced from the Queensland Department of Primary Industries Northern Fisheries Centre, Cairns QLD.

The definitive test reported here was initiated on 22 September 2015. The test was undertaken in 24-well polycarbonate tissue culture plates, where each well contained 4mL of test solution. WAFs were prepared for the condensate sample and tested using 4 replicate wells per concentration. A filtered seawater (FSW) control and a Water Accommodated Fraction (WAF) control were tested concurrently with the prepared WAF.

The pH, salinity and dissolved oxygen concentration of a representative sample from each concentration/treatment was measured. Salinity was measured using a WTW Cond330 salinity/conductivity meter with a WTW Tetracon 325 probe. The pH was measured using a WTW pH330 meter with a WTW SenTix 41 electrode. Dissolved oxygen was measured using a WTW Oxi 330 Oximeter, with a WTW CellOx 325 probe. Sub-samples for TRH (Total Recoverable Hydrocarbons, C6-C36), PAHs (Polycyclic aromatic hydrocarbons) and BTEX (benzene, toluene, ethylbenzene, and xylenes) were collected for each WAF dilution and controls and stored at 4°C in the dark until it was determined that the corresponding toxicity tests met QA criteria, upon which samples were forwarded to Envirolab Services Pty Ltd by same-day express courier.

Freshly fertilised copepod eggs were isolated from 30L laboratory mass cultures. Eggs were triple rinsed in FSW to remove debris and ciliates from the water and eggs. Five eggs were transferred to each tissue culture well using a Pasteur pipette and a dissecting microscope. Once seeded, the tissue culture plates were transferred to the constant temperature chamber.

After five days exposure, the number of non-immobilised normally developed copepodids in each test well was counted under a dissecting microscope. Toxicity test end-points were determined using loading rates and TRH concentrations. The loading rate and TRH concentration of WAF resulting in reductions in normal development to 10% and 50% of the test population (48-hr EL and EC values) was determined by either Maximum Liklihood Probit or Trimmed Spearman Karber or Probit Method using Toxcalc v5.0 software. The loading rate and TRH concentration causing no significant toxicity (No Observed Effect Loading Rate/Concentration – NOEL/NOEC), and the lowest loading rate causing significant toxicity (Lowest Observed Effect Loading Rate/Concentration – LOEL/LOEC) were determined by performing a Dunnett's or non-parametric test, depending on the data being normally distributed and homoscedastic.

Table 9.1. Summary of test conditions for the 5-d copepodid development toxicity test

Test species	Calanoid copepod *Parvocalanus crassiostris*
Test type	Static, non-renewal
Test duration	5 day
Test end-point	Normally developed coepodids
Test temperature	28±1°C
Test salinity	35±1‰
Test chamber size / volume	4mL well in 24-well tissue culture plates
Feeding	Isochrysis @ 16,000 cells/ copepod daily
Source of test organisms	In-house laboratory culture
Test concentrations	WAF dilutions of 100, 50, 25, 12.5 and 6.3% or lower
Test acceptability criteria	>70% non-immobilised copepodids in controls, reference toxicant results within prescribed range where range determined

To test the relative sensitivity of the test organisms and the proficiency of the Laboratory Technician, a separate positive control test was conducted using copper. The test was performed in the same manner as for the test conducted with the WAF sample. The results of this test were compared with the results from previous testing using a control chart.

9.2 Results

The results for the WAF of the Barossa Field Condensate using the sea anemone development toxicity tests are summarised in **Table 9.2** below. The mean and standard deviation of the responses of test organisms to the test treatment are given in the summary reports given in **Appendix I**. The statistical output from the Toxcalc statistical analyses are given in **Appendix Q**.

Table 9.2. The 5-d EL/EC10 and EL/EC50 (with 95% confidence limits), NOEL/NOEC and LOEL/NOEC (based on loading rates and TRH concentrations) for Water Accommodated Fractions (WAFs) of the Barossa Field Condensate sample using the copepod *P. crassirostris* toxicity test.

Sample	5-d EL/EC10	5-d EL/EC50	NOEL/ NOEC	LOEL/ LOEC
Barossa Field Condensate – Loading rate (g/L)	1.0*^	12.2 (10.84-13.73)	9.7	19.3
Barossa Field Condensate – TRH concentration (µg/L)	27.2*^	10506.8 (9451.82-11679.80)	8560	15830

*95% confidence limits are not reliable
^calculated from extrapolated data

Based on the loading rate, the WAF of the Barossa Field condensate had an EL10, EL50, NOEL and LOEL of 1.0, 12.2 (10.84-13.73), 9.7 and 19.3g/L, respectively. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 27.2, 10506.9 (9451.82-11679.80), 8560 and 15830µg/L, respectively.

The WAF control was not toxic to the copepod.

9.3 Quality Assurance

The 5-d copepodid development test undertaken with the WAF samples met all quality assurance criteria. The mean percentage non-immobilised normally developed copepodids in the laboratory controls was 70%, meeting the minimum control criteria of ≥70%. Water quality parameters for the control were also within test acceptability ranges (**Table 9.3**).

Table 10.4. Quality Assurance limits for the 5-d tropical copepod test.

QA Measure	Criterion	This Test
Control % normal	≥ 70%	70.0%
Reference toxicant Cusum limits	n/a*	2.8µg Cu/L

* Reference toxicant cusum chart limits are not available due to limited testing

10. 7-day Fish Imbalance and Growth Test

10.1 Summary of Test Methodology

The 7-day toxicity test using juveniles of the barramundi *Lates calcarifer* was undertaken in accordance with ESA Standard Operating Procedure 122, which is based on methods described by USEPA (2002b). Research with invertebrates in the state of New South Wales is subject to the Animal Research Act, and the toxicity test with juvenile fish was performed by ESA under the Animal Research Authority issued to ESA by the Director-General of NSW Department of Primary Industries (valid from 28 July 2014 to 28 July 2017) and Certificate of Approval from the Animal Care and Ethics Committee of the Director-General of the NSW Department of Primary Industries (valid from 16 May 2014 and 16 May 2017).

The definitive test reported here was initiated on 22 September 2015. Juvenile fish of approximately 10-30 mm in length used for the tests were obtained from a commercial hatchery in South Australia. The juvenile fish were shipped same-day express in a foam box and fish were contained within an air inflated bag containing approximately 4 litres of seawater. Upon arrival at ESA, the fish were transferred to test room of 25°C and provided gentle aeration using a Schego air pump. Clean seawater for holding the fish was collected from the Sydney region and filtered to 0.45μm on return to the laboratory. The seawater was acclimated to 25°C prior to use.

Toxicity tests were undertaken in 600mL glass beakers containing 500mL of test solution, with 4 replicates per treatment. A filtered seawater (FSW) control and a Water Accommodated Fraction (WAF) control were tested concurrently with the prepared WAF of the fresh and weathered condensate.

The pH, salinity and dissolved oxygen concentration of a representative sample from each concentration/treatment was measured. Salinity was measured using a WTW Cond330 salinity/conductivity meter with a WTW Tetracon 325 probe. The pH was measured using a WTW pH330 meter with a WTW SenTix 41 electrode. Dissolved oxygen was measured using a WTW Oxi 330 Oximeter, with a WTW CellOx 325 probe. Sub-samples for TRH (Total Recoverable Hydrocarbons, C6-C36), PAHs (Polycyclic aromatic hydrocarbons) and BTEX (benzene, toluene, ethylbenzene, and xylenes) were collected for each WAF dilution and controls and stored at 4°C in the dark until it was determined that the corresponding toxicity tests met QA criteria, upon which samples were forwarded to Envirolab Services Pty Ltd by same-day express courier.

Five juvenile fish were randomly selected and introduced into each of the test beakers. The beakers were covered with cling-wrap film to minimise evaporation and placed in a constant temperature room of 25$\pm$1°C. The test vessels were monitored daily to examine fish for signs of distress or imbalance. Juvenile fish demonstrating such signs were to be removed and euthanased in accordance with ESA SOP 122. Test vessels were also routinely checked to ensure aeration was being provided.

The beakers were examined every 24 hours and the number of surviving and apparently healthy juvenile fish recorded. The test was terminated after 7 days, and the temperature, pH, salinity and dissolved oxygen concentration of a representative sample from each concentration/treatment was measured, as detailed above. At the termination of the test, the juvenile fish were euthanased by the addition of AQUI-S solution. The euthanized fish were then dried at 60ºC for 24 hours and then weighed.

Toxicity test end-points were determined using loading rates and TRH concentrations. The loading rate and TRH concentration of WAF resulting in reductions in unaffected fish and biomass to 10% and 50% of the test population (7-d EL and EC values) was determined by either Maximum Liklihood Probit, Trimmed Spearman Karber or Non-Linear Interpolation method using Toxcalc v5.0 software. The loading rate and TRH concentration causing no significant toxicity (No Observed Effect Loading Rate/Concentration – NOEL/NOEC), and the lowest loading rate causing significant toxicity (Lowest Observed Effect Loading Rate/Concentration – LOEL/LOEC) were determined by performing a Dunnett's or non-parametric test, depending on the data being normally distributed and homoscedastic.

Table 10.1 Summary of test conditions for the 7-day fish imbalance and growth test using *Lates calcarifer*

Test species	Barramundi *Lates calcarifer*
Test type	Static, non-renewal
Test duration	7 day
Test end-point	Imbalance, including survival, and biomass.
Test temperature	25 ± 1ºC
Test salinity	35 ± 2‰
Test chamber size / volume	500 mL in 600mL borosilicate glass beakers
Test Feeding	800 brine shrimp per fish, daily
Test concentrations	WAF dilutions of 100, 50, 25, 12.5 and 6.3% or lower
Source of test organisms	Hatchery reared, SA
Test acceptability criteria	≥80% survival in controls

To test the relative sensitivity of the test organisms and the proficiency of the Laboratory Technician, a separate positive control test was conducted using ammonium. The test was performed in the same manner as for the test conducted with the WAF sample. The results of this test were compared with the results from previous testing using a control chart.

10.2 Results

The results for the WAF of the fresh and weathered Barossa Field Condensate using the fish imbalance test are summarised in **Tables 10.2 and 10.3** below. The mean and standard deviation of the responses of test organisms to each test treatment are given in the summary reports given in **Appendix J**. The statistical output from the Toxcalc statistical analyses are given in **Appendix R**.

Table 10.2. The 7-d EL/EC10 and EL/EC50 (with 95% confidence limits), NOEL/NOEC and LOEL/NOEC (based on loading rates and TRH concentrations) for Water Accommodated Fractions (WAFs) of the Barossa Field Condensate sample using the Barramundi fish imbalance and growth test - Imbalance.

Sample	7-d EL/EC10	7-d EL/EC50	NOEL/ NOEC	LOEL/ LOEC
Barossa Field Condensate – Loading rate (g/L)	19.4 (13.58-23.28)	29.3 (24.71-34.66)	19.3	38.6
Barossa Field Condensate – TRH concentration (µg/L)	15875.5 (11275.40-18756.60)	23182.2 (19851.60-27226.80)	15830	29770
Weathered Barossa Field Condensate – Loading rate (g/L)	69.1*	>79.5	79.5	>79.5
Weathered Barossa Field Condensate – TRH concentration (µg/L)	19596.3*	>22480.0	22480	>22480

*95% confidence limits are not reliable/available

Table 10.3. The 7-d IL/IC10 and EL/EC50 (with 95% confidence limits), NOEL/NOEC and LOEL/NOEC (based on loading rates and TRH concentrations) for Water Accommodated Fractions (WAFs) of the Barossa Field Condensate sample using the Barramundi fish imbalance and growth test - Biomass.

Sample	7-d IL/IC10	7-d IL/IC50	NOEL/ NOEC	LOEL/ LOEC
Barossa Field Condensate – Loading rate (g/L)	20.9 (8.44-22.09)	30.6 (27.79-31.44)	19.3	38.6
Barossa Field Condensate – TRH concentration (µg/L)	17016.3 (7373.18-18757.60)	24006.3 (21800.80-24621.00)	15830	29770
Weathered Barossa Field Condensate – Loading rate (g/L)	48.6*	>79.5	79.5	>79.5
Weathered Barossa Field Condensate – TRH concentration (µg/L)	13908.1*	>22480	22480	>22480

*95% confidence limits are not reliable/available

Based on the loading rate, the WAF of the fresh Barossa Field Condensate had an EL10, EL50, NOEL and LOEL of 19.4 (13.58-23.28), 29.3 (24.71-34.66), 19.3 and 38.6g/L, respectively, for the imbalance endpoint. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 15875.5 (11275.40-18756.60). 23182.2 (19851.60-27226.80), 15830 and 29770µg/L, respectively. The EL10, EL50, NOEL and LOEL for the biomass endpoint were 20.9 (8.44-22.09), 30.6 (27.79-31.44), 19.3 and 38.6g/L, respectively expressed as loading rate, and 17016.3 (737.18-18757.60), 24006.3 (21800.80-24621.00), 15830 and 29770µg/L, respectively, expressed as TRH concentration.

Based on the loading rate, the WAF of the Weathered Barossa Field Condensate had an EL10, EL50, NOEL and LOEL of 69.1, >79.5, 79.5 and >79.5g/L, respectively, for the imbalance endpoint. Expressed as TRH concentration, the corresponding EC10, EC50, NOEC and LOEC were 19596.3, >22480.0, 22480 and >22480µg/L, respectively. The EL10, EL50, NOEL and LOEL for the biomass endpoint were 48.6, >79.5, 79.5 and >79.5g/L, respectively expressed as loading rate, and 13908.1, >22480.0, 22480 and >22480µg/L, respectively, expressed as TRH concentration.

The WAF control was not toxic to the juvenile fish.

10.3 Quality Assurance

The 7-d juvenile fish imbalance and growth test undertaken with the prepared WAFs met all quality assurance criteria. The percentage survival in the controls was 100%, which met the minimum control survival criteria of ≥80%. Water quality parameters for control samples were also within test acceptability ranges (**Table 8.4**).

Table 8.4. Quality Assurance limits for the 7-d barramundi fish imbalance and growth test (1 August 2014).

QA Measure	Criterion	This Test
Control % unaffected	≥ 80%	100%
Control mean growth	≥20% of initial weight	52.6%
Reference toxicant within cusum chart limits	n/a	17.3 mg NH_4^+/L

11. References

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Appendix A: Chain of Custody

Datasheet ID: 601.2
Last Revised: 30 April 2009

Sample Receipt Notification

Attention : Celeste Wilson

Client : Jacobs Group (Australia) Pty Ltd
11th Floor, Durack Centre
263 Adelaide Terrace

Email : CXXWilson@skm.com.au
Telephone : 08 9469 4438
Facsimile : 08 9469 4488

Date : 27/08/2015

Re : Receipt of Samples **Pages :** **2**

ESA Project : PR1244 ☑ For Review ☐ Additional Documentation Required - Please Respond

Sample Delivery Details

Completed Chain of Custody accompanied samples: **YES**
Samples received in apparent good condition and correctly bottled: **YES**
Security seals on sample bottles and esky intact: **YES**

Date samples received : 27/08/2015
Time samples received : 13:00
No. of samples received : 1
Sample matrix : Other
Sample temperature : room temperature

Comments : Includes 2x20L Barossa Field Condensate (ESA ID# 7323)

Contact Details

Customer Services Officer : Tina Micevska
Telephone : 61 2 9420 9481
Facsimile : 61 2 9420 9484
Email : tmicevska@ecotox.com.au

Please contact customer services officer for all queries or issues regarding samples

Note that the chain-of-custody provides definitive information on the tests to be performed

Ecotox Services Australia
ABN 45 094 714 904
Unit 27, 2 Chaplin Drive
Lane Cove NSW 2066 Australia

Phone : 61 2 9420 9481
Fax : 61 2 9420 9484
Email : info@ecotox.com.au

Core Laboratories Australia Pty Ltd
Reservoir Fluids Laboratory
24 Hour Service

447-449 Belmont Avenue
Kewdale, W.A. 6105
Phone: (61 8) 9353 3944
Fax: (61 8) 9353 1369

Core Lab
RESERVOIR OPTIMIZATION

Subout and Chain of Custody Record

SCCR Number: 701

Client Information: Conoco Phillips
Highway 60 & 123 (661 S Highway 123),
Bartlesville, OK, United States - 74004.

Subout Authorized By: Brenton Chatfield
Phone Number: 08 6363 2666
Client Accounting Code:

Consignee Information: Ecotox Service Australia Pty Ltd
27/2 Chaplin Drive,
Lane Cove, NSW, Australia - 2066.

Contact: Tina Micevska
Phone Number: 02 9420 9481

Job No.	Sub	Sample Date	Sample Type	Sample Container Size	Cyl No	Pressure (psig)	Temp (°F)	Sample Volume (cc)	Sample Depth (Ft.)	Sand Name	Notes
2015003-29		27/12/2014	Condensate	Can 20L				18000			Surge Tank
2015003-30		27/12/2014	Condensate	Can 20L		0	0	18000			Surge Tank

Notes:
2x 20L cans of Dead Condensate

Client: Conoco Phillips
Well: Barossa-3
Job No: 2015003

Prepared By: Kate Hughes
Billing Code:
Third Party Shipper: Enlog-RGM #AU20124283
Packaging/Handling: GO-15-429

Relinquished By: Kate Hughes
Date: 20-Aug-2015 11:20 AM
Received By: Tina ECESA
Received Date: 27/8/15 @ 1300

#7323

Appendix B: Test Report for TRH Analyses

Summary of Analytical Results for Total Recoverable Hydrocarbons (TRH's)

Barossa- Fresh

Tests	Sea urchin fert Sea urchin larval Milky oyster Ecklonia	Isochrysis	7-d Barramundi Copepod	Sea Anemone
Test Date	10/09/2015	11/09/2015	22/09/2015	27/10/2015
Envirolab Report #	134814	134814	135588	137174
Loading rate (g/L)	TRH's (C6-C36), µg/L			
0	0	0	0	0
0.6	350	-	-	-
1.2	720	650	-	-
2.4	1673	1400	-	-
4.8	3180	3248	3860	2492
9.7	7160	6670	8560	7660
19.3	14060	12850	15830	15840
38.6	30860	27960	29770	28040
77.2	69620	65830	68390	63990

Barossa- Weathered

Tests	7-d Barramundi
Test Date	22/09/2015
Envirolab Report #	135588
Loading rate (g/L)	TRH's (C6-C36), µg/L
0	0
5	1410
9.9	2770
19.9	4850
39.8	11450
79.5	22480

12 Ashley Street, Chatswood, NSW 2067
tel: +61 2 9910 6200

email: sydney@envirolab.com.au
envirolab.com.au

Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS 137174

Client:
Ecotox Services Australasia Pty Ltd
Unit 27, 2 Chaplin Dr
Lane Cove
NSW 2066

Attention: Tina

Sample log in details:

Your Reference:	**PR1244**		
No. of samples:	8 Waters		
Date samples received / completed instructions received	10/11/15	/	10/11/15

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	17/11/15	/	17/11/15
Date of Preliminary Report:	Not Issued		

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Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

vTRH(C6-C10)/BTEXN in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	137174-1 FSW Control 27/10/15 27/10/2015 Water	137174-2 WAF Control 27/10/15 27/10/2015 Water	137174-3 Condensate 6.3% 27/10/15 27/10/2015 Water	137174-4 Condensate 12.5% 27/10/15 27/10/2015 Water	137174-5 Condensate 25% 27/10/15 27/10/2015 Water
Date extracted	-	11/11/2015	11/11/2015	11/11/2015	11/11/2015	11/11/2015
Date analysed	-	13/11/2015	13/11/2015	13/11/2015	13/11/2015	13/11/2015
TRHC$_6$ - C$_9$	µg/L	<10	<10	2,400	7,300	15,000
TRHC$_6$ - C$_{10}$	µg/L	<10	<10	2,800	7,600	16,000
TRHC$_6$ - C$_{10}$ less BTEX (F1)	µg/L	<10	<10	190	2,300	6,000
Benzene	µg/L	<1	<1	1,300	2,600	4,800
Toluene	µg/L	<1	<1	980	2,000	4,000
Ethylbenzene	µg/L	<1	<1	23	50	93
m+p-xylene	µg/L	<2	<2	230	480	860
o-xylene	µg/L	<1	<1	76	160	290
Naphthalene	µg/L	<1	<1	12	27	79
Surrogate Dibromofluoromethane	%	120	118	113	113	101
Surrogate toluene-d8	%	94	94	98	96	99
Surrogate 4-BFB	%	89	87	88	88	102

vTRH(C6-C10)/BTEXN in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	137174-6 Condensate 50% 27/10/15 27/10/2015 Water	137174-7 Condensate 100% 27/10/15 27/10/2015 Water
Date extracted	-	11/11/2015	11/11/2015
Date analysed	-	13/11/2015	13/11/2015
TRHC$_6$ - C$_9$	µg/L	26,000	60,000
TRHC$_6$ - C$_{10}$	µg/L	27,000	62,000
TRHC$_6$ - C$_{10}$ less BTEX (F1)	µg/L	4,300	7,000
Benzene	µg/L	11,000	27,000
Toluene	µg/L	8,700	21,000
Ethylbenzene	µg/L	210	490
m+p-xylene	µg/L	2,100	5,000
o-xylene	µg/L	650	1,500
Naphthalene	µg/L	110	210
Surrogate Dibromofluoromethane	%	113	111
Surrogate toluene-d8	%	98	97
Surrogate 4-BFB	%	88	90

svTRH (C10-C40) in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	137174-1 FSW Control 27/10/15 27/10/2015 Water	137174-2 WAF Control 27/10/15 27/10/2015 Water	137174-3 Condensate 6.3% 27/10/15 27/10/2015 Water	137174-4 Condensate 12.5% 27/10/15 27/10/2015 Water	137174-5 Condensate 25% 27/10/15 27/10/2015 Water
Date extracted	-	13/11/2015	13/11/2015	13/11/2015	13/11/2015	13/11/2015
Date analysed	-	15/11/2015	15/11/2015	15/11/2015	15/11/2015	15/11/2015
TRHC_{10} - C_{14}	µg/L	<50	<50	92	190	410
TRHC_{15} - C_{28}	µg/L	<100	<100	<100	170	320
TRHC_{29} - C_{36}	µg/L	<100	<100	<100	<100	110
TRH>C_{10} - C_{16}	µg/L	<50	<50	74	160	330
TRH>C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50	<50	62	130	250
TRH>C_{16} - C_{34}	µg/L	<100	<100	100	160	360
TRH>C_{34} - C_{40}	µg/L	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	87	95	89	93	98

svTRH (C10-C40) in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	137174-6 Condensate 50% 27/10/15 27/10/2015 Water	137174-7 Condensate 100% 27/10/15 27/10/2015 Water
Date extracted	-	13/11/2015	13/11/2015
Date analysed	-	15/11/2015	15/11/2015
TRHC_{10} - C_{14}	µg/L	860	1,800
TRHC_{15} - C_{28}	µg/L	900	1,700
TRHC_{29} - C_{36}	µg/L	280	490
TRH>C_{10} - C_{16}	µg/L	720	1,400
TRH>C_{10} - C_{16} less Naphthalene (F2)	µg/L	610	1,200
TRH>C_{16} - C_{34}	µg/L	1,000	1,900
TRH>C_{34} - C_{40}	µg/L	<100	140
Surrogate o-Terphenyl	%	106	96

PAHs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ---------- 	137174-1 FSW Control 27/10/15 27/10/2015 Water	137174-2 WAF Control 27/10/15 27/10/2015 Water	137174-3 Condensate 6.3% 27/10/15 27/10/2015 Water	137174-4 Condensate 12.5% 27/10/15 27/10/2015 Water	137174-5 Condensate 25% 27/10/15 27/10/2015 Water
Date extracted	-	13/11/2015	13/11/2015	13/11/2015	13/11/2015	13/11/2015
Date analysed	-	13/11/2015	13/11/2015	13/11/2015	13/11/2015	13/11/2015
Naphthalene	µg/L	<1	<1	11	23	50
Acenaphthylene	µg/L	<1	<1	<1	<1	<1
Acenaphthene	µg/L	<1	<1	<1	<1	<1
Fluorene	µg/L	<1	<1	<1	<1	<1
Phenanthrene	µg/L	<1	<1	<1	<1	<1
Anthracene	µg/L	<1	<1	<1	<1	<1
Fluoranthene	µg/L	<1	<1	<1	<1	<1
Pyrene	µg/L	<1	<1	<1	<1	<1
Benzo(a)anthracene	µg/L	<1	<1	<1	<1	<1
Chrysene	µg/L	<1	<1	<1	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	<2	<2	<2	<2	<2
Benzo(a)pyrene	µg/L	<1	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1	<1	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1	<1	<1	<1
Benzo(a)pyrene TEQ	µg/L	<5	<5	<5	<5	<5
Total +ve PAH's	µg/L	NIL (+)VE	NIL (+)VE	11	23	50
Surrogate p-Terphenyl-d14	%	84	88	87	94	89

PAHs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ---------- 	137174-6 Condensate 50% 27/10/15 27/10/2015 Water	137174-7 Condensate 100% 27/10/15 27/10/2015 Water
Date extracted	-	13/11/2015	13/11/2015
Date analysed	-	13/11/2015	13/11/2015
Naphthalene	µg/L	91	250
Acenaphthylene	µg/L	<1	<1
Acenaphthene	µg/L	<1	<1
Fluorene	µg/L	2	3
Phenanthrene	µg/L	2	2
Anthracene	µg/L	<1	<1
Fluoranthene	µg/L	<1	<1
Pyrene	µg/L	<1	<1
Benzo(a)anthracene	µg/L	<1	<1
Chrysene	µg/L	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	<2	<2
Benzo(a)pyrene	µg/L	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1
Benzo(a)pyrene TEQ	µg/L	<5	<5
Total +ve PAH's	µg/L	95	260
Surrogate p-Terphenyl-d14	%	94	80

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			11/11/2015	137174-1	11/11/2015 || 11/11/2015	LCS-W3	11/11/2015
Date analysed	-			13/11/2015	137174-1	13/11/2015 || 13/11/2015	LCS-W3	13/11/2015
TRHC_6 - C_9	µg/L	10	Org-016	<10	137174-1	<10 || <10	LCS-W3	94%
TRHC_6 - C_{10}	µg/L	10	Org-016	<10	137174-1	<10 || <10	LCS-W3	94%
Benzene	µg/L	1	Org-016	<1	137174-1	<1 || <1	LCS-W3	98%
Toluene	µg/L	1	Org-016	<1	137174-1	<1 || <1	LCS-W3	99%
Ethylbenzene	µg/L	1	Org-016	<1	137174-1	<1 || <1	LCS-W3	101%
m+p-xylene	µg/L	2	Org-016	<2	137174-1	<2 || <2	LCS-W3	86%
o-xylene	µg/L	1	Org-016	<1	137174-1	<1 || <1	LCS-W3	106%
Naphthalene	µg/L	1	Org-013	<1	137174-1	<1 || <1	[NR]	[NR]
Surrogate Dibromofluoromethane	%		Org-016	110	137174-1	120 || 127 || RPD: 6	LCS-W3	97%
Surrogate toluene-d8	%		Org-016	95	137174-1	94 || 90 || RPD: 4	LCS-W3	101%
Surrogate 4-BFB	%		Org-016	88	137174-1	89 || 80 || RPD: 11	LCS-W3	106%

QUALITY CONTROL svTRH (C10-C40) in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			13/11/2015	[NT]	[NT]	LCS-W1	13/11/2015
Date analysed	-			13/11/2015	[NT]	[NT]	LCS-W1	13/11/2015
TRHC_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	107%
TRHC_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	104%
TRHC_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	93%
TRH>C_{10} - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	107%
TRH>C_{16} - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	104%
TRH>C_{34} - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	93%
Surrogate o-Terphenyl	%		Org-003	72	[NT]	[NT]	LCS-W1	125%

QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			13/11/2015	[NT]	[NT]	LCS-W1	13/11/2015
Date analysed	-			13/11/2015	[NT]	[NT]	LCS-W1	13/11/2015
Naphthalene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	91%
Acenaphthylene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	111%
Phenanthrene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	98%
Anthracene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	101%
Pyrene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	106%
Benzo(a)anthracene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Chrysene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	111%
Benzo(b,j+k) fluoranthene	µg/L	2	Org-012	<2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	97%
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012	83	[NT]	[NT]	LCS-W1	92%

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NR: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

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Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS 135588

Client:
Ecotox Services Australasia Pty Ltd
Unit 27, 2 Chaplin Dr
Lane Cove
NSW 2066

Attention: Tina

Sample log in details:

Your Reference:	**PR1244**		
No. of samples:	12 Waters		
Date samples received / completed instructions received	08/10/15	/	08/10/15

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	15/10/15	/	14/10/15
Date of Preliminary Report:	Not Issued		

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Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

vTRH(C6-C10)/BTEXN in Water						
Our Reference:	UNITS	135588-1	135588-2	135588-3	135588-4	135588-5
Your Reference	----------	FSW Control 22/09/15	WAF Control 22/09/15	Condensate 6.3% 22/09/15	Condensate 12.5% 22/09/15	Condensate 25% 22/09/15
Date Sampled	----------	22/09/2015	22/09/2015	22/09/2015	22/09/2015	22/09/2015
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	12/10/2015	12/10/2015	12/10/2015	12/10/2015	12/10/2015
Date analysed	-	12/10/2015	12/10/2015	12/10/2015	12/10/2015	12/10/2015
$TRHC_6$ - C_9	µg/L	<10	<10	3,400	7,500	14,000
$TRHC_6$ - C_{10}	µg/L	<10	<10	3,400	7,700	14,000
$TRHC_6$ - C_{10} less BTEX (F1)	µg/L	<10	<10	480	1,800	2,700
Benzene	µg/L	<1	<1	1,400	2,800	5,500
Toluene	µg/L	<1	<1	1,100	2,300	4,400
Ethylbenzene	µg/L	<1	<1	23	51	90
m+p-xylene	µg/L	<2	<2	300	560	990
o-xylene	µg/L	<1	<1	93	180	330
Naphthalene	µg/L	<1	<1	28	63	110
Surrogate Dibromofluoromethane	%	103	103	101	99	99
Surrogate toluene-d8	%	87	87	94	97	98
Surrogate 4-BFB	%	88	87	102	102	102

vTRH(C6-C10)/BTEXN in Water						
Our Reference:	UNITS	135588-6	135588-7	135588-8	135588-9	135588-10
Your Reference	----------	Condensate 50% 22/09/15	Condensate 100% 22/09/15	Condensate weathered 6.3% 22/09/15	Condensate weathered 12.5% 22/09/15	Condensate weathered 25% 22/09/15
Date Sampled	----------	22/09/2015	22/09/2015	22/09/2015	22/09/2015	22/09/2015
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	12/10/2015	12/10/2015	12/10/2015	12/10/2015	12/10/2015
Date analysed	-	12/10/2015	12/10/2015	12/10/2015	12/10/2015	13/10/2015
$TRHC_6$ - C_9	µg/L	26,000	60,000	1,100	2,200	3,600
$TRHC_6$ - C_{10}	µg/L	26,000	60,000	1,300	2,500	4,000
$TRHC_6$ - C_{10} less BTEX (F1)	µg/L	4,000	11,000	450	850	1,000
Benzene	µg/L	11,000	26,000	35	64	140
Toluene	µg/L	8,200	19,000	450	870	1,500
Ethylbenzene	µg/L	200	290	26	47	87
m+p-xylene	µg/L	1,900	2,900	250	490	900
o-xylene	µg/L	660	960	89	180	330
Naphthalene	µg/L	220	210	48	82	140
Surrogate Dibromofluoromethane	%	98	98	99	97	96
Surrogate toluene-d8	%	100	100	101	103	107
Surrogate 4-BFB	%	102	101	109	108	108

vTRH(C6-C10)/BTEXN in Water			
Our Reference:	UNITS	135588-11	135588-12
Your Reference	----------	Condensate weathered 50% 22/09/15	Condensate weathered 100% 22/09/15
Date Sampled	----------	22/09/2015	22/09/2015
Type of sample		Water	Water
Date extracted	-	12/10/2015	12/10/2015
Date analysed	-	13/10/2015	13/10/2015
$TRHC_6$ - C_9	µg/L	7,900	18,000
$TRHC_6$ - C_{10}	µg/L	8,700	19,000
$TRHC_6$ - C_{10} less BTEX (F1)	µg/L	2,600	5,200
Benzene	µg/L	270	630
Toluene	µg/L	3,200	7,400
Ethylbenzene	µg/L	190	400
m+p-xylene	µg/L	1,800	4,000
o-xylene	µg/L	650	1,400
Naphthalene	µg/L	240	400
Surrogate Dibromofluoromethane	%	100	89
Surrogate toluene-d8	%	135	101
Surrogate 4-BFB	%	106	107

svTRH (C10-C40) in Water						
Our Reference:	UNITS	135588-1	135588-2	135588-3	135588-4	135588-5
Your Reference	----------	FSW Control 22/09/15	WAF Control 22/09/15	Condensate 6.3% 22/09/15	Condensate 12.5% 22/09/15	Condensate 25% 22/09/15
Date Sampled	----------	22/09/2015	22/09/2015	22/09/2015	22/09/2015	22/09/2015
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	12/10/2015	12/10/2015	12/10/2015	12/10/2015	12/10/2015
Date analysed	-	12/10/2015	12/10/2015	13/10/2015	13/10/2015	13/10/2015
TRHC$_{10}$ - C$_{14}$	µg/L	<50	<50	240	460	780
TRHC$_{15}$ - C$_{28}$	µg/L	<100	<100	220	600	910
TRHC$_{29}$ - C$_{36}$	µg/L	<100	<100	<100	<100	140
TRH>C$_{10}$ - C$_{16}$	µg/L	<50	<50	230	480	780
TRH>C$_{10}$ - C$_{16}$ less Naphthalene (F2)	µg/L	<50	<50	200	420	670
TRH>C$_{16}$ - C$_{34}$	µg/L	<100	<100	170	540	830
TRH>C$_{34}$ - C$_{40}$	µg/L	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	73	87	106	120	118

svTRH (C10-C40) in Water						
Our Reference:	UNITS	135588-6	135588-7	135588-8	135588-9	135588-10
Your Reference	----------	Condensate 50% 22/09/15	Condensate 100% 22/09/15	Condensate weathered 6.3% 22/09/15	Condensate weathered 12.5% 22/09/15	Condensate weathered 25% 22/09/15
Date Sampled	----------	22/09/2015	22/09/2015	22/09/2015	22/09/2015	22/09/2015
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	12/10/2015	12/10/2015	12/10/2015	12/10/2015	12/10/2015
Date analysed	-	13/10/2015	13/10/2015	13/10/2015	13/10/2015	13/10/2015
TRHC$_{10}$ - C$_{14}$	µg/L	1,400	3,000	160	270	490
TRHC$_{15}$ - C$_{28}$	µg/L	2,100	4,900	150	300	760
TRHC$_{29}$ - C$_{36}$	µg/L	270	490	<100	<100	<100
TRH>C$_{10}$ - C$_{16}$	µg/L	1,500	3,000	120	220	400
TRH>C$_{10}$ - C$_{16}$ less Naphthalene (F2)	µg/L	1,300	2,800	76	140	260
TRH>C$_{16}$ - C$_{34}$	µg/L	1,900	4,400	150	280	750
TRH>C$_{34}$ - C$_{40}$	µg/L	<100	170	<100	<100	<100
Surrogate o-Terphenyl	%	133	#	98	88	92

svTRH (C10-C40) in Water			
Our Reference:	UNITS	135588-11	135588-12
Your Reference	----------	Condensate weathered 50% 22/09/15	Condensate weathered 100% 22/09/15
Date Sampled	----------	22/09/2015	22/09/2015
Type of sample		Water	Water
Date extracted	-	12/10/2015	12/10/2015
Date analysed	-	13/10/2015	13/10/2015
TRHC_{10} - C_{14}	µg/L	1,200	1,600
TRHC_{15} - C_{28}	µg/L	2,200	2,700
TRHC_{29} - C_{36}	µg/L	150	180
TRH>C_{10} - C_{16}	µg/L	990	1,200
TRH>C_{10} - C_{16} less Naphthalene (F2)	µg/L	750	800
TRH>C_{16} - C_{34}	µg/L	2,100	2,600
TRH>C_{34} - C_{40}	µg/L	<100	<100
Surrogate o-Terphenyl	%	#	#

PAHs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ---------- 	135588-1 FSW Control 22/09/15 22/09/2015 Water	135588-2 WAF Control 22/09/15 22/09/2015 Water	135588-3 Condensate 6.3% 22/09/15 22/09/2015 Water	135588-4 Condensate 12.5% 22/09/15 22/09/2015 Water	135588-5 Condensate 25% 22/09/15 22/09/2015 Water
Date extracted	-	12/10/2015	12/10/2015	12/10/2015	12/10/2015	12/10/2015
Date analysed	-	12/10/2015	12/10/2015	12/10/2015	12/10/2015	12/10/2015
Naphthalene	µg/L	<1	<1	18	34	65
Acenaphthylene	µg/L	<1	<1	<1	<1	<1
Acenaphthene	µg/L	<1	<1	<1	<1	<1
Fluorene	µg/L	<1	<1	<1	1	3
Phenanthrene	µg/L	<1	<1	1	2	3
Anthracene	µg/L	<1	<1	<1	<1	<1
Fluoranthene	µg/L	<1	<1	<1	<1	<1
Pyrene	µg/L	<1	<1	<1	<1	<1
Benzo(a)anthracene	µg/L	<1	<1	<1	<1	<1
Chrysene	µg/L	<1	<1	<1	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	<2	<2	<2	<2	<2
Benzo(a)pyrene	µg/L	<1	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1	<1	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1	<1	<1	<1
Benzo(a)pyrene TEQ	µg/L	<5	<5	<5	<5	<5
Total +ve PAH's	µg/L	NIL (+)VE	NIL (+)VE	19	37	70
Surrogate p-Terphenyl-d14	%	82	103	96	92	90

PAHs in Water Our Reference: Your Reference	UNITS ----------	135588-6 Condensate 50% 22/09/15	135588-7 Condensate 100% 22/09/15	135588-8 Condensate weathered 6.3% 22/09/15	135588-9 Condensate weathered 12.5% 22/09/15	135588-10 Condensate weathered 25% 22/09/15
Date Sampled	----------	22/09/2015	22/09/2015	22/09/2015	22/09/2015	22/09/2015
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	12/10/2015	12/10/2015	12/10/2015	12/10/2015	12/10/2015
Date analysed	-	12/10/2015	12/10/2015	12/10/2015	12/10/2015	12/10/2015
Naphthalene	µg/L	110	220	22	45	69
Acenaphthylene	µg/L	<1	<1	<1	<1	<1
Acenaphthene	µg/L	<1	<1	<1	<1	<1
Fluorene	µg/L	4	5	<1	<1	2
Phenanthrene	µg/L	4	5	<1	<1	1
Anthracene	µg/L	<1	<1	<1	<1	<1
Fluoranthene	µg/L	<1	<1	<1	<1	<1
Pyrene	µg/L	<1	<1	<1	<1	<1
Benzo(a)anthracene	µg/L	<1	<1	<1	<1	<1
Chrysene	µg/L	<1	<1	<1	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	<2	<2	<2	<2	<2
Benzo(a)pyrene	µg/L	<1	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1	<1	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1	<1	<1	<1
Benzo(a)pyrene TEQ	µg/L	<5	<5	<5	<5	<5
Total +ve PAH's	µg/L	120	230	22	45	72
Surrogate p-Terphenyl-d14	%	92	74	93	91	83

PAHs in Water Our Reference: Your Reference	UNITS ----------	135588-11 Condensate weathered 50% 22/09/15	135588-12 Condensate weathered 100% 22/09/15
Date Sampled	----------	22/09/2015	22/09/2015
Type of sample		Water	Water
Date extracted	-	12/10/2015	12/10/2015
Date analysed	-	12/10/2015	12/10/2015
Naphthalene	µg/L	130	220
Acenaphthylene	µg/L	<1	<1
Acenaphthene	µg/L	<1	<1
Fluorene	µg/L	3	4
Phenanthrene	µg/L	2	2
Anthracene	µg/L	<1	<1
Fluoranthene	µg/L	<1	<1
Pyrene	µg/L	<1	<1
Benzo(a)anthracene	µg/L	<1	<1
Chrysene	µg/L	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	<2	<2
Benzo(a)pyrene	µg/L	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1
Benzo(a)pyrene TEQ	µg/L	<5	<5
Total +ve PAH's	µg/L	140	230
Surrogate p-Terphenyl-d14	%	77	62

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			12/10/2015	135588-1	12/10/2015 || 13/10/2015	LCS-W1	12/10/2015
Date analysed	-			12/10/2015	135588-1	12/10/2015 || 14/10/2015	LCS-W1	12/10/2015
TRHC_6 - C_9	µg/L	10	Org-016	<10	135588-1	<10 || <10	LCS-W1	108%
TRHC_6 - C_{10}	µg/L	10	Org-016	<10	135588-1	<10 || <10	LCS-W1	108%
Benzene	µg/L	1	Org-016	<1	135588-1	<1 || <1	LCS-W1	107%
Toluene	µg/L	1	Org-016	<1	135588-1	<1 || <1	LCS-W1	98%
Ethylbenzene	µg/L	1	Org-016	<1	135588-1	<1 || <1	LCS-W1	107%
m+p-xylene	µg/L	2	Org-016	<2	135588-1	<2 || <2	LCS-W1	113%
o-xylene	µg/L	1	Org-016	<1	135588-1	<1 || <1	LCS-W1	114%
Naphthalene	µg/L	1	Org-013	<1	135588-1	<1 || <1	[NR]	[NR]
Surrogate Dibromofluoromethane	%		Org-016	101	135588-1	103 || 102 || RPD: 1	LCS-W1	102%
Surrogate toluene-d8	%		Org-016	88	135588-1	87 || 92 || RPD: 6	LCS-W1	90%
Surrogate 4-BFB	%		Org-016	90	135588-1	88 || 88 || RPD: 0	LCS-W1	104%

QUALITY CONTROL svTRH (C10-C40) in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			12/10/2015	[NT]	[NT]	LCS-W3	12/10/2015
Date analysed	-			12/10/2015	[NT]	[NT]	LCS-W3	12/10/2015
TRHC_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W3	100%
TRHC_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W3	83%
TRHC_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W3	83%
TRH>C_{10} - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W3	100%
TRH>C_{16} - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W3	83%
TRH>C_{34} - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W3	83%
Surrogate o-Terphenyl	%		Org-003	84	[NT]	[NT]	LCS-W3	95%

QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			12/10/2015	[NT]	[NT]	LCS-W3	12/10/2015
Date analysed	-			12/10/2015	[NT]	[NT]	LCS-W3	12/10/2015
Naphthalene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	77%
Acenaphthylene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	70%
Phenanthrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	78%

QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	77%
Pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	79%
Benzo(a)anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	100%
Benzo(b,j+k) fluoranthene	µg/L	2	Org-012 subset	<2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	94%
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	95	[NT]	[NT]	LCS-W3	80%

Report Comments:

TRH_W(semi vol):# Percent recovery is not possible to report as the high concentration of analytes in the sample/s have caused interference.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

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CERTIFICATE OF ANALYSIS 134814

Client:
Ecotox Services Australasia Pty Ltd
Unit 27, 2 Chaplin Dr
Lane Cove
NSW 2066

Attention: Tina

Sample log in details:

Your Reference:	**PR1244**		
No. of samples:	19 Waters		
Date samples received / completed instructions received	23/09/2015	/	23/09/2015

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	30/09/15	/	30/09/15
Date of Preliminary Report:	Not Issued		

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Results Approved By:

Jacinta Hurst
Laboratory Manager

vTRH(C6-C10)/BTEXN in Water						
Our Reference:	UNITS	134814-1	134814-2	134814-3	134814-4	134814-5
Your Reference	----------	FSW Control 10/9/2015	WAF Control 10/9/2015	Condensate 0.8% 10/9/2015	Condensate 1.6% 10/9/2015	Condensate 3.1% 10/9/2015
Date Sampled	----------	10/09/2015	10/09/2015	10/09/2015	10/09/2015	10/09/2015
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	28/09/2015	28/09/2015	28/09/2015	28/09/2015	28/09/2015
Date analysed	-	29/09/2015	29/09/2015	29/09/2015	29/09/2015	29/09/2015
$TRHC_6$ - C_9	µg/L	<10	<10	350	720	1,500
$TRHC_6$ - C_{10}	µg/L	<10	<10	370	770	1,600
$TRHC_6$ - C_{10} less BTEX (F1)	µg/L	<10	<10	56	110	250
Benzene	µg/L	<1	<1	160	330	650
Toluene	µg/L	<1	<1	120	260	550
Ethylbenzene	µg/L	<1	<1	2	5	11
m+p-xylene	µg/L	<2	<2	23	49	100
o-xylene	µg/L	<1	<1	8	17	35
Naphthalene	µg/L	<1	<1	2	4	9
Surrogate Dibromofluoromethane	%	98	98	98	96	96
Surrogate toluene-d8	%	102	100	100	101	100
Surrogate 4-BFB	%	97	96	98	99	100

vTRH(C6-C10)/BTEXN in Water						
Our Reference:	UNITS	134814-6	134814-7	134814-8	134814-9	134814-10
Your Reference	----------	Condensate 6.3% 10/9/2015	Condensate 12.5% 10/9/2015	Condensate 25% 10/9/2015	Condensate 50% 10/9/2015	Condensate 100% 10/9/2015
Date Sampled	----------	10/09/2015	10/09/2015	10/09/2015	10/09/2015	10/09/2015
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	28/09/2015	28/09/2015	28/09/2015	28/09/2015	28/09/2015
Date analysed	-	29/09/2015	29/09/2015	29/09/2015	29/09/2015	29/09/2015
$TRHC_6$ - C_9	µg/L	2,900	6,600	13,000	29,000	66,000
$TRHC_6$ - C_{10}	µg/L	3,000	6,800	13,000	29,000	66,000
$TRHC_6$ - C_{10} less BTEX (F1)	µg/L	340	1,200	2,000	4,800	9,800
Benzene	µg/L	1,300	2,700	5,400	12,000	28,000
Toluene	µg/L	1,100	2,200	4,400	9,600	22,000
Ethylbenzene	µg/L	23	47	81	180	430
m+p-xylene	µg/L	170	460	850	1,800	4,400
o-xylene	µg/L	71	150	280	600	1,400
Naphthalene	µg/L	19	21	30	50	110
Surrogate Dibromofluoromethane	%	97	97	99	98	98
Surrogate toluene-d8	%	99	100	99	98	97
Surrogate 4-BFB	%	101	99	95	98	96

vTRH(C6-C10)/BTEXN in Water						
Our Reference:	UNITS	134814-11	134814-12	134814-13	134814-14	134814-15
Your Reference	----------	FSW Control 11/9/2015	WAF Control 11/9/2015	Condensate 1.6% 11/9/2015	Condensate 3.1% 11/9/2015	Condensate 6.3% 11/9/2015
Date Sampled	----------	11/09/2015	11/09/2015	11/09/2015	11/09/2015	11/09/2015
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	28/09/2015	28/09/2015	28/09/2015	28/09/2015	28/09/2015
Date analysed	-	29/09/2015	29/09/2015	29/09/2015	29/09/2015	29/09/2015
$TRHC_6$ - C_9	µg/L	<10	<10	650	1,400	3,000
$TRHC_6$ - C_{10}	µg/L	<10	<10	690	1,400	3,100
$TRHC_6$ - C_{10} less BTEX (F1)	µg/L	<10	<10	110	170	670
Benzene	µg/L	<1	<1	290	600	1,200
Toluene	µg/L	<1	<1	230	500	980
Ethylbenzene	µg/L	<1	<1	4	9	21
m+p-xylene	µg/L	<2	<2	43	89	160
o-xylene	µg/L	<1	<1	15	31	65
Naphthalene	µg/L	<1	<1	4	7	17
Surrogate Dibromofluoromethane	%	100	100	97	97	96
Surrogate toluene-d8	%	99	99	102	100	99
Surrogate 4-BFB	%	96	95	100	101	102

vTRH(C6-C10)/BTEXN in Water					
Our Reference:	UNITS	134814-16	134814-17	134814-18	134814-19
Your Reference	----------	Condensate 12.5% 11/9/2015	Condensate 25% 11/9/2015	Condensate 50% 11/9/2015	Condensate 100% 11/9/2015
Date Sampled	----------	11/09/2015	11/09/2015	11/09/2015	11/09/2015
Type of sample		Water	Water	Water	Water
Date extracted	-	28/09/2015	28/09/2015	28/09/2015	28/09/2015
Date analysed	-	29/09/2015	29/09/2015	29/09/2015	29/09/2015
$TRHC_6$ - C_9	µg/L	6,200	12,000	26,000	62,000
$TRHC_6$ - C_{10}	µg/L	6,400	12,000	26,000	62,000
$TRHC_6$ - C_{10} less BTEX (F1)	µg/L	1,200	1,600	3,900	8,500
Benzene	µg/L	2,500	5,100	11,000	27,000
Toluene	µg/L	2,100	4,100	8,700	21,000
Ethylbenzene	µg/L	42	78	160	380
m+p-xylene	µg/L	410	820	1,700	3,900
o-xylene	µg/L	140	270	530	1,200
Naphthalene	µg/L	19	33	43	110
Surrogate Dibromofluoromethane	%	97	100	100	98
Surrogate toluene-d8	%	99	99	98	97
Surrogate 4-BFB	%	99	97	94	97

svTRH (C10-C40) in Water						
Our Reference:	UNITS	134814-1	134814-2	134814-3	134814-4	134814-5
Your Reference	----------	FSW Control 10/9/2015	WAF Control 10/9/2015	Condensate 0.8% 10/9/2015	Condensate 1.6% 10/9/2015	Condensate 3.1% 10/9/2015
Date Sampled	----------	10/09/2015	10/09/2015	10/09/2015	10/09/2015	10/09/2015
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	24/09/2015	24/09/2015	24/09/2015	24/09/2015	24/09/2015
Date analysed	-	25/09/2015	25/09/2015	25/09/2015	25/09/2015	25/09/2015
TRHC$_{10}$ - C$_{14}$	µg/L	<50	<50	<50	<50	53
TRHC$_{15}$ - C$_{28}$	µg/L	<100	<100	<100	<100	120
TRHC$_{29}$ - C$_{36}$	µg/L	<100	<100	<100	<100	<100
TRH>C$_{10}$ - C$_{16}$	µg/L	<50	<50	<50	<50	<50
TRH>C$_{10}$ - C$_{16}$ less Naphthalene (F2)	µg/L	<50	<50	<50	<50	<50
TRH>C$_{16}$ - C$_{34}$	µg/L	<100	<100	<100	<100	120
TRH>C$_{34}$ - C$_{40}$	µg/L	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	87	79	83	88	97

svTRH (C10-C40) in Water						
Our Reference:	UNITS	134814-6	134814-7	134814-8	134814-9	134814-10
Your Reference	----------	Condensate 6.3% 10/9/2015	Condensate 12.5% 10/9/2015	Condensate 25% 10/9/2015	Condensate 50% 10/9/2015	Condensate 100% 10/9/2015
Date Sampled	----------	10/09/2015	10/09/2015	10/09/2015	10/09/2015	10/09/2015
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	24/09/2015	24/09/2015	24/09/2015	24/09/2015	24/09/2015
Date analysed	-	25/09/2015	25/09/2015	25/09/2015	25/09/2015	25/09/2015
TRHC$_{10}$ - C$_{14}$	µg/L	120	240	490	880	1,900
TRHC$_{15}$ - C$_{28}$	µg/L	160	320	570	980	1,600
TRHC$_{29}$ - C$_{36}$	µg/L	<100	<100	<100	<100	120
TRH>C$_{10}$ - C$_{16}$	µg/L	98	200	380	660	1,300
TRH>C$_{10}$ - C$_{16}$ less Naphthalene (F2)	µg/L	79	180	350	610	1,200
TRH>C$_{16}$ - C$_{34}$	µg/L	150	300	540	930	1,600
TRH>C$_{34}$ - C$_{40}$	µg/L	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	95	93	94	84	84

svTRH (C10-C40) in Water						
Our Reference:	UNITS	134814-11	134814-12	134814-13	134814-14	134814-15
Your Reference	----------	FSW Control 11/9/2015	WAF Control 11/9/2015	Condensate 1.6% 11/9/2015	Condensate 3.1% 11/9/2015	Condensate 6.3% 11/9/2015
Date Sampled	----------	11/09/2015	11/09/2015	11/09/2015	11/09/2015	11/09/2015
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	24/09/2015	24/09/2015	24/09/2015	24/09/2015	24/09/2015
Date analysed	-	29/09/2015	29/09/2015	29/09/2015	29/09/2015	29/09/2015
TRHC$_{10}$ - C$_{14}$	µg/L	<50	<50	<50	<50	78
TRHC$_{15}$ - C$_{28}$	µg/L	<100	<100	<100	<100	170
TRHC$_{29}$ - C$_{36}$	µg/L	<100	<100	<100	<100	<100
TRH>C$_{10}$ - C$_{16}$	µg/L	<50	<50	<50	<50	63
TRH>C$_{10}$ - C$_{16}$ less Naphthalene (F2)	µg/L	<50	<50	<50	<50	<50
TRH>C$_{16}$ - C$_{34}$	µg/L	<100	<100	<100	<100	170
TRH>C$_{34}$ - C$_{40}$	µg/L	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	102	98	91	100	83

svTRH (C10-C40) in Water					
Our Reference:	UNITS	134814-16	134814-17	134814-18	134814-19
Your Reference	----------	Condensate 12.5% 11/9/2015	Condensate 25% 11/9/2015	Condensate 50% 11/9/2015	Condensate 100% 11/9/2015
Date Sampled	----------	11/09/2015	11/09/2015	11/09/2015	11/09/2015
Type of sample		Water	Water	Water	Water
Date extracted	-	24/09/2015	24/09/2015	24/09/2015	24/09/2015
Date analysed	-	29/09/2015	29/09/2015	29/09/2015	29/09/2015
TRHC$_{10}$ - C$_{14}$	µg/L	190	410	960	1,900
TRHC$_{15}$ - C$_{28}$	µg/L	280	440	1,000	1,800
TRHC$_{29}$ - C$_{36}$	µg/L	<100	<100	<100	130
TRH>C$_{10}$ - C$_{16}$	µg/L	160	320	750	1,400
TRH>C$_{10}$ - C$_{16}$ less Naphthalene (F2)	µg/L	140	290	710	1,300
TRH>C$_{16}$ - C$_{34}$	µg/L	260	410	950	1,700
TRH>C$_{34}$ - C$_{40}$	µg/L	<100	<100	<100	<100
Surrogate o-Terphenyl	%	99	99	128	101

PAHs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ---------- 	134814-1 FSW Control 10/9/2015 10/09/2015 Water	134814-2 WAF Control 10/9/2015 10/09/2015 Water	134814-3 Condensate 0.8% 10/9/2015 10/09/2015 Water	134814-4 Condensate 1.6% 10/9/2015 10/09/2015 Water	134814-5 Condensate 3.1% 10/9/2015 10/09/2015 Water
Date extracted	-	24/09/2015	24/09/2015	24/09/2015	24/09/2015	24/09/2015
Date analysed	-	25/09/2015	25/09/2015	25/09/2015	25/09/2015	25/09/2015
Naphthalene	µg/L	<1	<1	2	4	8
Acenaphthylene	µg/L	<1	<1	<1	<1	<1
Acenaphthene	µg/L	<1	<1	<1	<1	<1
Fluorene	µg/L	<1	<1	<1	<1	<1
Phenanthrene	µg/L	<1	<1	<1	<1	<1
Anthracene	µg/L	<1	<1	<1	<1	<1
Fluoranthene	µg/L	<1	<1	<1	<1	<1
Pyrene	µg/L	<1	<1	<1	<1	<1
Benzo(a)anthracene	µg/L	<1	<1	<1	<1	<1
Chrysene	µg/L	<1	<1	<1	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	<2	<2	<2	<2	<2
Benzo(a)pyrene	µg/L	<1	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1	<1	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1	<1	<1	<1
Benzo(a)pyrene TEQ	µg/L	<5	<5	<5	<5	<5
Total +ve PAH's	µg/L	NIL (+)VE	NIL (+)VE	2.1	4.3	8.2
Surrogate p-Terphenyl-d14	%	93	89	87	93	91

PAHs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ---------- 	134814-6 Condensate 6.3% 10/9/2015 10/09/2015 Water	134814-7 Condensate 12.5% 10/9/2015 10/09/2015 Water	134814-8 Condensate 25% 10/9/2015 10/09/2015 Water	134814-9 Condensate 50% 10/9/2015 10/09/2015 Water	134814-10 Condensate 100% 10/9/2015 10/09/2015 Water
Date extracted	-	24/09/2015	24/09/2015	24/09/2015	24/09/2015	24/09/2015
Date analysed	-	25/09/2015	25/09/2015	25/09/2015	25/09/2015	25/09/2015
Naphthalene	µg/L	16	29	58	110	220
Acenaphthylene	µg/L	<1	<1	<1	<1	<1
Acenaphthene	µg/L	<1	<1	<1	<1	<1
Fluorene	µg/L	<1	<1	1	2	4
Phenanthrene	µg/L	<1	<1	1	2	3
Anthracene	µg/L	<1	<1	<1	<1	<1
Fluoranthene	µg/L	<1	<1	<1	<1	<1
Pyrene	µg/L	<1	<1	<1	<1	<1
Benzo(a)anthracene	µg/L	<1	<1	<1	<1	<1
Chrysene	µg/L	<1	<1	<1	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	<2	<2	<2	<2	<2
Benzo(a)pyrene	µg/L	<1	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1	<1	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1	<1	<1	<1
Benzo(a)pyrene TEQ	µg/L	<5	<5	<5	<5	<5
Total +ve PAH's	µg/L	16	29	61	110	230
Surrogate p-Terphenyl-d14	%	98	89	90	87	94

PAHs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ---------- 	134814-11 FSW Control 11/9/2015 11/09/2015 Water	134814-12 WAF Control 11/9/2015 11/09/2015 Water	134814-13 Condensate 1.6% 11/9/2015 11/09/2015 Water	134814-14 Condensate 3.1% 11/9/2015 11/09/2015 Water	134814-15 Condensate 6.3% 11/9/2015 11/09/2015 Water
Date extracted	-	25/09/2015	25/09/2015	25/09/2015	25/09/2015	25/09/2015
Date analysed	-	25/09/2015	25/09/2015	25/09/2015	25/09/2015	25/09/2015
Naphthalene	µg/L	<1	<1	4	7	14
Acenaphthylene	µg/L	<1	<1	<1	<1	<1
Acenaphthene	µg/L	<1	<1	<1	<1	<1
Fluorene	µg/L	<1	<1	<1	<1	<1
Phenanthrene	µg/L	<1	<1	<1	<1	<1
Anthracene	µg/L	<1	<1	<1	<1	<1
Fluoranthene	µg/L	<1	<1	<1	<1	<1
Pyrene	µg/L	<1	<1	<1	<1	<1
Benzo(a)anthracene	µg/L	<1	<1	<1	<1	<1
Chrysene	µg/L	<1	<1	<1	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	<2	<2	<2	<2	<2
Benzo(a)pyrene	µg/L	<1	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1	<1	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1	<1	<1	<1
Benzo(a)pyrene TEQ	µg/L	<5	<5	<5	<5	<5
Total +ve PAH's	µg/L	NIL (+)VE	NIL (+)VE	3.6	7.1	14
Surrogate p-Terphenyl-d14	%	104	107	103	107	94

PAHs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	134814-16 Condensate 12.5% 11/9/2015 11/09/2015 Water	134814-17 Condensate 25% 11/9/2015 11/09/2015 Water	134814-18 Condensate 50% 11/9/2015 11/09/2015 Water	134814-19 Condensate 100% 11/9/2015 11/09/2015 Water
Date extracted	-	25/09/2015	25/09/2015	25/09/2015	25/09/2015
Date analysed	-	25/09/2015	25/09/2015	25/09/2015	25/09/2015
Naphthalene	µg/L	29	55	100	200
Acenaphthylene	µg/L	<1	<1	<1	<1
Acenaphthene	µg/L	<1	<1	<1	<1
Fluorene	µg/L	<1	1	3	3
Phenanthrene	µg/L	<1	<1	2	2
Anthracene	µg/L	<1	<1	<1	<1
Fluoranthene	µg/L	<1	<1	<1	<1
Pyrene	µg/L	<1	<1	<1	<1
Benzo(a)anthracene	µg/L	<1	<1	<1	<1
Chrysene	µg/L	<1	<1	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	<2	<2	<2	<2
Benzo(a)pyrene	µg/L	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1	<1	<1
Benzo(a)pyrene TEQ	µg/L	<5	<5	<5	<5
Total +ve PAH's	µg/L	29	57	110	210
Surrogate p-Terphenyl-d14	%	104	106	115	100

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			28/09/2015	134814-1	28/09/2015 || 29/09/2015	LCS-W2	28/09/2015
Date analysed	-			29/09/2015	134814-1	29/09/2015 || 29/09/2015	LCS-W2	29/09/2015
TRHC_6 - C_9	µg/L	10	Org-016	<10	134814-1	<10 || <10	LCS-W2	101%
TRHC_6 - C_{10}	µg/L	10	Org-016	<10	134814-1	<10 || <10	LCS-W2	101%
Benzene	µg/L	1	Org-016	<1	134814-1	<1 || <1	LCS-W2	101%
Toluene	µg/L	1	Org-016	<1	134814-1	<1 || <1	LCS-W2	103%
Ethylbenzene	µg/L	1	Org-016	<1	134814-1	<1 || <1	LCS-W2	99%
m+p-xylene	µg/L	2	Org-016	<2	134814-1	<2 || <2	LCS-W2	100%
o-xylene	µg/L	1	Org-016	<1	134814-1	<1 || <1	LCS-W2	97%
Naphthalene	µg/L	1	Org-013	<1	134814-1	<1 || <1	[NR]	[NR]
Surrogate Dibromofluoromethane	%		Org-016	97	134814-1	98 || 103 || RPD: 5	LCS-W2	96%
Surrogate toluene-d8	%		Org-016	102	134814-1	102 || 95 || RPD: 7	LCS-W2	105%
Surrogate 4-BFB	%		Org-016	97	134814-1	97 || 89 || RPD: 9	LCS-W2	101%

QUALITY CONTROL svTRH (C10-C40) in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			25/09/2015	[NT]	[NT]	LCS-W2	24/09/2015
Date analysed	-			29/09/2015	[NT]	[NT]	LCS-W2	25/09/2015
TRHC_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W2	90%
TRHC_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W2	81%
TRHC_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W2	83%
TRH>C_{10} - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W2	90%
TRH>C_{16} - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W2	81%
TRH>C_{34} - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W2	83%
Surrogate o-Terphenyl	%		Org-003	90	[NT]	[NT]	LCS-W2	79%

QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			25/09/2015	[NT]	[NT]	LCS-W1	24/09/2015
Date analysed	-			25/09/2015	[NT]	[NT]	LCS-W1	25/09/2015
Naphthalene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	76%
Acenaphthylene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	77%
Phenanthrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	80%

QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	80%
Pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	85%
Benzo(a)anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	80%
Benzo(b,j+k) fluoranthene	µg/L	2	Org-012 subset	<2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	85%
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	84	[NT]	[NT]	LCS-W1	69%

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Water	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date extracted	-	134814-11	28/09/2015 || 29/09/2015
Date analysed	-	134814-11	29/09/2015 || 29/09/2015
$TRHC_6$ - C_9	µg/L	134814-11	<10 || <10
$TRHC_6$ - C_{10}	µg/L	134814-11	<10 || <10
Benzene	µg/L	134814-11	<1 || <1
Toluene	µg/L	134814-11	<1 || <1
Ethylbenzene	µg/L	134814-11	<1 || <1
m+p-xylene	µg/L	134814-11	<2 || <2
o-xylene	µg/L	134814-11	<1 || <1
Naphthalene	µg/L	134814-11	<1 || <1
Surrogate Dibromofluoromethane	%	134814-11	100 || 103 || RPD: 3
Surrogate toluene-d8	%	134814-11	99 || 95 || RPD: 4
Surrogate 4-BFB	%	134814-11	96 || 88 || RPD: 9

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Appendix C: Test Report for the Sea Urchin Fertilisation Test

Toxicity Test Report: TR1244/1

Accredited for compliance with ISO/IEC 17025

Client:	Jacobs Group (Australia) Pty Ltd 263 Adelaide Terrace Perth WA 6001	**ESA Job #:** **Date Sampled:** **Date Received:**	PR1244 27 December 2014 27 August 2015
Attention:	Celeste Wilson	**Sampled By:**	Client
Client Ref:	Not Supplied	**ESA Quote #:**	PL1244_q03

Lab ID No.:	Sample Name:	Sample Description:
7323	Barossa Field Condensate	Condensate sample received at room temperature in apparent good condition.

Test Performed:	1-hr sea urchin fertilisation success test using *Heliocidaris tuberculata*
Test Protocol:	ESA SOP 104 (ESA 2014), based on USEPA (2002) and Simon and Laginestra (1996)
Test Temperature:	The test was performed at 20±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	Pre-weighed aliquot of condensate were added to filtered seawater (FSW) at a single loading rate of 1 part oil to 9 parts FSW. The samples were mixed for 24 hours using a magnetic stirrer so that the peak of a vortex is achieved. Following mixing, the solutions were left to settle for 1 hour, after which time the water-accommodated fractions (WAF) were siphoned off. The WAF was serially diluted with FSW to prepare the remaining test concentrations. A FSW control and a WAF control were tested concurrently with the sample. The test concentrations are expressed as loading rates and total recoverable hydrocarbon (TRH) concentrations.
Source of Test Organisms:	Field collected from South Maroubra, NSW.
Test Initiated:	10 September 2015 at 1130h

Sample 7323*: Barossa Field Condensate*

Loading Rate (g/L)	% Fertilised Eggs (Mean ± SD)	
FSW Control	78.8 ± 3.2	
WAF Control	90.0 ± 2.6	
0.6	84.3 ± 6.5	
1.2	82.3 ± 3.4	*
2.4	80.5 ± 5.2	*
4.8	80.5 ± 4.1	*
9.7	80.0 ± 2.2	*
19.3	34.8 ± 8.8	*
38.6	0.0 ± 0.0	
77.2	0.0 ± 0.0	

EC10 = 14.6g/L**
EC50 = 18.6 (8.97-19.12)g/L
NOEC = 0.6g/L
LOEC = 1.2g/L

Sample 7323*: Barossa Field Condensate*

Concentration (µg/L)	% Fertilised Eggs (Mean ± SD)	
FSW Control	78.8 ± 3.2	
WAF Control	90.0 ± 2.6	
350	84.3 ± 6.5	
720	82.3 ± 3.4	*
1673	80.5 ± 5.2	*
3180	80.5 ± 4.1	*
7160	80.0 ± 2.2	*
14060	34.8 ± 8.8	*
30860	0.0 ± 0.0	
69620	0.0 ± 0.0	

EC10 = 9206.2 (7702.42-10203.00)µg/L
EC50 = 13202.7 (12495.20-13763.40)µg/L
NOEC = 350µg/L
LOEC = 720µg/L

*Significantly lower percentage fertilised eggs compared with the WAF Control (Dunnett's Test, 1-tailed, P=0.05)
**95% Confidence Limits not reliable

Toxicity Test Report: TR1244/1

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % fertilised eggs	≥70.0%	78.8%	Yes
Reference Toxicant within cusum chart limits	23.7-105.6µg Cu/L	26.7µg Cu/L	Yes

Test Report Authorised by: Dr Rick Krassoi, Director on 9 November 2015

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

ESA (2014) ESA SOP 104 - *Sea Urchin Fertilisation Success Test*. Issue No. 13. Ecotox Services Australasia, Sydney NSW.

Simon, J. and Laginestra, E.(1997) Bioassay for testing sublethal toxicity in effluents, using gametes of sea urchin *Heliocidaris tuberculata*. National Pulp Mills Research Program Technical Report No. 20. CSIRO, Canberra ACT

USEPA (2002) Short-term methods for measuring the chronic toxicity of effluents and receiving waters to marine and estuarine organisms. Third Edition. United States Environmental Protection Agency, Office of Water, Washington DC, EPA-821-R-02-014.

Appendix D: Test Report for the Sea Urchin Larval Development Test

Toxicity Test Report: TR1244/2

Accredited for compliance with ISO/IEC 17025

Client:	Jacobs Group (Australia) Pty Ltd 263 Adelaide Terrace Perth WA 6001	**ESA Job #:** **Date Sampled:** **Date Received:**	PR1244 27 December 2014 27 August 2015
Attention:	Celeste Wilson	**Sampled By:**	Client
Client Ref:	Not Supplied	**ESA Quote #:**	PL1244_q03

Lab ID No.:	Sample Name:	Sample Description:
7323	Barossa Field Condensate	Condensate sample received at room temperature in apparent good condition.

Test Performed:	72-hr sea urchin larval development test using *Heliocidaris tuberculata*
Test Protocol:	ESA SOP 105 (ESA 2014), based on APHA (1998), Simon and Laginestra (1996) and Doyle *et al*. (2003)
Test Temperature:	The test was performed at 20±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	Pre-weighed aliquot of condensate were added to filtered seawater (FSW) at a single loading rate of 1 part oil to 9 parts FSW. The samples were mixed for 24 hours using a magnetic stirrer so that the peak of a vortex is achieved. Following mixing, the solutions were left to settle for 1 hour, after which time the water-accommodated fractions (WAF) were siphoned off. The WAF was serially diluted with FSW to prepare the remaining test concentrations. A FSW control and a WAF control were tested concurrently with the sample. The test concentrations are expressed as loading rates and total recoverable hydrocarbon (TRH) concentrations.
Source of Test Organisms:	Field collected from South Maroubra, NSW.
Test Initiated:	10 September 2015 at 1245h

Sample 7323*: Barossa Field Condensate*

Loading Rate (g/L)	% Normal larvae (Mean ± SD)	
FSW Control	80.8 ± 5.0	
WAF Control	87.8 ± 2.2	
1.2	83.0 ± 3.2	
2.4	83.0 ± 5.4	
4.8	84.3 ± 6.7	
9.7	83.8 ± 4.8	
19.3	81.0 ± 4.2	
38.6	1.5 ± 1.3	*
77.2	0.0 ± 0.0	

EC10 = 21.0 (18.90-22.76)g/L
EC50 = 26.5 (24.67-28.01)g/L
NOEC = 19.3g/L
LOEC = 38.6g/L

Sample 7323*: Barossa Field Condensate*

Concentration (µg/L)	% Normal larvae (Mean ± SD)	
FSW Control	80.8 ± 5.0	
WAF Control	87.8 ± 2.2	
720	83.0 ± 3.2	
1673	83.0 ± 5.4	
3180	84.3 ± 6.7	
7160	83.8 ± 4.8	
14060	81.0 ± 4.2	
30860	1.5 ± 1.3	*
69620	0.0 ± 0.0	

EC10 = 15481.6 (13727.10-16947.80)µg/L
EC50 = 20104.40 (18575.70-21450.10)µg/L
NOEC = 14060µg/L
LOEC = 30860µg/L

*Significantly lower percentage of normally developed larvae compared with the WAF Control (Dunnett's Test, 1-tailed, P=0.05)

Toxicity Test Report: TR1244/2

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % normal larvae	≥70.0%	80.8%	Yes
Reference Toxicant within cusum chart limits	10.5-23.1µg Cu/L	12.2µg Cu/L	Yes

Test Report Authorised by: Dr Rick Krassoi, Director on 9 November 2015

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

APHA (1998) Method 8810 D. Echinoderm Embryo Development Test. In Standard Methods for the Examination of Water and Wastewater, 20th Ed. American Public Health Association, American Water Works Association and the Water Environment Federation, USA.

Doyle, C.J., Pablo, F., Lim, R.P. and Hyne, R.V. (2003) Assessment of metal toxicity in sediment pore water from Lake Macquarie, Australia. *Arch. Environ. Contam. Toxicology*, 44(3): 343-350.

ESA (2014) *ESA SOP 105 - Sea Urchin Larval Development Test*. Issue No. 10. Ecotox Services Australasia, Sydney NSW.

Simon, J. and Laginestra, E.(1997) Bioassay for testing sublethal toxicity in effluents, using gametes of sea urchin *Heliocidaris tuberculata*. National Pulp Mills Research Program Technical Report No. 20. CSIRO, Canberra, ACT.

Appendix E: Test Report for the Milky Oyster Larval Development Test

Toxicity Test Report: TR1244/3

Accredited for compliance with ISO/IEC 17025

Client:	Jacobs Group (Australia) Pty Ltd 263 Adelaide Terrace Perth WA 6001	**ESA Job #:** **Date Sampled:** **Date Received:**	PR1244 27 December 2014 27 August 2015
Attention:	Celeste Wilson	**Sampled By:**	Client
Client Ref:	Not Supplied	**ESA Quote #:**	PL1244_q03

Lab ID No.:	Sample Name:	Sample Description:
7323	Barossa Field Condensate	Condensate sample received at room temperature in apparent good condition.

Test Performed:	48-hr larval development test using the milky oyster *Saccostrea echinata*
Test Protocol:	ESA SOP 106 (ESA 2014), based on APHA (1998) and Krassoi (1995)
Test Temperature:	The test was performed at 29±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	Pre-weighed aliquot of condensate were added to filtered seawater (FSW) at a single loading rate of 1 part oil to 9 parts FSW. The samples were mixed for 24 hours using a magnetic stirrer so that the peak of a vortex is achieved. Following mixing, the solutions were left to settle for 1 hour, after which time the water-accommodated fractions (WAF) were siphoned off. The WAF was serially diluted with FSW to prepare the remaining test concentrations. A FSW control and a WAF control were tested concurrently with the sample. The test concentrations are expressed as loading rates and total recoverable hydrocarbon (TRH) concentrations
Source of Test Organisms:	Field collected from Mackay, QLD.
Test Initiated:	10 September 2015 at 1800h

Sample 7323*: Barossa Field Condensate*

Loading Rate (g/L)	% Normal larvae (Mean ± SD)	
FSW Control	74.5 ± 4.8	
WAF Control	72.5 ± 3.1	
1.2	70.8 ± 3.6	
2.4	72.5 ± 3.1	
4.8	72.3 ± 4.2	
9.7	73.5 ± 2.1	
19.3	62.0 ± 2.2	*
38.6	0.0 ± 0.0	
77.2	0.0 ± 0.0	

IC10 = 15.7(11.78-18.35)g/L
EC50 = 24.7 (24.11-25.32)g/L
NOEC = 9.7g/L
LOEC = 19.3g/L

Sample 7323*: Barossa Field Condensate*

Concentration (µg/L)	% Normal larvae (Mean ± SD)	
FSW Control	74.5 ± 4.8	
WAF Control	72.5 ± 3.1	
720	70.8 ± 3.6	
1673	72.5 ± 3.1	
3180	72.3 ± 4.2	
7160	73.5 ± 2.1	
14060	62.0 ± 2.2	*
30860	0.0 ± 0.0	
69620	0.0 ± 0.0	

IC10 = 11478.4 (9026.54-13230.50)µg/L
EC50 = 18747.2 (18266.80-19240.30)µg/L
NOEC = 7160µg/L
LOEC = 14060µg/L

*Significantly lower percentage of normal larvae compared with the WAF Control (Dunnett's Test, 1-tailed, P=0.05)

Toxicity Test Report: TR1244/3

QA/QC Parameter	Criterion	This Test	Criterion met?
FSW Control mean % normal	≥70%	74.5%	Yes
Reference Toxicant within cusum chart limits	10.2-20.0µg Cu/L	14.5µg Cu/L	Yes

Test Report Authorised by: Dr Rick Krassoi, Director on 9 November 2015

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

APHA (1998) Standard Methods for the Examination of Water and Wastewater. 20th Ed. American Public Health Association, American Water Works Association and the Water Environment Federation, Washington, DC.

ESA (2014) SOP 106 – *Bivalve Larval Development Test*. Issue No. 14. Ecotox Services Australasia, Sydney, NSW.

Krassoi, R (1995) Salinity adjustment of effluents for use with marine bioassays: effects on the larvae of the doughboy scallop Chlamys asperrimus and the Sydney rock oyster *Saccostrea commercialis*. *Australasian Journal of Ecotoxicology*, 1: 143-148.

Appendix F: Test Report for the Micro-Algal Growth Inhibition Test

Toxicity Test Report: TR1244/4

Accredited for compliance with ISO/IEC 17025

Client:	Jacobs Group (Australia) Pty Ltd 263 Adelaide Terrace Perth WA 6001	**ESA Job #:** **Date Sampled:** **Date Received:**	PR1244 27 December 2014 27 August 2015
Attention:	Celeste Wilson	**Sampled By:**	Client
Client Ref:	Not Supplied	**ESA Quote #:**	PL1244_q03

Lab ID No.:	Sample Name:	Sample Description:
7323	Barossa Field Condensate	Condensate sample received at room temperature in apparent good condition.

*NATA accreditation does not cover the performance of this service

Test Performed:	72-hr marine algal growth test using *Isochrysis aff. galbana*
Test Protocol:	ESA SOP 110 (ESA 2014), based on Stauber *et al*. (1994)
Test Temperature:	The test was performed at 29±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	Pre-weighed aliquot of condensate were added to filtered seawater (FSW) at a single loading rate of 1 part oil to 9 parts FSW. The samples were mixed for 24 hours using a magnetic stirrer so that the peak of a vortex is achieved. Following mixing, the solutions were left to settle for 1 hour, after which time the water-accommodated fractions (WAF) were siphoned off. The WAF was serially diluted with FSW to prepare the remaining test concentrations. A FSW control and a WAF control were tested concurrently with the sample. The test concentrations are expressed as loading rates and total recoverable hydrocarbon (TRH) concentrations.
Source of Test Organisms:	In-house culture, originally sourced from CSIRO Microalgae Supply Service, TAS
Test Initiated:	11 September 2015 at 1110h

Sample 7323*: Barossa Field Condensate*

Loading Rate (g/L)	**Cell Yield (Mean number of cells/mL x10^4 ± SD)**	
FSW Control	20.2 ± 3.2	
WAF Control	17.8 ± 1.0	
1.2	18.9 ± 4.3	
2.4	21.4 ± 7.3	
4.8	20.8 ± 6.2	
9.7	13.6 ± 5.1	
19.3	1.1 ± 0.5	*
38.6	0.0 ± 0.0	
77.2	0.0 ± 0.0	

IC10 = 6.39 (2.18-10.68)g/L
IC50 = 12.6 (7.45-15.09)g/L
NOEC = 9.7g/L
LOEC = 19.3g/L

Sample 7323*: Barossa Field Condensate*

Concentration (µg/L)	**Cell Yield (Mean number of cells/mL x10^4 ± SD)**	
FSW Control	20.2 ± 3.2	
WAF Control	17.8 ± 1.0	
650	18.9 ± 4.3	
1400	21.4 ± 7.3	
3248	20.8 ± 6.2	
6670	13.6 ± 5.1	
12850	1.1 ± 0.5	*
27960	0.0 ± 0.0	
65830	0.0 ± 0.0	

IC10 = 4355.2 (1641.13-7401.38)µg/L
IC50 = 8529.3 (5094.77-10126.00)µg/L
NOEC = 6670µg/L
LOEC = 12850µg/L

*Significantly lower cell yield compared with the WAF Control (Steel's Many-One Rank Test, 1-tailed, P=0.05)

Toxicity Test Report: TR1244/4

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean cell density	≥16.0x10^4 cells/mL	21.2x10^4 cells/mL	Yes
Control coefficient of variation	<20%	16.0%	Yes
Reference Toxicant within cusum chart limits	15.1-46.7µg Cu/L	19.0µg Cu/L	Yes

Test Report Authorised by: Dr Rick Krassoi, Director on 9 November 2015

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

ESA (2014) SOP 110 – *Marine Algal Growth Test*. Issue No. 11. Ecotox Services Australasia, Sydney NSW

Stauber, J.L., Tsai, J., Vaughan, G.T., Peterson, S.M. and Brockbank, C.I. (1994) Algae as indicators of toxicity of the effluent from bleached eucalypt kraft pulp mills. National Pulp Mills Research Program, Technical Report No. 3. CSIRO, Canberra, ACT

Appendix G: Test Report for the Macro-Algal Growth Test

ecotox SERVICES AUSTRALASIA

Toxicity Test Report: TR1244/5

Client:	Jacobs Group (Australia) Pty Ltd 263 Adelaide Terrace Perth WA 6001	**ESA Job #:** **Date Sampled:** **Date Received:**	PR1244 27 December 2014 27 August 2015
Attention:	Celeste Wilson	**Sampled By:**	Client
Client Ref:	Not Supplied	**ESA Quote #:**	PL1244_q03

Lab ID No.:	Sample Name:	Sample Description:
7323	Barossa Field Condensate	Condensate sample received at room temperature in apparent good condition.

Test Performed:	14-day macroalgal growth test using *Ecklonia radiata*
Test Protocol:	ESA SOP 116 (ESA 2010), based on Bidwell *et al*. (1998) and Burridge *et al.* (1999)
Test Temperature:	The test was performed at 18±1°C.
Deviations from Protocol:	Test extended from 72 hours to 14 days to encompass growth endpoint.
Comments on Solution Preparation:	Pre-weighed aliquot of condensate were added to filtered seawater (FSW) at a single loading rate of 1 part oil to 9 parts FSW. The samples were mixed for 24 hours using a magnetic stirrer so that the peak of a vortex is achieved. Following mixing, the solutions were left to settle for 1 hour, after which time the water-accommodated fractions (WAF) were siphoned off. The WAF was serially diluted with FSW to prepare the remaining test concentrations. A FSW control and a WAF control were tested concurrently with the sample. The test concentrations are expressed as loading rates and total recoverable hydrocarbon (TRH) concentrations.
Source of Test Organisms:	Field collected from Mercury Passage, TAS
Test Initiated:	10 September 2015 at 1400h

Sample 7323*: Barossa Field Condensate*

Loading Rate (g/L)	Gametophyte Length, µm (Mean ± SD)	
FSW Control	23.65 ± 1.12	
WAF Control	24.90 ± 2.80	
1.2	22.93 ± 1.35	
2.4	22.60 ± 3.28	
4.8	21.18 ± 1.14	*
9.7	18.63 ± 1.04	*
19.3	15.00 ± 0.85	*
38.6	13.78 ± 1.51	*
77.2	11.83 ± 1.11	*

14-day IC10 = 2.7g/L**
14-day IC50 = 64.8g/L**
NOEC = 2.4g/L
LOEC = 4.8g/L

Sample 7323: Barossa *Field Condensate*

Concentration (µg/L)	Gametophyte Length, µm (Mean ± SD)	
FSW Control	23.65 ± 1.12	
WAF Control	24.90 ± 2.80	
720	22.93 ± 1.35	
1673	22.60 ± 3.28	
3180	21.18 ± 1.14	*
7160	18.63 ± 1.04	*
14060	15.00 ± 0.85	*
30860	13.78 ± 1.51	*
69620	11.83 ± 1.11	*

14-day IC10 = 1873.9µg/L**
14-day IC50 = 57196.9µg/L**
NOEC = 1673µg/L
LOEC = 3180µg/L

*Significantly lower gametophyte length compared with the WAF Control (Dunnett's Test, 1-tailed, P=0.05)
**95% confidence limits are not reliable

Toxicity Test Report: TR1244/5

QA/QC Parameter	Criterion	This Test	Criterion met?
FSW Control mean % germination @ 72hrs	≥70%	90.3%	Yes
72-hr germination reference Toxicant within cusum chart limits	86.0-1262.1µg Cu/L	408.5µg Cu/L	Yes

Test Report Authorised by: Dr Rick Krassoi, Director on 9 November 2015

Results are based on the samples in the condition as received by ESA. This document shall not be reproduced except in full.

Citations:

Bidwell, J. R., Wheeler, K. W., & Burridge, T. R. (1998). Toxicant effects on the zoospore stage of the marine maroalga Ecklonia radiata (Phaeophyta:Laminariales). *Marine Ecology Progress Series.Vol 163* , 259-265.

Burridge, T. R., Karistanios, M., & Bidwell, J. (1999). The use of aquatic macrophyte ecotoxicological assays inmonitoring coastal effluent discharges in southern Australia. *Marine Pollution Bulletin. Vol 39* , 1-12.

ESA (2010) *SOP 116 – Macroalgal Germination Success Test.* Issue No. 11. Ecotox Services Australasia, Sydney NSW

Appendix H: Test Report for the Sea Anemone Development Test

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SERVICES AUSTRALASIA

Toxicity Test Report: TR1244/6

Client:	Jacobs Group (Australia) Pty Ltd 263 Adelaide Terrace Perth WA 6001	**ESA Job #:** **Date Sampled:** **Date Received:**	PR1244 27 December 2014 27 August 2015
Attention:	Celeste Wilson	**Sampled By:**	Client
Client Ref:	Not Supplied	**ESA Quote #:**	PL1244_q03

Lab ID No.:	Sample Name:	Sample Description:
7323	Barossa Field Condensate	Condensate sample received at room temperature in apparent good condition.

Test Performed:	8-day Sea anemone pedal lacerate development test using *Aiptasia pulchella*
Test Protocol:	ESA SOP 128 (ESA 2014), based on Howe *et al.* (2014)
Test Temperature:	The test was performed at 20±1°C.
Deviations from Protocol:	Three replicate were used for the sample concentrations.
Comments on Solution Preparation:	Pre-weighed aliquot of condensate were added to filtered seawater (FSW) at a single loading rate of 1 part oil to 9 parts FSW. The samples were mixed for 24 hours using a magnetic stirrer so that the peak of a vortex is achieved. Following mixing, the solutions were left to settle for 1 hour, after which time the water-accommodated fractions (WAF) were siphoned off. The WAF was serially diluted with FSW to prepare the remaining test concentrations. A FSW control and a WAF control were tested concurrently with the sample. The test concentrations are expressed as loading rates and total recoverable hydrocarbon (TRH) concentrations.
Source of Test Organisms:	In house cultures
Test Initiated:	27 October 2015 at 1130h

Sample 7323*: Barossa Field Condensate*

Loading Rate (g/L)	% Normal (Mean ± SD)
FSW Control	100 ± 0.0
WAF Control	95.0 ± 10.0
4.8	93.3 ± 11.6
9.7	86.7 ± 11.6
19.3	80.0 ± 20.0
38.6	73.3 ± 11.6
77.2	0.0 ± 0.0

8-day IC10 = 11.2g/L*
8-day EC50 = 40.1 (31.78-50.60)g/L
NOEC = 38.6g/L
LOEC = 77.2g/L

Sample 7323*: Barossa Field Condensate*

Concentration (µg/L)	% Normal (Mean ± SD)
FSW Control	100 ± 0.0
WAF Control	95.0 ± 10.0
2492	93.3 ± 11.6
7660	86.7 ± 11.6
15840	80.0 ± 20.0
28040	73.3 ± 11.6
63990	0.0 ± 0.0

8-day IC10 = 8862.4µg/L*
8-day EC50 = 30720.0 (23961.00-39385.50)µg/L
NOEC = 28040µg/L
LOEC = 63990µg/L

*95% confidence limits are not reliable

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % normal pedal lacerates	≥90.0%	100%	Yes
Reference Toxicant within cusum chart limits	n/a	11.5µg Cu/L	n/a

Toxicity Test Report: TR1244/6

Test Report Authorised by: Dr Rick Krassoi, Director on 7 December 2015

Results are based on the samples in the condition as received by ESA. This document shall not be reproduced except in full.

Citations:

Cary, L.R. (1911) A study of pedal laceration in actinians. The Biological Bulletin 20, 81-107.

ESA (2014) ESA SOP 128 – *Sea Anemone Pedal Lacerate Development Test*. Issue No. 1. Ecotox Services Australasia, Sydney NSW.

Howe, Pelli L., Reichelt-Brushett, Amanda J. and Clark, Malcolm W (2014) Development of a chronic, early life-stage sub-lethal toxicity test and recovery assessment for the tropical zooxanthellate sea anemone Aiptasia pulchella. Ecotoxicology and Environmental Safety 100: 138-147.

Stauber, Jennifer L, Julie Tsai, Gary T Vaughan, Sharon M Peterson, and Christopher I Brockbank. Algae as indicators of toxicity of the effluent from bleached eucalypt kraft pulp mills. Technical Report Series No. 3. Fyshwick: National Pulp Mills Research Program, 1994.

Appendix I: Test Report for the Copepodid Development Test

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SERVICES AUSTRALASIA

Toxicity Test Report: TR1244/7

Client:	Jacobs Group (Australia) Pty Ltd 263 Adelaide Terrace Perth WA 6001	**ESA Job #:**	PR1244
		Date Sampled:	27 December 2014
		Date Received:	27 August 2015
Attention:	Celeste Wilson	**Sampled By:**	Client
Client Ref:	Not Supplied	**ESA Quote #:**	PL1244_q03

Lab ID No.:	Sample Name:	Sample Description:
7323 B	arossa Field Condensate	Condensate sample received at room temperature in apparent good condition.

Test Performed:	5-day copepodid development toxicity test using the copepod *Parvocalanus crassirostris*
Test Protocol:	Based on ESA SOP 124 (2014)
Test Temperature:	The test was performed at 27±1°C.
Deviations from Protocol:	Test extended to 5 days. Copepod eggs added to test solutions at test initiation, and copepodid development counted at test termination. Test run at 28±1°C. Fed Isochrysis at a rate of 16,000 cells/copepod daily.
Comments on Solution Preparation:	Pre-weighed aliquot of condensate were added to filtered seawater (FSW) at a single loading rate of 1 part oil to 9 parts FSW. The samples were mixed for 24 hours using a magnetic stirrer so that the peak of a vortex is achieved. Following mixing, the solutions were left to settle for 1 hour, after which time the water-accommodated fractions (WAF) were siphoned off. The WAF was serially diluted with FSW to prepare the remaining test concentrations. A FSW control and a WAF control were tested concurrently with the sample. The test concentrations are expressed as loading rates and total recoverable hydrocarbon (TRH) concentrations.
Source of Test Organisms:	In house culture
Test Initiated:	22 September 2015 at 1400h

Sample 7323*: Barossa Field Condensate*

Loading Rate (g/L)	% Normal (Mean ± SD)	
FSW Control	70.0	± 10.7
WAF Control	60.0	± 16.3
4.8	40.0	± 28.3
9.7	50.0	± 11.6
19.3	0.0	± 0.0
38.6	0.0	± 0.0
77.2	0.0	± 0.0

IC10 = 1.0g/L*^
EC50 = 12.2 (10.84-13.73)g/L
NOEC = 9.7g/L
LOEC = 19.3g/L

Sample 7323*: Barossa Field Condensate*

Concentration (µg/L)	% Normal (Mean ± SD)	
FSW Control	70.0	± 10.7
WAF Control	60.0	± 16.3
38600	40.0	± 28.3
85600	50.0	± 11.6
15830	0.0	± 0.0
29770	0.0	± 0.0
68390	0.0	± 0.0

IC10 = 27.2µg/L*^
EC50 = 10506.9 (9451.82-11679.80)µg/L
NOEC = 8560µg/L
LOEC = 15830µg/L

%95% confidence limits are not reliable
^ Based on extrapolated data

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % Normal	≥70.0%	70.0% Yes	
Reference Toxicant within cusum chart limits	n/a*	2.8µg Cu/L	n/a

*Reference toxicant cusum chart limits are not available due to limited testing

Toxicity Test Report: TR1244/7

Test Report Authorised by: Dr Rick Krassoi, Director on 12 November 2015

Results are based on the samples in the condition as received by ESA.

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Citations:

ESA (2014) *SOP 124 – Acute toxicity test using the copepod Gladioferens imparipes*. Issue No. 3. Ecotox Services Australasia, Sydney, New South Wales.

Appendix J: Test Report for the Fish Imbalance and Growth Test

ecotox SERVICES AUSTRALASIA

Toxicity Test Report: TR1244/8

Client:	Jacobs Group (Australia) Pty Ltd 263 Adelaide Terrace Perth WA 6001	**ESA Job #:**	PR1244
		Date Sampled:	27 December 2014
		Date Received:	27 August 2015
Attention:	Celeste Wilson	**Sampled By:**	Client
Client Ref:	Not Supplied	**ESA Quote #:**	PL1244_q03

Lab ID No.:	Sample Name:	Sample Description:
7323 B	Barossa Field Condensate	Condensate sample received at room temperature in apparent good condition.

Test Performed:	7-day fish imbalance and biomass toxicity test using barramundi *Lates calcarifer*
Test Protocol:	ESA SOP 122 (ESA 2012), based on USEPA (2002)
Test Temperature:	The test was performed at 25±2°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	Pre-weighed aliquot of condensate were added to filtered seawater (FSW) at a single loading rate of 1 part oil to 9 parts FSW. The samples were mixed for 24 hours using a magnetic stirrer so that the peak of a vortex is achieved. Following mixing, the solutions were left to settle for 1 hour, after which time the water-accommodated fractions (WAF) were siphoned off. The WAF was serially diluted with FSW to prepare the remaining test concentrations. A FSW control and a WAF control were tested concurrently with the sample. The test concentrations are expressed as loading rates and total recoverable hydrocarbon (TRH) concentrations.
Source of Test Organisms:	Hatchery reared, SA
Test Initiated:	22 September 2015 at 1230h

Sample 7323: *Barossa Field Condensate*

Loading Rate (g/L)	% Unaffected (Mean ± SD)	
FSW Control	100 ± 0.0	
WAF Control	100 ± 0.0	
4.8	100 ± 0.0	
9.7	100 ± 0.0	
19.3	90.0 ± 11.6	
38.6	20.0 ± 0.0	*
77.2	0.0 ± 0.0	

7 day EC10 (unaffected) = 19.4 (13.58-23.28)g/L
7 day EC50 (unaffected) = 29.3 (24.71-34.66)g/L
NOEC = 19.3g/L
LOEC = 38.6g/L

Sample 7323: *Barossa Field Condensate*

Loading Rate (g/L)	Biomass, mg (Mean ± SD)	
FSW Control	8.3 ± 1.3	
WAF Control	8.0 ± 0.8	
4.8	7.7 ± 0.4	
9.7	8.3 ± 0.3	
19.3	7.7 ± 1.2	
38.6	1.4 ± 0.2	**
77.2	0.0 ± 0.0	

7 day IC10 (biomass) = 20.9 (8.44-22.09)g/L
7 day IC50 (biomass) = 30.6 (27.79-31.44)g/L
NOEC = 19.3g/L
LOEC = 38.6g/L

*Significantly lower percentage of unaffected larval fish compared with the WAF Control (Steel's Many-One Rank Test, 1-tailed, P=0.05)
**Significantly lower fish biomass compared with the WAF Control (Dunnett's Test, 1-tailed, P=0.05)

Toxicity Test Report: TR1244/8

Sample 7323: *Barossa Field Condensate*

Concentration (µg/L)	% Unaffected (Mean ± SD)
FSW Control	100 ± 0.0
WAF Control	100 ± 0.0
3860	100 ± 0.0
8560	100 ± 0.0
15830	90.0 ± 11.6
29770	20.0 ± 0.0 *
68390	0.0 ± 0.0

7 day EC10 (unaffected) = 15875.5 (11275.40-18756.60)µg/L
7 day EC50 (unaffected) = 23182.2 (19851.60-27226.80)µg/L
NOEC = 15830µg/L
LOEC = 29770µg/L

Sample 7323: *Barossa Field Condensate*

Concentration (µg/L)	Biomass, mg (Mean ± SD)
FSW Control	8.3 ± 1.3
WAF Control	8.0 ± 0.8
3860	7.7 ± 0.4
8560	8.3 ± 0.3
15830	7.7 ± 1.2
29770	1.4 ± 0.2 **
68390	0.0 ± 0.0

7 day IC10 (biomass) = 17016.3 (7373.18-18757.60)µg/L
7 day IC50 (biomass) = 24006.3 (21800.80-24621.00)µg/L
NOEC = 15830µg/L
LOEC = 29770µg/L

*Significantly lower percentage of unaffected larval fish compared with the WAF Control (Steel's Many-One Rank Test, 1-tailed, P=0.05)
**Significantly lower fish biomass compared with the WAF Control (Dunnett's Test, 1-tailed, P=0.05)

Sample 7323: *Weathered Barossa Field Condensate*

Loading Rate (g/L)	% Unaffected (Mean ± SD)
FSW Control	100 ± 0.0
WAF Control	100 ± 0.0
5.0	100 ± 0.0
9.9	100 ± 0.0
19.9	100 ± 0.0
39.8	100 ± 0.0
79.5	60.0 ± 49.0

7 day EC10 (unaffected) = 69.1g/L*
7 day EC50 (unaffected) = >79.5g/L
NOEC = 79.5g/L
LOEC = >79.5g/L

Sample 7323: *Weathered Barossa Field Condensate*

Loading Rate (g/L)	Biomass, mg (Mean ± SD)
FSW Control	8.3 ± 1.3
WAF Control	8.0 ± 0.8
5.0	8.7 ± 0.6
9.9	8.0 ± 1.0
19.9	8.1 ± 0.3
39.8	8.6 ± 0.7
79.5	5.0 ± 3.8

7 day IC10 (biomass) = 48.6g/L*
7 day IC50 (biomass) = >79.5g/L
NOEC = 79.5g/L
LOEC = >79.5g/L

*95% confidence limits are not available

Sample 7323: *Weathered Barossa Field Condensate*

Concentration (µg/L)	% Unaffected (Mean ± SD)
FSW Control	100 ± 0.0
WAF Control	100 ± 0.0
1410	100 ± 0.0
2770	100 ± 0.0
4850	100 ± 0.0
11450	100 ± 0.0
22480	60.0 ± 49.0

7 day EC10 (unaffected) = 19596.3µg/L*
7 day EC50 (unaffected) = >22480.0µg/L
NOEC = 22480µg/L
LOEC = >22480µg/L

Sample 7323: *Weathered Barossa Field Condensate*

Concentration (µg/L)	Biomass, mg (Mean ± SD)
FSW Control	8.3 ± 1.3
WAF Control	8.0 ± 0.8
1410	8.7 ± 0.6
2770	8.0 ± 1.0
4850	8.1 ± 0.3
11450	8.6 ± 0.7
22480	5.0 ± 3.8

7 day IC10 (biomass) = 13908.1µg/L*
7 day IC50 (biomass) = >22480.0µg/L
NOEC = 22480µg/L
LOEC = >22480µg/L

*95% confidence limits are not available

Toxicity Test Report: TR1244/8

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % unaffected	≥80.0%	100% Y	es
Control mean growth	≥20% of initial weight	52.6% Ye	s
Reference Toxicant within cusum chart limits	n/a	17.3mg NH_4^+/L n/a	

Test Report Authorised by: Dr Rick Krassoi, Director on 9 November 2015

Results are based on the samples in the condition as received by ESA. This document shall not be reproduced except in full.

Citations:

ESA (2012) SOP 122 – *7-day Fish Imbalance and Growth Test*. Issue No 2. Ecotox Services Australasia, Sydney, NSW

7

USEPA (2002) Short-term methods for estimating the chronic toxicity of effluents and receiving waters to marine and estuarine organisms. Third edition EPA-821-R-02-014. United States Environmental Protection Agency, Office of Research and Development, Washington FC, USA

Appendix K: Statistical Analyses of the Sea Urchin Fertilisation Test

Sea Urchin Fertilisation Test-Proportion Fertilised

Start Date:	10/09/2015 11:30	Test ID:	PR1244/01	Sample ID:	Borossa Field Condensate
End Date:	10/09/2015 12:50	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 104	Test Species:	HT-Heliocidaris tuberculata
Comments:	Loading Rate				

Conc-gm/L	1	2	3	4
FSW Control	0.7600	0.7600	0.8200	0.8100
WAF Control	0.9300	0.8900	0.8700	0.9100
0.6	0.7500	0.9000	0.8500	0.8700
1.2	0.8700	0.8100	0.7900	0.8200
2.4	0.7800	0.8700	0.7500	0.8200
4.8	0.8100	0.8500	0.8100	0.7500
9.7	0.8000	0.7800	0.7900	0.8300
19.3	0.4100	0.2300	0.4200	0.3300
38.6	0.0000	0.0000	0.0000	0.0000
77.2	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
FSW Control	0.7875	0.8750	1.0925	1.0588	1.1326	3.593	4					
WAF Control	0.9000	1.0000	1.2510	1.2019	1.3030	3.477	4	*			40	400
0.6	0.8425	0.9361	1.1678	1.0472	1.2490	7.389	4	1.847	2.451	0.1104	63	400
*1.2	0.8225	0.9139	1.1373	1.0948	1.2019	4.034	4	2.525	2.451	0.1104	71	400
*2.4	0.8050	0.8944	1.1161	1.0472	1.2019	6.013	4	2.996	2.451	0.1104	78	400
*4.8	0.8050	0.8944	1.1150	1.0472	1.1731	4.637	4	3.021	2.451	0.1104	78	400
*9.7	0.8000	0.8889	1.1076	1.0826	1.1458	2.473	4	3.185	2.451	0.1104	80	400
*19.3	0.3475	0.3861	0.6280	0.5002	0.7051	15.109	4	13.837	2.451	0.1104	261	400
38.6	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400
77.2	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400

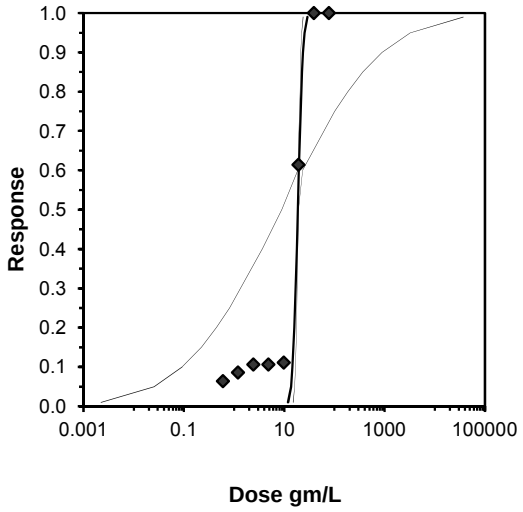
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.956873	0.924	-0.47569	0.016491
Bartlett's Test indicates equal variances (p = 0.50)	5.347583	16.81189		
The control means are significantly different (p = 1.65E-03)	5.407685	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.6	1.2	0.848528		0.075077	0.083314	0.16506	0.004053	1.7E-10	6, 21
Treatments vs WAF Control										

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	12.13036	5.86011	0.644542	23.61617	0.1	6.328178	12.59159	0.39	1.268647	0.082438	47
Intercept	-10.3891	7.536889	-25.1614	4.383164							
TSCR	0.170772	0.00769	0.155699	0.185845							

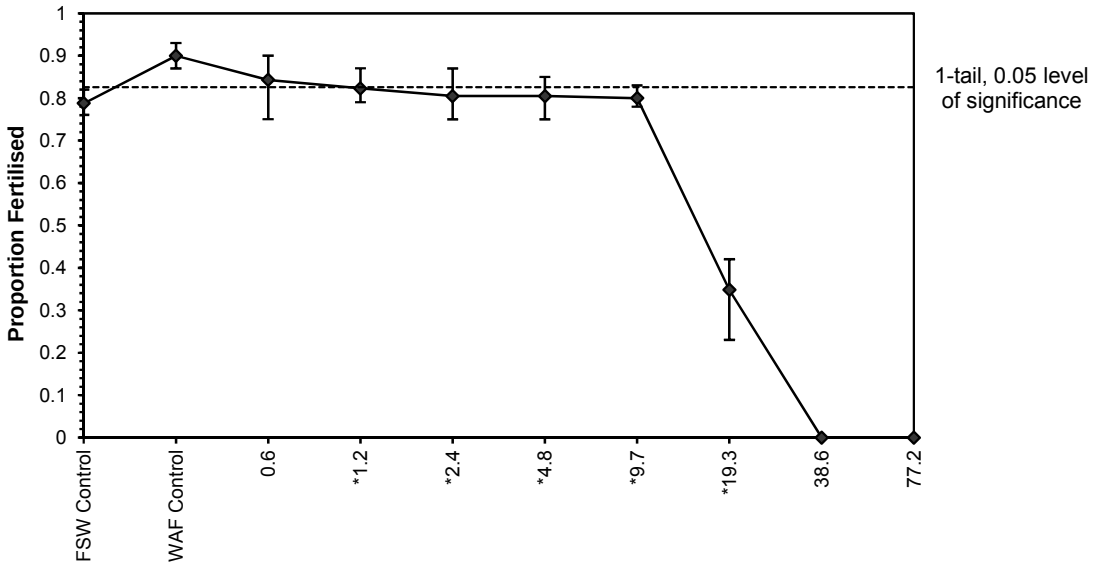
Point	Probits	gm/L	95% Fiducial Limits	
EC01	2.674	11.93624	0.002224	15.10118
EC05	3.355	13.58465	0.025375	16.14361
EC10	3.718	14.55454	0.092886	16.73032
EC15	3.964	15.24774	0.222909	17.13974
EC20	4.158	15.82214	0.446931	17.47387
EC25	4.326	16.33214	0.811669	17.76765
EC40	4.747	17.69136	3.64624	18.55218
EC50	5.000	18.56294	8.966176	19.11728
EC60	5.253	19.47745	18.64012	23.30117
EC75	5.674	21.09843	20.12496	101.2331
EC80	5.842	21.77851	20.48029	183.6966
EC85	6.036	22.59893	20.88954	368.1345
EC90	6.282	23.67527	21.40736	883.1808
EC95	6.645	25.36558	22.19035	3232.15
EC99	7.326	28.8686	23.72618	36865.22



Sea Urchin Fertilisation Test-Proportion Fertilised

Start Date:	10/09/2015 11:30	Test ID:	PR1244/01	Sample ID:	Borossa Field Condensate
End Date:	10/09/2015 12:50	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 104	Test Species:	HT-Heliocidaris tuberculata
Comments:	Loading Rate				

Dose-Response Plot



Sea Urchin Fertilisation Test-Proportion Fertilised

Start Date:	10/09/2015 11:30	Test ID:	PR1244/01	Sample ID:	Borossa Field Condensate
End Date:	10/09/2015 12:50	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 104	Test Species:	HT-Heliocidaris tuberculata
Comments:	Loading Rate				

		Auxiliary Data Summary					
Conc-gm/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Fertilised	78.75	76.00	82.00	3.20	2.27	4
WAF Control		90.00	87.00	93.00	2.58	1.79	4
0.6		84.25	75.00	90.00	6.50	3.03	4
1.2		82.25	79.00	87.00	3.40	2.24	4
2.4		80.50	75.00	87.00	5.20	2.83	4
4.8		80.50	75.00	85.00	4.12	2.52	4
9.7		80.00	78.00	83.00	2.16	1.84	4
19.3		34.75	23.00	42.00	8.81	8.54	4
38.6		0.00	0.00	0.00	0.00		4
77.2		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
0.6		8.10	8.10	8.10	0.00	0.00	1
1.2		8.10	8.10	8.10	0.00	0.00	1
2.4		8.10	8.10	8.10	0.00	0.00	1
4.8		8.10	8.10	8.10	0.00	0.00	1
9.7		8.00	8.00	8.00	0.00	0.00	1
19.3		7.90	7.90	7.90	0.00	0.00	1
38.6		7.70	7.70	7.70	0.00	0.00	1
77.2		7.40	7.40	7.40	0.00	0.00	1
FSW Control	Salinity ppt	35.40	35.40	35.40	0.00	0.00	1
WAF Control		35.60	35.60	35.60	0.00	0.00	1
0.6		35.40	35.40	35.40	0.00	0.00	1
1.2		35.40	35.40	35.40	0.00	0.00	1
2.4		35.40	35.40	35.40	0.00	0.00	1
4.8		35.40	35.40	35.40	0.00	0.00	1
9.7		35.50	35.50	35.50	0.00	0.00	1
19.3		35.50	35.50	35.50	0.00	0.00	1
38.6		35.60	35.60	35.60	0.00	0.00	1
77.2		35.80	35.80	35.80	0.00	0.00	1
FSW Control	DO %	100.20	100.20	100.20	0.00	0.00	1
WAF Control		100.90	100.90	100.90	0.00	0.00	1
0.6		100.00	100.00	100.00	0.00	0.00	1
1.2		99.60	99.60	99.60	0.00	0.00	1
2.4		91.80	91.80	91.80	0.00	0.00	1
4.8		96.10	96.10	96.10	0.00	0.00	1
9.7		98.70	98.70	98.70	0.00	0.00	1
19.3		90.10	90.10	90.10	0.00	0.00	1
38.6		90.20	90.20	90.20	0.00	0.00	1
77.2		87.20	87.20	87.20	0.00	0.00	1

Sea Urchin Fertilisation Test-Proportion Fertilised

Start Date:	10/09/2015 11:30	Test ID:	PR1244/01b	Sample ID:	Borossa Field Condensate
End Date:	10/09/2015 12:50	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 104	Test Species:	HT-Heliocidaris tuberculata
Comments:	TRH				

Conc-ug/L	1	2	3	4
FSW Control	0.7600	0.7600	0.8200	0.8100
WAF Control	0.9300	0.8900	0.8700	0.9100
350	0.7500	0.9000	0.8500	0.8700
720	0.8700	0.8100	0.7900	0.8200
1673	0.7800	0.8700	0.7500	0.8200
3180	0.8100	0.8500	0.8100	0.7500
7160	0.8000	0.7800	0.7900	0.8300
14060	0.4100	0.2300	0.4200	0.3300
30860	0.0000	0.0000	0.0000	0.0000
69620	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
FSW Control	0.7875	0.8750	1.0925	1.0588	1.1326	3.593	4					
WAF Control	0.9000	1.0000	1.2510	1.2019	1.3030	3.477	4	*			40	400
350	0.8425	0.9361	1.1678	1.0472	1.2490	7.389	4	1.847	2.451	0.1104	63	400
*720	0.8225	0.9139	1.1373	1.0948	1.2019	4.034	4	2.525	2.451	0.1104	71	400
*1673	0.8050	0.8944	1.1161	1.0472	1.2019	6.013	4	2.996	2.451	0.1104	78	400
*3180	0.8050	0.8944	1.1150	1.0472	1.1731	4.637	4	3.021	2.451	0.1104	78	400
*7160	0.8000	0.8889	1.1076	1.0826	1.1458	2.473	4	3.185	2.451	0.1104	80	400
*14060	0.3475	0.3861	0.6280	0.5002	0.7051	15.109	4	13.837	2.451	0.1104	261	400
30860	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400
69620	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400

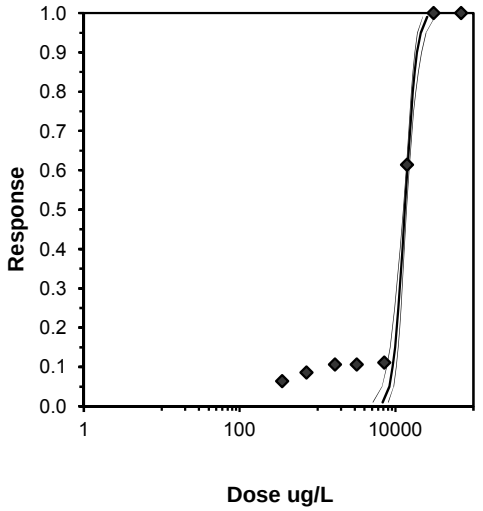
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.956873	0.924	-0.47569	0.016491
Bartlett's Test indicates equal variances (p = 0.50)	5.347583	16.81189		
The control means are significantly different (p = 1.65E-03)	5.407685	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	350	720	501.996		0.075077	0.083314	0.16506	0.004053	1.7E-10	6, 21
Treatments vs WAF Control										

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	8.184476	1.175402	5.880688	10.48826	0.1	6.111686	12.59159	0.41	4.120661	0.122183	15
Intercept	-28.7255	4.881007	-38.2922	-19.1587							
TSCR	0.168365	0.007944	0.152795	0.183936							

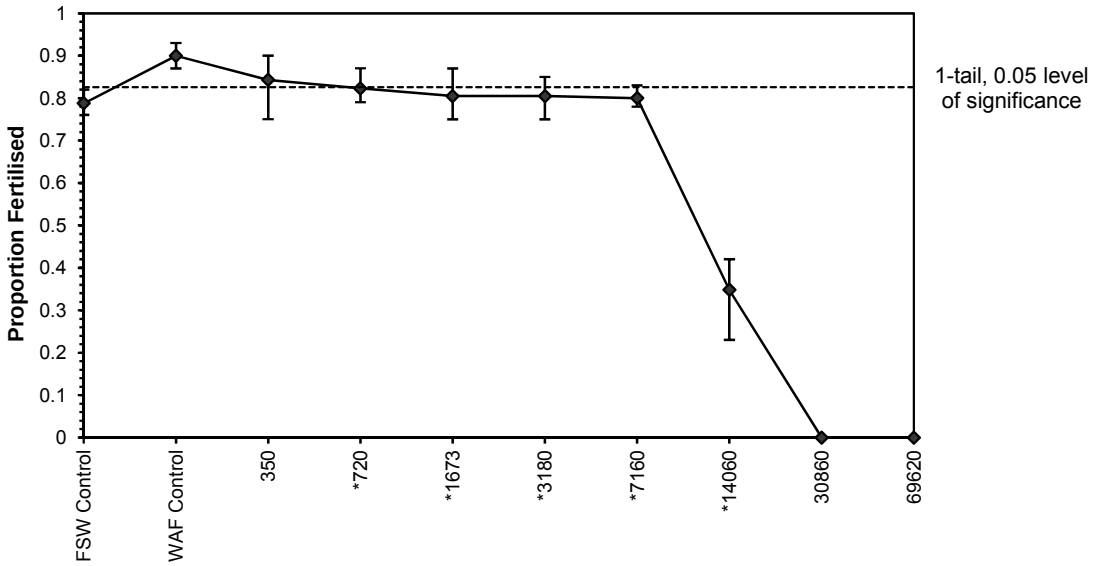
Point	Probits	ug/L	95% Fiducial Limits	
EC01	2.674	6861.551	5129.257	8091.332
EC05	3.355	8311.683	6688.936	9409.815
EC10	3.718	9206.152	7702.422	10203.02
EC15	3.964	9863.415	8468.76	10779.25
EC20	4.158	10419.09	9128.97	11263.89
EC25	4.326	10920.7	9732.943	11700.96
EC40	4.747	12294.38	11406.6	12914.51
EC50	5.000	13202.66	12495.25	13763.39
EC60	5.253	14178.03	13586.08	14777.9
EC75	5.674	15961.44	15266.99	17010.68
EC80	5.842	16729.88	15906.41	18082.49
EC85	6.036	17672.39	16656.57	19451.22
EC90	6.282	18934.09	17624.56	21353.38
EC95	6.645	20971.7	19133.71	24558.6
EC99	7.326	25403.9	22273.69	31994.42



Sea Urchin Fertilisation Test-Proportion Fertilised

Start Date:	10/09/2015 11:30	Test ID:	PR1244/01b	Sample ID:	Borossa Field Condensate
End Date:	10/09/2015 12:50	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 104	Test Species:	HT-Heliocidaris tuberculata
Comments:	TRH				

Dose-Response Plot



Sea Urchin Fertilisation Test-Proportion Fertilised

Start Date:	10/09/2015 11:30	Test ID:	PR1244/01b	Sample ID:	Borossa Field Condensate
End Date:	10/09/2015 12:50	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 104	Test Species:	HT-Heliocidaris tuberculata
Comments:	TRH				

		Auxiliary Data Summary					
Conc-ug/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Fertilised	78.75	76.00	82.00	3.20	2.27	4
WAF Control		90.00	87.00	93.00	2.58	1.79	4
350		84.25	75.00	90.00	6.50	3.03	4
720		82.25	79.00	87.00	3.40	2.24	4
1673		80.50	75.00	87.00	5.20	2.83	4
3180		80.50	75.00	85.00	4.12	2.52	4
7160		80.00	78.00	83.00	2.16	1.84	4
14060		34.75	23.00	42.00	8.81	8.54	4
30860		0.00	0.00	0.00	0.00		4
69620		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
350		8.10	8.10	8.10	0.00	0.00	1
720		8.10	8.10	8.10	0.00	0.00	1
1673		8.10	8.10	8.10	0.00	0.00	1
3180		8.10	8.10	8.10	0.00	0.00	1
7160		8.00	8.00	8.00	0.00	0.00	1
14060		7.90	7.90	7.90	0.00	0.00	1
30860		7.70	7.70	7.70	0.00	0.00	1
69620		7.40	7.40	7.40	0.00	0.00	1
FSW Control	Salinity ppt	35.40	35.40	35.40	0.00	0.00	1
WAF Control		35.60	35.60	35.60	0.00	0.00	1
350		35.40	35.40	35.40	0.00	0.00	1
720		35.40	35.40	35.40	0.00	0.00	1
1673		35.40	35.40	35.40	0.00	0.00	1
3180		35.40	35.40	35.40	0.00	0.00	1
7160		35.50	35.50	35.50	0.00	0.00	1
14060		35.50	35.50	35.50	0.00	0.00	1
30860		35.60	35.60	35.60	0.00	0.00	1
69620		35.80	35.80	35.80	0.00	0.00	1
FSW Control	DO %	100.20	100.20	100.20	0.00	0.00	1
WAF Control		100.90	100.90	100.90	0.00	0.00	1
350		100.00	100.00	100.00	0.00	0.00	1
720		99.60	99.60	99.60	0.00	0.00	1
1673		91.80	91.80	91.80	0.00	0.00	1
3180		96.10	96.10	96.10	0.00	0.00	1
7160		98.70	98.70	98.70	0.00	0.00	1
14060		90.10	90.10	90.10	0.00	0.00	1
30860		90.20	90.20	90.20	0.00	0.00	1
69620		87.20	87.20	87.20	0.00	0.00	1

Appendix L: Statistical Analyses of the Sea Urchin Larval Development Test

Sea Urchin Larval Development Test-Proportion Normal

Start Date:	10/09/2015 12:45	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	13/09/2015 12:45	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 105	Test Species:	HT-Heliocidaris tuberculata
Comments:	Loading Rate				

Conc-gm/L	1	2	3	4
FSW Control	0.8600	0.8400	0.7600	0.7700
WAF Control	0.9000	0.8700	0.8500	0.8900
1.2	0.8500	0.8600	0.8200	0.7900
2.4	0.7800	0.7900	0.8600	0.8900
4.8	0.9100	0.7500	0.8500	0.8600
9.7	0.8900	0.8600	0.7800	0.8200
19.3	0.8400	0.8400	0.8100	0.7500
38.6	0.0200	0.0300	0.0000	0.0100
77.2	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
FSW Control	0.8075	0.9202	1.1190	1.0588	1.1873	5.710	4					
WAF Control	0.8775	1.0000	1.2142	1.1731	1.2490	2.772	4	*			49	400
1.2	0.8300	0.9459	1.1470	1.0948	1.1873	3.644	4	1.552	2.451	0.1062	68	400
2.4	0.8300	0.9459	1.1493	1.0826	1.2327	6.320	4	1.497	2.451	0.1062	68	400
4.8	0.8425	0.9601	1.1684	1.0472	1.2661	7.752	4	1.056	2.451	0.1062	63	400
9.7	0.8375	0.9544	1.1588	1.0826	1.2327	5.630	4	1.278	2.451	0.1062	65	400
19.3	0.8100	0.9231	1.1214	1.0472	1.1593	4.713	4	2.142	2.451	0.1062	76	400
*38.6	0.0150	0.0171	0.1165	0.0500	0.1741	46.067	4	25.329	2.451	0.1062	394	400
77.2	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400

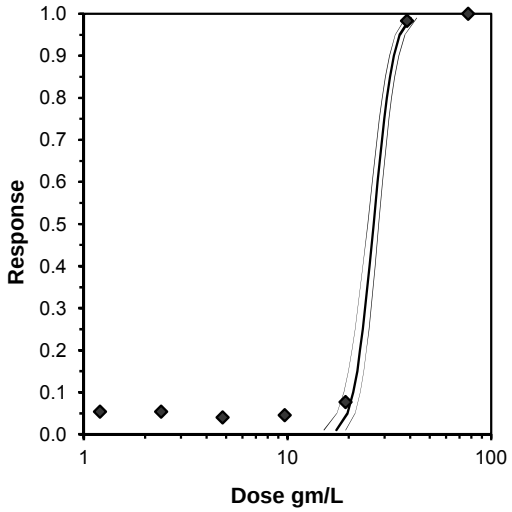
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.9702	0.924	-0.29751	-0.48312
Bartlett's Test indicates equal variances (p = 0.76)	3.405559	16.81189		
The control means are significantly different (p = 0.04)	2.636326	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	19.3	38.6	27.29432		0.077486	0.088239	0.62519	0.003756	1.4E-16	6, 21
Treatments vs WAF Control										

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	12.80885	1.109446	10.63434	14.98337	0.1225	1.216596	11.0705	0.94	1.422494	0.078071	8
Intercept	-13.2205	1.676767	-16.507	-9.93405							
TSCR	0.1565	0.008124	0.140576	0.172424							

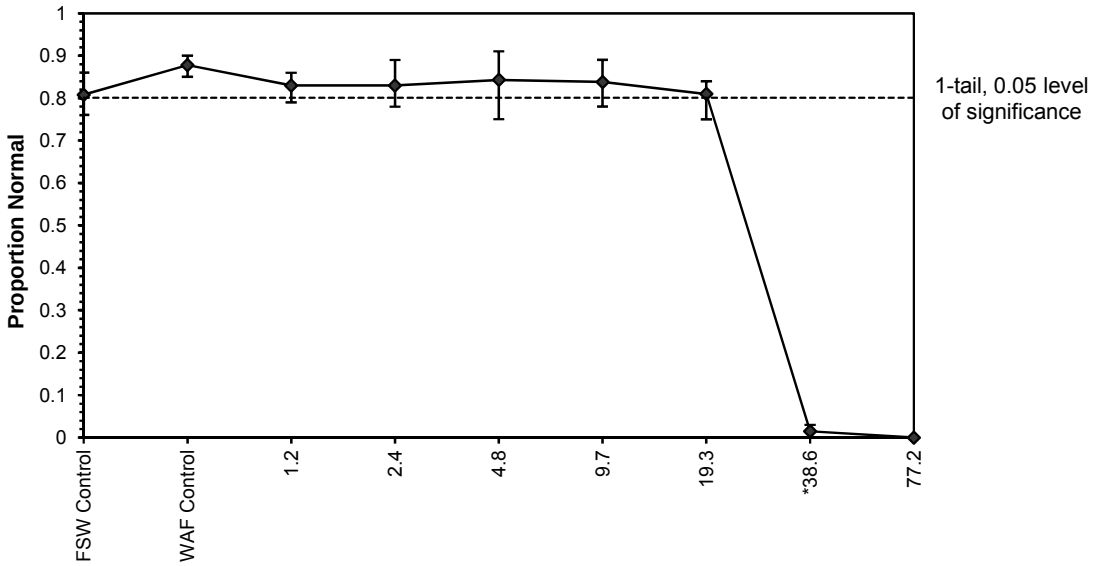
Point	Probits	gm/L	95% Fiducial Limits	
EC01	2.674	17.41299	15.13301	19.30053
EC05	3.355	19.68241	17.49698	21.48321
EC10	3.718	21.01075	18.89652	22.75572
EC15	3.964	21.95726	19.89879	23.66218
EC20	4.158	22.73984	20.7296	24.41245
EC25	4.326	23.43341	21.46688	25.07866
EC40	4.747	25.27636	23.42552	26.85922
EC50	5.000	26.45414	24.67237	28.00939
EC60	5.253	27.68679	25.96848	29.22808
EC75	5.674	29.86425	28.22241	31.43128
EC80	5.842	30.77512	29.14738	32.37631
EC85	6.036	31.87198	30.24463	33.53511
EC90	6.282	33.30777	31.65174	35.08805
EC95	6.645	35.55568	33.78822	37.6012
EC99	7.326	40.18962	37.97549	43.05577



Sea Urchin Larval Development Test-Proportion Normal

Start Date:	10/09/2015 12:45	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	13/09/2015 12:45	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 105	Test Species:	HT-Heliocidaris tuberculata
Comments:	Loading Rate				

Dose-Response Plot



 ToxCalc v5.0.23 Reviewed by:_____

Sea Urchin Larval Development Test-Proportion Normal

Start Date:	10/09/2015 12:45	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	13/09/2015 12:45	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 105	Test Species:	HT-Heliocidaris tuberculata
Comments:	Loading Rate				

		Auxiliary Data Summary					
Conc-gm/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Normal	80.75	76.00	86.00	4.99	2.77	4
WAF Control		87.75	85.00	90.00	2.22	1.70	4
1.2		83.00	79.00	86.00	3.16	2.14	4
2.4		83.00	78.00	89.00	5.35	2.79	4
4.8		84.25	75.00	91.00	6.70	3.07	4
9.7		83.75	78.00	89.00	4.79	2.61	4
19.3		81.00	75.00	84.00	4.24	2.54	4
38.6		1.50	0.00	3.00	1.29	75.75	4
77.2		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
1.2		8.10	8.10	8.10	0.00	0.00	1
2.4		8.10	8.10	8.10	0.00	0.00	1
4.8		8.10	8.10	8.10	0.00	0.00	1
9.7		8.00	8.00	8.00	0.00	0.00	1
19.3		7.90	7.90	7.90	0.00	0.00	1
38.6		7.70	7.70	7.70	0.00	0.00	1
77.2		7.40	7.40	7.40	0.00	0.00	1
FSW Control	Salinity ppt	35.40	35.40	35.40	0.00	0.00	1
WAF Control		35.60	35.60	35.60	0.00	0.00	1
1.2		35.40	35.40	35.40	0.00	0.00	1
2.4		35.40	35.40	35.40	0.00	0.00	1
4.8		35.40	35.40	35.40	0.00	0.00	1
9.7		35.50	35.50	35.50	0.00	0.00	1
19.3		35.50	35.50	35.50	0.00	0.00	1
38.6		35.60	35.60	35.60	0.00	0.00	1
77.2		35.80	35.80	35.80	0.00	0.00	1
FSW Control	DO %	100.20	100.20	100.20	0.00	0.00	1
WAF Control		100.90	100.90	100.90	0.00	0.00	1
1.2		99.60	99.60	99.60	0.00	0.00	1
2.4		91.80	91.80	91.80	0.00	0.00	1
4.8		96.10	96.10	96.10	0.00	0.00	1
9.7		98.70	98.70	98.70	0.00	0.00	1
19.3		90.10	90.10	90.10	0.00	0.00	1
38.6		90.20	90.20	90.20	0.00	0.00	1
77.2		87.20	87.20	87.20	0.00	0.00	1

Sea Urchin Larval Development Test-Proportion Normal

Start Date:	10/09/2015 12:45	Test ID:	PR1244/02b	Sample ID:	Borossa Field Condensate
End Date:	13/09/2015 12:45	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 105	Test Species:	HT-Heliocidaris tuberculata
Comments:	TRH				

Conc-ug/L	1	2	3	4
FSW Control	0.8600	0.8400	0.7600	0.7700
WAF Control	0.9000	0.8700	0.8500	0.8900
720	0.8500	0.8600	0.8200	0.7900
1673	0.7800	0.7900	0.8600	0.8900
3180	0.9100	0.7500	0.8500	0.8600
7160	0.8900	0.8600	0.7800	0.8200
14060	0.8400	0.8400	0.8100	0.7500
30860	0.0200	0.0300	0.0000	0.0100
69620	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
FSW Control	0.8075	0.9202	1.1190	1.0588	1.1873	5.710	4					
WAF Control	0.8775	1.0000	1.2142	1.1731	1.2490	2.772	4	*			49	400
720	0.8300	0.9459	1.1470	1.0948	1.1873	3.644	4	1.552	2.451	0.1062	68	400
1673	0.8300	0.9459	1.1493	1.0826	1.2327	6.320	4	1.497	2.451	0.1062	68	400
3180	0.8425	0.9601	1.1684	1.0472	1.2661	7.752	4	1.056	2.451	0.1062	63	400
7160	0.8375	0.9544	1.1588	1.0826	1.2327	5.630	4	1.278	2.451	0.1062	65	400
14060	0.8100	0.9231	1.1214	1.0472	1.1593	4.713	4	2.142	2.451	0.1062	76	400
*30860	0.0150	0.0171	0.1165	0.0500	0.1741	46.067	4	25.329	2.451	0.1062	394	400
69620	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400

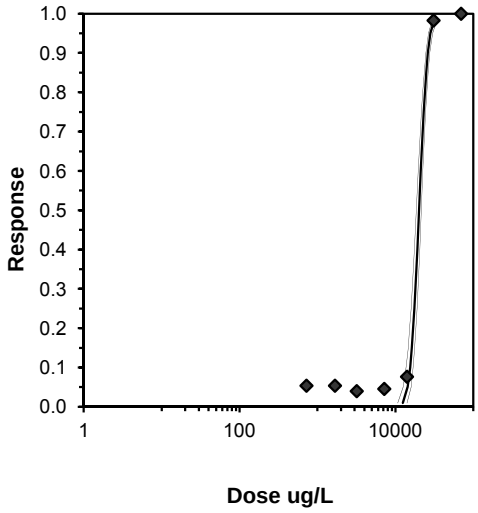
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.9702	0.924	-0.29751	-0.48312
Bartlett's Test indicates equal variances (p = 0.76)	3.405559	16.81189		
The control means are significantly different (p = 0.04)	2.636326	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	14060	30860	20830.06		0.077486	0.088239	0.62519	0.003756	1.4E-16	6, 21
Treatments vs WAF Control										

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	11.29387	0.978228	9.376539	13.21119	0.1225	1.216603	11.0705	0.94	4.30329	0.088544	8
Intercept	-43.6008	4.30439	-52.0374	-35.1642							
TSCR	0.1565	0.008124	0.140576	0.172424							

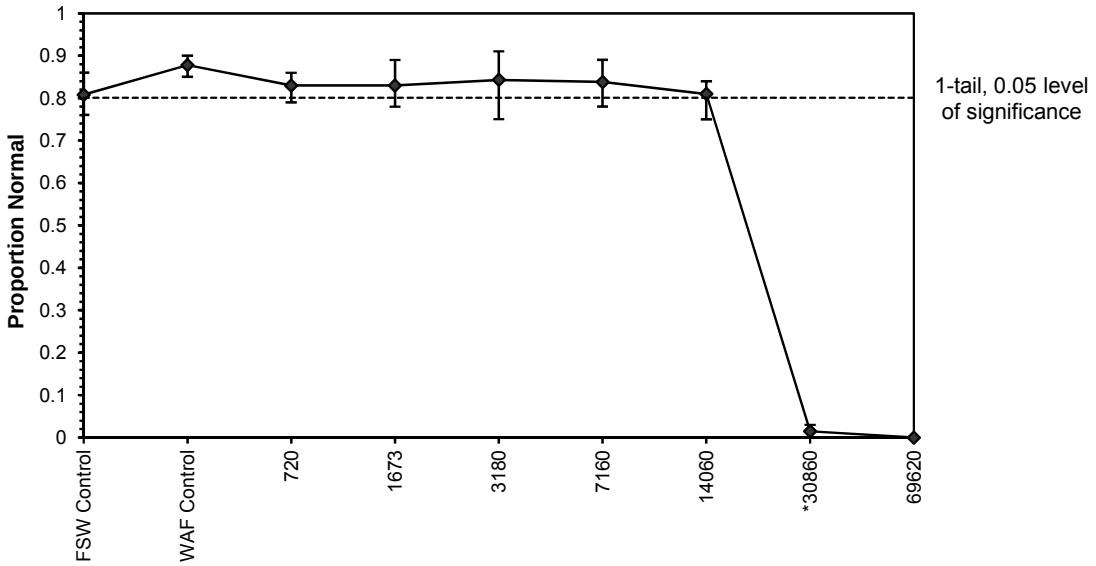
Point	Probits	ug/L	95% Fiducial Limits	
EC01	2.674	12511.43	10670.46	14060.43
EC05	3.355	14376.36	12579.9	15877.06
EC10	3.718	15481.64	13727.1	16947.82
EC15	3.964	16274.99	14555.74	17715.52
EC20	4.158	16934.41	15246.91	18353.93
EC25	4.326	17521.39	15863.37	18923.02
EC40	4.747	19092.29	17514.7	20453.87
EC50	5.000	20104.36	18575.71	21450.06
EC60	5.253	21170.08	19686.28	22511.6
EC75	5.674	23068.11	21635.17	24445.67
EC80	5.842	23867.7	22441.11	25280.93
EC85	6.036	24834.76	23401.61	26309.6
EC90	6.282	26107.39	24640.21	27695.61
EC95	6.645	28114.58	26534.89	29955.98
EC99	7.326	32305.29	30294.34	34930.5



Sea Urchin Larval Development Test-Proportion Normal

Start Date:	10/09/2015 12:45	Test ID:	PR1244/02b	Sample ID:	Borossa Field Condensate
End Date:	13/09/2015 12:45	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 105	Test Species:	HT-Heliocidaris tuberculata
Comments:	TRH				

Dose-Response Plot



Sea Urchin Larval Development Test-Proportion Normal

Start Date:	10/09/2015 12:45	Test ID:	PR1244/02b	Sample ID:	Borossa Field Condensate
End Date:	13/09/2015 12:45	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 105	Test Species:	HT-Heliocidaris tuberculata
Comments:	TRH				

		Auxiliary Data Summary					
Conc-ug/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Normal	80.75	76.00	86.00	4.99	2.77	4
WAF Control		87.75	85.00	90.00	2.22	1.70	4
720		83.00	79.00	86.00	3.16	2.14	4
1673		83.00	78.00	89.00	5.35	2.79	4
3180		84.25	75.00	91.00	6.70	3.07	4
7160		83.75	78.00	89.00	4.79	2.61	4
14060		81.00	75.00	84.00	4.24	2.54	4
30860		1.50	0.00	3.00	1.29	75.75	4
69620		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
720		8.10	8.10	8.10	0.00	0.00	1
1673		8.10	8.10	8.10	0.00	0.00	1
3180		8.10	8.10	8.10	0.00	0.00	1
7160		8.00	8.00	8.00	0.00	0.00	1
14060		7.90	7.90	7.90	0.00	0.00	1
30860		7.70	7.70	7.70	0.00	0.00	1
69620		7.40	7.40	7.40	0.00	0.00	1
FSW Control	Salinity ppt	35.40	35.40	35.40	0.00	0.00	1
WAF Control		35.60	35.60	35.60	0.00	0.00	1
720		35.40	35.40	35.40	0.00	0.00	1
1673		35.40	35.40	35.40	0.00	0.00	1
3180		35.40	35.40	35.40	0.00	0.00	1
7160		35.50	35.50	35.50	0.00	0.00	1
14060		35.50	35.50	35.50	0.00	0.00	1
30860		35.60	35.60	35.60	0.00	0.00	1
69620		35.80	35.80	35.80	0.00	0.00	1
FSW Control	DO %	100.20	100.20	100.20	0.00	0.00	1
WAF Control		100.90	100.90	100.90	0.00	0.00	1
720		99.60	99.60	99.60	0.00	0.00	1
1673		91.80	91.80	91.80	0.00	0.00	1
3180		96.10	96.10	96.10	0.00	0.00	1
7160		98.70	98.70	98.70	0.00	0.00	1
14060		90.10	90.10	90.10	0.00	0.00	1
30860		90.20	90.20	90.20	0.00	0.00	1
69620		87.20	87.20	87.20	0.00	0.00	1

Appendix M: Statistical Analyses of the Milky Oyster Larval Development Test

Bivalve Larval Development Test-Proportion Normal

Start Date:	10/09/2015 18:00	Test ID:	PR1244/04	Sample ID:	Borossa Field Condensate
End Date:	12/09/2015 16:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:	Loading Rate				

Conc-gm/L	1	2	3	4
FSW Control	0.7200	0.7900	0.7800	0.6900
WAF Control	0.6800	0.7300	0.7400	0.7500
1.2	0.7600	0.7000	0.6800	0.6900
2.4	0.6900	0.7400	0.7100	0.7600
4.8	0.7800	0.7200	0.6800	0.7100
9.7	0.7100	0.7600	0.7400	0.7300
19.3	0.6300	0.5900	0.6400	0.6200
38.6	0.0000	0.0000	0.0000	0.0000
77.2	0.0000	0.0000	0.0000	0.0000

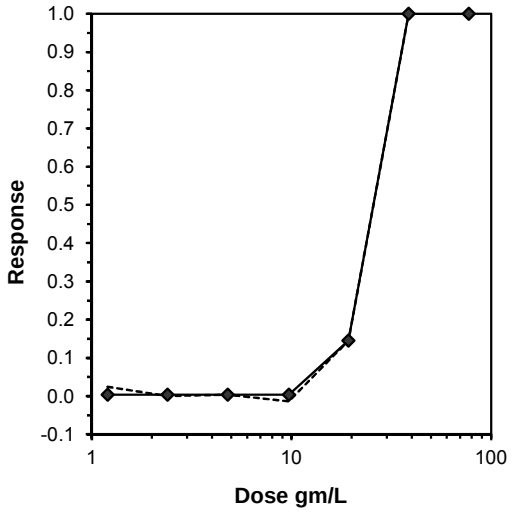
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
FSW Control	0.7450	1.0276	1.0427	0.9803	1.0948	5.272	4					
WAF Control	0.7250	1.0000	1.0192	0.9695	1.0472	3.376	4	*			110	400
1.2	0.7075	0.9759	1.0000	0.9695	1.0588	4.023	4	0.779	2.410	0.0596	117	400
2.4	0.7250	1.0000	1.0192	0.9803	1.0588	3.421	4	-0.001	2.410	0.0596	110	400
4.8	0.7225	0.9966	1.0169	0.9695	1.0826	4.679	4	0.095	2.410	0.0596	111	400
9.7	0.7350	1.0138	1.0303	1.0021	1.0588	2.291	4	-0.447	2.410	0.0596	106	400
*19.3	0.6200	0.8552	0.9067	0.8759	0.9273	2.448	4	4.553	2.410	0.0596	152	400
38.6	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400
77.2	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.974316	0.916	0.369425	-0.29632
Bartlett's Test indicates equal variances (p = 0.82)	2.211731	15.08627		
The control means are not significantly different (p = 0.50)	0.724702	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	9.7	19.3	13.68247		0.054646	0.075334	0.008512	0.001222	8.8E-04	5, 18
Treatments vs WAF Control										

Trimmed Spearman-Karber

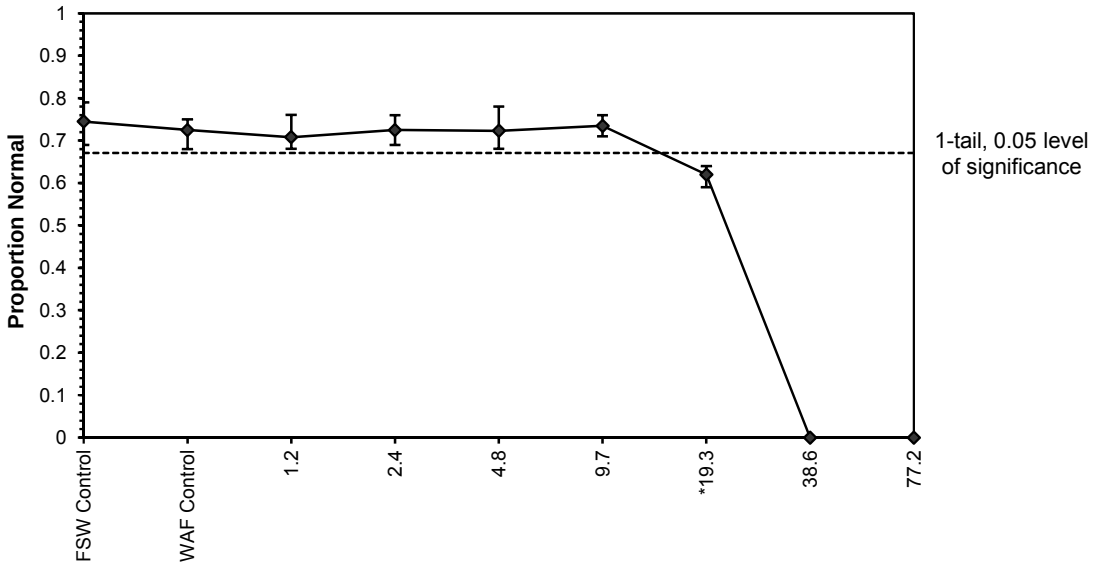
Trim Level	EC50	95% CL	
0.0%			
5.0%	25.222	24.515	25.950
10.0%	25.608	24.672	26.579
20.0%	25.738	25.313	26.171
Auto-0.3%	24.709	24.110	25.323



Bivalve Larval Development Test-Proportion Normal

Start Date:	10/09/2015 18:00	Test ID:	PR1244/04	Sample ID:	Borossa Field Condensate
End Date:	12/09/2015 16:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:	Loading Rate				

Dose-Response Plot



Bivalve Larval Development Test-Proportion Normal

Start Date:	10/09/2015 18:00	Test ID:	PR1244/04	Sample ID:	Borossa Field Condensate
End Date:	12/09/2015 16:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:	Loading Rate				

Auxiliary Data Summary

Conc-gm/L	Parameter	Mean	Min	Max	SD	CV%	N
FSW Control	% Normal	74.50	69.00	79.00	4.80	2.94	4
WAF Control		72.50	68.00	75.00	3.11	2.43	4
1.2		70.75	68.00	76.00	3.59	2.68	4
2.4		72.50	69.00	76.00	3.11	2.43	4
4.8		72.25	68.00	78.00	4.19	2.83	4
9.7		73.50	71.00	76.00	2.08	1.96	4
19.3		62.00	59.00	64.00	2.16	2.37	4
38.6		0.00	0.00	0.00	0.00		4
77.2		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
1.2		8.10	8.10	8.10	0.00	0.00	1
2.4		8.10	8.10	8.10	0.00	0.00	1
4.8		8.10	8.10	8.10	0.00	0.00	1
9.7		8.00	8.00	8.00	0.00	0.00	1
19.3		7.90	7.90	7.90	0.00	0.00	1
38.6		7.70	7.70	7.70	0.00	0.00	1
77.2		7.40	7.40	7.40	0.00	0.00	1
FSW Control	Salinity ppt	35.40	35.40	35.40	0.00	0.00	1
WAF Control		35.60	35.60	35.60	0.00	0.00	1
1.2		35.40	35.40	35.40	0.00	0.00	1
2.4		35.40	35.40	35.40	0.00	0.00	1
4.8		35.40	35.40	35.40	0.00	0.00	1
9.7		35.50	35.50	35.50	0.00	0.00	1
19.3		35.50	35.50	35.50	0.00	0.00	1
38.6		35.60	35.60	35.60	0.00	0.00	1
77.2		35.80	35.80	35.80	0.00	0.00	1
FSW Control	DO %	100.20	100.20	100.20	0.00	0.00	1
WAF Control		100.90	100.90	100.90	0.00	0.00	1
1.2		99.60	99.60	99.60	0.00	0.00	1
2.4		91.80	91.80	91.80	0.00	0.00	1
4.8		96.10	96.10	96.10	0.00	0.00	1
9.7		98.70	98.70	98.70	0.00	0.00	1
19.3		90.10	90.10	90.10	0.00	0.00	1
38.6		90.20	90.20	90.20	0.00	0.00	1
77.2		87.20	87.20	87.20	0.00	0.00	1

Bivalve Larval Development Test-Proportion Normal

Start Date:	10/09/2015 18:00	Test ID:	PR1244/04	Sample ID:	Borossa Field Condensate
End Date:	12/09/2015 16:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:	Loading Rate				

Conc-gm/L	1	2	3	4
FSW Control	0.7200	0.7900	0.7800	0.6900
WAF Control	0.6800	0.7300	0.7400	0.7500
1.2	0.7600	0.7000	0.6800	0.6900
2.4	0.6900	0.7400	0.7100	0.7600
4.8	0.7800	0.7200	0.6800	0.7100
9.7	0.7100	0.7600	0.7400	0.7300
19.3	0.6300	0.5900	0.6400	0.6200
38.6	0.0000	0.0000	0.0000	0.0000
77.2	0.0000	0.0000	0.0000	0.0000

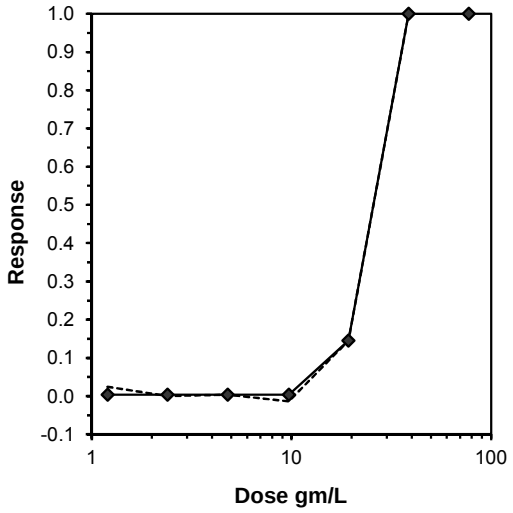
			Transform: Arcsin Square Root						1-Tailed		Isotonic	
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
FSW Control	0.7450	1.0276	1.0427	0.9803	1.0948	5.272	4					
WAF Control	0.7250	1.0000	1.0192	0.9695	1.0472	3.376	4	*			0.7250	1.0000
1.2	0.7075	0.9759	1.0000	0.9695	1.0588	4.023	4	0.779	2.410	0.0596	0.7225	0.9966
2.4	0.7250	1.0000	1.0192	0.9803	1.0588	3.421	4	-0.001	2.410	0.0596	0.7225	0.9966
4.8	0.7225	0.9966	1.0169	0.9695	1.0826	4.679	4	0.095	2.410	0.0596	0.7225	0.9966
9.7	0.7350	1.0138	1.0303	1.0021	1.0588	2.291	4	-0.447	2.410	0.0596	0.7225	0.9966
*19.3	0.6200	0.8552	0.9067	0.8759	0.9273	2.448	4	4.553	2.410	0.0596	0.6200	0.8552
38.6	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000
77.2	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.974316	0.916	0.369425	-0.29632
Bartlett's Test indicates equal variances (p = 0.82)	2.211731	15.08627		
The control means are not significantly different (p = 0.50)	0.724702	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	9.7	19.3	13.68247		0.054646	0.075334	0.008512	0.001222	8.E-04	5, 18
Treatments vs WAF Control										

Log-Logit Interpolation (200 Resamples)

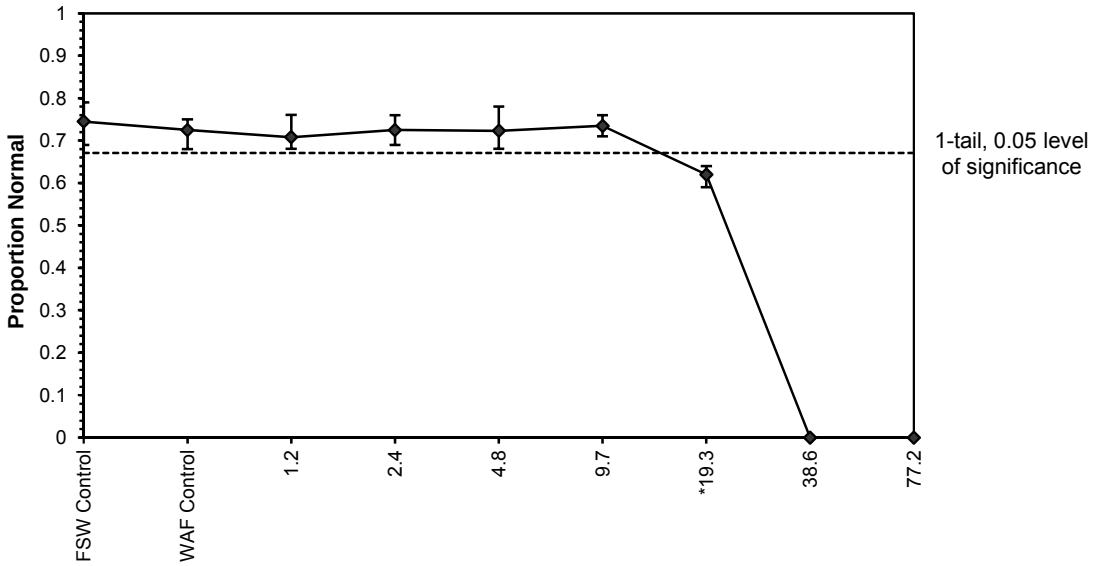
Point	gm/L	SD	95% CL(Exp)		Skew
IC05	12.371	1.054	9.095	13.474	-5.6672
IC10	15.745	1.017	11.783	18.345	-0.1579
IC15	19.322	0.819	14.886	19.494	-1.6728
IC20	19.535	0.082	19.253	19.698	-1.9600
IC25	19.744	0.071	19.470	19.901	-0.5760
IC40	20.378	0.066	20.122	20.523	-0.5922
IC50	20.829	0.064	20.582	20.970	-0.5981



Bivalve Larval Development Test-Proportion Normal

Start Date:	10/09/2015 18:00	Test ID:	PR1244/04	Sample ID:	Borossa Field Condensate
End Date:	12/09/2015 16:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:	Loading Rate				

Dose-Response Plot



Bivalve Larval Development Test-Proportion Normal

Start Date:	10/09/2015 18:00	Test ID:	PR1244/04	Sample ID:	Borossa Field Condensate
End Date:	12/09/2015 16:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:	Loading Rate				

Auxiliary Data Summary

Conc-gm/L	Parameter	Mean	Min	Max	SD	CV%	N
FSW Control	% Normal	74.50	69.00	79.00	4.80	2.94	4
WAF Control		72.50	68.00	75.00	3.11	2.43	4
1.2		70.75	68.00	76.00	3.59	2.68	4
2.4		72.50	69.00	76.00	3.11	2.43	4
4.8		72.25	68.00	78.00	4.19	2.83	4
9.7		73.50	71.00	76.00	2.08	1.96	4
19.3		62.00	59.00	64.00	2.16	2.37	4
38.6		0.00	0.00	0.00	0.00		4
77.2		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
1.2		8.10	8.10	8.10	0.00	0.00	1
2.4		8.10	8.10	8.10	0.00	0.00	1
4.8		8.10	8.10	8.10	0.00	0.00	1
9.7		8.00	8.00	8.00	0.00	0.00	1
19.3		7.90	7.90	7.90	0.00	0.00	1
38.6		7.70	7.70	7.70	0.00	0.00	1
77.2		7.40	7.40	7.40	0.00	0.00	1
FSW Control	Salinity ppt	35.40	35.40	35.40	0.00	0.00	1
WAF Control		35.60	35.60	35.60	0.00	0.00	1
1.2		35.40	35.40	35.40	0.00	0.00	1
2.4		35.40	35.40	35.40	0.00	0.00	1
4.8		35.40	35.40	35.40	0.00	0.00	1
9.7		35.50	35.50	35.50	0.00	0.00	1
19.3		35.50	35.50	35.50	0.00	0.00	1
38.6		35.60	35.60	35.60	0.00	0.00	1
77.2		35.80	35.80	35.80	0.00	0.00	1
FSW Control	DO %	100.20	100.20	100.20	0.00	0.00	1
WAF Control		100.90	100.90	100.90	0.00	0.00	1
1.2		99.60	99.60	99.60	0.00	0.00	1
2.4		91.80	91.80	91.80	0.00	0.00	1
4.8		96.10	96.10	96.10	0.00	0.00	1
9.7		98.70	98.70	98.70	0.00	0.00	1
19.3		90.10	90.10	90.10	0.00	0.00	1
38.6		90.20	90.20	90.20	0.00	0.00	1
77.2		87.20	87.20	87.20	0.00	0.00	1

Bivalve Larval Development Test-Proportion Normal

Start Date:	10/09/2015 18:00	Test ID:	PR1244/04b	Sample ID:	Borossa Field Condensate
End Date:	12/09/2015 16:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:	TRH				

Conc-ug/L	1	2	3	4
FSW Control	0.7200	0.7900	0.7800	0.6900
WAF Control	0.6800	0.7300	0.7400	0.7500
720	0.7600	0.7000	0.6800	0.6900
1673	0.6900	0.7400	0.7100	0.7600
3180	0.7800	0.7200	0.6800	0.7100
7160	0.7100	0.7600	0.7400	0.7300
14060	0.6300	0.5900	0.6400	0.6200
30860	0.0000	0.0000	0.0000	0.0000
69620	0.0000	0.0000	0.0000	0.0000

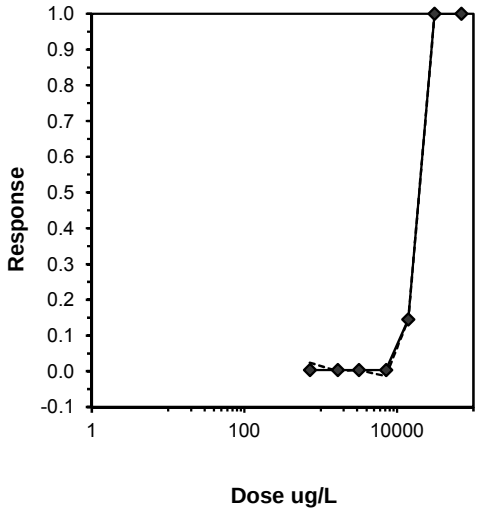
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
FSW Control	0.7450	1.0276	1.0427	0.9803	1.0948	5.272	4					
WAF Control	0.7250	1.0000	1.0192	0.9695	1.0472	3.376	4	*			110	400
720	0.7075	0.9759	1.0000	0.9695	1.0588	4.023	4	0.779	2.410	0.0596	117	400
1673	0.7250	1.0000	1.0192	0.9803	1.0588	3.421	4	-0.001	2.410	0.0596	110	400
3180	0.7225	0.9966	1.0169	0.9695	1.0826	4.679	4	0.095	2.410	0.0596	111	400
7160	0.7350	1.0138	1.0303	1.0021	1.0588	2.291	4	-0.447	2.410	0.0596	106	400
*14060	0.6200	0.8552	0.9067	0.8759	0.9273	2.448	4	4.553	2.410	0.0596	152	400
30860	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400
69620	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.974316	0.916	0.369425	-0.29632
Bartlett's Test indicates equal variances (p = 0.82)	2.211731	15.08627		
The control means are not significantly different (p = 0.50)	0.724702	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	7160	14060	10033.42		0.054646	0.075334	0.008512	0.001222	8.8E-04	5, 18
Treatments vs WAF Control										

Trimmed Spearman-Karber

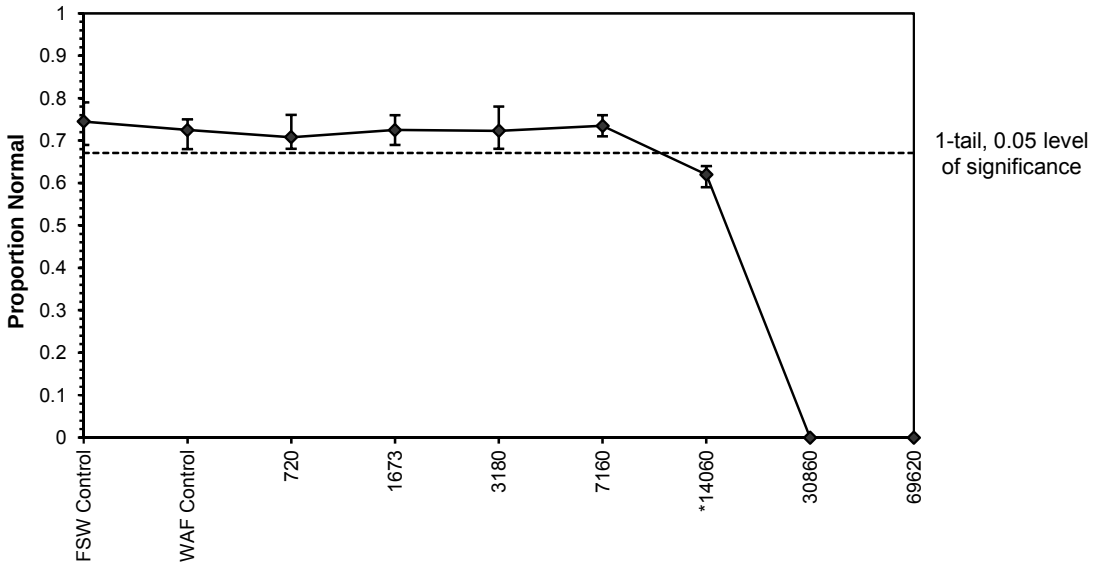
Trim Level	EC50	95% CL	
0.0%			
5.0%	19116.99	18552.77	19698.36
10.0%	19394.51	18656.02	20162.23
20.0%	19488.61	19123.45	19860.75
Auto-0.3%	18747.24	18266.79	19240.34



Bivalve Larval Development Test-Proportion Normal

Start Date:	10/09/2015 18:00	Test ID:	PR1244/04b	Sample ID:	Borossa Field Condensate
End Date:	12/09/2015 16:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:	TRH				

Dose-Response Plot



Bivalve Larval Development Test-Proportion Normal

Start Date:	10/09/2015 18:00	Test ID:	PR1244/04b	Sample ID:	Borossa Field Condensate
End Date:	12/09/2015 16:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:	TRH				

		Auxiliary Data Summary					
Conc-ug/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Normal	74.50	69.00	79.00	4.80	2.94	4
WAF Control		72.50	68.00	75.00	3.11	2.43	4
720		70.75	68.00	76.00	3.59	2.68	4
1673		72.50	69.00	76.00	3.11	2.43	4
3180		72.25	68.00	78.00	4.19	2.83	4
7160		73.50	71.00	76.00	2.08	1.96	4
14060		62.00	59.00	64.00	2.16	2.37	4
30860		0.00	0.00	0.00	0.00		4
69620		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
720		8.10	8.10	8.10	0.00	0.00	1
1673		8.10	8.10	8.10	0.00	0.00	1
3180		8.10	8.10	8.10	0.00	0.00	1
7160		8.00	8.00	8.00	0.00	0.00	1
14060		7.90	7.90	7.90	0.00	0.00	1
30860		7.70	7.70	7.70	0.00	0.00	1
69620		7.40	7.40	7.40	0.00	0.00	1
FSW Control	Salinity ppt	35.40	35.40	35.40	0.00	0.00	1
WAF Control		35.60	35.60	35.60	0.00	0.00	1
720		35.40	35.40	35.40	0.00	0.00	1
1673		35.40	35.40	35.40	0.00	0.00	1
3180		35.40	35.40	35.40	0.00	0.00	1
7160		35.50	35.50	35.50	0.00	0.00	1
14060		35.50	35.50	35.50	0.00	0.00	1
30860		35.60	35.60	35.60	0.00	0.00	1
69620		35.80	35.80	35.80	0.00	0.00	1
FSW Control	DO %	100.20	100.20	100.20	0.00	0.00	1
WAF Control		100.90	100.90	100.90	0.00	0.00	1
720		99.60	99.60	99.60	0.00	0.00	1
1673		91.80	91.80	91.80	0.00	0.00	1
3180		96.10	96.10	96.10	0.00	0.00	1
7160		98.70	98.70	98.70	0.00	0.00	1
14060		90.10	90.10	90.10	0.00	0.00	1
30860		90.20	90.20	90.20	0.00	0.00	1
69620		87.20	87.20	87.20	0.00	0.00	1

Bivalve Larval Development Test-Proportion Normal

Start Date:	10/09/2015 18:00	Test ID:	PR1244/04b	Sample ID:	Borossa Field Condensate
End Date:	12/09/2015 16:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:	TRH				

Conc-ug/L	1	2	3	4
FSW Control	0.7200	0.7900	0.7800	0.6900
WAF Control	0.6800	0.7300	0.7400	0.7500
720	0.7600	0.7000	0.6800	0.6900
1673	0.6900	0.7400	0.7100	0.7600
3180	0.7800	0.7200	0.6800	0.7100
7160	0.7100	0.7600	0.7400	0.7300
14060	0.6300	0.5900	0.6400	0.6200
30860	0.0000	0.0000	0.0000	0.0000
69620	0.0000	0.0000	0.0000	0.0000

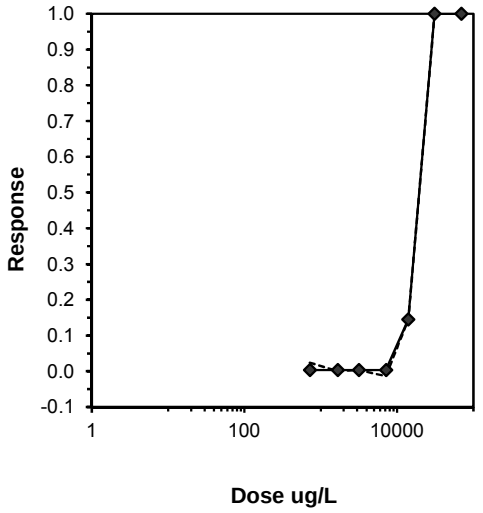
			Transform: Arcsin Square Root						1-Tailed		Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
FSW Control	0.7450	1.0276	1.0427	0.9803	1.0948	5.272	4					
WAF Control	0.7250	1.0000	1.0192	0.9695	1.0472	3.376	4	*			0.7250	1.0000
720	0.7075	0.9759	1.0000	0.9695	1.0588	4.023	4	0.779	2.410	0.0596	0.7225	0.9966
1673	0.7250	1.0000	1.0192	0.9803	1.0588	3.421	4	-0.001	2.410	0.0596	0.7225	0.9966
3180	0.7225	0.9966	1.0169	0.9695	1.0826	4.679	4	0.095	2.410	0.0596	0.7225	0.9966
7160	0.7350	1.0138	1.0303	1.0021	1.0588	2.291	4	-0.447	2.410	0.0596	0.7225	0.9966
*14060	0.6200	0.8552	0.9067	0.8759	0.9273	2.448	4	4.553	2.410	0.0596	0.6200	0.8552
30860	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000
69620	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.974316	0.916	0.369425	-0.29632
Bartlett's Test indicates equal variances (p = 0.82)	2.211731	15.08627		
The control means are not significantly different (p = 0.50)	0.724702	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	7160	14060	10033.42		0.054646	0.075334	0.008512	0.001222	8.E-04	5, 18
Treatments vs WAF Control										

Log-Logit Interpolation (200 Resamples)

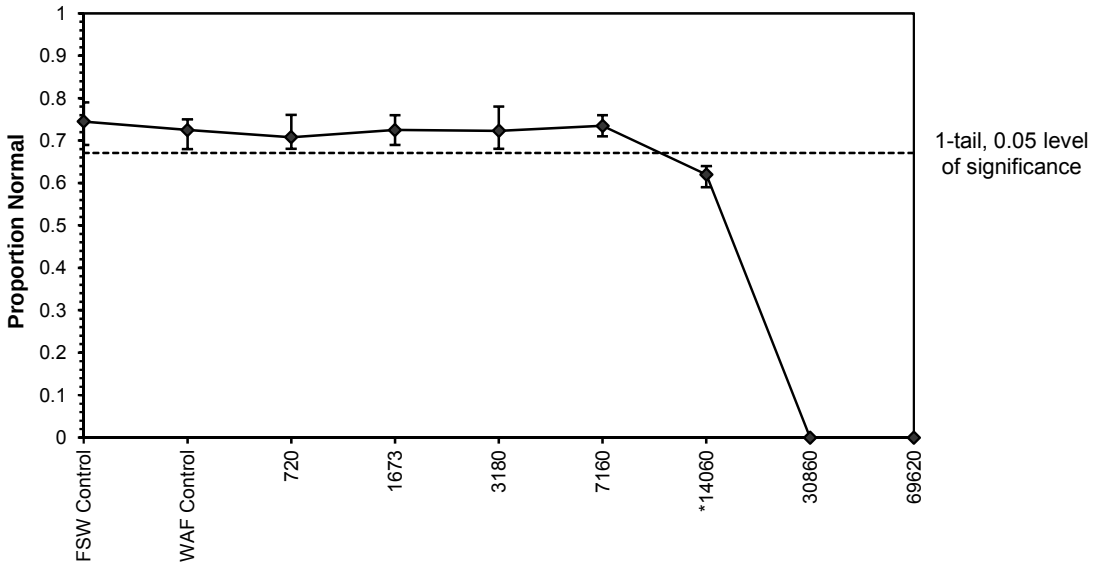
Point	ug/L	SD	95% CL(Exp)		Skew
IC05	9055.039	550.0583	6722.156	9886.09	-0.4671
IC10	11478.4	746.7707	9026.542	13230.49	0.0761
IC15	14078.12	576.9736	11380.46	14211.57	-1.1160
IC20	14251.33	59.23795	14048.25	14383.92	-0.1525
IC25	14422.52	57.71578	14222.15	14551.48	-0.1687
IC40	14942.4	54.40733	14753.36	15064.09	-0.2065
IC50	15313.95	52.80835	15128.32	15435.3	-0.2244



Bivalve Larval Development Test-Proportion Normal

Start Date:	10/09/2015 18:00	Test ID:	PR1244/04b	Sample ID:	Borossa Field Condensate
End Date:	12/09/2015 16:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:	TRH				

Dose-Response Plot



Bivalve Larval Development Test-Proportion Normal

Start Date:	10/09/2015 18:00	Test ID:	PR1244/04b	Sample ID:	Borossa Field Condensate
End Date:	12/09/2015 16:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:	TRH				

		Auxiliary Data Summary					
Conc-ug/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Normal	74.50	69.00	79.00	4.80	2.94	4
WAF Control		72.50	68.00	75.00	3.11	2.43	4
720		70.75	68.00	76.00	3.59	2.68	4
1673		72.50	69.00	76.00	3.11	2.43	4
3180		72.25	68.00	78.00	4.19	2.83	4
7160		73.50	71.00	76.00	2.08	1.96	4
14060		62.00	59.00	64.00	2.16	2.37	4
30860		0.00	0.00	0.00	0.00		4
69620		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
720		8.10	8.10	8.10	0.00	0.00	1
1673		8.10	8.10	8.10	0.00	0.00	1
3180		8.10	8.10	8.10	0.00	0.00	1
7160		8.00	8.00	8.00	0.00	0.00	1
14060		7.90	7.90	7.90	0.00	0.00	1
30860		7.70	7.70	7.70	0.00	0.00	1
69620		7.40	7.40	7.40	0.00	0.00	1
FSW Control	Salinity ppt	35.40	35.40	35.40	0.00	0.00	1
WAF Control		35.60	35.60	35.60	0.00	0.00	1
720		35.40	35.40	35.40	0.00	0.00	1
1673		35.40	35.40	35.40	0.00	0.00	1
3180		35.40	35.40	35.40	0.00	0.00	1
7160		35.50	35.50	35.50	0.00	0.00	1
14060		35.50	35.50	35.50	0.00	0.00	1
30860		35.60	35.60	35.60	0.00	0.00	1
69620		35.80	35.80	35.80	0.00	0.00	1
FSW Control	DO %	100.20	100.20	100.20	0.00	0.00	1
WAF Control		100.90	100.90	100.90	0.00	0.00	1
720		99.60	99.60	99.60	0.00	0.00	1
1673		91.80	91.80	91.80	0.00	0.00	1
3180		96.10	96.10	96.10	0.00	0.00	1
7160		98.70	98.70	98.70	0.00	0.00	1
14060		90.10	90.10	90.10	0.00	0.00	1
30860		90.20	90.20	90.20	0.00	0.00	1
69620		87.20	87.20	87.20	0.00	0.00	1

Appendix N: Statistical Analyses of Micro-Algal Growth Inhibition Test

Marine Algal Growth Test-Cell Yield

Start Date:	11/09/2015 11:10	Test ID:	PR1244/05	Sample ID:	Borossa Field Condensate
End Date:	14/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 110	Test Species:	IG-isochrysis aff galbana
Comments:	Loading Rate				

Conc-gm/L	1	2	3	4	5	6	7	8
FSW Control	24.809	22.609	15.409	21.609	17.009	22.609	18.409	18.809
WAF Control	18.209	17.609	16.409	18.809				
1.2	19.009	22.609	12.809	21.009				
2.4	32.209	16.409	18.209	18.809				
4.8	16.409	16.209	29.409	21.009				
9.7	14.009	6.409	18.009	16.009				
19.3	0.409	1.409	1.609	1.009				
38.6	0.000	0.000	0.000	0.000				
77.2	0.000	0.000	0.000	0.000				

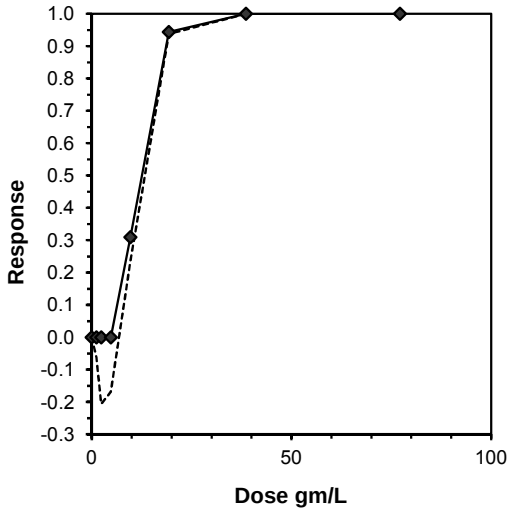
			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
FSW Control	20.159	1.1351	20.159	15.409	24.809	16.030	8				
WAF Control	17.759	1.0000	17.759	16.409	18.809	5.770	4	*		19.697	1.0000
1.2	18.859	1.0619	18.859	12.809	22.609	22.768	4	22.00	10.00	19.697	1.0000
2.4	21.409	1.2055	21.409	16.409	32.209	33.966	4	20.50	10.00	19.697	1.0000
4.8	20.759	1.1689	20.759	16.209	29.409	29.761	4	18.50	10.00	19.697	1.0000
9.7	13.609	0.7663	13.609	6.409	18.009	37.256	4	12.00	10.00	13.609	0.6909
*19.3	1.109	0.0624	1.109	0.409	1.609	47.713	4	10.00	10.00	1.109	0.0563
38.6	0.000	0.0000	0.000	0.000	0.000	0.000	4			0.000	0.0000
77.2	0.000	0.0000	0.000	0.000	0.000	0.000	4			0.000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.940018	0.916	0.707398	1.092201
Bartlett's Test indicates unequal variances (p = 5.62E-03)	16.46936	15.08627		
The control means are not significantly different (p = 0.19)	1.419305	2.228139		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	9.7	19.3	13.68247	
Treatments vs WAF Control				

Linear Interpolation (200 Resamples)

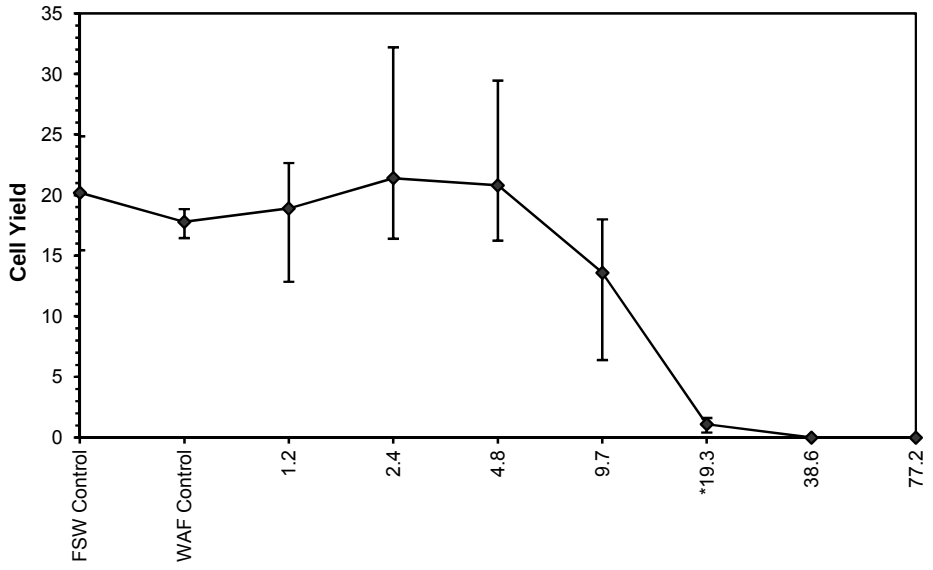
Point	gm/L	SD	95% CL(Exp)		Skew
IC05	5.593	1.260	0.093	7.552	-0.6336
IC10	6.385	1.313	2.183	10.675	0.1652
IC15	7.178	1.381	3.325	11.694	0.4336
IC20	7.971	1.427	4.320	12.176	0.2373
IC25	8.764	1.374	5.558	12.659	0.1009
IC40	11.076	1.350	6.896	14.139	-0.3797
IC50	12.588	1.286	7.448	15.094	-0.8271



Marine Algal Growth Test-Cell Yield

Start Date:	11/09/2015 11:10	Test ID:	PR1244/05	Sample ID:	Borossa Field Condensate
End Date:	14/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 110	Test Species:	IG-isochrysis aff galbana
Comments:	Loading Rate				

Dose-Response Plot



Marine Algal Growth Test-Cell Yield

Start Date:	11/09/2015 11:10	Test ID:	PR1244/05	Sample ID:	Borossa Field Condensate
End Date:	14/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 110	Test Species:	IG-isochrysis aff galbana
Comments:	Loading Rate				

Auxiliary Data Summary

Conc-gm/L	Parameter	Mean	Min	Max	SD	CV%	N
FSW Control	Cell Yield	20.16	15.41	24.81	3.23	8.92	8
WAF Control		17.76	16.41	18.81	1.02	5.70	4
1.2		18.86	12.81	22.61	4.29	10.99	4
2.4		21.41	16.41	32.21	7.27	12.60	4
4.8		20.76	16.21	29.41	6.18	11.97	4
9.7		13.61	6.41	18.01	5.07	16.55	4
19.3		1.11	0.41	1.61	0.53	65.59	4
38.6		0.00	0.00	0.00	0.00		4
77.2		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
1.2		8.10	8.10	8.10	0.00	0.00	1
2.4		8.10	8.10	8.10	0.00	0.00	1
4.8		8.10	8.10	8.10	0.00	0.00	1
9.7		8.10	8.10	8.10	0.00	0.00	1
19.3		8.00	8.00	8.00	0.00	0.00	1
38.6		7.80	7.80	7.80	0.00	0.00	1
77.2		7.60	7.60	7.60	0.00	0.00	1
FSW Control	Salinity ppt	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.90	35.90	35.90	0.00	0.00	1
1.2		35.60	35.60	35.60	0.00	0.00	1
2.4		35.40	35.40	35.40	0.00	0.00	1
4.8		35.30	35.30	35.30	0.00	0.00	1
9.7		35.30	35.30	35.30	0.00	0.00	1
19.3		35.60	35.60	35.60	0.00	0.00	1
38.6		35.40	35.40	35.40	0.00	0.00	1
77.2		35.40	35.40	35.40	0.00	0.00	1

Marine Algal Growth Test-Cell Yield

Start Date:	11/09/2015 11:10	Test ID:	PR1244/05b	Sample ID:	Borossa Field Condensate
End Date:	14/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 110	Test Species:	IG-isochrysis aff galbana
Comments:	TRH				

Conc-ug/L	1	2	3	4	5	6	7	8
FSW Control	24.809	22.609	15.409	21.609	17.009	22.609	18.409	18.809
WAF Control	18.209	17.609	16.409	18.809				
650	19.009	22.609	12.809	21.009				
1400	32.209	16.409	18.209	18.809				
3248	16.409	16.209	29.409	21.009				
6670	14.009	6.409	18.009	16.009				
12850	0.409	1.409	1.609	1.009				
27960	0.000	0.000	0.000	0.000				
65830	0.000	0.000	0.000	0.000				

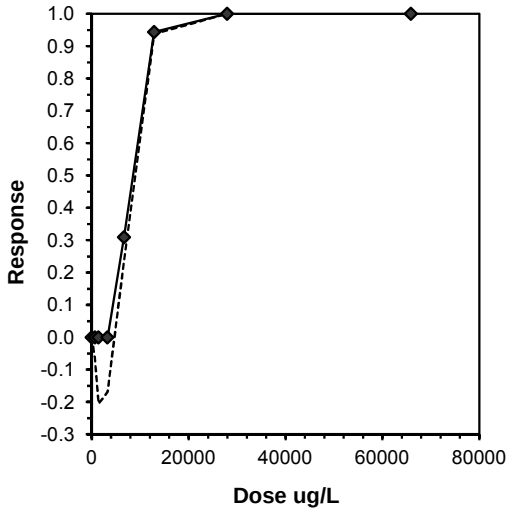
			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
FSW Control	20.159	1.1351	20.159	15.409	24.809	16.030	8				
WAF Control	17.759	1.0000	17.759	16.409	18.809	5.770	4	*		19.697	1.0000
650	18.859	1.0619	18.859	12.809	22.609	22.768	4	22.00	10.00	19.697	1.0000
1400	21.409	1.2055	21.409	16.409	32.209	33.966	4	20.50	10.00	19.697	1.0000
3248	20.759	1.1689	20.759	16.209	29.409	29.761	4	18.50	10.00	19.697	1.0000
6670	13.609	0.7663	13.609	6.409	18.009	37.256	4	12.00	10.00	13.609	0.6909
*12850	1.109	0.0624	1.109	0.409	1.609	47.713	4	10.00	10.00	1.109	0.0563
27960	0.000	0.0000	0.000	0.000	0.000	0.000	4			0.000	0.0000
65830	0.000	0.0000	0.000	0.000	0.000	0.000	4			0.000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.940018	0.916	0.707398	1.092201
Bartlett's Test indicates unequal variances (p = 5.62E-03)	16.46936	15.08627		
The control means are not significantly different (p = 0.19)	1.419305	2.228139		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	6670	12850	9257.943	
Treatments vs WAF Control				

Linear Interpolation (200 Resamples)

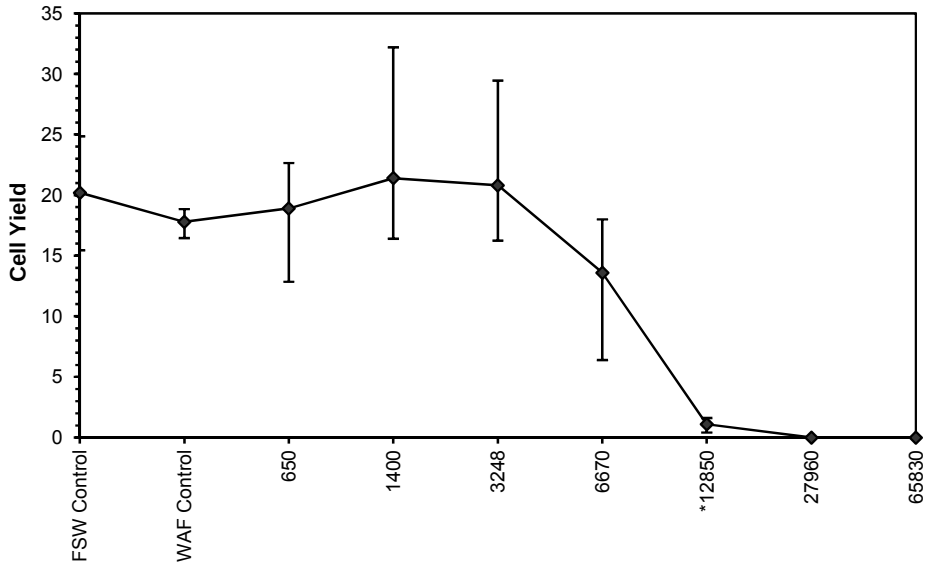
Point	ug/L	SD	95% CL(Exp)		Skew
IC05	3801.606	785.5934	207.0058	5212.784	-0.7487
IC10	4355.211	856.1277	1641.129	7401.379	0.2877
IC15	4908.817	918.0294	2434.842	8021.064	0.5678
IC20	5462.423	938.173	3189.309	8299.437	0.4571
IC25	6016.028	930.5002	3814.942	8577.81	0.2738
IC40	7555.524	913.1011	4589.661	9476.525	-0.1698
IC50	8529.32	856.3443	5094.774	10125.96	-0.5333



Marine Algal Growth Test-Cell Yield

Start Date:	11/09/2015 11:10	Test ID:	PR1244/05b	Sample ID:	Borossa Field Condensate
End Date:	14/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 110	Test Species:	IG-isochrysis aff galbana
Comments:	TRH				

Dose-Response Plot



Marine Algal Growth Test-Cell Yield

Start Date:	11/09/2015 11:10	Test ID:	PR1244/05b	Sample ID:	Borossa Field Condensate
End Date:	14/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 110	Test Species:	IG-isochrysis aff galbana
Comments:	TRH				

Auxiliary Data Summary

Conc-ug/L	Parameter	Mean	Min	Max	SD	CV%	N
FSW Control	Cell Yield	20.16	15.41	24.81	3.23	8.92	8
WAF Control		17.76	16.41	18.81	1.02	5.70	4
650		18.86	12.81	22.61	4.29	10.99	4
1400		21.41	16.41	32.21	7.27	12.60	4
3248		20.76	16.21	29.41	6.18	11.97	4
6670		13.61	6.41	18.01	5.07	16.55	4
12850		1.11	0.41	1.61	0.53	65.59	4
27960		0.00	0.00	0.00	0.00		4
65830		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
650		8.10	8.10	8.10	0.00	0.00	1
1400		8.10	8.10	8.10	0.00	0.00	1
3248		8.10	8.10	8.10	0.00	0.00	1
6670		8.10	8.10	8.10	0.00	0.00	1
12850		8.00	8.00	8.00	0.00	0.00	1
27960		7.80	7.80	7.80	0.00	0.00	1
65830		7.60	7.60	7.60	0.00	0.00	1
FSW Control	Salinity ppt	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.90	35.90	35.90	0.00	0.00	1
650		35.60	35.60	35.60	0.00	0.00	1
1400		35.40	35.40	35.40	0.00	0.00	1
3248		35.30	35.30	35.30	0.00	0.00	1
6670		35.30	35.30	35.30	0.00	0.00	1
12850		35.60	35.60	35.60	0.00	0.00	1
27960		35.40	35.40	35.40	0.00	0.00	1
65830		35.40	35.40	35.40	0.00	0.00	1

Appendix O: Statistical Analyses of Macro-Algal Growth Test

Macroalgal Growth Test-Gametophyte Length

Start Date:	10/09/2015 14:00	Test ID:	PR1244/15	Sample ID:	Borossa Field Condensate
End Date:	24/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 116	Test Species:	ER-Ecklonia radiata
Comments:	Loading Rate				

Conc-gm/L	1	2	3	4
FSW Control	23.400	22.900	23.000	25.300
WAF Control	28.200	21.900	23.400	26.100
1.2	23.600	22.600	21.200	24.300
2.4	26.200	22.400	23.500	18.300
4.8	20.400	22.100	22.200	20.000
9.7	17.200	18.500	19.500	19.300
19.3	15.800	15.300	15.100	13.800
38.6	12.400	12.900	14.000	15.800
77.2	13.100	10.800	12.400	11.000

			Transform: Untransformed						1-Tailed		Isotonic	
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
FSW Control	23.650	0.9498	23.650	22.900	25.300	4.740	4					
WAF Control	24.900	1.0000	24.900	21.900	28.200	11.259	4	*			24.900	1.0000
1.2	22.925	0.9207	22.925	21.200	24.300	5.867	4	1.519	2.480	3.224	22.925	0.9207
2.4	22.600	0.9076	22.600	18.300	26.200	14.519	4	1.769	2.480	3.224	22.600	0.9076
*4.8	21.175	0.8504	21.175	20.000	22.200	5.376	4	2.865	2.480	3.224	21.175	0.8504
*9.7	18.625	0.7480	18.625	17.200	19.500	5.603	4	4.826	2.480	3.224	18.625	0.7480
*19.3	15.000	0.6024	15.000	13.800	15.800	5.683	4	7.615	2.480	3.224	15.000	0.6024
*38.6	13.775	0.5532	13.775	12.400	15.800	10.936	4	8.557	2.480	3.224	13.775	0.5532
*77.2	11.825	0.4749	11.825	10.800	13.100	9.376	4	10.057	2.480	3.224	11.825	0.4749

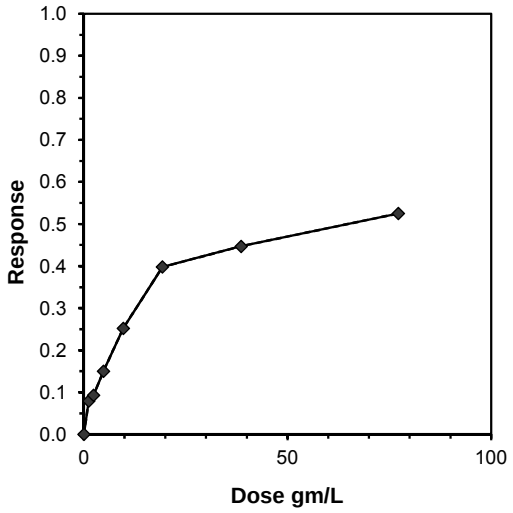
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.969423	0.93	-0.20116	1.06828
Bartlett's Test indicates equal variances (p = 0.20)	9.76692	18.47531		
The control means are not significantly different (p = 0.44)	0.827984	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	2.4	4.8	3.394113		3.224348	0.129492	92.94603	3.380729	5.5E-10	7, 24
Treatments vs WAF Control										

Linear Interpolation (200 Resamples)

Point	gm/L	SD	95% CL(Exp)		Skew
IC05*	0.756	1.099	0.175	5.754	1.4236
IC10	2.720	1.551	0.000	7.717	0.6850
IC15	4.819	1.913	0.000	10.477	0.1349
IC20	7.212	2.030	0.601	13.586	0.0468
IC25	9.604	2.128	3.717	16.457	0.1881
IC40	20.245	7.848	11.624	55.512	1.4840
IC50	64.828				

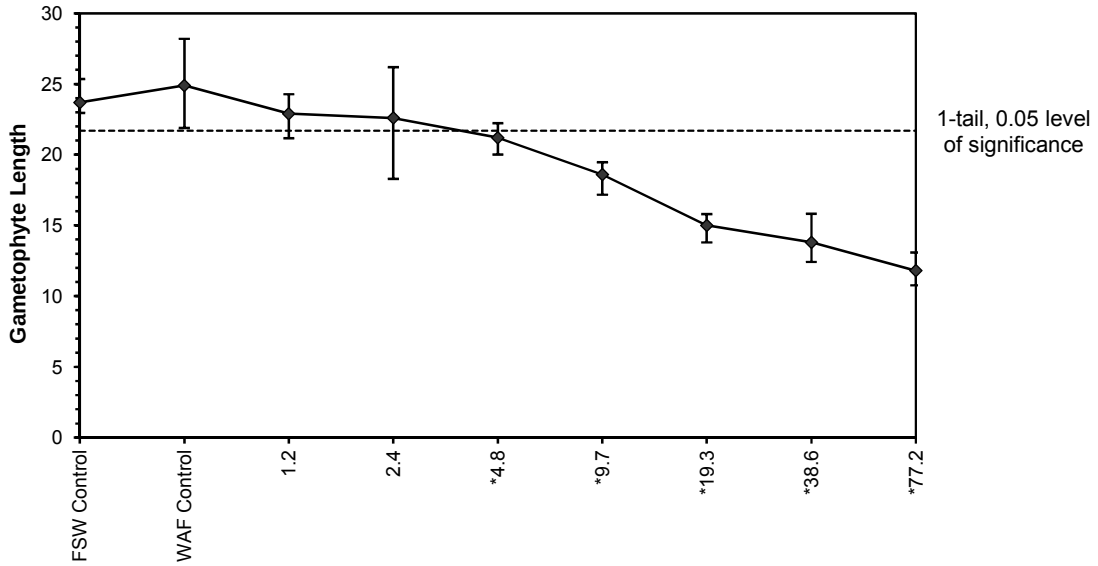
* indicates IC estimate less than the lowest concentration



Macroalgal Growth Test-Gametophyte Length

Start Date:	10/09/2015 14:00	Test ID:	PR1244/15	Sample ID:	Borossa Field Condensate
End Date:	24/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 116	Test Species:	ER-Ecklonia radiata
Comments:	Loading Rate				

Dose-Response Plot



Macroalgal Growth Test-Gametophyte Length

Start Date:	10/09/2015 14:00	Test ID:	PR1244/15	Sample ID:	Borossa Field Condensate
End Date:	24/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 116	Test Species:	ER-Ecklonia radiata
Comments:	Loading Rate				

		Auxiliary Data Summary					
Conc-gm/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	Length um	23.65	22.90	25.30	1.12	4.48	4
WAF Control		24.90	21.90	28.20	2.80	6.72	4
1.2		22.93	21.20	24.30	1.35	5.06	4
2.4		22.60	18.30	26.20	3.28	8.02	4
4.8		21.18	20.00	22.20	1.14	5.04	4
9.7		18.63	17.20	19.50	1.04	5.49	4
19.3		15.00	13.80	15.80	0.85	6.16	4
38.6		13.78	12.40	15.80	1.51	8.91	4
77.2		11.83	10.80	13.10	1.11	8.90	4
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
1.2		8.10	8.10	8.10	0.00	0.00	1
2.4		8.10	8.10	8.10	0.00	0.00	1
4.8		8.10	8.10	8.10	0.00	0.00	1
9.7		8.00	8.00	8.00	0.00	0.00	1
19.3		7.90	7.90	7.90	0.00	0.00	1
38.6		7.70	7.70	7.70	0.00	0.00	1
77.2		7.40	7.40	7.40	0.00	0.00	1
FSW Control	Salinity ppt	35.40	35.40	35.40	0.00	0.00	1
WAF Control		35.60	35.60	35.60	0.00	0.00	1
1.2		35.40	35.40	35.40	0.00	0.00	1
2.4		35.40	35.40	35.40	0.00	0.00	1
4.8		35.40	35.40	35.40	0.00	0.00	1
9.7		35.50	35.50	35.50	0.00	0.00	1
19.3		35.50	35.50	35.50	0.00	0.00	1
38.6		35.60	35.60	35.60	0.00	0.00	1
77.2		35.80	35.80	35.80	0.00	0.00	1
FSW Control	DO % sat	100.20	100.20	100.20	0.00	0.00	1
WAF Control		100.90	100.90	100.90	0.00	0.00	1
1.2		99.60	99.60	99.60	0.00	0.00	1
2.4		91.80	91.80	91.80	0.00	0.00	1
4.8		96.10	96.10	96.10	0.00	0.00	1
9.7		98.70	98.70	98.70	0.00	0.00	1
19.3		90.10	90.10	90.10	0.00	0.00	1
38.6		90.20	90.20	90.20	0.00	0.00	1
77.2		87.20	87.20	87.20	0.00	0.00	1

Macroalgal Growth Test-Gametophyte Length

Start Date:	10/09/2015 14:00	Test ID:	PR1244/15b	Sample ID:	Borossa Field Condensate
End Date:	24/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 116	Test Species:	ER-Ecklonia radiata
Comments:	TRH				

Conc-ug/L	1	2	3	4
FSW Control	23.400	22.900	23.000	25.300
WAF Control	28.200	21.900	23.400	26.100
720	23.600	22.600	21.200	24.300
1673	26.200	22.400	23.500	18.300
3180	20.400	22.100	22.200	20.000
7160	17.200	18.500	19.500	19.300
14060	15.800	15.300	15.100	13.800
30860	12.400	12.900	14.000	15.800
69620	13.100	10.800	12.400	11.000

			Transform: Untransformed						1-Tailed		Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
FSW Control	23.650	0.9498	23.650	22.900	25.300	4.740	4					
WAF Control	24.900	1.0000	24.900	21.900	28.200	11.259	4	*			24.900	1.0000
720	22.925	0.9207	22.925	21.200	24.300	5.867	4	1.519	2.480	3.224	22.925	0.9207
1673	22.600	0.9076	22.600	18.300	26.200	14.519	4	1.769	2.480	3.224	22.600	0.9076
*3180	21.175	0.8504	21.175	20.000	22.200	5.376	4	2.865	2.480	3.224	21.175	0.8504
*7160	18.625	0.7480	18.625	17.200	19.500	5.603	4	4.826	2.480	3.224	18.625	0.7480
*14060	15.000	0.6024	15.000	13.800	15.800	5.683	4	7.615	2.480	3.224	15.000	0.6024
*30860	13.775	0.5532	13.775	12.400	15.800	10.936	4	8.557	2.480	3.224	13.775	0.5532
*69620	11.825	0.4749	11.825	10.800	13.100	9.376	4	10.057	2.480	3.224	11.825	0.4749

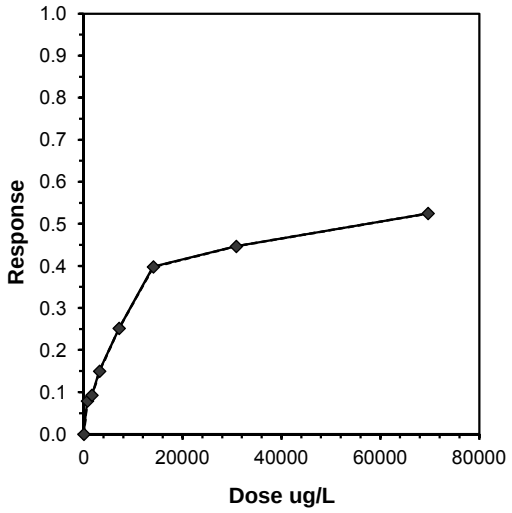
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.969423	0.93	-0.20116	1.06828
Bartlett's Test indicates equal variances (p = 0.20)	9.76692	18.47531		
The control means are not significantly different (p = 0.44)	0.827984	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	1673	3180	2306.543		3.224348	0.129492	92.94603	3.380729	5.5E-10	7, 24
Treatments vs WAF Control										

Linear Interpolation (200 Resamples)

Point	ug/L	SD	95% CL(Exp)		Skew
IC05*	453.8734	743.0149	88.53384	3725.254	1.1789
IC10	1873.933	1097.594	0	5705.609	0.4406
IC15	3195.608	1427.685	0	7450.03	0.1707
IC20	5138.784	1630.032	0	9230.277	-0.0001
IC25	7081.961	1574.98	2817.731	11498.48	0.1329
IC40	14882.86	7355.097	9376.753	48927.62	1.1696
IC50	57196.92				

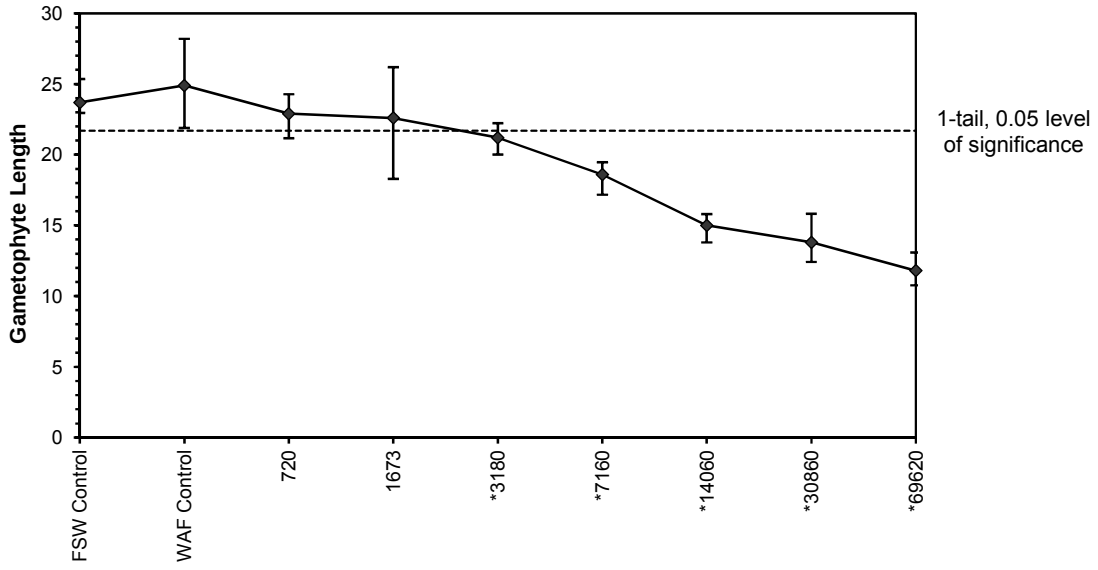
* indicates IC estimate less than the lowest concentration



Macroalgal Growth Test-Gametophyte Length

Start Date:	10/09/2015 14:00	Test ID:	PR1244/15b	Sample ID:	Borossa Field Condensate
End Date:	24/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 116	Test Species:	ER-Ecklonia radiata
Comments:	TRH				

Dose-Response Plot



Macroalgal Growth Test-Gametophyte Length

Start Date:	10/09/2015 14:00	Test ID:	PR1244/15b	Sample ID:	Borossa Field Condensate
End Date:	24/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 116	Test Species:	ER-Ecklonia radiata
Comments:	TRH				

		Auxiliary Data Summary					
Conc-ug/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	Length um	23.65	22.90	25.30	1.12	4.48	4
WAF Control		24.90	21.90	28.20	2.80	6.72	4
720		22.93	21.20	24.30	1.35	5.06	4
1673		22.60	18.30	26.20	3.28	8.02	4
3180		21.18	20.00	22.20	1.14	5.04	4
7160		18.63	17.20	19.50	1.04	5.49	4
14060		15.00	13.80	15.80	0.85	6.16	4
30860		13.78	12.40	15.80	1.51	8.91	4
69620		11.83	10.80	13.10	1.11	8.90	4
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
720		8.10	8.10	8.10	0.00	0.00	1
1673		8.10	8.10	8.10	0.00	0.00	1
3180		8.10	8.10	8.10	0.00	0.00	1
7160		8.00	8.00	8.00	0.00	0.00	1
14060		7.90	7.90	7.90	0.00	0.00	1
30860		7.70	7.70	7.70	0.00	0.00	1
69620		7.40	7.40	7.40	0.00	0.00	1
FSW Control	Salinity ppt	35.40	35.40	35.40	0.00	0.00	1
WAF Control		35.60	35.60	35.60	0.00	0.00	1
720		35.40	35.40	35.40	0.00	0.00	1
1673		35.40	35.40	35.40	0.00	0.00	1
3180		35.40	35.40	35.40	0.00	0.00	1
7160		35.50	35.50	35.50	0.00	0.00	1
14060		35.50	35.50	35.50	0.00	0.00	1
30860		35.60	35.60	35.60	0.00	0.00	1
69620		35.80	35.80	35.80	0.00	0.00	1
FSW Control	DO % sat	100.20	100.20	100.20	0.00	0.00	1
WAF Control		100.90	100.90	100.90	0.00	0.00	1
720		99.60	99.60	99.60	0.00	0.00	1
1673		91.80	91.80	91.80	0.00	0.00	1
3180		96.10	96.10	96.10	0.00	0.00	1
7160		98.70	98.70	98.70	0.00	0.00	1
14060		90.10	90.10	90.10	0.00	0.00	1
30860		90.20	90.20	90.20	0.00	0.00	1
69620		87.20	87.20	87.20	0.00	0.00	1

Appendix P: Statistical Analyses of Sea Anemone Development Test

Anemone Larval Toxicity Test-% Normal

Start Date:	27/10/2015 11:30	Test ID:	PR1244/31	Sample ID:	Barossa Field Condensate
End Date:	4/11/2015 10:30	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 128	Test Species:	AI-Aiptasia pulchella
Comments:					

Conc-g/L	1	2	3	4
FSW Control	1.0000	1.0000	1.0000	1.0000
WAF Control	1.0000	1.0000	0.8000	1.0000
4.8	0.8000	1.0000	1.0000	
9.7	0.8000	0.8000	1.0000	
19.3	0.6000	0.8000	1.0000	
38.6	0.8000	0.6000	0.8000	
77.2	0.0000	0.0000	0.0000	

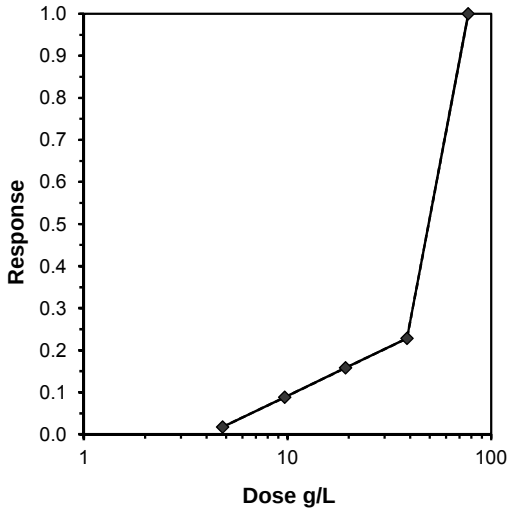
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-g/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
FSW Control	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	4					
WAF Control	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	*			1	20
4.8	0.9333	0.9825	1.2659	1.1071	1.3453	10.861	3	0.170	2.593	0.3023	1	15
9.7	0.8667	0.9123	1.1865	1.1071	1.3453	11.587	3	0.851	2.593	0.3023	2	15
19.3	0.8000	0.8421	1.1128	0.8861	1.3453	20.637	3	1.483	2.593	0.3023	3	15
38.6	0.7333	0.7719	1.0335	0.8861	1.1071	12.350	3	2.164	2.593	0.3023	4	15
77.2	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	3				15	15

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.931661	0.887	-0.22409	-0.77909
Bartlett's Test indicates equal variances (p = 0.88)	1.183699	13.2767		
The control means are not significantly different (p = 0.36)	1	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	38.6	77.2	54.58864		0.227972	0.247547	0.036184	0.023292	0.254275	4, 11
Treatments vs WAF Control										

Trimmed Spearman-Karber

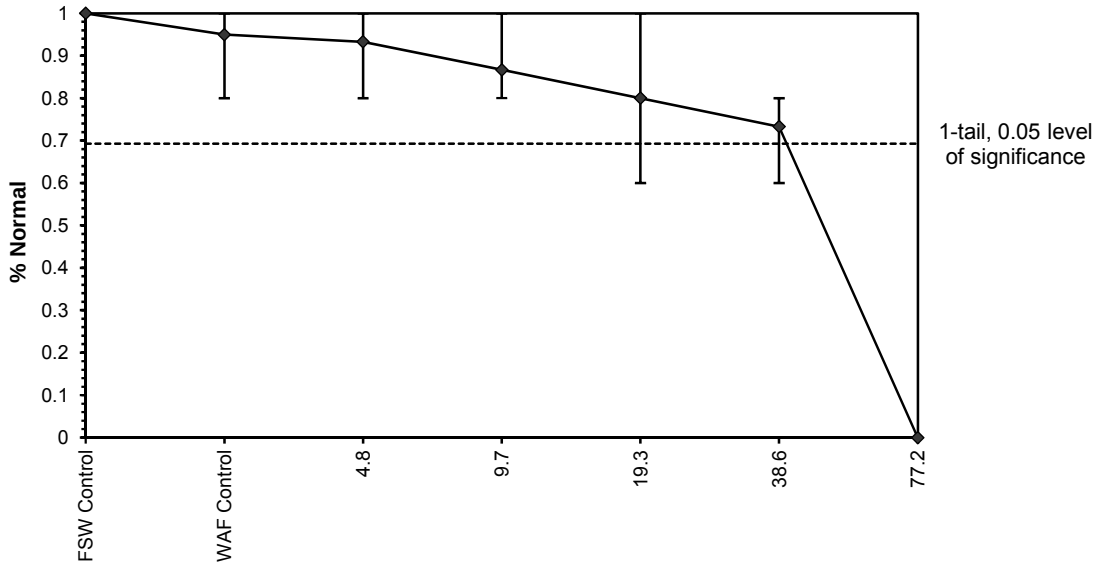
Trim Level	EC50	95% CL	
0.0%			
5.0%	42.079	33.018	53.627
10.0%	44.949	35.034	57.670
20.0%	48.986	36.746	65.302
Auto-1.8%	40.101	31.780	50.600



Anemone Larval Toxicity Test-% Normal

Start Date:	27/10/2015 11:30	Test ID:	PR1244/31	Sample ID:	Barossa Field Condensate
End Date:	4/11/2015 10:30	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 128	Test Species:	AI-Aiptasia pulchella
Comments:					

Dose-Response Plot



Anemone Larval Toxicity Test-% Normal

Start Date:	27/10/2015 11:30	Test ID:	PR1244/31	Sample ID:	Barossa Field Condensate
End Date:	4/11/2015 10:30	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 128	Test Species:	AI-Aiptasia pulchella
Comments:					

		Auxiliary Data Summary					
Conc-g/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Normal	100.00	100.00	100.00	0.00	0.00	4
WAF Control		95.00	80.00	100.00	10.00	3.33	4
4.8		93.33	80.00	100.00	11.55	3.64	3
9.7		86.67	80.00	100.00	11.55	3.92	3
19.3		80.00	60.00	100.00	20.00	5.59	3
38.6		73.33	60.00	80.00	11.55	4.63	3
77.2		0.00	0.00	0.00	0.00		3
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
4.8		8.10	8.10	8.10	0.00	0.00	1
9.7		8.10	8.10	8.10	0.00	0.00	1
19.3		8.00	8.00	8.00	0.00	0.00	1
38.6		7.90	7.90	7.90	0.00	0.00	1
77.2		7.60	7.60	7.60	0.00	0.00	1
FSW Control	Salinity ppt	35.10	35.10	35.10	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
4.8		34.90	34.90	34.90	0.00	0.00	1
9.7		34.90	34.90	34.90	0.00	0.00	1
19.3		35.00	35.00	35.00	0.00	0.00	1
38.6		35.00	35.00	35.00	0.00	0.00	1
77.2		35.10	35.10	35.10	0.00	0.00	1
FSW Control	DO %	102.10	102.10	102.10	0.00	0.00	1
WAF Control		101.60	101.60	101.60	0.00	0.00	1
4.8		103.90	103.90	103.90	0.00	0.00	1
9.7		105.10	105.10	105.10	0.00	0.00	1
19.3		105.20	105.20	105.20	0.00	0.00	1
38.6		104.50	104.50	104.50	0.00	0.00	1
77.2		110.40	110.40	110.40	0.00	0.00	1

Anemone Larval Toxicity Test-% Unaffected

Start Date:	27/10/2015 11:30	Test ID:	PR1244/31b	Sample ID:	BAROSSA FIELD CONDENSATE
End Date:	4/11/2015 10:30	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 128	Test Species:	AI-Aiptasia pulchella
Comments:	TRH Concentration				

Conc-ug/L	1	2	3	4
FSW Control	1.0000	1.0000	1.0000	1.0000
WAF Control	1.0000	1.0000	0.8000	1.0000
2492	0.8000	1.0000	1.0000	
7660	0.8000	0.8000	1.0000	
15840	0.6000	0.8000	1.0000	
28040	0.8000	0.6000	0.8000	
63990	0.0000	0.0000	0.0000	

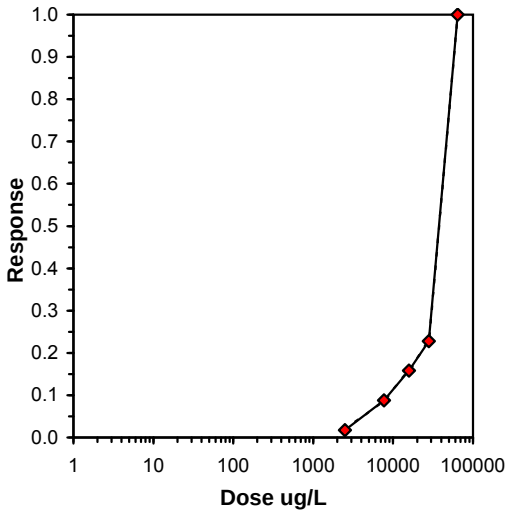
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
FSW Control	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	4					
WAF Control	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	*			1	20
2492	0.9333	0.9825	1.2659	1.1071	1.3453	10.861	3	0.170	2.593	0.3023	1	15
7660	0.8667	0.9123	1.1865	1.1071	1.3453	11.587	3	0.851	2.593	0.3023	2	15
15840	0.8000	0.8421	1.1128	0.8861	1.3453	20.637	3	1.483	2.593	0.3023	3	15
28040	0.7333	0.7719	1.0335	0.8861	1.1071	12.350	3	2.164	2.593	0.3023	4	15
63990	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	3				15	15

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.931661	0.887	-0.22409	-0.77909
Bartlett's Test indicates equal variances (p = 0.88)	1.183699	13.2767		
The control means are not significantly different (p = 0.36)	1	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	28040	63990	42358.94		0.227972	0.247547	0.036184	0.023292	0.254275	4, 11
Treatments vs WAF Control										

Trimmed Spearman-Karber

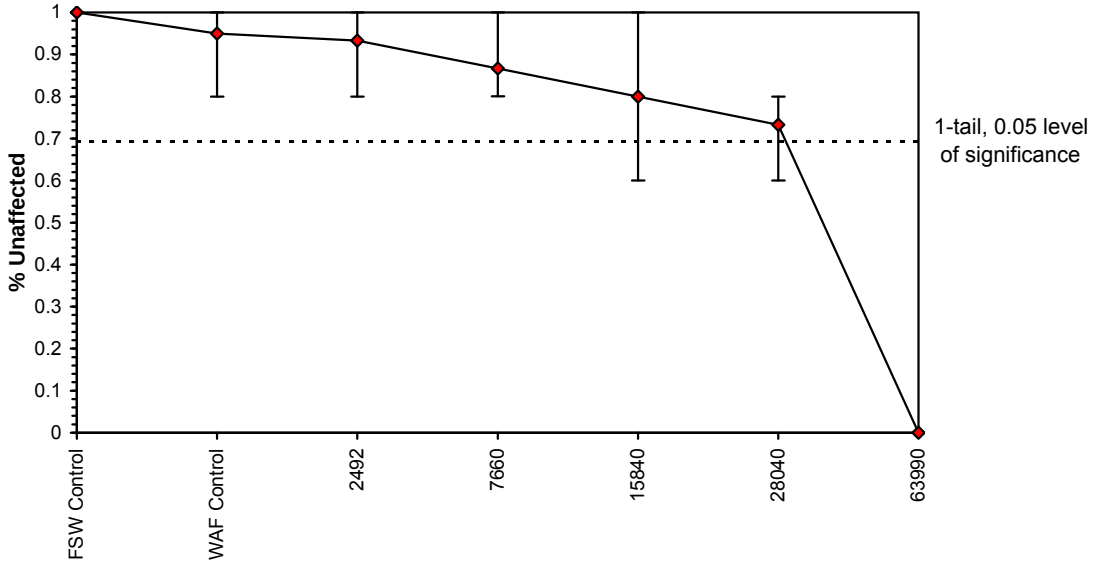
Trim Level	EC50	95% CL	
0.0%			
5.0%	32491.19	25241.84	41822.52
10.0%	34715.36	27194.92	44315.51
20.0%	37324.45	28220.84	49364.76
Auto-1.8%	30719.95	23960.98	39385.52



Anemone Larval Toxicity Test-% Unaffected

Start Date:	27/10/2015 11:30	Test ID:	PR1244/31b	Sample ID:	BAROSSA FIELD CONDENSATE
End Date:	4/11/2015 10:30	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 128	Test Species:	AI-Aiptasia pulchella
Comments:	TRH Concentration				

Dose-Response Plot



Anemone Larval Toxicity Test-% Unaffected

Start Date:	27/10/2015 11:30	Test ID:	PR1244/31b	Sample ID:	BAROSSA FIELD CONDENSATE
End Date:	4/11/2015 10:30	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 128	Test Species:	AI-Aiptasia pulchella
Comments:	TRH Concentration				

		Auxiliary Data Summary					
Conc-ug/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Normal	100.00	100.00	100.00	0.00	0.00	4
WAF Control		95.00	80.00	100.00	10.00	3.33	4
2492		93.33	80.00	100.00	11.55	3.64	3
7660		86.67	80.00	100.00	11.55	3.92	3
15840		80.00	60.00	100.00	20.00	5.59	3
28040		73.33	60.00	80.00	11.55	4.63	3
63990		0.00	0.00	0.00	0.00		3
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
2492		8.10	8.10	8.10	0.00	0.00	1
7660		8.10	8.10	8.10	0.00	0.00	1
15840		8.00	8.00	8.00	0.00	0.00	1
28040		7.90	7.90	7.90	0.00	0.00	1
63990		7.60	7.60	7.60	0.00	0.00	1
FSW Control	Salinity ppt	35.10	35.10	35.10	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
2492		34.90	34.90	34.90	0.00	0.00	1
7660		34.90	34.90	34.90	0.00	0.00	1
15840		35.00	35.00	35.00	0.00	0.00	1
28040		35.00	35.00	35.00	0.00	0.00	1
63990		35.10	35.10	35.10	0.00	0.00	1
FSW Control	DO %	102.10	102.10	102.10	0.00	0.00	1
WAF Control		101.60	101.60	101.60	0.00	0.00	1
2492		103.90	103.90	103.90	0.00	0.00	1
7660		105.10	105.10	105.10	0.00	0.00	1
15840		105.20	105.20	105.20	0.00	0.00	1
28040		104.50	104.50	104.50	0.00	0.00	1
63990		110.40	110.40	110.40	0.00	0.00	1

Anemone Larval Toxicity Test-% Normal

Start Date:	27/10/2015 11:30	Test ID:	PR1244/31	Sample ID:	Barossa Field Condensate
End Date:	4/11/2015 10:30	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 128	Test Species:	AI-Aiptasia pulchella
Comments:					

Conc-g/L	1	2	3	4
FSW Control	1.0000	1.0000	1.0000	1.0000
WAF Control	1.0000	1.0000	0.8000	1.0000
4.8	0.8000	1.0000	1.0000	
9.7	0.8000	0.8000	1.0000	
19.3	0.6000	0.8000	1.0000	
38.6	0.8000	0.6000	0.8000	
77.2	0.0000	0.0000	0.0000	

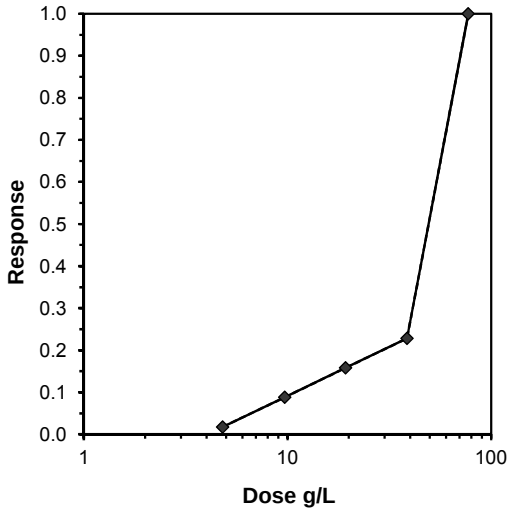
			Transform: Arcsin Square Root						1-Tailed		Isotonic	
Conc-g/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
FSW Control	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	4					
WAF Control	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	*			0.9500	1.0000
4.8	0.9333	0.9825	1.2659	1.1071	1.3453	10.861	3	0.170	2.593	0.3023	0.9333	0.9825
9.7	0.8667	0.9123	1.1865	1.1071	1.3453	11.587	3	0.851	2.593	0.3023	0.8667	0.9123
19.3	0.8000	0.8421	1.1128	0.8861	1.3453	20.637	3	1.483	2.593	0.3023	0.8000	0.8421
38.6	0.7333	0.7719	1.0335	0.8861	1.1071	12.350	3	2.164	2.593	0.3023	0.7333	0.7719
77.2	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	3				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.931661	0.887	-0.22409	-0.77909
Bartlett's Test indicates equal variances (p = 0.88)	1.183699	13.2767		
The control means are not significantly different (p = 0.36)	1	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	38.6	77.2	54.58864		0.227972	0.247547	0.036184	0.023292	0.254275	4, 11
Treatments vs WAF Control										

Log-Logit Interpolation (200 Resamples)

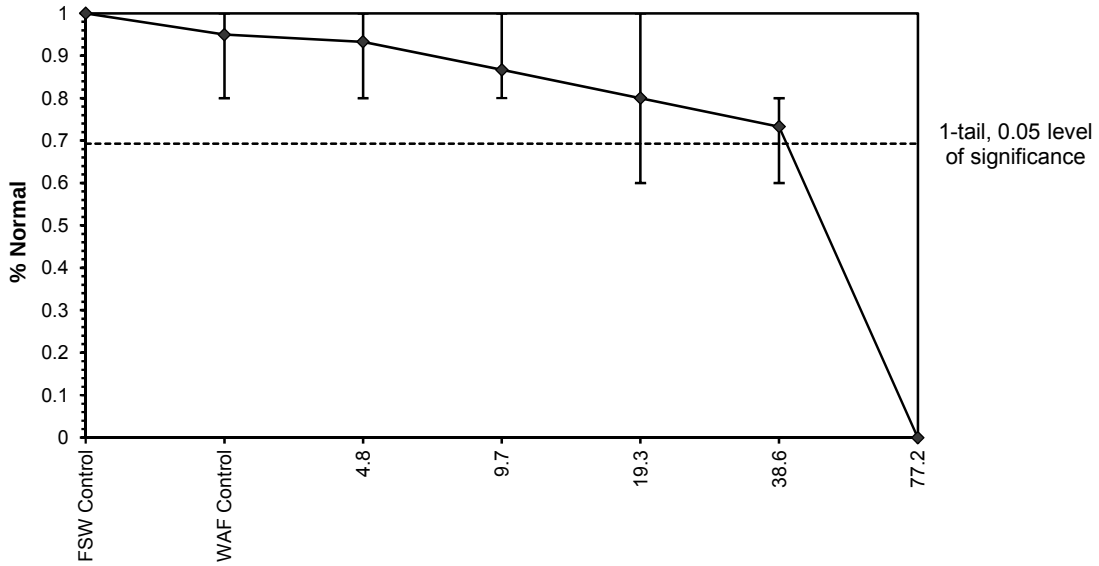
Point	g/L	SD	95% CL(Exp)		Skew
IC05	7.069	4.665	0.000	29.205	1.5128
IC10	11.167	7.033	0.284	38.143	1.0232
IC15	18.066	8.803	1.959	48.486	0.5551
IC20	29.791	10.145	1.565	44.843	-0.1692
IC25	38.875	8.426	3.066	40.413	-1.1606
IC40	40.571	0.665	38.281	42.074	-0.1870
IC50	41.642	0.649	39.342	43.120	-0.1869



Anemone Larval Toxicity Test-% Normal

Start Date:	27/10/2015 11:30	Test ID:	PR1244/31	Sample ID:	Barossa Field Condensate
End Date:	4/11/2015 10:30	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 128	Test Species:	AI-Aiptasia pulchella
Comments:					

Dose-Response Plot



Anemone Larval Toxicity Test-% Normal

Start Date:	27/10/2015 11:30	Test ID:	PR1244/31	Sample ID:	Barossa Field Condensate
End Date:	4/11/2015 10:30	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 128	Test Species:	AI-Aiptasia pulchella
Comments:					

		Auxiliary Data Summary					
Conc-g/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Normal	100.00	100.00	100.00	0.00	0.00	4
WAF Control		95.00	80.00	100.00	10.00	3.33	4
4.8		93.33	80.00	100.00	11.55	3.64	3
9.7		86.67	80.00	100.00	11.55	3.92	3
19.3		80.00	60.00	100.00	20.00	5.59	3
38.6		73.33	60.00	80.00	11.55	4.63	3
77.2		0.00	0.00	0.00	0.00		3
FSW Control	pH	8.10	8.10	8.10	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
4.8		8.10	8.10	8.10	0.00	0.00	1
9.7		8.10	8.10	8.10	0.00	0.00	1
19.3		8.00	8.00	8.00	0.00	0.00	1
38.6		7.90	7.90	7.90	0.00	0.00	1
77.2		7.60	7.60	7.60	0.00	0.00	1
FSW Control	Salinity ppt	35.10	35.10	35.10	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
4.8		34.90	34.90	34.90	0.00	0.00	1
9.7		34.90	34.90	34.90	0.00	0.00	1
19.3		35.00	35.00	35.00	0.00	0.00	1
38.6		35.00	35.00	35.00	0.00	0.00	1
77.2		35.10	35.10	35.10	0.00	0.00	1
FSW Control	DO %	102.10	102.10	102.10	0.00	0.00	1
WAF Control		101.60	101.60	101.60	0.00	0.00	1
4.8		103.90	103.90	103.90	0.00	0.00	1
9.7		105.10	105.10	105.10	0.00	0.00	1
19.3		105.20	105.20	105.20	0.00	0.00	1
38.6		104.50	104.50	104.50	0.00	0.00	1
77.2		110.40	110.40	110.40	0.00	0.00	1

Appendix Q: Statistical Analyses of Copepodid Development Test

Marine Copepod Development Test-% Normal

Start Date:	22/09/2015 14:00	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	27/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:		Test Species:	PC-Parvocalanus crassirostris
Comments:					

Conc-gm/L	1	2	3	4	5	6	7	8
FSW Control	0.6000	0.8000	0.6000	0.8000	0.6000	0.8000	0.6000	0.8000
WAF Control	0.8000	0.4000	0.6000	0.6000				
4.8	0.4000	0.6000	0.6000	0.0000				
9.7	0.6000	0.6000	0.4000	0.4000				
19.3	0.0000	0.0000	0.0000	0.0000				
38.6	0.0000	0.0000	0.0000	0.0000				
77.2	0.0000	0.0000	0.0000	0.0000				

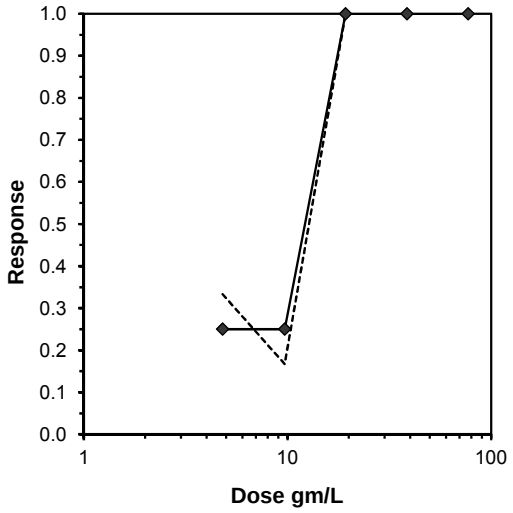
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
FSW Control	0.7000	1.1667	0.9966	0.8861	1.1071	11.857	8					
WAF Control	0.6000	1.0000	0.8910	0.6847	1.1071	19.366	4	*			8	20
4.8	0.4000	0.6667	0.6706	0.2255	0.8861	46.456	4	1.441	2.180	0.3334	12	20
9.7	0.5000	0.8333	0.7854	0.6847	0.8861	14.802	4	0.691	2.180	0.3334	10	20
19.3	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20
38.6	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20
77.2	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.909212	0.859	-0.97373	1.125224
Bartlett's Test indicates equal variances (p = 0.28)	2.518146	9.21034		
The control means are not significantly different (p = 0.24)	1.260902	2.228139		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	9.7	19.3	13.68247		0.324825	0.537057	0.048608	0.046781	0.392639	2, 9
Treatments vs WAF Control										

Trimmed Spearman-Karber

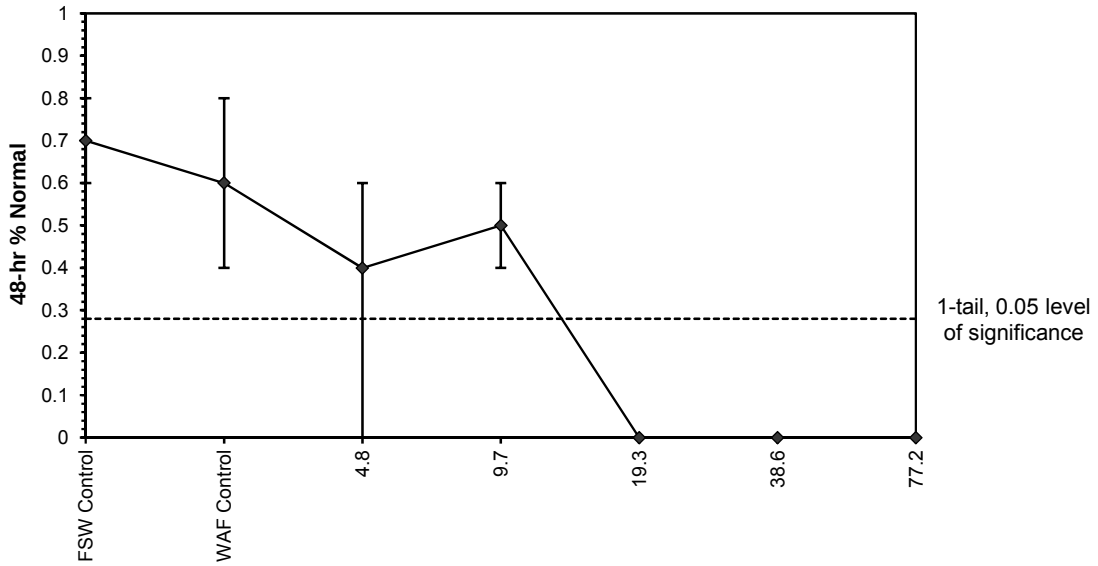
Trim Level	EC50	95% CL	
0.0%			
5.0%			
10.0%			
20.0%			
Auto-25.0%	12.200	10.838	13.734



Marine Copepod Development Test-% Normal

Start Date:	22/09/2015 14:00	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	27/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:		Test Species:	PC-Parvocalanus crassirostris
Comments:					

Dose-Response Plot



Marine Copepod Development Test-% Normal

Start Date:	22/09/2015 14:00	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	27/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:		Test Species:	PC-Parvocalanus crassirostris
Comments:					

		Auxiliary Data Summary					
Conc-gm/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% normal	70.00	60.00	80.00	10.69	4.67	8
WAF Control		60.00	40.00	80.00	16.33	6.74	4
4.8		40.00	0.00	60.00	28.28	13.30	4
9.7		50.00	40.00	60.00	11.55	6.80	4
19.3		0.00	0.00	0.00	0.00		4
38.6		0.00	0.00	0.00	0.00		4
77.2		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
WAF Control		8.20	8.20	8.20	0.00	0.00	1
4.8		8.10	8.10	8.10	0.00	0.00	1
9.7		8.10	8.10	8.10	0.00	0.00	1
19.3		8.00	8.00	8.00	0.00	0.00	1
38.6		7.80	7.80	7.80	0.00	0.00	1
77.2		7.30	7.30	7.30	0.00	0.00	1
FSW Control	DO %	99.80	99.80	99.80	0.00	0.00	1
WAF Control		92.80	92.80	92.80	0.00	0.00	1
4.8		96.30	96.30	96.30	0.00	0.00	1
9.7		95.70	95.70	95.70	0.00	0.00	1
19.3		96.70	96.70	96.70	0.00	0.00	1
38.6		95.60	95.60	95.60	0.00	0.00	1
77.2		85.10	85.10	85.10	0.00	0.00	1
FSW Control	Salinity ppt	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
4.8		35.10	35.10	35.10	0.00	0.00	1
9.7		35.10	35.10	35.10	0.00	0.00	1
19.3		35.20	35.20	35.20	0.00	0.00	1
38.6		35.30	35.30	35.30	0.00	0.00	1
77.2		35.30	35.30	35.30	0.00	0.00	1

Marine Copepod Development Test-% Normal

Start Date:	22/09/2015 14:00	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	27/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:		Test Species:	PC-Parvocalanus crassirostris
Comments:					

Conc-gm/L	1	2	3	4	5	6	7	8
FSW Control	0.6000	0.8000	0.6000	0.8000	0.6000	0.8000	0.6000	0.8000
WAF Control	0.8000	0.4000	0.6000	0.6000				
4.8	0.4000	0.6000	0.6000	0.0000				
9.7	0.6000	0.6000	0.4000	0.4000				
19.3	0.0000	0.0000	0.0000	0.0000				
38.6	0.0000	0.0000	0.0000	0.0000				
77.2	0.0000	0.0000	0.0000	0.0000				

			Transform: Arcsin Square Root						1-Tailed		Isotonic	
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
FSW Control	0.7000	1.1667	0.9966	0.8861	1.1071	11.857	8					
WAF Control	0.6000	1.0000	0.8910	0.6847	1.1071	19.366	4	*			0.6000	1.0000
4.8	0.4000	0.6667	0.6706	0.2255	0.8861	46.456	4	1.441	2.180	0.3334	0.4500	0.7500
9.7	0.5000	0.8333	0.7854	0.6847	0.8861	14.802	4	0.691	2.180	0.3334	0.4500	0.7500
19.3	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				0.0000	0.0000
38.6	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				0.0000	0.0000
77.2	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				0.0000	0.0000

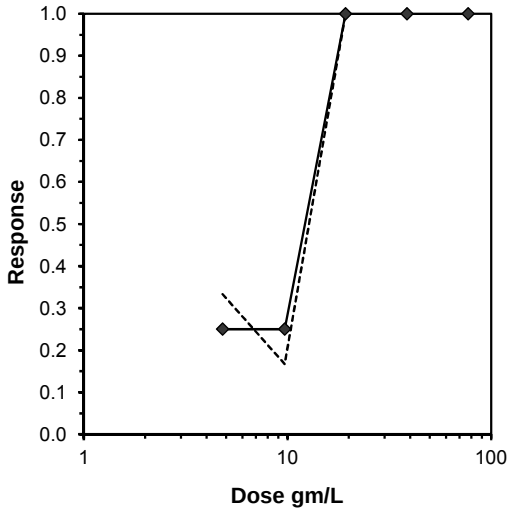
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.909212	0.859	-0.97373	1.125224
Bartlett's Test indicates equal variances (p = 0.28)	2.518146	9.21034		
The control means are not significantly different (p = 0.24)	1.260902	2.228139		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	9.7	19.3	13.68247		0.324825	0.537057	0.048608	0.046781	0.392639	2, 9
Treatments vs WAF Control										

Log-Logit Interpolation (200 Resamples)

Point	gm/L	SD	95% CL(Exp)		Skew
IC05*	0.431	3.000	0.067	14.446	1.9198
IC10*	1.036	3.573	0.073	14.258	1.1432
IC15*	1.886	3.723	0.004	13.948	0.6563
IC20*	3.088	3.708	0.000	13.465	0.2468
IC25	9.700	3.615	0.000	10.280	-0.2825
IC40	9.989	2.233	0.000	10.530	-2.2276
IC50	10.203	1.300	0.965	10.723	-4.2905

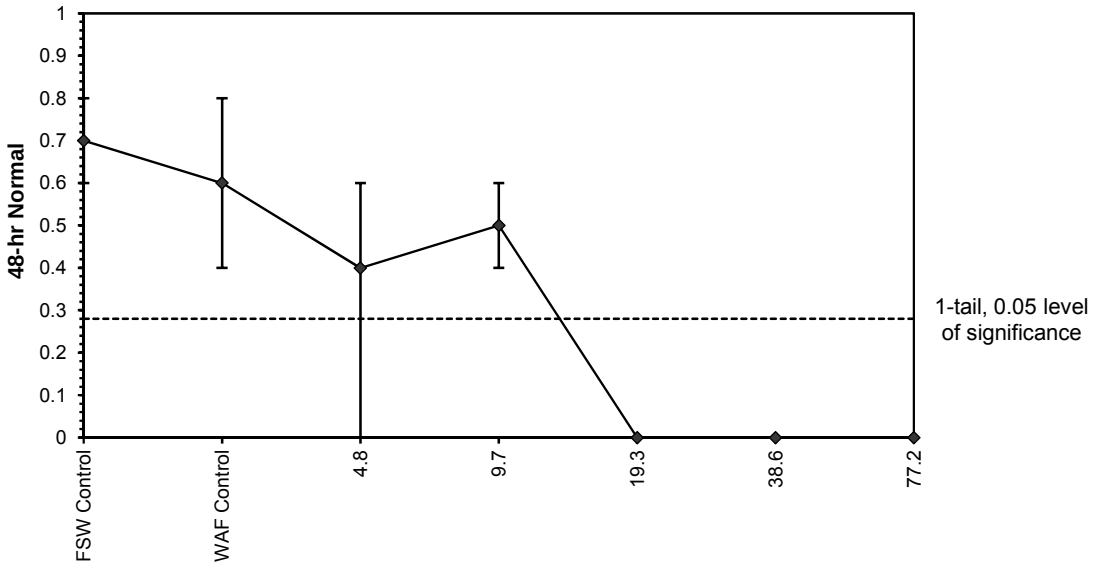
* indicates IC estimate less than the lowest concentration



Marine Copepod Development Test-% Normal

Start Date:	22/09/2015 14:00	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	27/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:		Test Species:	PC-Parvocalanus crassirostris
Comments:					

Dose-Response Plot



Marine Copepod Development Test-% Normal

Start Date:	22/09/2015 14:00	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	27/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:		Test Species:	PC-Parvocalanus crassirostris
Comments:					

		Auxiliary Data Summary					
Conc-gm/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% normal	70.00	60.00	80.00	10.69	4.67	8
WAF Control		60.00	40.00	80.00	16.33	6.74	4
4.8		40.00	0.00	60.00	28.28	13.30	4
9.7		50.00	40.00	60.00	11.55	6.80	4
19.3		0.00	0.00	0.00	0.00		4
38.6		0.00	0.00	0.00	0.00		4
77.2		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
WAF Control		8.20	8.20	8.20	0.00	0.00	1
4.8		8.10	8.10	8.10	0.00	0.00	1
9.7		8.10	8.10	8.10	0.00	0.00	1
19.3		8.00	8.00	8.00	0.00	0.00	1
38.6		7.80	7.80	7.80	0.00	0.00	1
77.2		7.30	7.30	7.30	0.00	0.00	1
FSW Control	DO %	99.80	99.80	99.80	0.00	0.00	1
WAF Control		92.80	92.80	92.80	0.00	0.00	1
4.8		96.30	96.30	96.30	0.00	0.00	1
9.7		95.70	95.70	95.70	0.00	0.00	1
19.3		96.70	96.70	96.70	0.00	0.00	1
38.6		95.60	95.60	95.60	0.00	0.00	1
77.2		85.10	85.10	85.10	0.00	0.00	1
FSW Control	Salinity ppt	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
4.8		35.10	35.10	35.10	0.00	0.00	1
9.7		35.10	35.10	35.10	0.00	0.00	1
19.3		35.20	35.20	35.20	0.00	0.00	1
38.6		35.30	35.30	35.30	0.00	0.00	1
77.2		35.30	35.30	35.30	0.00	0.00	1

Marine Copepod Development Test-% Normal

Start Date:	22/09/2015 14:00	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	27/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:		Test Species:	PC-Parvocalanus crassirostris
Comments:					

Conc-gm/L	1	2	3	4	5	6	7	8
FSW Control	0.6000	0.8000	0.6000	0.8000	0.6000	0.8000	0.6000	0.8000
WAF Control	0.8000	0.4000	0.6000	0.6000				
3860	0.4000	0.6000	0.6000	0.0000				
8560	0.6000	0.6000	0.4000	0.4000				
15830	0.0000	0.0000	0.0000	0.0000				
29770	0.0000	0.0000	0.0000	0.0000				
68390	0.0000	0.0000	0.0000	0.0000				

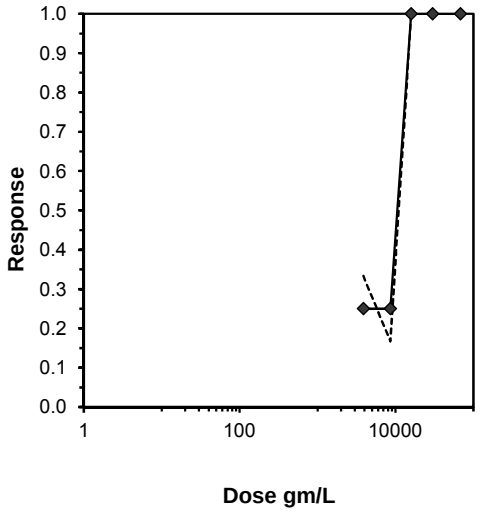
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
FSW Control	0.7000	1.1667	0.9966	0.8861	1.1071	11.857	8					
WAF Control	0.6000	1.0000	0.8910	0.6847	1.1071	19.366	4	*			8	20
3860	0.4000	0.6667	0.6706	0.2255	0.8861	46.456	4	1.441	2.180	0.3334	12	20
8560	0.5000	0.8333	0.7854	0.6847	0.8861	14.802	4	0.691	2.180	0.3334	10	20
15830	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20
29770	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20
68390	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				20	20

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.909212	0.859	-0.97373	1.125224
Bartlett's Test indicates equal variances (p = 0.28)	2.518146	9.21034		
The control means are not significantly different (p = 0.24)	1.260902	2.228139		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	8560	15830	11640.65		0.324825	0.537057	0.048608	0.046781	0.392639	2, 9
Treatments vs WAF Control										

Trimmed Spearman-Karber

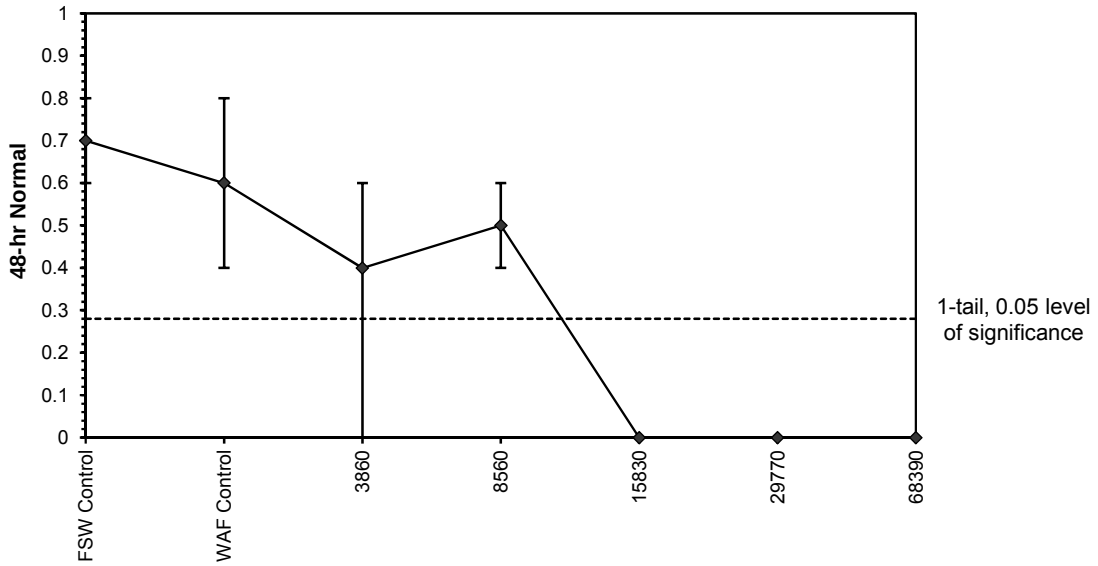
Trim Level	EC50	95% CL	
0.0%			
5.0%			
10.0%			
20.0%			
Auto-25.0%	10506.94	9451.822	11679.84



Marine Copepod Development Test-% Normal

Start Date:	22/09/2015 14:00	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	27/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:		Test Species:	PC-Parvocalanus crassirostris
Comments:					

Dose-Response Plot



Marine Copepod Development Test-% Normal

Start Date:	22/09/2015 14:00	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	27/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:		Test Species:	PC-Parvocalanus crassirostris
Comments:					

Auxiliary Data Summary

Conc-gm/L	Parameter	Mean	Min	Max	SD	CV%	N
FSW Control	% normal	70.00	60.00	80.00	10.69	4.67	8
WAF Control		60.00	40.00	80.00	16.33	6.74	4
3860		40.00	0.00	60.00	28.28	13.30	4
8560		50.00	40.00	60.00	11.55	6.80	4
15830		0.00	0.00	0.00	0.00		4
29770		0.00	0.00	0.00	0.00		4
68390		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
WAF Control		8.20	8.20	8.20	0.00	0.00	1
3860		8.10	8.10	8.10	0.00	0.00	1
8560		8.10	8.10	8.10	0.00	0.00	1
15830		8.00	8.00	8.00	0.00	0.00	1
29770		7.80	7.80	7.80	0.00	0.00	1
68390		7.30	7.30	7.30	0.00	0.00	1
FSW Control	DO %	99.80	99.80	99.80	0.00	0.00	1
WAF Control		92.80	92.80	92.80	0.00	0.00	1
3860		96.30	96.30	96.30	0.00	0.00	1
8560		95.70	95.70	95.70	0.00	0.00	1
15830		96.70	96.70	96.70	0.00	0.00	1
29770		95.60	95.60	95.60	0.00	0.00	1
68390		85.10	85.10	85.10	0.00	0.00	1
FSW Control	Salinity ppt	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
3860		35.10	35.10	35.10	0.00	0.00	1
8560		35.10	35.10	35.10	0.00	0.00	1
15830		35.20	35.20	35.20	0.00	0.00	1
29770		35.30	35.30	35.30	0.00	0.00	1
68390		35.30	35.30	35.30	0.00	0.00	1

Marine Copepod Development Test-% Normal

Start Date:	22/09/2015 14:00	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	27/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:		Test Species:	PC-Parvocalanus crassirostris
Comments:					

Conc-gm/L	1	2	3	4	5	6	7	8
FSW Control	0.6000	0.8000	0.6000	0.8000	0.6000	0.8000	0.6000	0.8000
WAF Control	0.8000	0.4000	0.6000	0.6000				
3860	0.4000	0.6000	0.6000	0.0000				
8560	0.6000	0.6000	0.4000	0.4000				
15830	0.0000	0.0000	0.0000	0.0000				
29770	0.0000	0.0000	0.0000	0.0000				
68390	0.0000	0.0000	0.0000	0.0000				

			Transform: Arcsin Square Root						1-Tailed		Isotonic	
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
FSW Control	0.7000	1.1667	0.9966	0.8861	1.1071	11.857	8					
WAF Control	0.6000	1.0000	0.8910	0.6847	1.1071	19.366	4	*			0.6000	1.0000
3860	0.4000	0.6667	0.6706	0.2255	0.8861	46.456	4	1.441	2.180	0.3334	0.4500	0.7500
8560	0.5000	0.8333	0.7854	0.6847	0.8861	14.802	4	0.691	2.180	0.3334	0.4500	0.7500
15830	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				0.0000	0.0000
29770	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				0.0000	0.0000
68390	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4				0.0000	0.0000

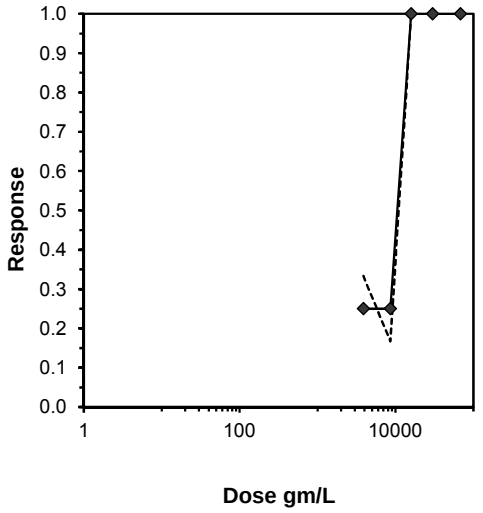
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.909212	0.859	-0.97373	1.125224
Bartlett's Test indicates equal variances (p = 0.28)	2.518146	9.21034		
The control means are not significantly different (p = 0.24)	1.260902	2.228139		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	8560	15830	11640.65		0.324825	0.537057	0.048608	0.046781	0.392639	2, 9
Treatments vs WAF Control										

Log-Logit Interpolation (200 Resamples)

Point	gm/L	SD	95% CL(Exp)		Skew
IC05*	4.388444	2798.854	0	12928.47	2.0197
IC10*	27.21423	3271.518	0	13008.23	1.3764
IC15*	144.3927	3767.918	0	13041.84	0.7201
IC20*	745.2861	4038.67	0	12835.18	0.2071
IC25	8560	3983.675	0	9023.806	-0.2610
IC40	8781.697	2442.853	0	9221.466	-2.2951
IC50	8946.181	1148.001	8126.509	9372.164	-5.9722

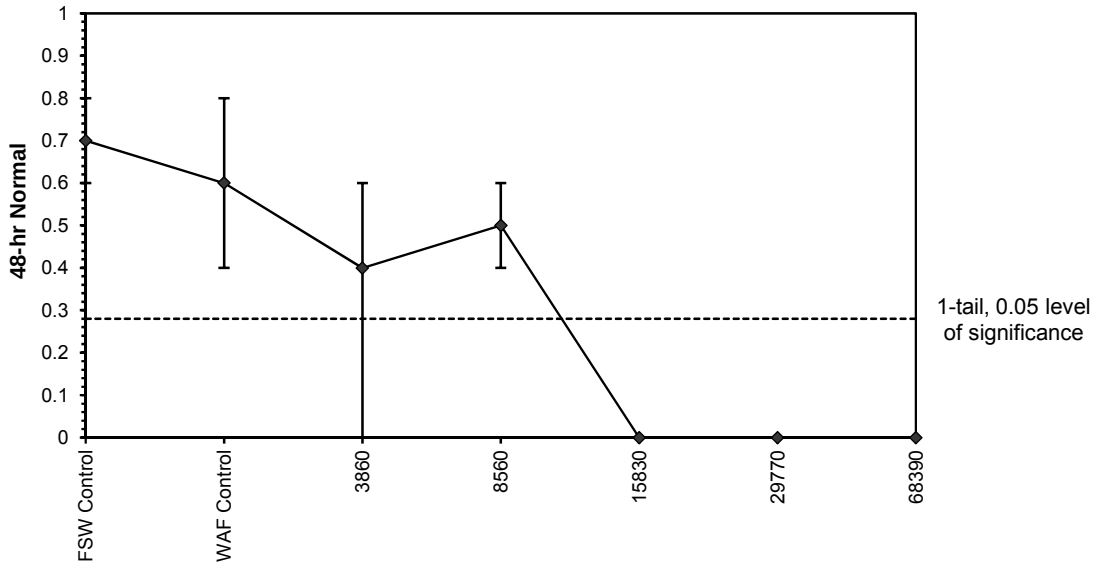
* indicates IC estimate less than the lowest concentration



Marine Copepod Development Test-% Normal

Start Date:	22/09/2015 14:00	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	27/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:		Test Species:	PC-Parvocalanus crassirostris
Comments:					

Dose-Response Plot



Marine Copepod Development Test-% Normal

Start Date:	22/09/2015 14:00	Test ID:	PR1244/02	Sample ID:	Borossa Field Condensate
End Date:	27/09/2015 14:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:		Test Species:	PC-Parvocalanus crassirostris
Comments:					

Auxiliary Data Summary

Conc-gm/L	Parameter	Mean	Min	Max	SD	CV%	N
FSW Control	% normal	70.00	60.00	80.00	10.69	4.67	8
WAF Control		60.00	40.00	80.00	16.33	6.74	4
3860		40.00	0.00	60.00	28.28	13.30	4
8560		50.00	40.00	60.00	11.55	6.80	4
15830		0.00	0.00	0.00	0.00		4
29770		0.00	0.00	0.00	0.00		4
68390		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
WAF Control		8.20	8.20	8.20	0.00	0.00	1
3860		8.10	8.10	8.10	0.00	0.00	1
8560		8.10	8.10	8.10	0.00	0.00	1
15830		8.00	8.00	8.00	0.00	0.00	1
29770		7.80	7.80	7.80	0.00	0.00	1
68390		7.30	7.30	7.30	0.00	0.00	1
FSW Control	DO %	99.80	99.80	99.80	0.00	0.00	1
WAF Control		92.80	92.80	92.80	0.00	0.00	1
3860		96.30	96.30	96.30	0.00	0.00	1
8560		95.70	95.70	95.70	0.00	0.00	1
15830		96.70	96.70	96.70	0.00	0.00	1
29770		95.60	95.60	95.60	0.00	0.00	1
68390		85.10	85.10	85.10	0.00	0.00	1
FSW Control	Salinity ppt	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
3860		35.10	35.10	35.10	0.00	0.00	1
8560		35.10	35.10	35.10	0.00	0.00	1
15830		35.20	35.20	35.20	0.00	0.00	1
29770		35.30	35.30	35.30	0.00	0.00	1
68390		35.30	35.30	35.30	0.00	0.00	1

Appendix R: Statistical Analyses of the Fish Imbalance and Growth Test

Fish Growth Test-7 Day Unaffected

Start Date:	22/09/2015 12:30	Test ID:	PR1244/06	Sample ID:	Barossa Field Condensate
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	Loading Rate				

Conc-gm/L	1	2	3	4
FSW Control	1.0000	1.0000	1.0000	1.0000
WAF Control	1.0000	1.0000	1.0000	1.0000
4.8	1.0000	1.0000	1.0000	1.0000
9.7	1.0000	1.0000	1.0000	1.0000
19.3	0.8000	0.8000	1.0000	1.0000
38.6	0.2000	0.2000	0.2000	0.2000
77.2	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
FSW Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4				
WAF Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	*		0	20
4.8	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
9.7	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
19.3	0.9000	0.9000	1.2262	1.1071	1.3453	11.212	4	14.00	10.00	2	20
*38.6	0.2000	0.2000	0.4636	0.4636	0.4636	0.000	4	10.00	10.00	16	20
77.2	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20

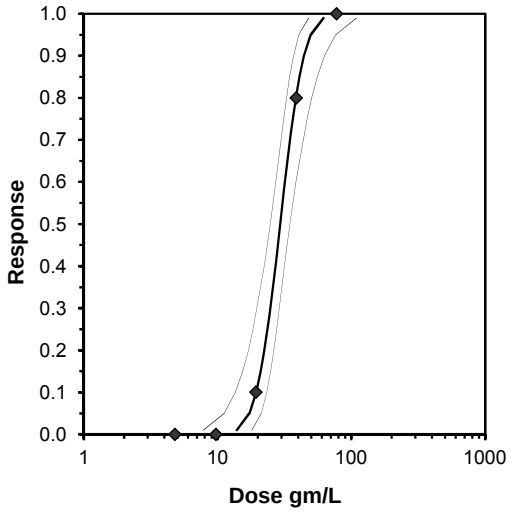
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.63123	0.905	5.4E-15	2.980392
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	19.3	38.6	27.29432	
Treatments vs WAF Control				

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	7.178029	1.531775	4.175749	10.18031	0	0.036857	7.814728	1	1.466663	0.139314	3
Intercept	-5.52775	2.261845	-9.96097	-1.09453							
TSCR											

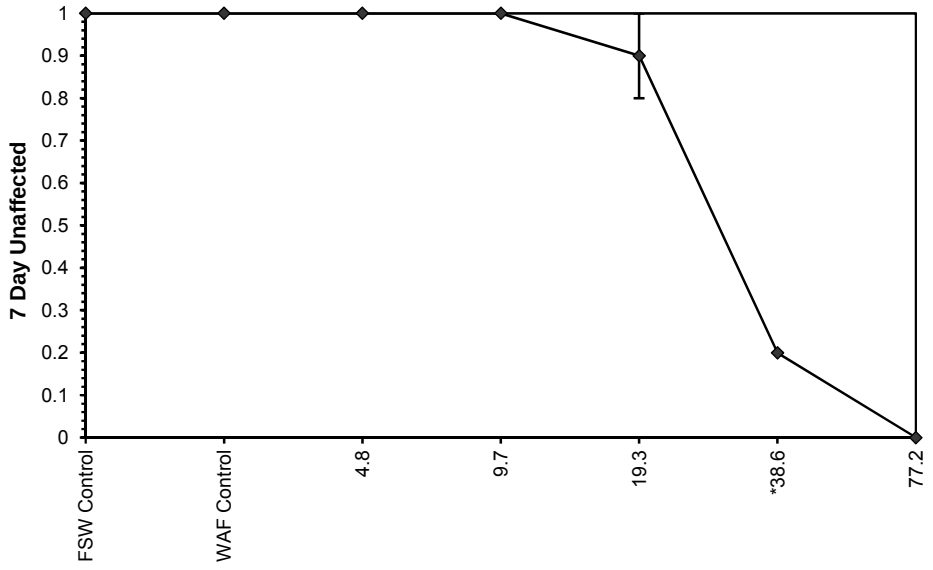
Point	Probits	gm/L	95% Fiducial Limits	
EC01	2.674	13.88578	7.816206	17.95356
EC05	3.355	17.27874	11.23676	21.21538
EC10	3.718	19.41445	13.58027	23.28484
EC15	3.964	21.00263	15.38899	24.86277
EC20	4.158	22.35701	16.95756	26.25341
EC25	4.326	23.58834	18.39006	27.56814
EC40	4.747	27.00029	22.27634	31.5769
EC50	5.000	29.28622	24.7131	34.66116
EC60	5.253	31.76568	27.14661	38.42481
EC75	5.674	36.36044	31.12336	46.50115
EC80	5.842	38.36303	32.69047	50.41624
EC85	6.036	40.83692	34.52706	55.54199
EC90	6.282	44.17752	36.87479	62.9259
EC95	6.645	49.63802	40.48028	76.03354
EC99	7.326	61.76696	47.84469	109.285



Fish Growth Test-7 Day Unaffected

Start Date:	22/09/2015 12:30	Test ID:	PR1244/06	Sample ID:	Barossa Field Condensate
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	Loading Rate				

Dose-Response Plot



Fish Growth Test-7 Day Unaffected

Start Date:	22/09/2015 12:30	Test ID:	PR1244/06	Sample ID:	Barossa Field Condensate
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	Loading Rate				

		Auxiliary Data Summary					
Conc-gm/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Un-affected	100.00	100.00	100.00	0.00	0.00	4
WAF Control		100.00	100.00	100.00	0.00	0.00	4
4.8		100.00	100.00	100.00	0.00	0.00	4
9.7		100.00	100.00	100.00	0.00	0.00	4
19.3		90.00	80.00	100.00	11.55	3.78	4
38.6		20.00	20.00	20.00	0.00	0.00	4
77.2		0.00	0.00	0.00	0.00		4
FSW Control	Biomass	8.33	7.12	10.12	1.31	13.72	4
WAF Control		7.98	7.16	9.02	0.79	11.13	4
4.8		7.74	7.34	8.30	0.43	8.50	4
9.7		8.26	7.94	8.58	0.30	6.63	4
19.3		7.74	6.22	9.04	1.16	13.93	4
38.6		1.36	1.20	1.60	0.17	30.57	4
77.2		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
WAF Control		8.20	8.20	8.20	0.00	0.00	1
4.8		8.10	8.10	8.10	0.00	0.00	1
9.7		8.10	8.10	8.10	0.00	0.00	1
19.3		8.00	8.00	8.00	0.00	0.00	1
38.6		7.80	7.80	7.80	0.00	0.00	1
77.2		7.30	7.30	7.30	0.00	0.00	1
FSW Control	Salinity	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
4.8		35.10	35.10	35.10	0.00	0.00	1
9.7		35.10	35.10	35.10	0.00	0.00	1
19.3		35.20	35.20	35.20	0.00	0.00	1
38.6		35.30	35.30	35.30	0.00	0.00	1
77.2		35.30	35.30	35.30	0.00	0.00	1
FSW Control	% DO	99.80	99.80	99.80	0.00	0.00	1
WAF Control		92.80	92.80	92.80	0.00	0.00	1
4.8		96.30	96.30	96.30	0.00	0.00	1
9.7		95.70	95.70	95.70	0.00	0.00	1
19.3		96.70	96.70	96.70	0.00	0.00	1
38.6		95.60	95.60	95.60	0.00	0.00	1
77.2		85.10	85.10	85.10	0.00	0.00	1

Fish Growth Test-7 Day Unaffected

Start Date:	22/09/2015 12:30	Test ID:	PR1244/06b	Sample ID:	Barossa Field Condensate
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	TRH				

Conc-ug/L	1	2	3	4
FSW Control	1.0000	1.0000	1.0000	1.0000
WAF Control	1.0000	1.0000	1.0000	1.0000
3860	1.0000	1.0000	1.0000	1.0000
8560	1.0000	1.0000	1.0000	1.0000
15830	0.8000	0.8000	1.0000	1.0000
29770	0.2000	0.2000	0.2000	0.2000
68390	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
FSW Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4				
WAF Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	*		0	20
3860	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
8560	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
15830	0.9000	0.9000	1.2262	1.1071	1.3453	11.212	4	14.00	10.00	2	20
*29770	0.2000	0.2000	0.4636	0.4636	0.4636	0.000	4	10.00	10.00	16	20
68390	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20

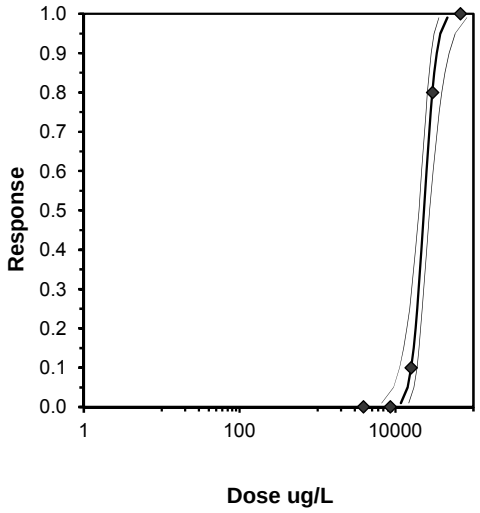
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.63123	0.905	5.4E-15	2.980392
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	15830	29770	21708.5	
Treatments vs WAF Control				

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	7.794081	1.747035	4.369893	11.21827	0	0.010855	7.814728	1	4.365154	0.128302	3
Intercept	-29.0224	7.620937	-43.9594	-14.0853							
TSCR											

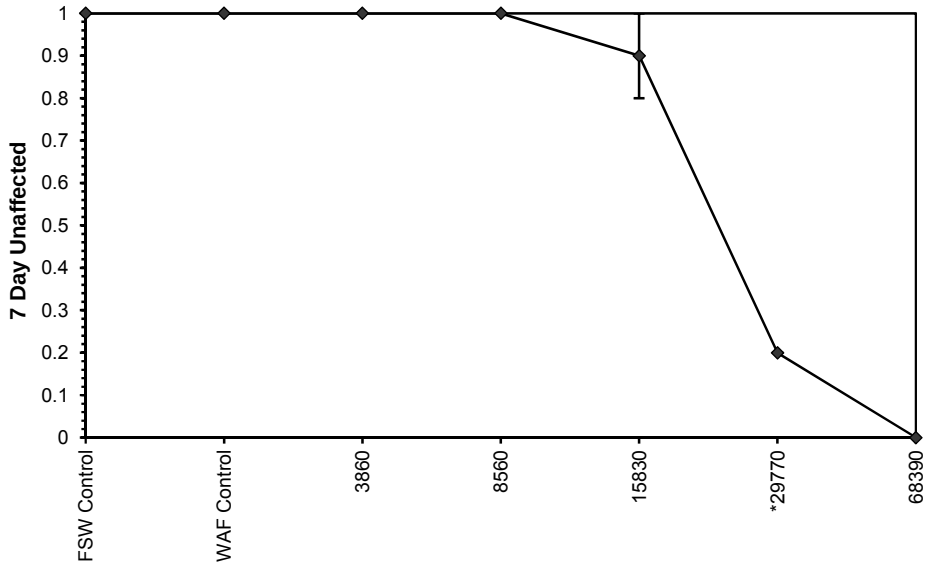
Point	Probits	ug/L	95% Fiducial Limits	
EC01	2.674	11659.45	6649.302	14800.89
EC05	3.355	14259.87	9408.471	17228.43
EC10	3.718	15875.53	11275.41	18756.63
EC15	3.964	17067.8	12704.42	19919.32
EC20	4.158	18078.91	13934.91	20944.57
EC25	4.326	18993.97	15050.69	21916.11
EC40	4.747	21510.44	18029.4	24903.08
EC50	5.000	23182.19	19851.65	27226.81
EC60	5.253	24983.86	21633.54	30076.32
EC75	5.674	28293.92	24480.92	36177.54
EC80	5.842	29726	25588.28	39117.39
EC85	6.036	31487.01	26878.99	42948.14
EC90	6.282	33851.71	28519.97	48434.02
EC95	6.645	37687.14	31023.54	58093.9
EC99	7.326	46092.54	36082.36	82267.42



Fish Growth Test-7 Day Unaffected

Start Date:	22/09/2015 12:30	Test ID:	PR1244/06b	Sample ID:	Barossa Field Condensate
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	TRH				

Dose-Response Plot



 ToxCalc v5.0.23 Reviewed by:_____

Fish Growth Test-7 Day Unaffected

Start Date:	22/09/2015 12:30	Test ID:	PR1244/06b	Sample ID:	Barossa Field Condensate
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	TRH				

		Auxiliary Data Summary					
Conc-ug/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Un-affected	100.00	100.00	100.00	0.00	0.00	4
WAF Control		100.00	100.00	100.00	0.00	0.00	4
3860		100.00	100.00	100.00	0.00	0.00	4
8560		100.00	100.00	100.00	0.00	0.00	4
15830		90.00	80.00	100.00	11.55	3.78	4
29770		20.00	20.00	20.00	0.00	0.00	4
68390		0.00	0.00	0.00	0.00		4
FSW Control	Biomass	8.33	7.12	10.12	1.31	13.72	4
WAF Control		7.98	7.16	9.02	0.79	11.13	4
3860		7.74	7.34	8.30	0.43	8.50	4
8560		8.26	7.94	8.58	0.30	6.63	4
15830		7.74	6.22	9.04	1.16	13.93	4
29770		1.36	1.20	1.60	0.17	30.57	4
68390		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
WAF Control		8.20	8.20	8.20	0.00	0.00	1
3860		8.10	8.10	8.10	0.00	0.00	1
8560		8.10	8.10	8.10	0.00	0.00	1
15830		8.00	8.00	8.00	0.00	0.00	1
29770		7.80	7.80	7.80	0.00	0.00	1
68390		7.30	7.30	7.30	0.00	0.00	1
FSW Control	Salinity	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
3860		35.10	35.10	35.10	0.00	0.00	1
8560		35.10	35.10	35.10	0.00	0.00	1
15830		35.20	35.20	35.20	0.00	0.00	1
29770		35.30	35.30	35.30	0.00	0.00	1
68390		35.30	35.30	35.30	0.00	0.00	1
FSW Control	% DO	99.80	99.80	99.80	0.00	0.00	1
WAF Control		92.80	92.80	92.80	0.00	0.00	1
3860		96.30	96.30	96.30	0.00	0.00	1
8560		95.70	95.70	95.70	0.00	0.00	1
15830		96.70	96.70	96.70	0.00	0.00	1
29770		95.60	95.60	95.60	0.00	0.00	1
68390		85.10	85.10	85.10	0.00	0.00	1

Fish Growth Test-7 day Biomass

Start Date:	22/09/2015 12:30	Test ID:	PR1244/06	Sample ID:	Barossa Field Condensate
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	Loading Rate				

Conc-gm/L	1	2	3	4
FSW Control	8.4200	10.1200	7.1200	7.6600
WAF Control	8.0800	9.0200	7.1600	7.6600
4.8	7.3400	8.3000	7.8400	7.4600
9.7	7.9400	8.4400	8.5800	8.0800
19.3	7.7200	6.2200	7.9600	9.0400
38.6	1.2800	1.2000	1.6000	1.3600
77.2	0.0000	0.0000	0.0000	0.0000

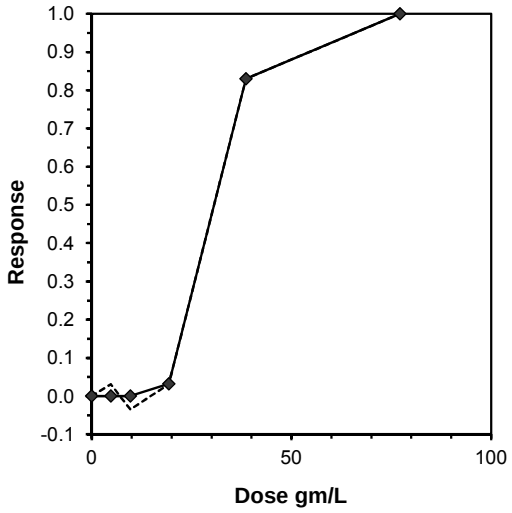
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
FSW Control	8.3300	1.0439	8.3300	7.1200	10.1200	15.691	4					
WAF Control	7.9800	1.0000	7.9800	7.1600	9.0200	9.884	4	*			7.9917	1.0000
4.8	7.7350	0.9693	7.7350	7.3400	8.3000	5.595	4	0.513	2.360	1.1266	7.9917	1.0000
9.7	8.2600	1.0351	8.2600	7.9400	8.5800	3.629	4	-0.587	2.360	1.1266	7.9917	1.0000
19.3	7.7350	0.9693	7.7350	6.2200	9.0400	15.020	4	0.513	2.360	1.1266	7.7350	0.9679
*38.6	1.3600	0.1704	1.3600	1.2000	1.6000	12.707	4	13.868	2.360	1.1266	1.3600	0.1702
77.2	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.940823	0.905	-0.16077	2.019523
Bartlett's Test indicates equal variances (p = 0.04)	10.16842	13.2767		
The control means are not significantly different (p = 0.66)	0.458533	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	19.3	38.6	27.29432		1.126604	0.141178	34.69307	0.455773	8.9E-10	4, 15
Treatments vs WAF Control										

Linear Interpolation (200 Resamples)

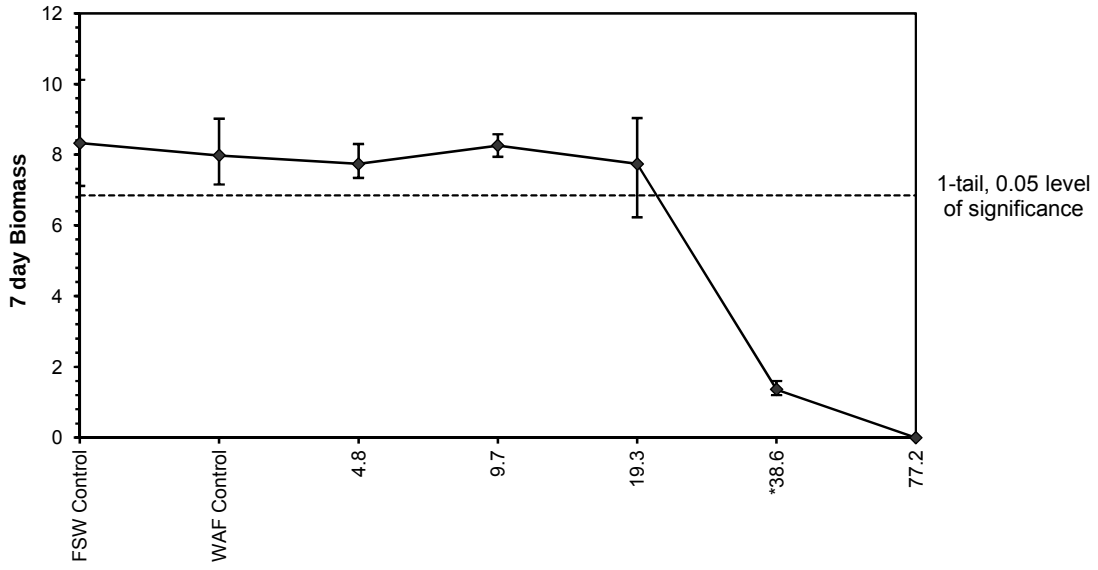
Point	gm/L	SD	95% CL(Exp)		Skew
IC05	19.733	5.770	0.000	20.929	-1.2041
IC10	20.942	2.422	8.439	22.092	-2.6612
IC15	22.152	1.438	15.155	23.255	-2.0412
IC20	23.362	1.168	17.945	24.430	-1.4775
IC25	24.572	1.055	19.614	25.602	-1.2318
IC40	28.201	0.804	24.611	29.105	-1.1814
IC50	30.620	0.643	27.794	31.439	-1.0997



Fish Growth Test-7 day Biomass

Start Date:	22/09/2015 12:30	Test ID:	PR1244/06	Sample ID:	Barossa Field Condensate
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	Loading Rate				

Dose-Response Plot



Fish Growth Test-7 day Biomass

Start Date:	22/09/2015 12:30	Test ID:	PR1244/06	Sample ID:	Barossa Field Condensate
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	Loading Rate				

		Auxiliary Data Summary					
Conc-gm/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Un-affected	100.00	100.00	100.00	0.00	0.00	4
WAF Control		100.00	100.00	100.00	0.00	0.00	4
4.8		100.00	100.00	100.00	0.00	0.00	4
9.7		100.00	100.00	100.00	0.00	0.00	4
19.3		90.00	80.00	100.00	11.55	3.78	4
38.6		20.00	20.00	20.00	0.00	0.00	4
77.2		0.00	0.00	0.00	0.00		4
FSW Control	Biomass	8.33	7.12	10.12	1.31	13.72	4
WAF Control		7.98	7.16	9.02	0.79	11.13	4
4.8		7.74	7.34	8.30	0.43	8.50	4
9.7		8.26	7.94	8.58	0.30	6.63	4
19.3		7.74	6.22	9.04	1.16	13.93	4
38.6		1.36	1.20	1.60	0.17	30.57	4
77.2		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
WAF Control		8.20	8.20	8.20	0.00	0.00	1
4.8		8.10	8.10	8.10	0.00	0.00	1
9.7		8.10	8.10	8.10	0.00	0.00	1
19.3		8.00	8.00	8.00	0.00	0.00	1
38.6		7.80	7.80	7.80	0.00	0.00	1
77.2		7.30	7.30	7.30	0.00	0.00	1
FSW Control	Salinity	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
4.8		35.10	35.10	35.10	0.00	0.00	1
9.7		35.10	35.10	35.10	0.00	0.00	1
19.3		35.20	35.20	35.20	0.00	0.00	1
38.6		35.30	35.30	35.30	0.00	0.00	1
77.2		35.30	35.30	35.30	0.00	0.00	1
FSW Control	% DO	99.80	99.80	99.80	0.00	0.00	1
WAF Control		92.80	92.80	92.80	0.00	0.00	1
4.8		96.30	96.30	96.30	0.00	0.00	1
9.7		95.70	95.70	95.70	0.00	0.00	1
19.3		96.70	96.70	96.70	0.00	0.00	1
38.6		95.60	95.60	95.60	0.00	0.00	1
77.2		85.10	85.10	85.10	0.00	0.00	1

Fish Growth Test-7 day Biomass

Start Date:	22/09/2015 12:30	Test ID:	PR1244/06b	Sample ID:	Barossa Field Condensate
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	TRH				

Conc-ug/L	1	2	3	4
FSW Control	8.4200	10.1200	7.1200	7.6600
WAF Control	8.0800	9.0200	7.1600	7.6600
3860	7.3400	8.3000	7.8400	7.4600
8560	7.9400	8.4400	8.5800	8.0800
15830	7.7200	6.2200	7.9600	9.0400
29770	1.2800	1.2000	1.6000	1.3600
68390	0.0000	0.0000	0.0000	0.0000

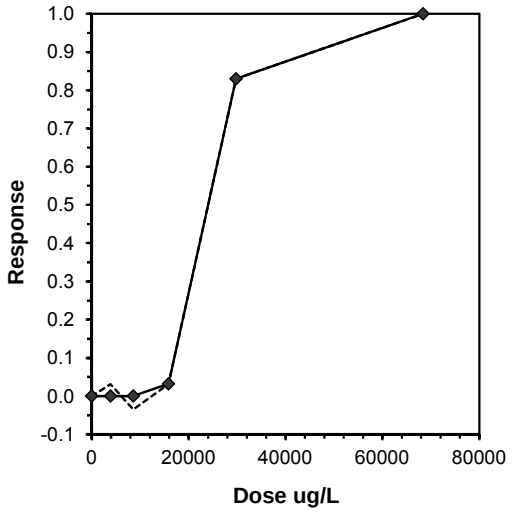
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
FSW Control	8.3300	1.0439	8.3300	7.1200	10.1200	15.691	4					
WAF Control	7.9800	1.0000	7.9800	7.1600	9.0200	9.884	4	*			7.9917	1.0000
3860	7.7350	0.9693	7.7350	7.3400	8.3000	5.595	4	0.513	2.360	1.1266	7.9917	1.0000
8560	8.2600	1.0351	8.2600	7.9400	8.5800	3.629	4	-0.587	2.360	1.1266	7.9917	1.0000
15830	7.7350	0.9693	7.7350	6.2200	9.0400	15.020	4	0.513	2.360	1.1266	7.7350	0.9679
*29770	1.3600	0.1704	1.3600	1.2000	1.6000	12.707	4	13.868	2.360	1.1266	1.3600	0.1702
68390	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.940823	0.905	-0.16077	2.019523
Bartlett's Test indicates equal variances (p = 0.04)	10.16842	13.2767		
The control means are not significantly different (p = 0.66)	0.458533	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	15830	29770	21708.5		1.126604	0.141178	34.69307	0.455773	8.9E-10	4, 15
Treatments vs WAF Control										

Linear Interpolation (200 Resamples)

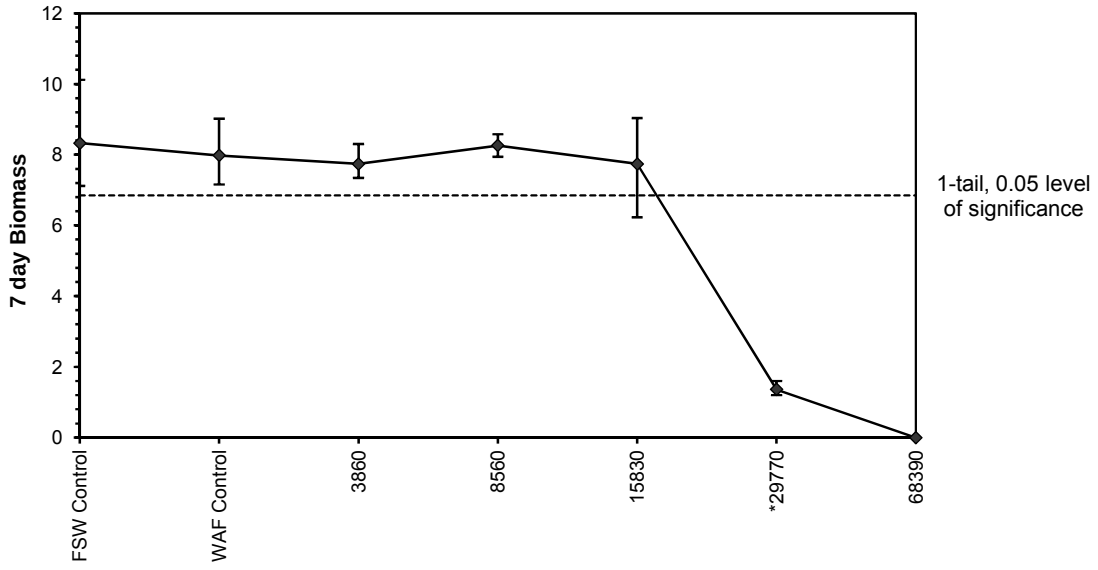
Point	ug/L	SD	95% CL(Exp)		Skew
IC05	16142.51	4671.806	0	17012.18	-1.2421
IC10	17016.27	1954.101	7373.185	17857.61	-2.6555
IC15	17890.02	1097.801	11899.05	18703.04	-2.2030
IC20	18763.78	880.4609	14909.07	19548.47	-1.5117
IC25	19637.53	784.3117	16057.69	20393.89	-1.1569
IC40	22258.8	599.5128	19503.55	22930.18	-1.1881
IC50	24006.31	479.4807	21800.79	24621.04	-1.2016



Fish Growth Test-7 day Biomass

Start Date:	22/09/2015 12:30	Test ID:	PR1244/06b	Sample ID:	Barossa Field Condensate
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	TRH				

Dose-Response Plot



Fish Growth Test-7 day Biomass

Start Date:	22/09/2015 12:30	Test ID:	PR1244/06b	Sample ID:	Barossa Field Condensate
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	TRH				

		Auxiliary Data Summary					
Conc-ug/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Un-affected	100.00	100.00	100.00	0.00	0.00	4
WAF Control		100.00	100.00	100.00	0.00	0.00	4
3860		100.00	100.00	100.00	0.00	0.00	4
8560		100.00	100.00	100.00	0.00	0.00	4
15830		90.00	80.00	100.00	11.55	3.78	4
29770		20.00	20.00	20.00	0.00	0.00	4
68390		0.00	0.00	0.00	0.00		4
FSW Control	Biomass	8.33	7.12	10.12	1.31	13.72	4
WAF Control		7.98	7.16	9.02	0.79	11.13	4
3860		7.74	7.34	8.30	0.43	8.50	4
8560		8.26	7.94	8.58	0.30	6.63	4
15830		7.74	6.22	9.04	1.16	13.93	4
29770		1.36	1.20	1.60	0.17	30.57	4
68390		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
WAF Control		8.20	8.20	8.20	0.00	0.00	1
3860		8.10	8.10	8.10	0.00	0.00	1
8560		8.10	8.10	8.10	0.00	0.00	1
15830		8.00	8.00	8.00	0.00	0.00	1
29770		7.80	7.80	7.80	0.00	0.00	1
68390		7.30	7.30	7.30	0.00	0.00	1
FSW Control	Salinity	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
3860		35.10	35.10	35.10	0.00	0.00	1
8560		35.10	35.10	35.10	0.00	0.00	1
15830		35.20	35.20	35.20	0.00	0.00	1
29770		35.30	35.30	35.30	0.00	0.00	1
68390		35.30	35.30	35.30	0.00	0.00	1
FSW Control	% DO	99.80	99.80	99.80	0.00	0.00	1
WAF Control		92.80	92.80	92.80	0.00	0.00	1
3860		96.30	96.30	96.30	0.00	0.00	1
8560		95.70	95.70	95.70	0.00	0.00	1
15830		96.70	96.70	96.70	0.00	0.00	1
29770		95.60	95.60	95.60	0.00	0.00	1
68390		85.10	85.10	85.10	0.00	0.00	1

Fish Growth Test-7 Day Unaffected

Start Date:	22/09/2015 12:30	Test ID:	PR1244/08	Sample ID:	Barossa Field Condensate Weathered
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	LR				

Conc-gm/L	1	2	3	4
FSW Control	1.0000	1.0000	1.0000	1.0000
WAF Control	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000
9.9	1.0000	1.0000	1.0000	1.0000
19.9	1.0000	1.0000	1.0000	1.0000
39.8	1.0000	1.0000	1.0000	1.0000
79.5	1.0000	1.0000	0.4000	0.0000

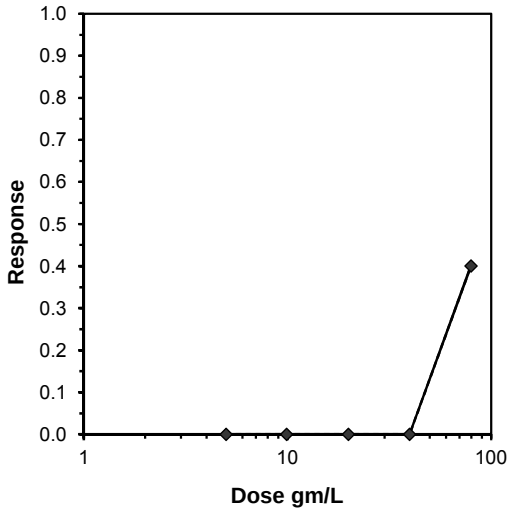
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
FSW Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4				
WAF Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	*		1.0000	1.0000
5	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	1.0000	1.0000
9.9	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	1.0000	1.0000
19.9	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	1.0000	1.0000
39.8	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	1.0000	1.0000
79.5	0.6000	0.6000	0.9002	0.2255	1.3453	60.771	4	14.00	10.00	0.6000	0.6000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.557919	0.916	-0.86578	7.231261
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	79.5	>79.5		
Treatments vs WAF Control				

Log-Logit Interpolation (200 Resamples)

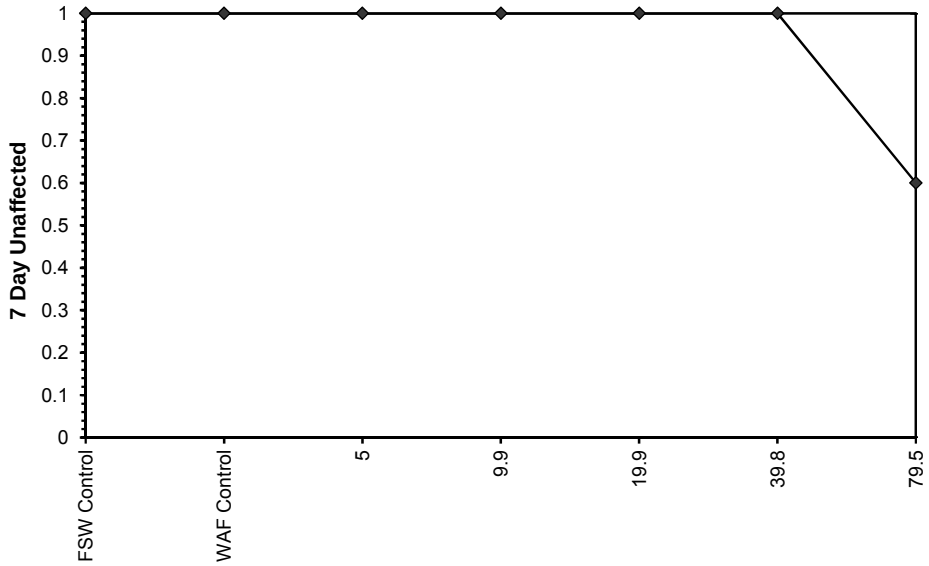
Point	gm/L	SD	95% CL(Exp)	Skew
IC05	65.174			
IC10	69.103			
IC15	71.651			
IC20	73.631			
IC25	75.307			
IC40	>79.5			
IC50	>79.5			



Fish Growth Test-7 Day Unaffected

Start Date:	22/09/2015 12:30	Test ID:	PR1244/08	Sample ID:	Barossa Field Condensate Weathered
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	LR				

Dose-Response Plot



Fish Growth Test-7 Day Unaffected

Start Date:	22/09/2015 12:30	Test ID:	PR1244/08	Sample ID:	Barossa Field Condensate Weathered
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	LR				

		Auxiliary Data Summary					
Conc-gm/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Un-affected	100.00	100.00	100.00	0.00	0.00	4
WAF Control		100.00	100.00	100.00	0.00	0.00	4
5		100.00	100.00	100.00	0.00	0.00	4
9.9		100.00	100.00	100.00	0.00	0.00	4
19.9		100.00	100.00	100.00	0.00	0.00	4
39.8		100.00	100.00	100.00	0.00	0.00	4
79.5		60.00	0.00	100.00	48.99	11.67	4
FSW Control	Biomass	8.33	7.12	10.12	1.31	13.72	4
WAF Control		7.98	7.16	9.02	0.79	11.13	4
5		8.65	7.82	9.24	0.60	8.93	4
9.9		7.95	7.18	9.34	0.95	12.29	4
19.9		8.11	7.64	8.32	0.32	6.97	4
39.8		8.57	7.90	9.46	0.66	9.50	4
79.5		4.95	0.00	8.58	3.78	39.25	4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
WAF Control		8.20	8.20	8.20	0.00	0.00	1
5		8.10	8.10	8.10	0.00	0.00	1
9.9		8.20	8.20	8.20	0.00	0.00	1
19.9		8.20	8.20	8.20	0.00	0.00	1
39.8		8.20	8.20	8.20	0.00	0.00	1
79.5		8.20	8.20	8.20	0.00	0.00	1
FSW Control	Salinity	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
5		35.40	35.40	35.40	0.00	0.00	1
9.9		35.20	35.20	35.20	0.00	0.00	1
19.9		35.20	35.20	35.20	0.00	0.00	1
39.8		35.20	35.20	35.20	0.00	0.00	1
79.5		35.20	35.20	35.20	0.00	0.00	1
FSW Control	% DO	99.80	99.80	99.80	0.00	0.00	1
WAF Control		92.80	92.80	92.80	0.00	0.00	1
5		96.40	96.40	96.40	0.00	0.00	1
9.9		96.90	96.90	96.90	0.00	0.00	1
19.9		96.60	96.60	96.60	0.00	0.00	1
39.8		96.70	96.70	96.70	0.00	0.00	1
79.5		94.70	94.70	94.70	0.00	0.00	1

Fish Growth Test-7 Day Unaffected

Start Date:	22/09/2015 12:30	Test ID:	PR1244/07b	Sample ID:	Barossa Field Condensate Weathered
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	TRH				

Conc-ug/L	1	2	3	4
FSW Control	1.0000	1.0000	1.0000	1.0000
WAF Control	1.0000	1.0000	1.0000	1.0000
1410	1.0000	1.0000	1.0000	1.0000
2770	1.0000	1.0000	1.0000	1.0000
4850	1.0000	1.0000	1.0000	1.0000
11450	1.0000	1.0000	1.0000	1.0000
22480	1.0000	1.0000	0.4000	0.0000

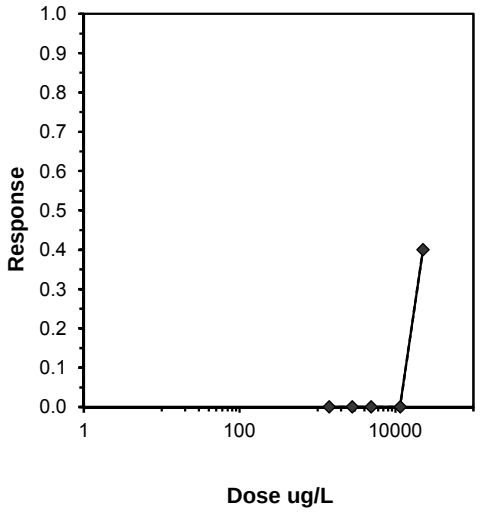
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
FSW Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4				
WAF Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	*		1.0000	1.0000
1410	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	1.0000	1.0000
2770	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	1.0000	1.0000
4850	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	1.0000	1.0000
11450	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	1.0000	1.0000
22480	0.6000	0.6000	0.9002	0.2255	1.3453	60.771	4	14.00	10.00	0.6000	0.6000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.557919	0.916	-0.86578	7.231261
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 1.00)	0	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	22480	>22480		
Treatments vs WAF Control				

Log-Logit Interpolation (200 Resamples)

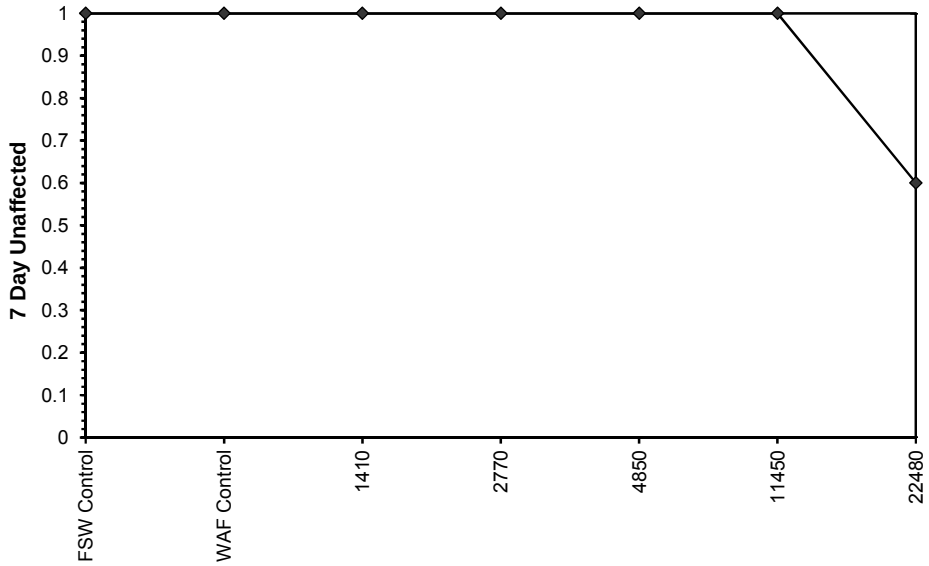
Point	ug/L	SD	95% CL(Exp)	Skew
IC05	18505.88			
IC10	19596.3			
IC15	20303.38			
IC20	20852.52			
IC25	21317.26			
IC40	>22480			
IC50	>22480			



Fish Growth Test-7 Day Unaffected

Start Date:	22/09/2015 12:30	Test ID:	PR1244/07b	Sample ID:	Barossa Field Condensate Weathered
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	TRH				

Dose-Response Plot



Fish Growth Test-7 Day Unaffected

Start Date:	22/09/2015 12:30	Test ID:	PR1244/07b	Sample ID:	Barossa Field Condensate Weathered
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	TRH				

		Auxiliary Data Summary					
Conc-ug/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Un-affected	100.00	100.00	100.00	0.00	0.00	4
WAF Control		100.00	100.00	100.00	0.00	0.00	4
1410		100.00	100.00	100.00	0.00	0.00	4
2770		100.00	100.00	100.00	0.00	0.00	4
4850		100.00	100.00	100.00	0.00	0.00	4
11450		100.00	100.00	100.00	0.00	0.00	4
22480		60.00	0.00	100.00	48.99	11.67	4
FSW Control	Biomass	8.33	7.12	10.12	1.31	13.72	4
WAF Control		7.98	7.16	9.02	0.79	11.13	4
1410		8.65	7.82	9.24	0.60	8.93	4
2770		7.95	7.18	9.34	0.95	12.29	4
4850		8.11	7.64	8.32	0.32	6.97	4
11450		8.57	7.90	9.46	0.66	9.50	4
22480		4.95	0.00	8.58	3.78	39.25	4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
WAF Control		8.20	8.20	8.20	0.00	0.00	1
1410		8.10	8.10	8.10	0.00	0.00	1
2770		8.10	8.10	8.10	0.00	0.00	1
4850		8.00	8.00	8.00	0.00	0.00	1
11450		7.80	7.80	7.80	0.00	0.00	1
22480		7.30	7.30	7.30	0.00	0.00	1
FSW Control	Salinity	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
1410		35.10	35.10	35.10	0.00	0.00	1
2770		35.10	35.10	35.10	0.00	0.00	1
4850		35.20	35.20	35.20	0.00	0.00	1
11450		35.30	35.30	35.30	0.00	0.00	1
22480		35.30	35.30	35.30	0.00	0.00	1
FSW Control	% DO	99.80	99.80	99.80	0.00	0.00	1
WAF Control		92.80	92.80	92.80	0.00	0.00	1
1410		96.30	96.30	96.30	0.00	0.00	1
2770		95.70	95.70	95.70	0.00	0.00	1
4850		96.70	96.70	96.70	0.00	0.00	1
11450		95.60	95.60	95.60	0.00	0.00	1
22480		85.10	85.10	85.10	0.00	0.00	1

Fish Growth Test-7 day Biomass

Start Date:	22/09/2015 12:30	Test ID:	PR1244/08	Sample ID:	Barossa Field Condensate Weathered
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	LR				

Conc-gm/L	1	2	3	4
FSW Control	8.4200	10.1200	7.1200	7.6600
WAF Control	8.0800	9.0200	7.1600	7.6600
5	8.8000	9.2400	7.8200	8.7400
9.9	9.3400	7.7200	7.5600	7.1800
19.9	8.1800	8.3200	8.3000	7.6400
39.8	8.3000	7.9000	9.4600	8.6200
79.5	7.0600	8.5800	4.1600	0.0000

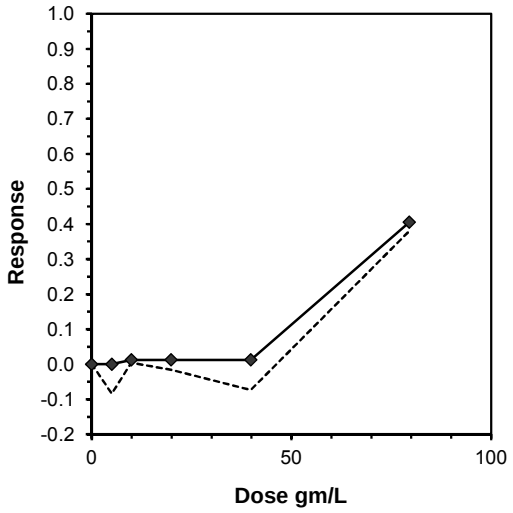
			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
FSW Control	8.3300	1.0439	8.3300	7.1200	10.1200	15.691	4				
WAF Control	7.9800	1.0000	7.9800	7.1600	9.0200	9.884	4	*		8.3150	1.0000
5	8.6500	1.0840	8.6500	7.8200	9.2400	6.896	4	22.00	10.00	8.3150	1.0000
9.9	7.9500	0.9962	7.9500	7.1800	9.3400	11.999	4	18.00	10.00	8.2100	0.9874
19.9	8.1100	1.0163	8.1100	7.6400	8.3200	3.938	4	20.00	10.00	8.2100	0.9874
39.8	8.5700	1.0739	8.5700	7.9000	9.4600	7.730	4	22.00	10.00	8.2100	0.9874
79.5	4.9500	0.6203	4.9500	0.0000	8.5800	76.266	4	13.00	10.00	4.9500	0.5953

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.824168	0.916	-0.91513	6.12451
Bartlett's Test indicates unequal variances (p = 5.86E-04)	21.74163	15.08627		
The control means are not significantly different (p = 0.66)	0.458533	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	79.5	>79.5		
Treatments vs WAF Control				

Linear Interpolation (200 Resamples)

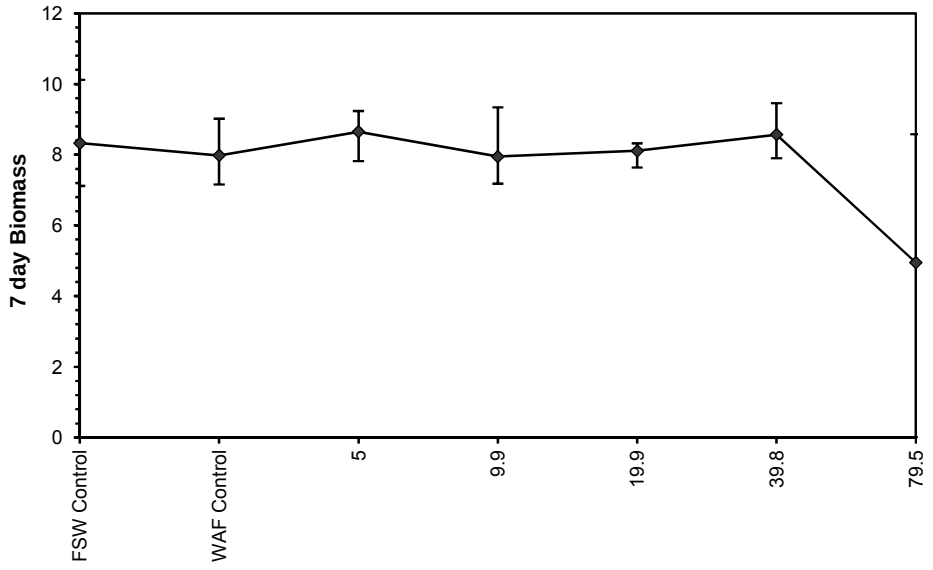
Point	gm/L	SD	95% CL(Exp)	Skew
IC05	43.584			
IC10	48.647			
IC15	53.710			
IC20	58.773			
IC25	63.836			
IC40	79.025			
IC50	>79.5			



Fish Growth Test-7 day Biomass

Start Date:	22/09/2015 12:30	Test ID:	PR1244/08	Sample ID:	Barossa Field Condensate Weathered
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	LR				

Dose-Response Plot



Fish Growth Test-7 day Biomass

Start Date:	22/09/2015 12:30	Test ID:	PR1244/08	Sample ID:	Barossa Field Condensate Weathered
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	LR				

		Auxiliary Data Summary					
Conc-gm/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Un-affected	100.00	100.00	100.00	0.00	0.00	4
WAF Control		100.00	100.00	100.00	0.00	0.00	4
5		100.00	100.00	100.00	0.00	0.00	4
9.9		100.00	100.00	100.00	0.00	0.00	4
19.9		100.00	100.00	100.00	0.00	0.00	4
39.8		100.00	100.00	100.00	0.00	0.00	4
79.5		60.00	0.00	100.00	48.99	11.67	4
FSW Control	Biomass	8.33	7.12	10.12	1.31	13.72	4
WAF Control		7.98	7.16	9.02	0.79	11.13	4
5		8.65	7.82	9.24	0.60	8.93	4
9.9		7.95	7.18	9.34	0.95	12.29	4
19.9		8.11	7.64	8.32	0.32	6.97	4
39.8		8.57	7.90	9.46	0.66	9.50	4
79.5		4.95	0.00	8.58	3.78	39.25	4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
WAF Control		8.20	8.20	8.20	0.00	0.00	1
5		8.10	8.10	8.10	0.00	0.00	1
9.9		8.20	8.20	8.20	0.00	0.00	1
19.9		8.20	8.20	8.20	0.00	0.00	1
39.8		8.20	8.20	8.20	0.00	0.00	1
79.5		8.20	8.20	8.20	0.00	0.00	1
FSW Control	Salinity	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
5		35.40	35.40	35.40	0.00	0.00	1
9.9		35.20	35.20	35.20	0.00	0.00	1
19.9		35.20	35.20	35.20	0.00	0.00	1
39.8		35.20	35.20	35.20	0.00	0.00	1
79.5		35.20	35.20	35.20	0.00	0.00	1
FSW Control	% DO	99.80	99.80	99.80	0.00	0.00	1
WAF Control		92.80	92.80	92.80	0.00	0.00	1
5		96.40	96.40	96.40	0.00	0.00	1
9.9		96.90	96.90	96.90	0.00	0.00	1
19.9		96.60	96.60	96.60	0.00	0.00	1
39.8		96.70	96.70	96.70	0.00	0.00	1
79.5		94.70	94.70	94.70	0.00	0.00	1

Fish Growth Test-7 day Biomass

Start Date:	22/09/2015 12:30	Test ID:	PR1244/07b	Sample ID:	Barossa Field Condensate Weathered
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	TRH				

Conc-ug/L	1	2	3	4
FSW Control	8.4200	10.1200	7.1200	7.6600
WAF Control	8.0800	9.0200	7.1600	7.6600
1410	8.8000	9.2400	7.8200	8.7400
2770	9.3400	7.7200	7.5600	7.1800
4850	8.1800	8.3200	8.3000	7.6400
11450	8.3000	7.9000	9.4600	8.6200
22480	7.0600	8.5800	4.1600	0.0000

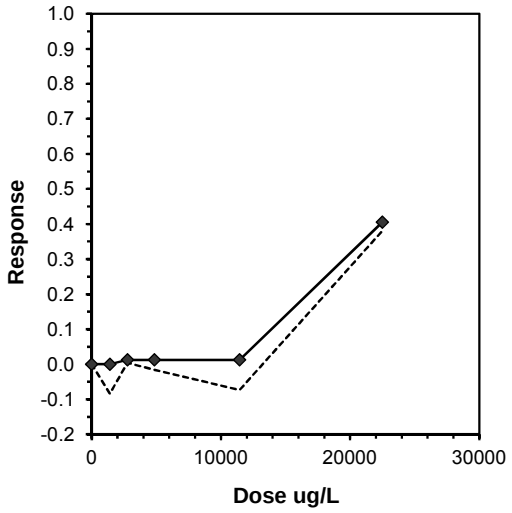
			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
FSW Control	8.3300	1.0439	8.3300	7.1200	10.1200	15.691	4				
WAF Control	7.9800	1.0000	7.9800	7.1600	9.0200	9.884	4	*		8.3150	1.0000
1410	8.6500	1.0840	8.6500	7.8200	9.2400	6.896	4	22.00	10.00	8.3150	1.0000
2770	7.9500	0.9962	7.9500	7.1800	9.3400	11.999	4	18.00	10.00	8.2100	0.9874
4850	8.1100	1.0163	8.1100	7.6400	8.3200	3.938	4	20.00	10.00	8.2100	0.9874
11450	8.5700	1.0739	8.5700	7.9000	9.4600	7.730	4	22.00	10.00	8.2100	0.9874
22480	4.9500	0.6203	4.9500	0.0000	8.5800	76.266	4	13.00	10.00	4.9500	0.5953

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.824168	0.916	-0.91513	6.12451
Bartlett's Test indicates unequal variances (p = 5.86E-04)	21.74163	15.08627		
The control means are not significantly different (p = 0.66)	0.458533	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	22480	>22480		
Treatments vs WAF Control				

Linear Interpolation (200 Resamples)

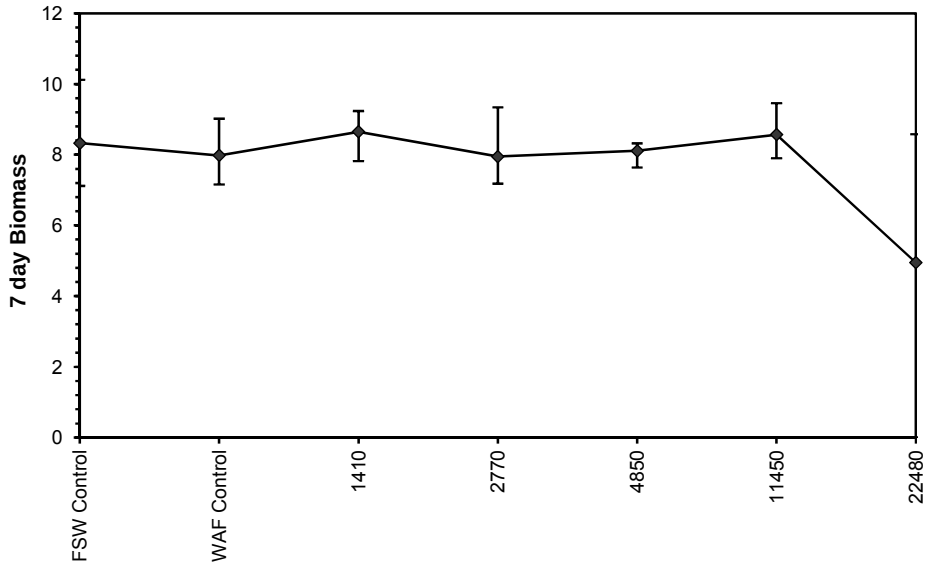
Point	ug/L	SD	95% CL(Exp)	Skew
IC05	12501.4			
IC10	13908.07			
IC15	15314.73			
IC20	16721.39			
IC25	18128.06			
IC40	22348.05			
IC50	>22480			



Fish Growth Test-7 day Biomass

Start Date:	22/09/2015 12:30	Test ID:	PR1244/07b	Sample ID:	Barossa Field Condensate Weathered
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	TRH				

Dose-Response Plot



Fish Growth Test-7 day Biomass

Start Date:	22/09/2015 12:30	Test ID:	PR1244/07b	Sample ID:	Barossa Field Condensate Weathered
End Date:	29/09/2015 11:00	Lab ID:	7323	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 122	Test Species:	LT-Lates calcarifer
Comments:	TRH				

		Auxiliary Data Summary					
Conc-ug/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Un-affected	100.00	100.00	100.00	0.00	0.00	4
WAF Control		100.00	100.00	100.00	0.00	0.00	4
1410		100.00	100.00	100.00	0.00	0.00	4
2770		100.00	100.00	100.00	0.00	0.00	4
4850		100.00	100.00	100.00	0.00	0.00	4
11450		100.00	100.00	100.00	0.00	0.00	4
22480		60.00	0.00	100.00	48.99	11.67	4
FSW Control	Biomass	8.33	7.12	10.12	1.31	13.72	4
WAF Control		7.98	7.16	9.02	0.79	11.13	4
1410		8.65	7.82	9.24	0.60	8.93	4
2770		7.95	7.18	9.34	0.95	12.29	4
4850		8.11	7.64	8.32	0.32	6.97	4
11450		8.57	7.90	9.46	0.66	9.50	4
22480		4.95	0.00	8.58	3.78	39.25	4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
WAF Control		8.20	8.20	8.20	0.00	0.00	1
1410		8.10	8.10	8.10	0.00	0.00	1
2770		8.10	8.10	8.10	0.00	0.00	1
4850		8.00	8.00	8.00	0.00	0.00	1
11450		7.80	7.80	7.80	0.00	0.00	1
22480		7.30	7.30	7.30	0.00	0.00	1
FSW Control	Salinity	34.90	34.90	34.90	0.00	0.00	1
WAF Control		35.10	35.10	35.10	0.00	0.00	1
1410		35.10	35.10	35.10	0.00	0.00	1
2770		35.10	35.10	35.10	0.00	0.00	1
4850		35.20	35.20	35.20	0.00	0.00	1
11450		35.30	35.30	35.30	0.00	0.00	1
22480		35.30	35.30	35.30	0.00	0.00	1
FSW Control	% DO	99.80	99.80	99.80	0.00	0.00	1
WAF Control		92.80	92.80	92.80	0.00	0.00	1
1410		96.30	96.30	96.30	0.00	0.00	1
2770		95.70	95.70	95.70	0.00	0.00	1
4850		96.70	96.70	96.70	0.00	0.00	1
11450		95.60	95.60	95.60	0.00	0.00	1
22480		85.10	85.10	85.10	0.00	0.00	1

Appendix C. Burrlioz Output Report

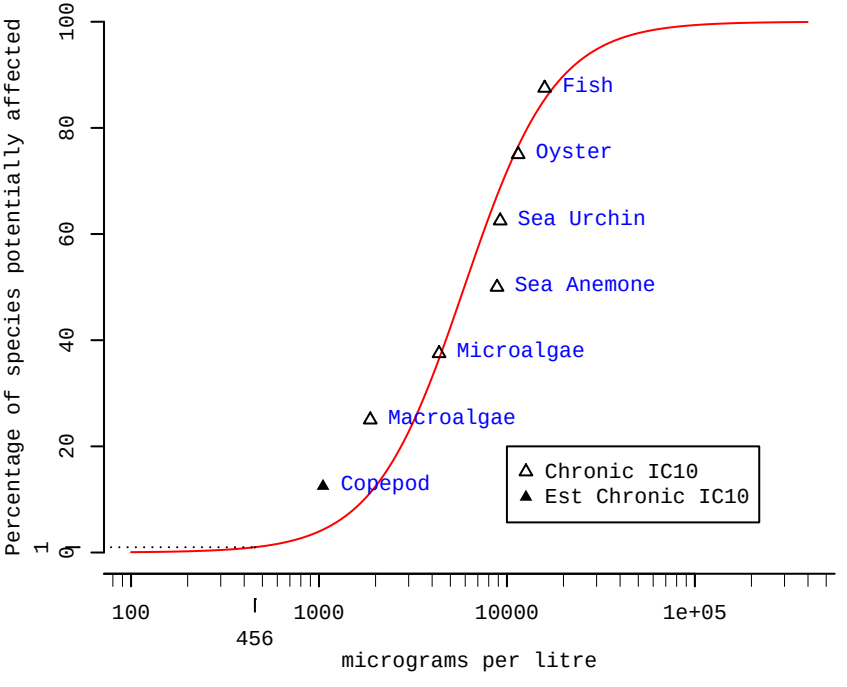
Burrlioz 2.0 report

Toxicant: Barossa-3 condensate
Input file: C:\Users\cxxwilson\Documents\Celeste Desktop\Conoco Phillips\Barossa\Ecotox\
Time read: Thu Dec 10 10:10:24 2015
Units: micrograms per litre
Model: log logistic

Protection level information

Protect. level	Guideline Value	lower 95% CI	upper 95% CI
99%	456	121	4285
95%	1146	367	5928
90%	1739	605	6680
80%	2735	1051	7859

notes: 6 chronic IC10 values and 1 estimated chronic value



Data:

Data	Species	Type	Test
4355.2	Isochrysis aff. Galbana	Microalgae	Chronic IC10
1873.9	Ecklonia radiata	Macroalgae	Chronic IC10
9206.2	Heliocidaris tuberculata	Sea Urchin	Chronic IC10
11478.4	Saccostrea echinata	Oyster	Chronic IC10
1050.7	Parvocalanus crassirostris	Copepod	Est Chronic IC10
8862.4	Aiptasia pulchella	Sea Anemone	Chronic IC10
15875.5	Lates calcarifer	Fish	Chronic IC10