Halyard-2 Drilling & Completions Environment Plan

PROJECT / FACILITY	Halyard-2
REVIEW INTERVAL (MONTHS)	No Review Required
SAFETY CRITICAL DOCUMENT	NONO

Rev	**Owner**	**Reviewer/s** *Managerial / Technical / Site*	**Approver**
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Abbreviations

Abbreviation	Description
°C	degrees celsius
µ	micron
µPa	micro Pascal
ACHIS	Aboriginal cultural heritage inquiry system
AEP	Australian Energy Producers (formerly Australian Petroleum Production and Exploration Association [APPEA]; from 13 September 2023)
AFFF	aqueous firefighting foam
AFMA	Australian Fisheries Management Authority
AFZ	Australian fishing zone
AHO	Australian Hydrographic Office
AIS	automatic identification system
ALARP	as low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre
AMP	Australian marine parks
AMSA	Australian Maritime Safety Authority
API	American Petroleum Institute
APPEA	Former Australian Petroleum Production and Exploration Association (to 12 September 2023; now Australian Energy Producers [AEP])
AUD	Australian dollar
AUV	autonomous underwater vehicle
BIA	biologically important area
BIB	biologically important behaviour
BODIS	BOD-test for insoluble substances
BOP	blowout preventor
Bscf	billion standard cubic feet
Cd	cadmium
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CH4	methane
CHARM	chemical hazard assessment and risk management
CM	control measure
CMID	common marine inspection document

CMMS	computerized maintenance management system
CO_2	carbon dioxide
COLREGS	International Rules for Preventing Collisions at Sea
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cth	Commonwealth
D&C	drilling and completions
DAFF	Department of Agriculture, Forestry and Fisheries
DAH	dissolved aromatic hydrocarbons
DAWE	Department of Agriculture, Water and the Environment (Department changed to DCCEW in 2022)
dB	decibels
DBCA	Department of Biodiversity, Conservation and Attractions (Western Australia)
DCCEEW	Department of Climate Change, Energy, the Environment and Water (formerly DAWE)
DCMP	drilling & completions management process
DISER	Department of Industry, Science and Resources
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety (Western Australia)
DNP	Director of National Parks
DoD	Department of Defence
DoE	Department of Environment
DoT	Department of Transport
DP	dynamic positioning
DPIRD	Department of Primary Industries and Regional Development (Western Australia)
DPLH	Department of Planning, Lands and Heritage
E	East
EFL	electrical flying lead
EHS	environment, health & safety
EMBA	environment that may be affected
ENVID	Environmental hazard identification workshop
EP	Environment plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*

EPBC Regulations	Environment Protection and Biodiversity Conservation Regulations 2000
EPO	environmental performance outcome
EPS	environmental performance standard
ESD	ecologically sustainable development
FH	fish habitat
FHPA	Fish Habitat Protection Areas
g/m^2	Grams per square metres
GES	Greater East Spar
GHG	greenhouse gas
GHS	globally harmonized system
H_2S	Hydrogen sulphide
HEV	high environmental value
HEVA	high exposure value area
HF	high frequency
HFL	hydraulic flying lead
HFO	heavy fuel oil
Hg	mercury
HMAS	His Majesty's Australian Ship
HOCNF	harmonised offshore chemical notification format
HP	horse power
HQ	hazard quotients
HSEMS	health, safety and environmental management system
Hz	hertz
IAPP	International air pollution prevention
IBC	intermediate bulk containers
IFO	intermediate fuel oil
ILUA	Indigenous Land Use Agreement
IMCA	International Marine Contractors Association
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMDG	International Maritime Dangerous Goods
IMS	invasive marine species
IMT	incident management team
IPIECA	International Maritime Organisation and International Association of Oil and Gas Producers

IRP	industry recommended practice
ISO	International Organisation for Standardisation,
ISV	installation support vessel
IUCN	International Union for Conservation of Nature
JRCC	joint reception coordination centre
KEF	key ecological feature
kHz	kilohertz
km	kilometre
km2	square kilometres
kW	kilowatt
L	litre
LBL	long baseline
LCM	lost circulation material
LF	low frequency
LiDAR	light detection and ranging
LOC	Loss of Containment
LOWC	loss of well control
m	metres
m2	square metres
m3	cubic metres
MARPOL	International Convention for the Prevention of Pollution from Ships
MC	measurement criteria
MDO	marine diesel oil
MEG	monoethylene glycol
MEVA	moderate exposure value area
mg/L	milligram per litre
mm	millimetres
MMA	marine management area
MMO	marine mammal observer
MMSTB	million stock tank barrels of oil
MNES	matters of national environmental significance
MoC	management of change
MODU	mobile offshore drilling unit
MoU	memorandum of understanding

MP	marine park
MQC	multi quick connect
N	North
N_2O	nitrous oxide
NAF	non-aqueous fluid
NB	nominal bore
NBPMF	Nickol Bay Prawn Managed Fishery
NEBA	net environmental benefit analysis
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
North-west MPNMP	North-West Marine Parks Network Management Plan
NOx	oxides of nitrogen
NOX	nitrogen oxides
NR	nature reserve
NW	north west
NWS	North West Shelf
OCNS	offshore chemical notification scheme
ODS	ozone-depleting substances
OECD	Organization of Economic Cooperation and Development
OIW	oil in water
OPEP	oil pollution emergency plan
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act 2006*
OPGGS(E)R or the Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023
OSPAR	Convention for the Protection of the Marine Environment of the Northeast Atlantic
OSR	oil spill response
PAH	polycyclic aromatic hydrocarbons
PAM	passive acoustic monitoring
PAR	photosynthetically active radiation
PFTIMF	Pilbara Fish Trawl Interim Managed Fishery
PFW	produced formation water
PK	peak

PK-PK	peak-to-peak
PLEM	pipeline end manifold
PLONOR	pose little or no risk to the environment
PMS	planned maintenance system
PMST	protected matters search tool
POLREP	pollution report
PPA	Pilbara Ports Authority
ppb	parts per billion
ppm	parts per million
PSZ	petroleum safety zone
PTS	permanent threshold shift
PTTEP	PTT Exploration and Production
RAAF	Royal Australian Air Force
RAMSAR	Convention on Wetlands of International Importance Especially as Waterfowl Habitat
ROV	remotely operated vehicle
RSM	response surface model
S	South
SCM	subsea control module
SCP	source control plan
SDS	safety data sheet
SEL	sound energy levels
SFRT	subsea first response toolkit
SIMAP	spill impact mapping and analysis program
SITREP	situation report
SLT	senior leadership team
SMPEP	shipboard marine pollution emergency plan
SMS	safety management system
SOLAS	safety of life at sea
SOPEP	shipboard oil pollution emergency plan
SOX	sulphur oxides
SPL	sound pressure level
TD	total depth
TSS	total suspended solids
TSSC	Threatened Species Scientific Committee

TTS	temporary threshold shift
UK	United Kingdom
USBL	ultra-short baseline
USD	United States dollar
UV	ultra violet
VHF	very high frequency
VI	Varanus Island
W	West
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WAMSI	Western Australian Marine Science Institution
WBM	water-based muds
WDCS	Whale and Dolphin Conservation Society
WOMP	Well Operations Management Plan
XT	Xmas tree

1 Introduction

1.1 EP Summary

Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 OPGGS(E)R
Regulation 35(7)
+ The summary: a) must include the following material from the environment plan: i. the location of the activity; ii. a description of the receiving environment; iii. a description of the activity; iv. details of environmental impacts and risks; v. a summary of the control measures for the activity; vi. a summary of the arrangements for ongoing monitoring of the titleholder's environmental performance; vii. a summary of the response arrangements in the oil pollution emergency plan; viii. details of consultation already undertaken, and plans for ongoing consultation; and ix. details of the titleholder's nominated liaison person for the activity. b) must be to the satisfaction of the NOPSEMA.

The Halyard-2 Drilling & Completion Environment Plan (EP) Summary in **Table 1-1** has been prepared from material provided in the EP. The summary meets the requirement of Regulation 35(7) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (the Regulations).

Table 1-1 : EP summary requirements and relevant sections of the EP

EP Summary Requirement Regulation 35(7) of the OPGGS(E)R	Relevant Section of the EP
The location of the activity	**Section 2.1**
A description of the receiving environment	**Section 3**
A description of the activity	**Section 2**
Details of the environmental impacts and risks	**Sections 6** and **7**
Control measures for the activity	**Sections 6** and **7**
Arrangements for the ongoing monitoring of the titleholder's environmental performance	**Section 8**
Response arrangements in the oil pollution emergency plan (OPEP)	**Sections 6.9**, **7.5**, **7.6**, **7.7**, **7.8**, **7.9** and **7.10** See Oil Pollution Emergency Plan (OPEP)
Consultation already undertaken and plans for ongoing consultation	**Section 4**
Details of the titleholder's nominated liaison person for the activity	**Section 1.5**

1.2 Activity Overview

Activities covered by this EP will occur in permits WA-13-L and WA-45-L. The activities under this EP consist of:

+ drilling and completing the Halyard-2 development well, to replace the Halyard-1 well;
+ disconnect the existing Halyard-1 Xmas tree production tie in, and install long term cap;
+ installing subsea equipment to connect the Halyard-2 well to the existing pipeline end manifold (PLEM); and
+ pre-commissioning activities.

Commissioning and operation of the Halyard-2 well will be undertaken in accordance with the VI Hub Ops Cth EP. Within the VI Hub Ops Cth EP, Section 2.7.9 details that 'During the field life, the John Brookes wells, Spartan-2 well, Halyard-1 and Spar-2 wells may be temporarily suspended or plugged and abandoned in accordance with the requirements of the OPGGS Act.

Given the increased production of produced water from Halyard-1, Santos assessed the possibility of drilling a sidetrack well to the existing Halyard-1, in 2022, and determined Halyard-1 to be unsuitable to re-enter/sidetrack. This was based on the following:

- The existing 30" conductor is not suitable for access with current generation semi-submersible MODUs (axial and fatigue capacity)
- A suitable long leg jack-up MODU is currently not available (to deploy a top-tensioned HP riser to address conductor capacity concern)
- The Halyard-1 XT is not configured for drill-through; meaning that to facilitate a side-track of this well, Santos would need to recover and re-deploy the existing XT (increased integrity risk as compared to deploying a new XT)

Based on this Santos WA Southwest Pty Limited (Santos) proposes to drill and complete a replacement production well, Halyard-2, located in Commonwealth waters, approximately 100 km north of Onslow, Western Australia. Hydrocarbons produced are transported through existing GES subsea infrastructure to Varanus Island (VI) for processing. There is no change to the design throughput.

This EP and the associated activities will be run simultaneously to activities provisioned for under the in force Varanus Island Hub Operations Environment Plan for Commonwealth Waters (EA-60-RI-10003 (RMS ID 6896)), including the operations of the John Brookes facility and processing at Varanus Island.

1.2.1 Activity Approvals

The development of Halyard-1 was administered by Department of Industry and Resources (DOIR). The Halyard-1 well was drilled under the Halyard-1 Environment Plan Bridging Document to the accepted State & Commonwealth Waters - Generic Environment Plan : North West Shelf Drilling Programme 2007 to 2011, and approved by Department of Industry and Resources (DOIR) on 24th August 2007. Halyard-2 is a proposed replacement well to Halyard-1, located approximately 10m from Halyard-1.

This EP, the Halyard-2 Drilling & Completions EP, will manage the impacts and risks associated with the drilling and associated installation activity to tieback Halyard 2 to the PLEM, commissioning and production will be managed as per the Varanus Island Hub Operations Environment Plan for Commonwealth Waters, which includes for production via a single well from the Halyard reservoir.

The tieback of the Halyard-1 production well to the East Spar production system and the connection of control umbilical to the existing John Brookes platform was referred and determined to be a not controlled action under the EPBC Act Referral Decision 2010/5611. This approval included for:

+ several subsea wells attached to an unmanned platform (fully equipped for remote operation);
+ a wellstream transfer pipeline from East Spar to Barrow and/or Varanus Island; onshore processing facilities for gas and condensate;
+ a gas export pipeline linking to CS#1 either directly from Barrow Island or indirectly from Barrow or Varanus Island via the existing Apache gas pipeline; and
+ transfer facilities on Barrow or Varanus Island for direct export of stabilised condensate.

A subsea tie-back to link the Spar-2 XT into the existing Halyard subsea facility and the Varanus Island (VI) onshore processing facility was assessed under the Greater East Spar Installation and Commissioning Environment Plan and approved by NOPSEMA on 28 June 2017.

The development of the Spar and Halyard reservoirs was covered and approved under the Spar and Halyard Field Development Plan (FDP) by National Offshore Petroleum Titles Authority (NOPTA). The currently accepted Spar and Halyard FDPs identify that future infill wells could be required to optimally drain the Spar/Halyard gas reservoirs. The proposed Halyard-2 well is aligned with the field development strategies outlined within both documents. Santos met with NOPTA in Q3 2023 to discuss if further amendments to the FDP were required for the construction and operation of the Halyard-2 well, NOPTA advised that no further revision was required.

1.3 Purpose of the Environment Plan

The EP has been prepared in accordance with the Regulations for assessment and acceptance by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). This EP details the environmental impacts and risks associated with the petroleum activity and demonstrates how these are reduced to a level that is as low as reasonably practicable (ALARP) and acceptable.

This EP also provides an implementation strategy that will be used to measure and report on environmental performance during planned activities and unplanned events to ensure impacts and risks are continuously reduced to ALARP and are at an acceptable level. The environmental management of the activity described in this EP (**Section 2**) complies with the Santos Environmental Management Policy and with all relevant legislation. This EP also documents and considers all relevant stakeholder consultation performed during planning (**Section 4**) and the preparation of this EP.

1.4 Titleholder

OPGGS(E)R 2023 Requirements
Regulation 23. Details of titleholder and liaison person

23(1) The environment plan must include the following details for the titleholder: a) Name; b) business address c) telephone number (if any); d) fax number (if any); e) email address (if any); and f) if the titleholder is a body corporate that has an ACN (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 person: a) name; b) business address; c) telephone number (if any); d) fax number (if any); and e) email address (if any).

The titleholder for WA-13-L and WA-45-L is Santos WA Southwest Pty Limited (Santos). Santos holds 100% interest in WA-13-L and WA-45-L and operates the activities within these titles.

The details for the titleholder's nominated liaison person are:

Name:	Dawn MacInnes
Business address:	Level 7, 100 St Georges Terrace, Perth, WA 6000
Telephone number:	(08) 6218 7100
Email address:	offshore.environment.admin@santos.com

1.5 Environmental Management Framework

OPGGS(E)R 2023 Requirements
Regulation 21. Environmental assessment
Description of the activity 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.
Regulation 24(a). Other information in the environment plan
The environment plan must contain the following: a) a statement of the titleholder's corporate environmental policy

1.5.1 Santos Environmental Management Policy

The activities will be conducted in accordance with the Santos Environment, Health and Safety Policy **Appendix A**, and **Sections 5, 6**, **7** and **8** of this EP explain how the activities align with this policy.

1.5.2 Relevant Requirements

Australia is a signatory to numerous international conventions and agreements that obligate the Commonwealth government to prevent pollution and protect specified habitats, flora and fauna. Those that are relevant to the activities are described in **Appendix B**.

2 Activity Description

OPGGS(E)R 2023 Requirements
Regulation21. Environmental assessment.
Description of the Activity: 21(1) The environment plan must contain a comprehensive description of the Activity including the following: a) the location or locations of the Activity; b) general details of the construction and layout of any facility; c) an outline of the operational details of the Activity (for example, seismic surveys, exploration drilling or production) and proposed timetables; and d) 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 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 – see regulation 34.

2.1 Activity Location

The activities will occur within the WA-13-L and WA-45-L, in Commonwealth waters within the Carnarvon Basin, approximately 100 km north of Onslow, Western Australia (**Figure 2.1**), in water depths ranging from approximately 95 m to 125 m. The Halyard-2 well will be drilled from within WA-13-L with the bottomhole extending into WA-45-L. The moorings of the mobile offshore drilling unit (MODU) may also extend into WA-45-L. All subsea infrastructure associated with Halyard-2 will be within WA-13-L.

The coordinates for key components of the activities are provided in **Figure 2.1**.

A 500 m temporary safety exclusion zone will be established around the MODU, ISV and the support vessel(s) during the activities.

Table 2-1: Activities location

Well Name	+ Halyard-2 (drilling and completion) + Halyard-1 (disconnection)
Location	Carnarvon Basin, North West Shelf (NWS), Western Australia
Petroleum Titles	WA-13-L, WA-45-L
Planned Surface Coordinates for Halyard-2 Location (eastings / northings)[1]	283,145.55 mE, 7,720,606.49 mN

[1] Coordinate reference system MGA50 GDA94

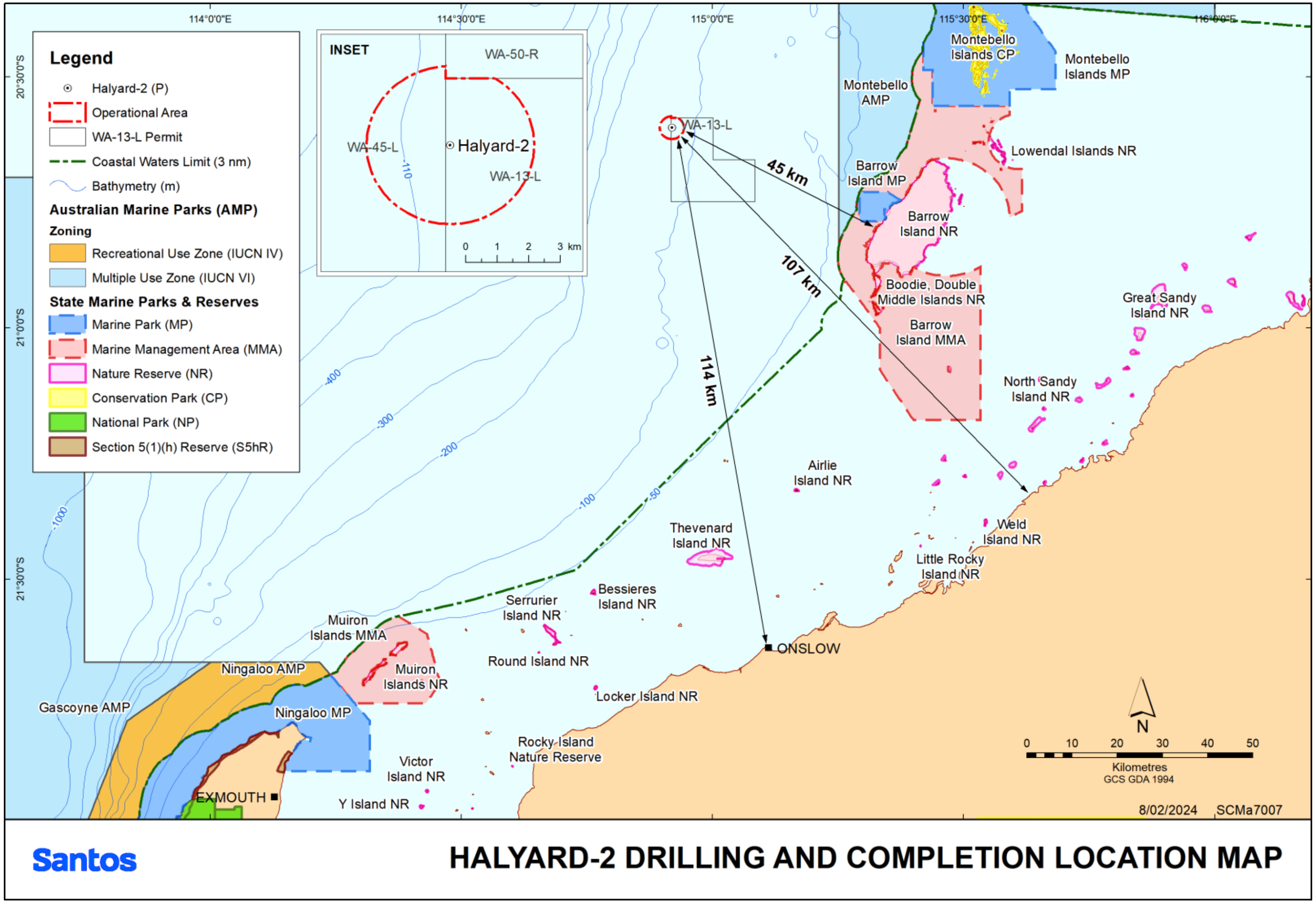

Figure 2.1 Location of the Halyard-2 operational area

2.1.1 Operational Area

An operational area will be established around the Halyard-2 well. All planned activities will occur within the operational area. The operational area comprises:

+ A 2,500 m radius around the Halyard-2 well location, within which all Halyard-2 drilling, completions and installation activities will occur.

The operational area is shown in **Figure 2.1**.

2.2 Activity Duration and Timing

The activities may be undertaken at any time of year within the EP validity period. The activities are planned to occur between Q2 2024 and the end of 2026. Approximate durations for components of activities are summarised in **Table 2-2** and include:

+ Drilling and completion: approximately 50 days; and
+ Subsea installation and pre-commissioning: approximately 15 days.

It is possible that activities timing and duration may change due to project requirements, MODU/vessel availability, weather and unforeseen circumstances (technical difficulties, equipment failures, supply chain issues etc.). This EP has assessed the environmental impacts and risks of the activities throughout the calendar year (for all seasons) to provide operational flexibility.

Table 2-2: Approximate timing and duration of the activities

Activity	Approximate Timing and Duration
Drilling and completion	Commence between Q2 2024 and end of 2026, 50-day duration
Subsea installation and pre-commissioning	Commence between Q2 2024 and the end of 2026, 15-day duration

2.3 Project Vessels

Several vessel types will be required and may include:

+ semi-submersible MODU;
+ installation support vessel (ISV); and
+ support vessels for activities such as anchor handling, MODU towing, transportation of equipment and consumables, bunkering etc.

All project vessels will use diesel fuel for the main engines. Project vessels are described in detail in the following sections.

2.3.1 Mobile Offshore Drilling Unit

The Halyard-2 well will be drilled by a moored semi-submersible MODU. The MODU will be towed into position at the well location by one or more support vessels. Moorings for the MODU may be pre-laid before the MODU arriving in the field, laid by the MODU, or a combination of both.

The MODU will be fitted with various equipment to support operations, including:

+ power generation systems;
+ diesel storage;

+ cooling water and freshwater systems;
+ drainage, effluent and waste systems;
+ cementing systems; and
+ solids control equipment used to separate cuttings and drilling fluids (e.g., shale shakers, centrifuges and cuttings driers).

MODU refuelling may occur in the operational area during the activities.

A 500 m temporary safety exclusion zone will be maintained around the MODU during the activities.

2.3.2 Installation Support Vessel

The subsea installation activities are planned to be carried out by an Installation Support Vessel (ISV), which will be a dynamic positioning (DP) Class 2 or 3 vessel with a built-in crane. Specifications for an indicative ISV are provided in **Table 2-3**.

The ISV is expected to have various systems to support operations including:

+ power generation systems;
+ fuel storage;
+ cooling and freshwater systems;
+ drainage, effluent and waste systems; and
+ remotely operated vehicles (ROVs).

A 500 m temporary safety exclusion zone will be maintained around the ISV during the activity.

The ISV will not anchor during the activity. The ISV may refuel within the operational area during the activity.

Table 2-3: Indicative ISV specifications

Attribute	Indicative Specification
Overall length	117.35 m
Maximum draught	7.15 m
Deadweight	6,400 t
Main crane capacity	250 t
ROVs	Up to two work class ROVs
Deck space	1,300 m^2
Accommodation	120 persons
Total fuel capacity	1,006 m^3
Potable water capacity	1,253 m^3

2.3.3 Support Vessels

Typically, two support vessels will be required to assist the MODU, however there could be times where up to four support vessels may be required in the operational area (e.g. used for towing, equipment and material transfers, standby operations etc.). At least one support vessel will remain on standby to the MODU within the distance defined in the Safety Case. The ISV may be supported by a support vessel during subsea installation activities.

The support vessels are yet to be confirmed but are usually offshore multi-purpose or anchor handling vessels. These vessels may conduct activities such as:

+ towing the MODU;
+ holding the MODU position temporarily while pinning the rig;
+ running and recovering MODU moorings;
+ standing by within the temporary safety exclusion zone around the MODU or ISV during critical operations;
+ standing by outside the temporary safety exclusion zone;
+ delivering equipment and consumables to the MODU or ISV such as potable water, food, hydrocarbons (e.g. diesel, lubricating oil, hydraulic fluids, grease etc.), bulk drilling products, chemicals, subsea tie in spool etc.; and
+ delivering equipment and materials from the MODU or ISV to shore such as wastes and equipment.

Cranes onboard the MODU and/or ISV will be used for transfers to and from support vessels.

Bulk products may also be transferred via hose from the support vessels and MODU. Products may include drilling fluids and solids, completion fluids, drilling water, cement and diesel.

Support vessels are not expected to refuel or anchor in the operational area.

2.4 Other Support

2.4.1 Remotely Operated Vehicles

The MODU, ISV or support vessels may be equipped with one or more work-class remotely operated vehicles (ROV). An ROV is a tethered underwater vehicle deployed from a vessel or the MODU. ROVs are unoccupied, highly manoeuvrable and operated by a crew aboard a vessel or MODU to undertake subsea activities during the activities. ROVs may be fitted with hydraulic tooling. An ROV will also be used to perform a dimensional survey (metrology) at the Halyard-2 Xmas tree and the PLEM so that the new rigid spool for the tie-in of the Halyard-2 well can be fabricated. ROV's will also be used for all subsea construction activities required as detailed here-in. ROVs will be the prime means of disconnecting and completing the subsea tie in spool connections to Xmas trees and manifold and installation of control system hardware.

2.4.2 Helicopters

Helicopters will be used primarily for a crew change, medivac and occasionally equipment and material transfers. Helicopter flights are expected to occur several times per week on average during the activities.

2.5 Drilling Activities

The planned drilling activities are expected to consist of:

- optional pre-mobilisation survey and pre-lay of moorings before moving the MODU to the operational area;
- towing the MODU to the operational area and deploying moorings or connecting to pre-laid moorings;
- placement of LBL or USBL positioning beacons around the well location;
- riserless drilling and casing of the conductor and surface sections of the well;
- install drill-through Xmas tree;
- install riser and blowout preventer (BOP);
- drilling and casing of the intermediate and production sections of the well;
- perform well cleanout and displace well contents with completion fluid;
- run wireline evaluation program;
- run well completion;
- perforate the well and undertake clean-up flow;
- suspend well ready for commissioning; and
- ROV dimensional survey between Halyard-2 Xmas tree and the Greater East Spar (GES) Pipeline End Manifold (PLEM) (Metrology).

2.5.1 Pre-mobilisation Survey and Pre-lay of Moorings

Before laying moorings to hold the MODU in position, a survey may be undertaken using an ROV to inspect the seabed conditions and existing infrastructure. If required by the MODU mooring analysis, some or all of the moorings may be installed before the MODU is mobilised to the operational area.

2.5.2 MODU Mobilisation

The MODU will be towed into the operational area, where it will connect to pre-laid moorings (if any) and deploy additional moorings (if required) in accordance with the MODU mooring analysis.

2.5.3 Well Design

The well design includes riserless drilling of the 42” conductor and 17½” surface sections of the well to install the conductor and surface casings. The riser and BOP will then be installed and tested before drilling the 12¼” intermediate and 8½”reservoir sections of the well. The planned total depth of the well is approximately 3,225 m measured depth relative to the rotary table.

2.5.4 Drilling and Completion Fluid

Water-based muds (WBM) are intended to be used for all sections of the well, however contingency non-aqueous fluid (NAF) may be used to meet technical requirements for safe and effective drilling. Aqueous-based lost circulation material may also be pumped downhole at times.

The conductor and surface hole section will be drilled using seawater with pre-hydrated gel sweeps to clean the hole. This fluid will be discharged from the well to the sea at or near the seabed.

Once the surface casing, wellhead, riser and BOP are installed, a closed circulating drilling fluid system will be established for drilling the intermediate and production sections of the well. The drilling fluids used to drill these sections may be WBM or NAF, depending on technical requirements. The BOP will be tested in accordance with the accepted Well Operations Management Plan (WOMP). Testing of the BOP will release minor volumes of hydraulic fluids to the sea near the wellhead.

Bulk WBM will be discharged to sea when no longer required (e.g., no longer meeting technical specifications or after drilling a section) or if required for safety reasons, such as during cyclone demobilisation. NAF will be separated from cuttings and retained onboard the MODU for disposal onshore. Residual WBM and NAF on cuttings will also be discharged to sea (refer to **Section 2.5.5** for information on cuttings treatment and discharges).

Before running the completion, the well contents will be displaced by a weighted brine completion fluid. After the upper completion is run, but before setting the production packer, a hydrocarbon-based underbalance fluid will be circulated into the well. The underbalance fluid is flowed back to the MODU during well clean-up and is flared. Brine returned to the MODU will be discharged to the sea.

All drilling chemicals will be assessed in accordance with Santos' chemical selection requirements (**Section 2.8**), which considers the environmental impacts of drilling fluids. Estimated volumes of drilling and completion fluids discharged to the marine environment are provided in **Table 2-4**.

Table 2-4: Estimated discharges of drilling fluids

Drilling Fluid	Estimated Discharge Volume	Notes
Seawater/gel sweeps	3,500 m^3	+ Discharged at or near the seabed. + Estimate based on riserless conductor and surface sections.
WBM	1,800 m^3	+ Discharged at the sea surface. + Estimate based on intermediate and production sections.
Completion brine	300 m^3	+ Completion brine returns discharged at sea surface.
Excess bulk chemicals (e.g., bentonite, brine)	Up to 70 m^3 each	+ Discharged from the MODU at the sea surface + Based on expected worst-case stock at the end of the well that cannot be sold for use on subsequent wells.
NAF	No planned discharge of NAF	+ Residual NAF on cuttings is the only scenario where NAF may be discharged to the marine environment. Cuttings volumes are presented in **Table 2-5**.

2.5.5 Drill Cuttings

Similar to drilling fluids, cuttings for the conductor and surface sections will be discharged at or near the seabed.

Cuttings for the remaining hole sections will be discharged from the MODU after being removed from the drilling fluids system by the MODU's solids control equipment. The solids control system comprises shale shakers and, if required, centrifuges. Additional treatment of cuttings with NAF fluid may include the use of cuttings dryers prior to discharging to the sea. Cuttings with residual NAF that do not meet Santos' residual NAF performance standard will be retained onboard the MODU for disposal onshore. Estimated cuttings volumes are provided in **Table 2-5**.

Table 2-5: Estimated discharges of drill cuttings

Cuttings	Estimated Discharge Volume	Notes
Conductor and surface sections	350 m^3	+ Discharged to the seabed during riserless drilling.
WBM cuttings from intermediate and production sections	175 m^3	+ Discharged at sea surface while drilling with riser in place after treatment with solids control equipment.
NAF cuttings from intermediate and production sections	175 m^3	+ Discharged at sea surface while drilling with riser in place after treatment with solids control equipment.

2.5.6 Cement Operations

Primary casing cement jobs are planned for the conductor, surface casing, production casing and production liner strings. These cement jobs will provide a structural base for the well and are critical to well integrity.

Any cement returns during the conductor cement job will be to the seabed around the conductor. No cement returns are planned for subsequent casing cement jobs; however, cement may be circulated to the MODU during drilling operations and discharged to the sea at the sea surface.

Surface cementing equipment and lines will need to be flushed, washed and cleaned with water during cementing operations. The residual cement and wash water will be discharged at the sea surface from the MODU after each cement job.

Cement spacers in well returns and residual surface tank volumes will also be discharged at the sea surface from the MODU during cementing operations.

Estimated volumes of cement discharge, including contingencies for failed cement jobs, are provided in **Table 2-6**.

Table 2-6: Estimated discharge volumes of cement during drilling

Cement Discharge	Estimated Discharge Volume	Notes
Conductor cement job	40 m^3	+ Wet cement discharge to seabed around conductor during conductor cement job.
MODU wet cement discharges	< 15 m^3	+ Wet or set cement discharges to sea (i.e., cement spacer, flushing tanks and lines etc.)
Off-specification cement	100-250 m^3	+ 100 m^3 of cement (wet) discharged at sea surface or 250 m^3 at the seabed in the event of

Cement Discharge	Estimated Discharge Volume	Notes
		a cement job not meeting technical and safety standards
Excess bulk cement	Up to 70 m^3 each	+ Based on expected worst-case stock at the end of the well that cannot be sold for use on subsequent wells.

2.5.7 Well Evaluation

Downhole formation evaluation will be performed via logging while drilling and wireline logging equipment. Radioactive sources used in downhole tools for logging purposes will be managed in accordance with the MODU safety case.

2.5.8 Xmas Tree Installation

The drill-through Xmas tree will be installed on top of the subsea wellhead prior to installation of the riser and BOP. Adequate barriers will be installed in the well and verified prior to removing the riser and BOP.

2.5.9 Well Clean-up

After the upper completion is set and well integrity confirmed, a clean-up flow will be performed. This consists of perforating the casing at the reservoir target and flowing the well back to a temporary well test package on the MODU, which includes flare booms designed for cleanly burning oil and gas. All the fluids recovered from the well will be either burned or, if not possible to burn (e.g., large volumes of completion fluid or formation water), discharged overboard from the MODU after being cleaned by the water treatment equipment.

2.5.10 Well Suspension

The well will be suspended following drilling, completion and clean-up flow activities.

2.5.11 Spool Metrology

In order to accurately measure the production spool between the Halyard-2 well and the GES PLEM, metrology will be performed by a ROV. Metrology will be performed using LiDAR equipment mounted on the ROV or may use long baseline (LBL) acoustic measurements.

2.5.12 Contingency Activities

2.5.12.1 Well Re-spud and Side Track

Should drilling difficulties be experienced and the well cannot progress, contingency options exist to recover and progress drilling operations. These include, but are not limited to:

+ side-track: cementing up the existing hole above the trouble zone and side-tracking the well around the problem; and
+ re-spud: plugging and abandoning the existing wellbore and re-drilling the well from the surface.

These activities would require additional time on location, and increase in the volume of cuttings, drilling fluids and cement consumed compared to the planned activities. These contingency operations would only be exercised should drilling difficulties be experienced.

Any re-spud or side-track are within the scope of this EP and are not considered a further modification or new stage of the activities. If required, a re-spud would be conducted within approximately 25 m of the planned well location.

2.5.13 Cyclone Response

Standard well suspension equipment will be available offshore to safely install temporary barriers should the MODU require evacuation for any reason (e.g. due to cyclone).

2.6 Subsea Installation Activities

The subsea installation and pre-commissioning activities will include shutting in and disconnecting the production spool from the Halyard-1 well and installing the subsea infrastructure listed in **Table 2-7** to connect the Halyard-2 well (**Figure 2.2**). Subsea installation activities will be done using the ISV holding position using the vessel's DP system.

Where the subsea equipment being removed and installed poses a dropped object risk to the existing subsea infrastructure, the object will be raised from or lowered to the seabed away from the existing infrastructure by moving the ISV using DP. Equipment that is being installed would then be moved into position once deployed close to the seabed.

The design of all installed subsea equipment will be such that its full removal is not precluded, which is consistent with NOPSEMA's *Section 572 Maintenance and Removal of Property* (2020) policy.

Table 2-7: Halyard-2 Drilling & Completion equipment

Infrastructure	Description	Approximate Dimensions
Subsea control module (SCM) skid	Skid consisting of frame and mudmat to house the SCM and provide mechanism to connect HFLs and EFLs to/ from the SCM	6.5 m x 2.9 m x 3.0 m high
Electrical flying leads (EFLs)	Electrical cables terminated with electrical connectors	50 m and 100 m in length and 30 approx. 25 mm diameter
Hydraulic flying leads (HFLs)	Hydraulic hose bundle terminated with cobrahead style termination heads	50 m and 100 m in length and approximately 150 mm diameter
Production spool	Duplex pipe in ½ M configuration terminated with diverless subsea connectors either end. Note that the spool does not contact the seabed and is only supported by the XT and PLEM connectors	Pipe is 6" NB. No greater than 30 m end to end length and 8 m height
Stabilisation	Stabilisation bags (Grout or sand), etc.	Approx. 1 m long x 0.4 m wide and 0.1 m height

2.6.1 Surveys

A pre-installation survey will be undertaken using an ROV to confirm the condition of the environment and equipment. The survey may use a range of methods, such as visual, LiDAR and acoustic (e.g. USBL, LBL) survey methods. If required, the ROV may use water jetting to remove marine growth and relocate sediment around equipment. Marine growth removal may also occur using high pressure water jetting, however if this isn't effective, inorganic or organic acid (as contingency) to assist in the disconnection of multi quick connect (MQC) connectors, such as the long term MQC cap installed on the GES PLEM that's used for the connection of the Halyard-2 Xmas tree hydraulic flying lead.

An array of positioning transponders (e.g. ultrashort baseline (USBL)) will be installed for positioning the ROV and equipment being installed. Transponders will be recovered at the completion of the activities.

An as-built survey will be undertaken at the completion of the subsea installation activities.

2.6.2 Halyard-1 Shut-in

The existing Halyard-1 well will be shut-in by implementing barriers in accordance with the accepted WOMP (7910-289-PLA-0001, Rev 1). The shut-in of the well is required to free up a slot on the PLEM to tie-in the Halyard-2 well. Valve actuations to shut-in Halyard-1 may release small quantities of hydraulic fluid to the environment – this is normal operations and covered under the existing EP (VI Hub Operations EP (Cth) (EA-66-RI-10003)). A rated pressure cap will be installed on the Halyard-1 Xmas tree, with the space below the cap filled with preservation fluid to inhibit corrosion and marine growth. The HFL and EFL will remain connected to the Halyard-1 Xmas tree, providing the ability to continue to monitor parameters such as pressure to assure ongoing well containment. Ongoing management and monitoring of the Halyard-1 well is covered in the VI Hub Operations EP (Cth) (EA-66-RI-10003).

2.6.3 Spool Removal

The existing rigid production spool connecting the Halyard-1 Xmas tree to the PLEM will be flushed to displace hydrocarbons with monoethylene glycol (MEG). The flushed rigid spool will then be removed and recovered for disposal onshore within Australia after the spool is isolated from the Halyard-1 Xmas tree and the PLEM. If required, the spool may be cut during removal using a cutting tool (e.g., diamond wire cutter), and temporarily wet stored on the seabed (if required due to deck space constraints, until new spool is installed).

The disconnection of the Halyard-1 rigid production spool will release flushing fluid and trace residual hydrocarbons from within the spool to the sea during recovery, with relatively small quantities of flushing fluid from the Halyard-1 Xmas tree and the PLEM comingling with seawater until capped.

2.6.4 Subsea Control Module Skid Installation

A SCM skid will be installed to provide electrical and hydraulic power and communications to the Halyard-2 Xmas tree. The SCM skid has a footprint of approximately 20 m^2. The SCM will be lowered into position on the seabed using the ISV crane, with monitoring by positioning systems and ROV.

2.6.5 Flying Leads Connection

The electrical flying leads (EFLs) and hydraulic flying leads (HFLs) connecting the SCM to the PLEM and the SCM to the Halyard-2 tree will be installed. The HFLs will be pre-filled with hydraulic fluid and MEG and lowered to the seabed on a deployment frame. An ROV will connect the EFLs and HFLs to the respective structures. A small discharge of hydraulic fluid may occur during the installation of the HFL as the system equalises to ambient seabed conditions.

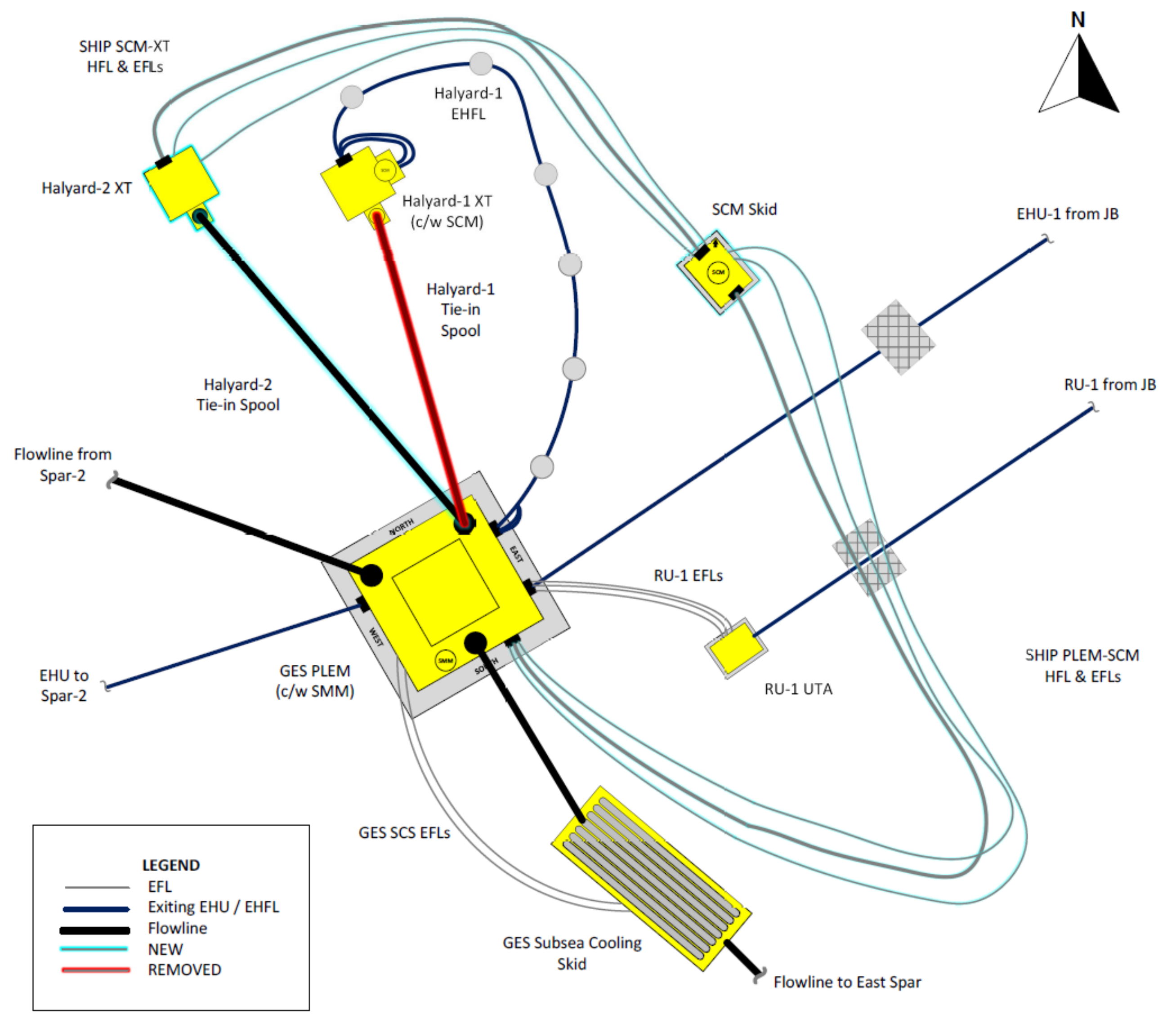

Figure 2.2: Schematic drawing showing equipment that will be removed and installed

2.6.6 Rigid Production Spool Installation

The new rigid production spool will be installed between the Halyard-2 Xmas tree and the PLEM. The cap on the Halyard-2 Xmas tree will be removed in preparation for the new rigid production spool, resulting in a small quantity of preservation fluid below the cap being released to the sea. The spool will then be moved into position and secured to the Halyard-2 Xmas tree and the PLEM by an ROV. The spool will free-flood during installation, it may be purged with nitrogen during spool installation to minimise corrosion risks to the spool prior to start up.

Chemical sticks will be inserted into the spool prior to deployment and prior to connection to the PLEM and XT to minimise corrosion risks to the spool prior to start up. Chemical sticks will consist of corrosion inhibitor, oxygen scavenger, biocide and dye.

2.6.7 Stabilisation

Stabilisation may be required to ensure the installed flying leads remain in position. Stabilisation may be achieved by the installation of sand or grout bags. If required, sand or grout bags will be lowered to the seabed by the ISV crane and positioned by an ROV.

2.7 Pre-commissioning

Production system pressure testing will be completed prior to the introduction of fluids from the Halyard-2 well. The production path between the Halyard-2 Xmas tree and the PLEM will be pressurised and monitored for leaks. Leak testing of the production spool may release small quantities of fluid containing chemicals (e.g., corrosion inhibitor, oxygen scavenger, biocide, dye etc.).

The control systems on the Halyard-2 Xmas tree and SCM will be tested. Hydraulic valve actuations will release small quantities (approximately 5 L) of hydraulic fluid per valve movement.

All chemicals that may be released during pre-commissioning are subject to the chemical assessment requirements described in **Section 2.8**.

2.8 Chemical Assessment

A risk-based approach to select chemical products ranked under the Offshore Chemical Notification Scheme (OCNS) is applied for those chemicals used and discharged to the marine environment. This scheme lists and ranks all chemicals used in the exploration, exploitation, and associated offshore processing of petroleum on the UK Continental Shelf.

Chemicals are ranked according to their calculated Hazard Quotients (HQ) by the CHARM (Chemical Hazard Assessment and Risk Management) mathematical model, which uses aquatic toxicity, biodegradation and bioaccumulation data. The HQ is converted to a colour banding with Gold and Silver colour bands representing the least environmentally hazardous chemicals. 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.

The Santos Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) and Santos Drilling Fluid and Chemical Selection in Drilling Activities Procedure (EA-91-II-00007) accept 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 OSPAR Pose Little or No Risk to the Environment (PLONOR) List. The PLONOR Listed, agreed upon by the OSPAR Convention

(Convention for the Protection of the Marine Environment of the North-East Atlantic), contains a list of substances that will pose little or no risk to the environment in offshore waters. If chemicals are ranked lower than Gold, Silver, E or D (i.e. CHARM ranked purple, orange, blue or white, or non-CHARM A, B or C ranked chemicals) and no alternatives are available, a risk assessment is conducted providing technical justification for their use, and showing that their use and associated risk is acceptable and ALARP.

As described above, investigation of potential alternative chemicals are completed when chemicals are ranked lower than CHARM Gold, Silver, E or D (i.e. CHARM ranked purple, orange, blue or white, or non-CHARM A, B or C ranked chemicals). There is a preference for chemical options that are CHARM ranked Gold/Silver, or non-CHARM ranked E/D chemicals and / or chemical that have a low aquatic toxicity, are readily biodegradable and do not bioaccumulate (discussed below).

Any chemicals that may be discharged to the marine environment and not OCNS CHARM or non-CHARM ranked are risk assessed using the OCNS CHARM or non-CHARM models. The chemical is assigned a pseudo-ranking based on the available aquatic toxicity, biodegradation and bioaccumulation data (discussed below) and assessed for environmental acceptability for discharge to the marine environment.

2.8.1 Ecotoxicity Assessment

Table 2-8 and **Table 2-9** act as guidance in assessing the ecotoxicity of chemicals during the investigation of potential alternatives. **Table 2-8** is used by CEFAS to group a chemical based on ecotoxicity results, 'A' representing highest toxicity/risk to environment and 'E' lowest. **Table 2-9** shows classifications/categories of toxicity against aquatic toxicity results.

Table 2-8: Initial OCNS grouping (from Blake *et al.*, 2022)

Initial **Grouping**	**A**	**B**	**C**	**D**	**E**
Result for aquatic toxicity data (ppm)	< 1	≥ 1-10	> 10-100	> 100-1,000	> 1,000
Result for sediment toxicity data (ppm)	< 10	≥ 10-100	> 100-1,000	> 1,000-10,000	> 10,000
Aquatic toxicity refers to the *Skeletonema costatum* EC50, *Acartia tonsa* LC50, and Scophthalmus maximus (juvenile turbot) LC50 toxicity tests. Sediment toxicity refers to the *Corophium volutator* LC50 test.					

Table 2-9: Aquatic species toxicity grouping (from United Nations, 2021)

Category	Species	LC_{50} and EC_{50} Criteria
Category acute 1 hazard statement – very toxic to aquatic life	Fish	LC_{50} (96 hr) of ≤ 1 mg/L
	Crustacea	EC_{50} (48 hr) of ≤ 1 mg/L
	Algae / other aquatic plant species	ErC_{50} (72 or 96 hr) of ≤ 1 mg/L
Category acute 2 hazard statement – toxic to aquatic life	Fish	LC_{50} (96 hr) of ≤ 1 mg/L
	Crustacea	EC_{50} (48 hr) of ≤ 1 mg/L
	Algae / other aquatic plant species	ErC_{50} (72 or 96 hr) of ≤ 1 mg/L
Category acute 3 hazard statement – harmful to aquatic life	Fish	LC_{50} (96 hr) of ≤ 1 mg/L
	Crustacea	EC_{50} (48 hr) of ≤ 1 mg/L
	Algae / other aquatic plant species	ErC_{50} (72 or 96 hr) of ≤ 1 mg/L

2.8.2 Biodegradation Assessment

The biodegradation of chemicals is assessed using the CEFAS biodegradation criteria, which aligns with the categorisation outlined in the Annex 9 of the *Globally harmonized system of classification and labelling of chemicals (GHS)* (United Nations, 2021). The below is used as a guide during the investigation of potential chemical alternatives. Preference is to select readily biodegradable chemicals.

CEFAS categorises biodegradation into the following groups:

+ readily biodegradable: results of > X% biodegradation in 28 days to an OSPAR harmonised offshore chemical notification format (HOCNF) accepted ready biodegradation protocol;
+ moderately biodegradable: results > 20% and < X% to an OSPAR HOCNF accepted ready biodegradation protocol; and
+ poorly biodegradable: results from OSPAR HOCNF accepted ready biodegradation protocol

  Where X is equal to:

  - 60% in 28 days in OECD 306, Marine BODIS or any other acceptable marine protocols, or in the absence of valid results for such tests
  - 60% in 28 days (OECD 301B, 301C, 301D, 301F, Freshwater BODIS), or
  - 70% in 28 days (OECD 301A, 301E).

2.8.3 Bioaccumulation Assessment

The bioaccumulation of chemicals is assessed using the CEFAS bioaccumulation criteria, which aligns with the categorisation outlined in Annex 9 of the *Globally harmonized system of classification and labelling of chemicals (GHS)* (United Nations, 2021). Preference is to select non bioaccumulative chemicals.

The following guidance is used by CEFAS:

- non-bioaccumulative/non-bioaccumulating: Log Pow < 3, or results from a bioaccumulation test (preferably using *Mytilus edulis*) demonstrates a satisfactory rate of uptake and depuration, and the molecular mass is ≥ 700; and
- bioaccumulative/bioaccumulates: Log Pow ≥ 3, or results from a bioaccumulation test (preferably using *Mytilus edulis*) demonstrates an unsatisfactory rate of uptake and depuration, and the molecular mass is < 700.

All chemicals will be selected in accordance with the Santos Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) and Santos Drilling Fluid and Chemical Selection in Drilling Activities Procedure (EA-91-II-00007), as applicable.

3 Description of the Environment

OPGGSIR 2023 Requirements
Regulation 21. Environmental assessment.
Description of the environment 21(2) The environment plan must: a) describe the existing environment that may be affected by the activity; and b) include details of the particular relevant values and sensitivities (if any) of that environment. Note: The definition of environment in regulation 5 includes its social, economic and cultural features. 21(3) Without limiting paragraph (2)(b), particular relevant values and sensitivities may include any of the following: a) the world heritage values of a declared World Heritage property within the meaning of the EPBC Act; b) the national heritage values of a National Heritage place within the meaning of that Act; c) the ecological character of a declared Ramsar wetland within the meaning of that Act; d) the presence of a listed threatened species or listed threatened ecological community within the meaning of that Act; e) the presence of a listed migratory species within the meaning of that Act; f) any values and sensitivities that exist in, or in relation to, part or all of: i) a Commonwealth marine area within the meaning of that Act; or ii) Commonwealth land within the meaning of that Act.

3.1 Environment that may be Affected

This section summarises the key physical, biological, socio-economic and cultural characteristics of the existing environment that may be affected (EMBA), both from planned activities and unplanned events associated with the activity. The description of the environment applies to two areas:

+ the operational area, as presented in **Figure 2-1**; and
+ the EMBA, as shown in **Figure 3-1**.

A detailed and comprehensive description of the environment (required by OPGGS(E)R 2023, Section 21(5)) in the operational area is provided within Santos' Values and Sensitivities of the Western Australian Marine Environment (EA-00-RI-10062; **Appendix C**).

The EMBA encompasses the full range of environmental receptors that might be contacted by hydrocarbons in the highly unlikely event of a worst-case hydrocarbon spill (from a loss of well control). Most planned and unplanned events associated with the activity may affect the environment up to a few kilometres from the operational area e.g., from noise impacts. A large unplanned hydrocarbon spill would extend substantially beyond this (**Section 7.6**).

3.1.1 Protected Matters Search Tool

The Protected Matters Search Tool (PMST) has been used to identify the matters of national environmental significance and other matters protected under the EPBC Act that occur, or have potential to occur, within the operational area and EMBA.

The results of these searches are provided in **Appendix D**.

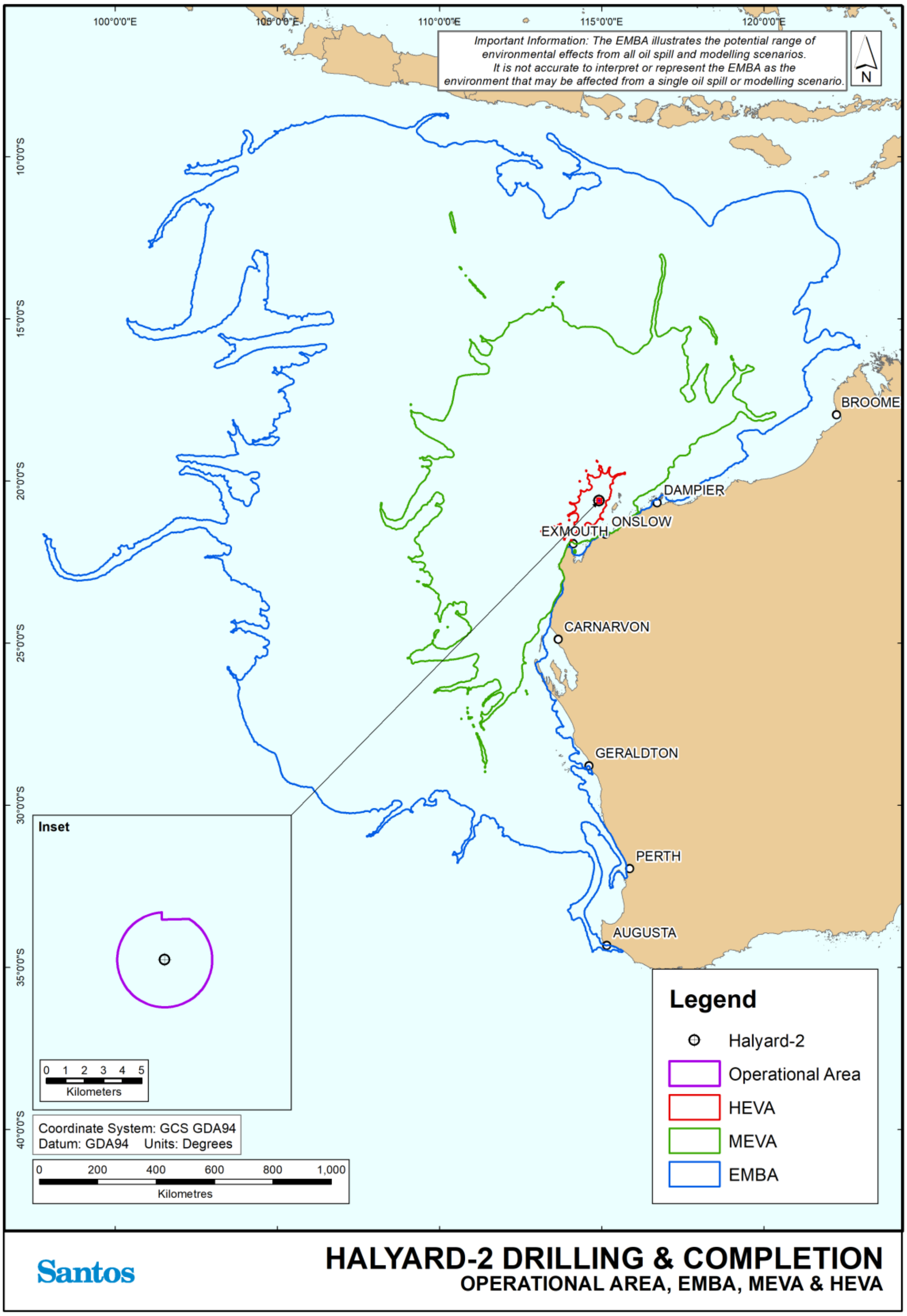

Figure 3.1: Operational area and EMBA, MEVA and HEVA

3.1.2 Determining the Environment that May be Affected

Stochastic hydrocarbon dispersion and fate modelling was undertaken for the worst-case credible spill scenario (defined in **Section 7**). Stochastic modelling is created by overlaying 120 individual hypothetical oil spill simulations from an oil spill into a single map, with each simulation subject to a different set of metocean conditions drawn from historical records. Stochastic modelling is completed to reduce uncertainty in risk assessment and spill response planning and does not represent the actual path that an individual spill scenario could take.

The modelling considered four key physical or chemical phases of hydrocarbons that pose differing environmental and socioeconomic risks: surface, entrained, dissolved aromatic and shoreline accumulated hydrocarbons. The modelling used defined hydrocarbon exposure values, as relevant, to identifying an area that might be contacted by hydrocarbons, environment risk assessment and oil spill response planning, for the various hydrocarbon phases. Refer to **Table 3-1** for the exposure values used and to **Section 7.5.4** for further information on the reasons why these exposure values have been selected and how they relate to the risk assessment.

The EMBA is based on stochastic modelling, using the low exposure values. The EMBA encompasses the outer most boundary of the overlaid worst-case spatial extent of the four hydrocarbon phases listed above for the worst case credible spill scenario.

+ the EMBA is defined by the low exposure values.
+ the moderate exposure value area (MEVA) is defined by the moderate exposure values.
+ the high exposure value area (HEVA) is defined by the high exposure values.

These three exposure values are shown in **Figure 3-1**.

The low exposure values are used as a predictive tool to set the outer boundaries of an EMBA and are not expected to result in ecological impacts. The low exposure value represents a visible oil (rainbow) sheen, has been used to provide an indication of the extent to which other marine users may visually observe oil on the sea surface. This is considered to provide a conservative extent of potential impacts to other marine users. Biological impacts are expected to occur within the moderate and high exposure values which represent a subset of the EMBA. Refer to **Section 7.5.4** for further information on the spill trajectory modelling thresholds that have been selected.

To inform the evaluation of potential environmental consequences of a hydrocarbon release (impact assessment), modelling is undertaken using high and moderate exposure values (i.e. the concentrations at which environmental consequences may result). Applying the same method used to determine the EMBA, spatial areas were derived for moderate and high exposure values as illustrated on **Figure 3-1**.

To ensure a representative EMBA was correctly assessed in this EP, the EMBA for both of the modelled worst-case loss of well control (LOWC) scenarios (surface and subsea) were combined to create the greatest extent of a potential spill with the area and create one defined EMBA.

Table 3-1: Hydrocarbon Exposure Values (NOPSEMA, 2019)

Hydrocarbon Phase	Exposure Value		
	Low	Moderate	High
Surface (g/m^2)	1	10	50
Shoreline accumulation (g/m^2)	10	100	1,000
Dissolved aromatics (ppb)	10	50	400
Entrained (ppb)	10	100	-

3.2 Environmental Values and Sensitivities

This section summarises environmental values and sensitivities, including physical, biological, socio-economic and cultural features in the marine and coastal environment that are relevant to the operational area and the EMBA.

A comprehensive description of the environmental values and sensitivities of the existing environment within the EMBA, is provided for in *Santos' Values and Sensitivities of the Western Australian Marine Environment* (EA-00-RI-10062; **Appendix C**). **Appendix C** is a compilation of environmental values and sensitivities including physical, biological, social, economic and cultural features within the marine and coastal environment that are relevant to all of Santos' activities, including those that are relevant to this EP and therefore values that are not directly relevant to this EP are also described therein.

3.2.1 Climate and Meteorology

The climate of the North West Marine Region (NWMR) is dry tropical, exhibiting a hot summer season from October to April and a milder winter season between May and September (BoM 2021a). There are often distinct transition periods between the summer and winter regimes, which are characterised by periods of relatively low winds (Pearce et al. 2003).

Air temperatures in the region, as measured at the Dampier Port platform (approximately 120 km south of WA-20-L), indicate maximum average temperatures during summer of 34.8 °C and minimum temperatures of 17.3 °C in winter (BoM 2021a).

The region experiences a tropical monsoon climate, with distinct wet (October to April) and dry (May to September) seasons (Pearce et al. 2003). Rainfall in the region (measured at the Dampier Port platform) typically occurs during the wet season (summer), with highest falls observed during late summer, and often associated with the passage of tropical low-pressure systems and cyclones (BoM 2021a; Pearce et al. 2003). Rainfall outside this period is typically low (BoM 2021a).

This region typically experiences moderate winds all year round and with average and maximum wind speeds of 12 knots and 52 knots, respectively. Winds typically blow from the southwest during the summer months, while winds are typically easterly or southerly during the winter months (RPS, 2023). Climate of the NWS is described further in Santos' Values and Sensitivities of the Western Australian Marine Environment (EA-00-RI-10062; **Appendix C**).

Tropical cyclones are a relatively frequent event for the region, with the Pilbara coast experiencing more cyclonic activity than any other region of the Australian mainland coast (BoM 2021b). Tropical cyclone activity can occur between November and April and is most frequent in the region during January to March, with an annual average of approximately one storm per month. Cyclones are less frequent in the months of November, December and April but historically the worst storms have occurred in April (DEWHA 2008).

Water depths in the operational area range from approximately 95 m to 125 m, with the deepest water depths situated in the northwest and the shallowest water depths situated in the southwest corner of the survey area (see **Figure 2.1**). The monthly average sea surface temperatures, which ranged from 23.6°C (September) to 29.6°C (March), whilst salinity remained relatively consistent throughout the year, ranging between 34.7 psu (November) to 35.1 psu (January and May) (RPS, 2023). Water temperature over the NWS is described further in Santos' Values and Sensitivities of the Western Australian Marine Environment (EA-00-RI-10062; **Appendix C**).

The area is typified by strong tidal flow due to the shallow region, particularly along the inshore region of the NWS and among the islands stretching from Dampier to NWS, where the activity is located (RPS, 2023). Wind shear on the water surface also generates local-scale currents that can be present within the area and can persist for extended periods (hours to days) and result in long trajectories. The average and maximum surface current speeds in the operational area are 0.19 m/s and 1.72 m/s, respectively (RPS, 2023). The predominant current direction is towards the southwest, oceanography over the NWS is described further in Santos' Values and Sensitivities of the Western Australian Marine Environment (EA-00-RI-10062; **Appendix C**).

3.2.2 Bioregions

Based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA), Version 4.0 (Department of the Environment and Heritage, 2006), the regional descriptions relevant to the operational area and the EMBA are provided in **Table 3-2** and **Figure 3-2**.

Table 3-2: Provincial bioregions relevant to the activity

Bioregion	Operational Area	EMBA
North West Marine Region		
Northwest Shelf Province	✓	✓
Timor Province	×	✓
Northwest Transition	×	✓
Northwest Province	×	✓
Northwest Shelf Transition	×	✓
Central Western Transition	×	✓
Central Western Shelf Transition	×	✓
Central Western Shelf Province	×	✓
South West Marine Region		
Central Western Province	×	✓
Southwest Shelf Transition	×	✓
Southwest Transition	×	✓
Southwest Shelf Province	×	✓

Bioregion	Operational Area	EMBA
Other		
Christmas Island Province	×	✓

3.2.3 Benthic Habitats

The benthic (at or just below the seabed) habitats in waters in the operational area lie at depths ranging from approximately 95 m – 125 m. The operational area is likely to consist of soft sediment seabeds and sandy and muddy substrates, occasionally interspersed with hard substrates covered with sand and veneers (Department of the Environment, Water, Heritage and the Arts, 2008). Non-coral benthic invertebrates are likely to be the dominant community, albeit in low densities. Non-coral benthic invertebrates that occur in the operational area are likely to include sea cucumbers, urchins, crabs and polychaetes on soft substrate. Hard substrates are likely to contain sessile (fixed in one place) invertebrates, such as sponges and gorgonians (Department of the Environment, Water, Heritage and the Arts, 2008).

There are no known offshore reefs or islands within or in close proximity (less than 20 km) to the operational area. However, there are a number of emergent oceanic reefs and islands in the EMBA, including Barrow Island, Montebello Islands, Lowendal Islands, Dampier Archipelago, Thevenard Islands, Muiron Islands, Rowley Shoals, Christmas Island and the Pilbara Southern Islands. A description of the values and sensitivities associated with these reefs and islands is provided in **Appendix C**.

A number of shoals and banks in the open offshore waters of the region have recognised environmental value. The key shoals and banks in the EMBA include Glomar Shoals, Rowley Shoals and Rankin Bank. An understanding of these features has been gained from the Big Bank Shoals study (Heyward et al., 1997) and the PTTEP Australasia surveys initiated in response to the Montara incident (Heyward et al., 2012, 2010).

The shoals and banks in the EMBA contain benthic habitats and associated fauna assemblages that are highly diverse compared to the surrounding relatively deep and bare seabed that constitutes the majority of the outer continental shelf in the region. These shoals and banks may act as important sources of larvae of important taxa such as fish and corals, which may be advected considerable distances. The shoals and banks support many of the same species found on emergent reef systems of the Indo-West Pacific region. This indicates a high level of ecological connectivity among the reef systems and between the shoals and banks. This is further supported by an analysis undertaken by the Australian Institute of Marine Science that compared benthic habitat community data from a number of shoals and banks in the Timor Sea and Bonaparte Gulf region. The analysis showed that neighbouring shoals and banks frequently share many attributes in terms of benthic community composition and species (Heyward et al., 2017).

Table 3-3 contains a summary of the benthic habitats within the operational are and EMBA and what bioregions they are expected to occur within.

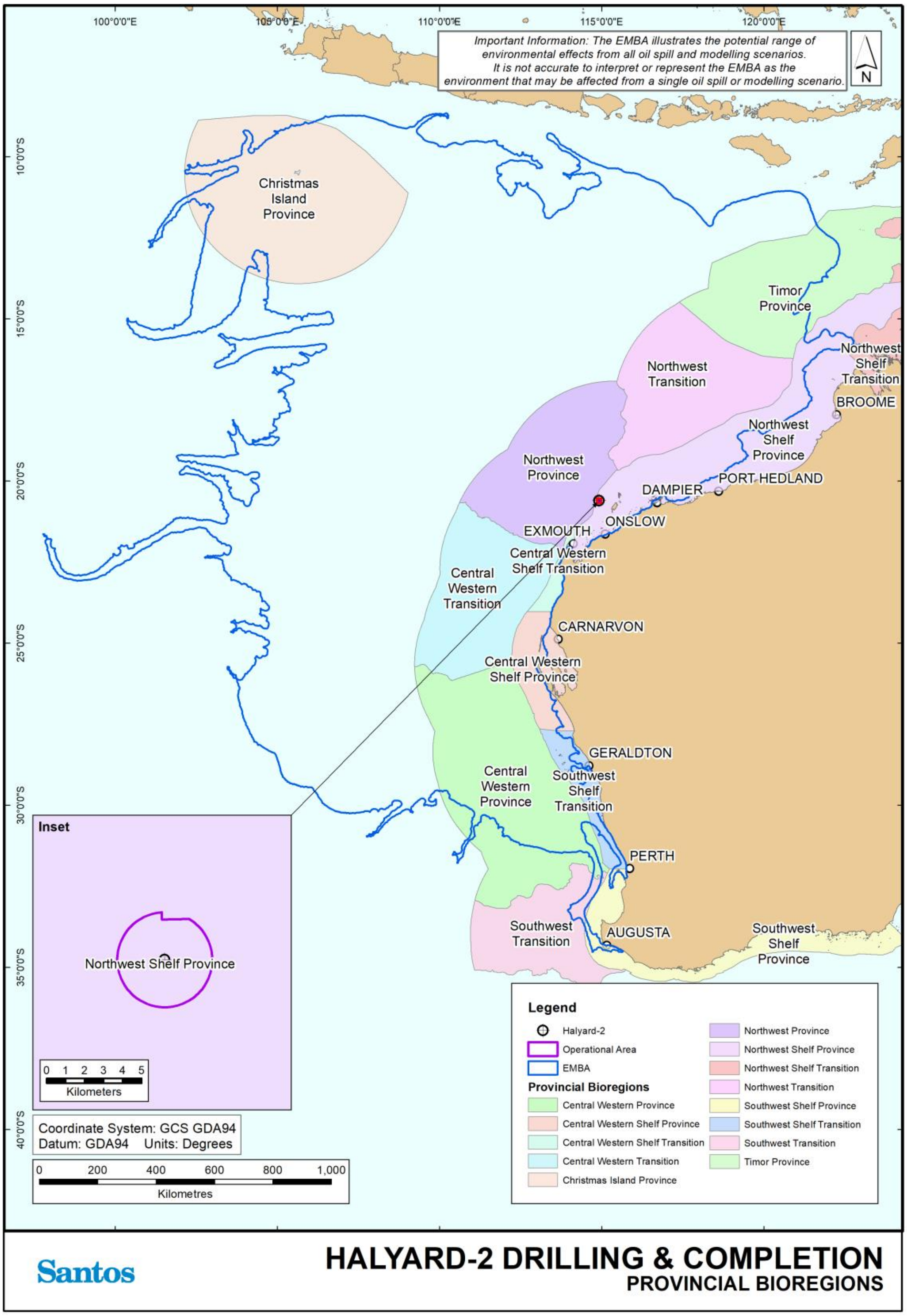

Figure 3.2: IMCRA 4.0 Provincial bioregions within the EMBA and operational area

Table 3-3: Benthic habitats within the operational area and environment that may be affected

Category	Receptor	Operational area Presence	EMBA Presence												Relevant Events That May Impact on the Receptors
			Northwest Province	Northwest Shelf Province	Northwest Transition	Timor Province	Central Western Transition	Central Western Shelf Transition	Central Western Province	Central Western Shelf Province	Southwest Shelf Transition	Southwest Transition	Southwest Shelf Province	Christmas Island Province	
Benthic Habitats	Coral reefs	×	×	✓	✓	✓	×	✓	×	✓	✓	×	✓	✓	<u>Unplanned</u> Condensate release due to subsea or surface well release. Diesel release from vessel collision.
	Non-reef building soft corals	×	✓	✓	✓	✓	✓	✓	✓	×	×	×	×	×	
	Seagrass	×	×	×	✓	✓	×	✓	×	✓	✓	×	✓	✓	
	Macroalgae	×	×	✓	✓	✓	×	✓	×	✓	✓	×	✓	✓	
	Non-coral benthic invertebrates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	<u>Planned</u> Seabed disturbance. Planned operational discharges. <u>Unplanned</u> Condensate release due to subsea or surface well release. Diesel release from vessel collision. Unplanned release of solids.

3.2.4 Protected and Significant Areas

Protected and significant areas identified in the operational area and EMBA are listed in **Table 3-4** and illustrated in **Figure 3-3** and **Figure 3-4**. Note: protected and significant areas that are terrestrial and not linked to the shoreline but occur in the EPBC Protected Matters search of the EMBA have been excluded as there is no shoreline accumulation of hydrocarbons predicted within the EMBA.

3.2.4.1 Australian marine parks and state marine parks, management areas and reserves

The operational area does not intercept any Australian Marine Parks (AMPs) or state marine parks, management areas or reserves. The closest AMP is the Montebello AMP, located approximately 32 km east of the operational area. The closest state marine park is the Montebello Island Marine Park, located approximately 52 km east of the operational area.

The EMBA overlaps a number of AMPs and state marine parks, management areas and nature reserves. These areas are shown in **Figure 3-3** and **Figure 3-4** and are further discussed in **Appendix C**.

AMPs are recognised under the EPBC Act for protecting and maintaining biological diversity and contributing to a national representative network of marine protected areas. Management plans for AMPs have been developed and came into force on 1 July 2018. Under these plans, AMPs are allocated conservation objectives based on the Australian IUCN reserve management principles in Schedule 8 of the EPBC Regulations 2000. These principles determine what activities are acceptable within a protected area under the EPBC Act. The marine park management zones that are relevant to the AMPs and State marine parks within the EMBA are listed in **Table 3-4**. Section 3.2.6.1 includes additional details regarding cultural heritage and marine parks.

Table 3-4: Distance from Operational Area Boundary to Protected Areas and Threatened Ecological Communities in the EMBA

Value/Sensitivity Name	Status, Zone or IUCN Classification	Presence in Operational Area	Presence in MEVA	Presence in EMBA	Distance to Operational Area (km)
Australian Marine Parks					
Montebello Marine Park (MP)	Multiple Use Zone (IUCN VI)	×	✓	✓	32
Abrolhos MP	Multiple Use Zone (IUCN VI)	×	✓	✓	688
	National Park Zone (IUCN II)	×	×	✓	735
	Special Purpose Zone (IUCN VI)	×	×	✓	765
	Habitat Protection Zone (IUCN IV)	×	×	✓	618
Carnarvon Canyon MP	Habitat Protection Zone (IUCN IV)	×	✓	✓	469
Gascoyne MP	Multiple Use Zone (IUCN VI)	×	✓	✓	120

Value/Sensitivity Name	Status, Zone or IUCN Classification	Presence in Operational Area	Presence in MEVA	Presence in EMBA	Distance to Operational Area (km)
	Habitat Protection Zone (IUCN IV)	×	✓	✓	251
	National Park Zone (IUCN II)	×	✓	✓	326
Ningaloo MP	Recreational Use Zone (IUCN IV)	×	✓	✓	136
	National Park Zone (IUCN II)	×	✓	✓	266
Argo-Rowley Terrace MP	Multiple Use Zone (IUCN VI)	×	✓	✓	349
	National Park Zone (IUCN II)	×	×	✓	648
	Special Purpose Zone (Trawl) (IUCN VI)	×	×	✓	525
Two Rocks MP	Multiple Use Zone (IUCN VI)	×	×	✓	1205
	National Park Zone (IUCN II)	×	×	✓	1229
Kimberley MP	National Park Zone (IUCN II)	×	×	✓	940
	Multiple Use Zone (IUCN VI)	×	×	✓	752
	Habitat Protection Zone (IUCN IV)	×	×	✓	914
Jurien MP	Special Purpose Zone (IUCN VI)	×	×	✓	1058
	National Park Zone (IUCN II)	×	×	✓	1113
Perth Canyon MP	National Park Zone (IUCN II)	×	×	✓	1227
	Habitat Protection Zone (IUCN IV)	×	×	✓	1228
	Multiple Use Zone (IUCN VI)	×	×	✓	1249

Value/Sensitivity Name	Status, Zone or IUCN Classification	Presence in Operational Area	Presence in MEVA	Presence in EMBA	Distance to Operational Area (km)
South-west corner MP	Special Purpose Zone (Mining Exclusion) (IUCN VI)	×	×	✓	1427
	National Park Zone (IUCN II)	×	×	✓	1427
	Special Purpose Zone (IUCN IV)	×	×	✓	1613
	Habitat Protection Zone (IUCN IV)	×	×	✓	1625
Shark Bay MP	Multiple Use Zone (IUCN VI)	×	✓	✓	448
Christmas Island MP	National Park Zone (IUCN II)	×	×	✓	1115
	Habitat Protection Zone (IUCN IV)	×	×	✓	1452
Dampier MP	National Park Zone (IUCN II)	×	×	✓	219
	Habitat Protection Zone (IUCN IV)	×	×	✓	204
	Multiple Use Zone (IUCN VI)	×	×	✓	228
Eighty Mile Beach MP	Multiple Use Zone (IUCN VI)	×	×	✓	425
Mermaid Reef MP	National Park Zone (IUCN II)	×	×	✓	611
State Marine Parks, Management Areas and Reserves					
Montebello Islands MP	Sanctuary Zone, Special Purpose Zone, Aquaculture Zone, recreational Use Zone, General Use Zone	×	✓	✓	52

Value/Sensitivity Name	Status, Zone or IUCN Classification	Presence in Operational Area	Presence in MEVA	Presence in EMBA	Distance to Operational Area (km)
Montebello Islands Conservation Park (CP)	General Use Zone	×	✓	✓	52
Muiron Islands Marine Management Area (MMA)	Conservation Area, Unzoned Area	×	✓	✓	119
Ningaloo MP	Recreational Use Zone, Sanctuary Zone, Special Purpose Zone, Special Purpose Zones, General Use Zone.	×	✓	✓	137
Rowley Shoals MP	Sanctuary Zone, Recreation Zone, General Use Zone	×	✓	✓	526
Scott Reef Nature Reserve (NR)	Nature Reserve	×	×	✓	1012
Great Sandy Island NR	Nature Reserve	×	✓	✓	89
Thevanard Island NR	Nature Reserve	×	✓	✓	91
Shoalwater Islands MP	National Park Zone	×	×	✓	1290
Point Quobba Fish Habitat (FH)	Fish Habitat Protection Area	×	×	✓	455
Ngari Capes MP	National Park Zone, Multiple Use Zone, Special Purpose Zone	×	×	✓	1424
Cottesloe Reef FH	Fish Habitat Protection Area	×	×	✓	1262
Outer Rock Nature Reserve	Nature Reserve	×	×	✓	1087
Lancelin Island Lagoon FH	Fish Habitat Protection Area	×	×	✓	1151

Value/Sensitivity Name	Status, Zone or IUCN Classification	Presence in Operational Area	Presence in MEVA	Presence in EMBA	Distance to Operational Area (km)
Shark Bay MP	Sanctuary Zone, Special Purpose Zone, Recreational Use Zone, General Use Zone	×	×	✓	493
Shoalwater Bay Islands NR	Sanctuary Zone, Special Purpose Zones, General Use Zone	×	×	✓	1292
Jurien Bay MP	Sanctuary Zone, Special Purpose Zones, Recreational Use Zone, General Use Zone, Aquaculture Zones	×	×	✓	1047
Buller, Whittell And Green Islands NR	Nature Reserve	×	×	✓	1111
Cervantes Islands NR	Nature Reserve	×	×	✓	1096
Ronsard Rocks NR	Nature Reserve	×	×	✓	1091
Marmion MP	Sanctuary Zone, General Use Zone,	×	×	✓	1232
Abrolhos Islands FH	Fish Habitat Protection Area	×	×	✓	852
Rocky Island NR	Nature Reserve	×	✓	✓	142
Barrow Island MP	Sanctuary Zone	×	✓	✓	45
Barrow Island MMA	Unzoned (with exception of Bandicoot Bay Conservation Area)	×	✓	✓	39

Table 3-5: Management zones for the Australian and State Marine Parks found in the environment that may be affected and the associated objectives

Management Zones	Objective
Australian Marine Parks	
Multiple Use (IUCN VI)	The objective is to provide for ecologically sustainable use and the conservation of ecosystems, habitats and native species.
Recreational Use (IUCN IV)	The objective is to provide for the conservation of ecosystems, habitats and native species in as natural a state as possible, while providing for recreational use.
Habitat Protection Zone (IUCN IV)	The objective is to provide for the conservation of ecosystems, habitats and native species in as natural a state as possible, while allowing activities that do not harm or cause destruction to seafloor habitats.
National Park Zone (IUCN II)	The objective is to protect natural biodiversity with its underlying ecological structure and supporting environmental processes, and to promote education and recreation.
Special Purpose Zone	The objective is to protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.
State Marine Parks	
Sanctuary Zones	The primary purpose of sanctuary zones is for the protection and conservation of marine biodiversity. Sanctuary zones are 'no-take' areas managed solely for nature conservation and low-impact recreation and tourism.
Special Purpose Zones	*Special purpose (benthic protection) zone*: This zone has the priority purpose of conservation of benthic habitat. *Special purpose (shore-based activities) zone*: Special purpose zones in marine parks are managed for a priority purpose or use, such as a seasonal event (e.g., wildlife breeding, whale watching) or a commercial activity (e.g., pearling).
Recreation Zones	Recreation zones have the primary purpose of providing opportunities for recreational activities, including fishing, for visitors and for commercial tourism operators, where these activities are compatible with the maintenance of the values of the zone.
General Use Zones	Conservation of natural values is still the priority of general use zones, but activities such as sustainable commercial and recreational fishing, aquaculture, pearling and petroleum exploration and production may be permitted provided they do not compromise the ecological values of the marine park.
Other	
Fish Habitat Protection Areas (FHPA)	Fish and their habitats within a particular area can be covered by special protection and management in Western Australian waters by including them within a Fish Habitat Protection Area. FHPAs can be established in any area of the aquatic environment (freshwater and marine) which has been identified as having a particular value for the protection of fish and their habitats,

	education and/or aquaculture and which is considered to require a higher level of protection than other parts of the marine environment.
Nature Reserves	Nature reserves are established for wildlife and landscape conservation, scientific study and preservation of features of archaeological, historic or scientific interest. Recreation that does not harm natural ecosystems is allowed, but other activities are usually not permitted.

Oil spill response may be conducted in a Multiple Use Zone (IUCN VI) subject to the class approval and prescriptions in the North-West Marine Parks Network Management Plan (North-west MPNMP) (Director of National Parks, 2018). The Class Approval – Mining Operations and Greenhouse Gas Activities for the North-west MPNMP, which is applicable to petroleum-related activities, came into effect on 1 July 2018. Prescriptions/conditions of the North-west MPNMP and Class Approval for the North-west MPNMP that are considered relevant to the scope of this EP are provided in **Table 3-6**.

Table 3-6: Prescriptions/conditions from the North-West and North Marine Parks Network Management Plan 2018 relevant to the activities in this Environment Plan

Prescription/ Condition Number	Prescription/Condition	Relevant Section of EP
North-West MPNMP (Director of National Parks, 2018)		
4.2.9.8	Notwithstanding section 4.2.9.1 (of the North-West MPNMP), 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 the Director, provided that the actions are taken in accordance with: An environment plan that has been accepted by NOPSEMA the Director 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.	This EP **Section 4** (Stakeholder Consultation), reporting under **Section 7** of the OPEP
Class Approval – Mining Operations and Green House Gas Activities – for North-West MPNMP (Director of National Parks, 2018)		
1	Approved action must be conducted in accordance with: An Environment Plan accepted under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (2023).	The OPEP (some proposed response activities in the event of an oil pollution incident may be undertaken within the North-West Marine Park Network)
	The EPBC Act.	(Legislation)
	The EPBC Regulations.	This EP

Prescription/ Condition Number	Prescription/Condition	Relevant Section of EP
	The North-west Network Management Plan.	This table
	Any prohibitions, restrictions or determinations made under the EPBC Regulations by the Director of National Parks.	Not applicable
	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)).	**Appendix B** (Legislation), and the OPEP
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** (Reporting) and **Section 7** of the OPEP
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

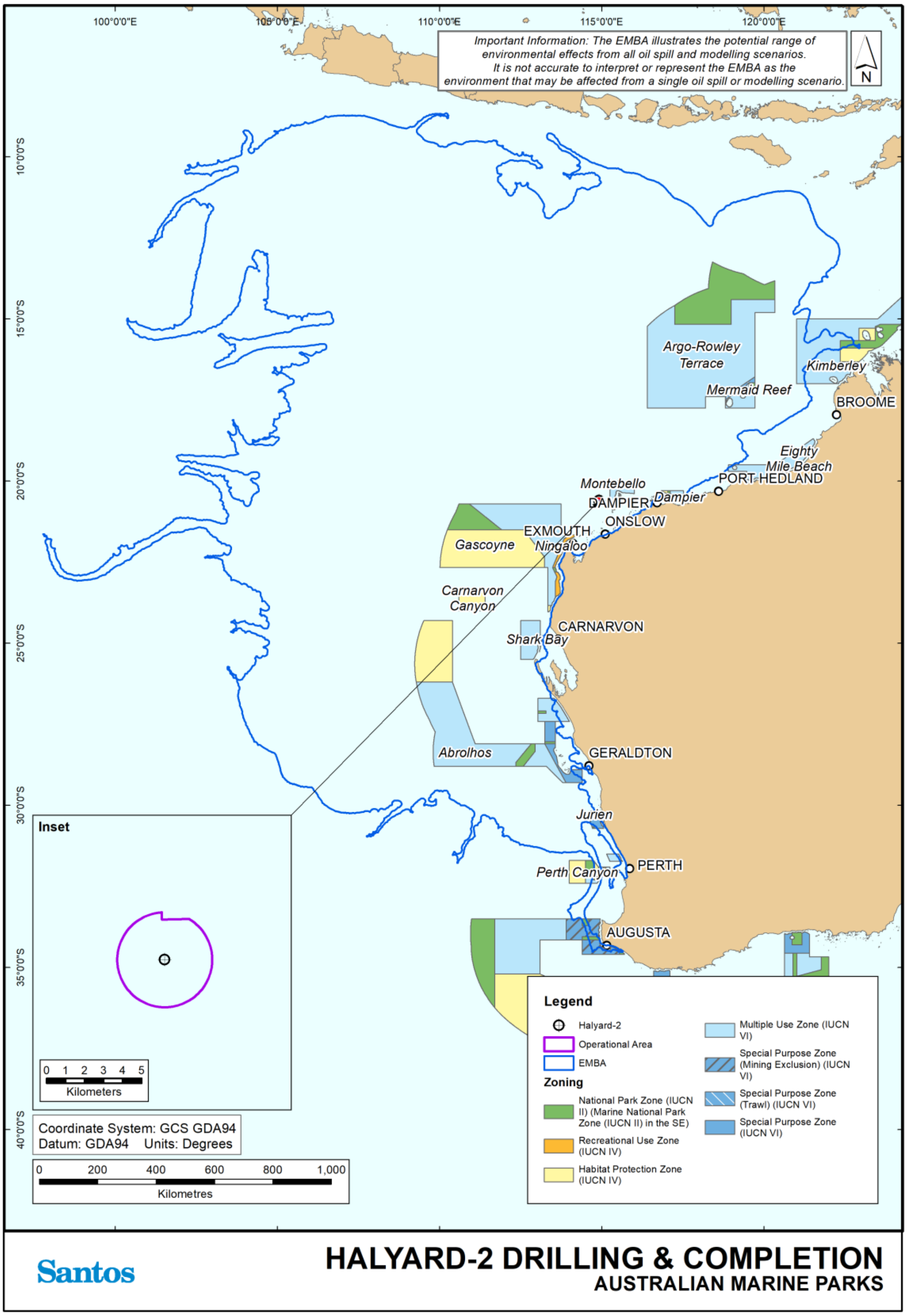

Figure 3.3: Australian Marine Parks in relation to the EMBA and operational area

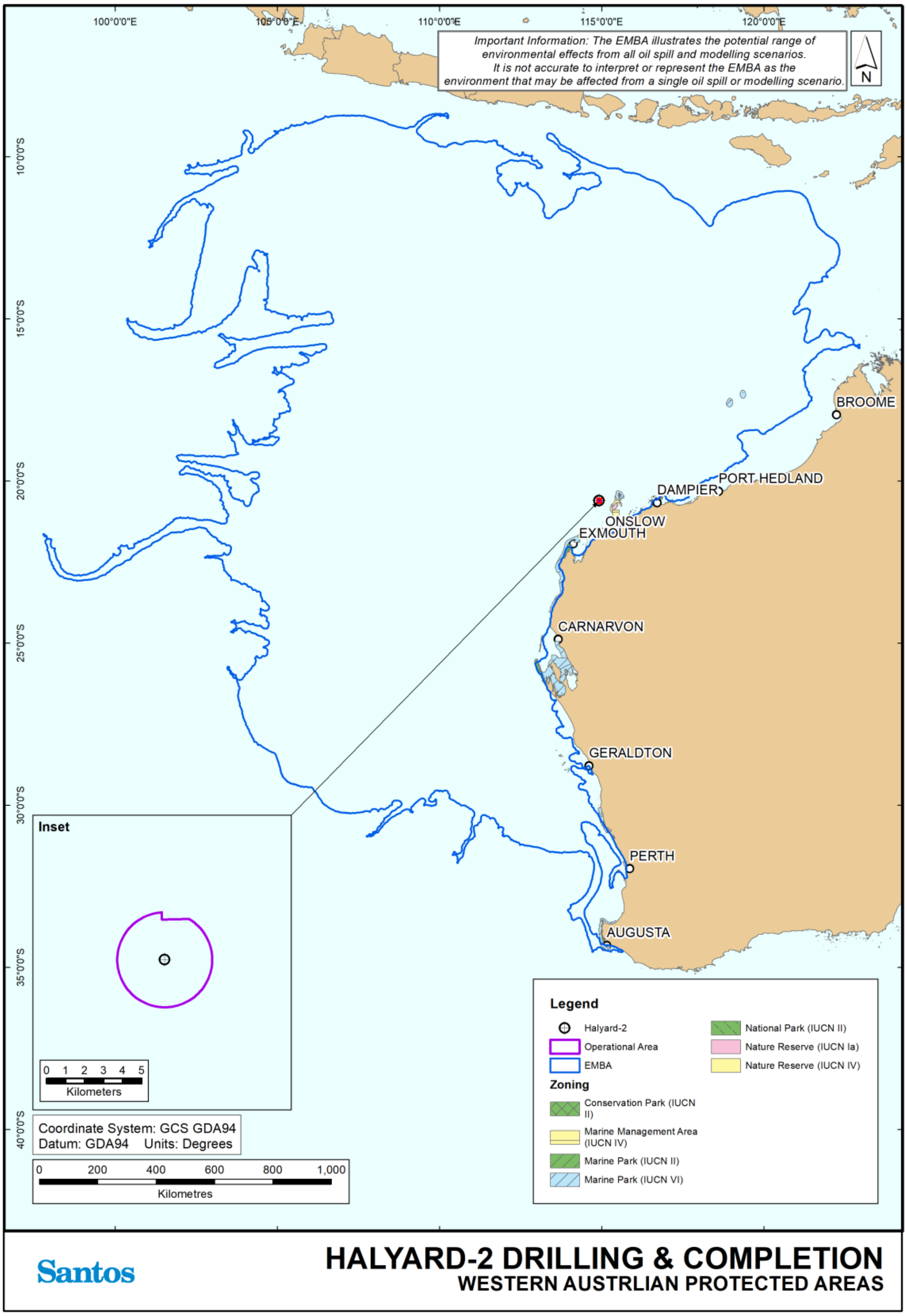

Figure 3.4: State Protected Areas in relation to the EMBA and operational area

3.2.4.2 Key ecological features

Key ecological features (KEFs) are components of the marine ecosystem that are considered to be important for biodiversity or ecosystem function and integrity of the Commonwealth Marine Area. The Ancient Coastline at 125 m depth contour KEF (the Ancient Coastline KEF) is within close proximity to the operational area (approximately 1 km), but does not overlap. A number of other KEFs are present within the EMBA as shown in **Table 3-7, Figure 3.5** and **Figure 3.6,** these are described in **Section 10** of Santos' Values and Sensitivities of the Western Australian Marine Environment (**Appendix C**).

Table 3-7: Distance from Operational Area Boundary to Key Ecological Features in the EMBA

Value/Sensitivity Name	Presence in Operational Area	Presence in MEVA	Presence in EMBA	Distance to Operational Area (km)
Key Ecological Features				
Ancient coastline at 90-120m depth	×	×	✓	797
Ancient coastline at 125 m depth contour	×	✓	✓	1
Seringapatam Reef and Commonwealth waters in the Scott Reef Complex	×	×	✓	1011
Canyons linking the Argo Abyssal Plain with the Scott Plateau	×	×	✓	826
Perth Canyon and adjacent shelf break, and other west coast canyons	×	×	✓	831
Commonwealth marine environment within and adjacent to the west coast inshore lagoons	×	×	✓	832
Cape Mentelle upwelling	×	×	✓	1430
Wallaby Saddle	×	✓	✓	631
Glomar Shoals	×	✓	✓	199
Commonwealth marine environment surrounding the Houtman Abrolhos Islands	×	×	✓	836
Western rock lobster	×	×	✓	789
Continental slope demersal fish communities	×	✓	✓	11
Exmouth Plateau	×	✓	✓	133
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	×	✓	✓	515
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	×	✓	✓	93

Value/Sensitivity Name	Presence in Operational Area	Presence in MEVA	Presence in EMBA	Distance to Operational Area (km)
Commonwealth waters adjacent to Ningaloo Reef	×	✓	✓	136
Demersal slope and associated fish communities of the Central Western Province	×	✓	✓	607

3.2.4.3 State and Commonwealth listed Heritage areas

Australia's heritage is managed by various levels of government and peak bodies that identify and list places for their heritage values. Significant heritage places are identified and grouped (by type) into lists that guide the protection and management of heritage values. A search of the EPBC Protected Matters database identified no heritage areas are located within the operational area, but several are within the EMBA. These areas are shown in **Table 3-8, Figure 3.7** and are further discussed in **Appendix C**.

Table 3-8: Distance from Operational Area Boundary to National Heritage Areas and Places in the EMBA

Value/Sensitivity Name	Presence in Operational Area	Presence in MEVA	Presence in EMBA	Distance to Operational Area (km)
World and National Heritage Areas				
The Ningaloo Coast	×	✓	✓	119
Dampier Archipelago (including Burrup Peninsula)	×	×	✓	158
HMAS Sydney II and HSK Kormoran Shipwreck Sites	×	✓	✓	721
Barrow Island and the Montebello-Barrow Islands Marine Conservation Reserves	×	✓	✓	39
Shark Bay, Western Australia	×	×	✓	483
Batavia Shipwreck Site	×	×	✓	879
Dirk Hartog Landing Site	×	×	✓	573
Commonwealth Heritage Places				
Mermaid Reef – Rowley Shoals	×	×	✓	515
Scott Reef and Surrounds - Commonwealth Area	×	×	✓	1012
Ningaloo Marine Area – Commonwealth Waters	×	✓	✓	119
Christmas Island Natural Areas	×	×	✓	2124

Value/Sensitivity Name	Presence in Operational Area	Presence in MEVA	Presence in EMBA	Distance to Operational Area (km)
HMAS Sydney II and HSK Kormoran Shipwreck Sites	×	✓	✓	721

3.2.4.4 Wetlands of international or national importance

Wetlands are a critical part of our natural environment. They protect our shores from wave action, reduce the impacts of floods, absorb pollutants and improve water quality. They provide habitat for animals and plants and many contain a wide diversity of life, supporting plants and animals that are found nowhere else. No wetlands of international or national importance are located within the operational area or EMBA. The nationally important wetlands of Mermaid Reef and Cape Range subterranean waterways are located within the EMBA. These areas are shown in **Table 3-9** and are further discussed in **Appendix C**.

Table 3-9: Distance from Operational Area Boundary to Wetlands of National Importance in the EMBA

Value/Sensitivity Name	Presence in Operational Area	Presence in MEVA	Presence in EMBA	Distance to Operational Area (km)
Wetlands of National Importance				
Gingilup-Jasper Wetland System	×	×	✓	1516
Hutt Lagoon System	×	×	✓	827
Swan-Canning Estuary	×	×	✓	1254
Blackwood River (Lower Reaches) and Tributaries System	×	×	✓	1490
Shark Bay East	×	×	✓	489
Bundera Sinkhole	×	✓	✓	231
Exmouth Gulf East	×	✓	✓	15
Cape Range Subterranean Waterways	×	✓	✓	155
Mermaid Reef	×	×	✓	624

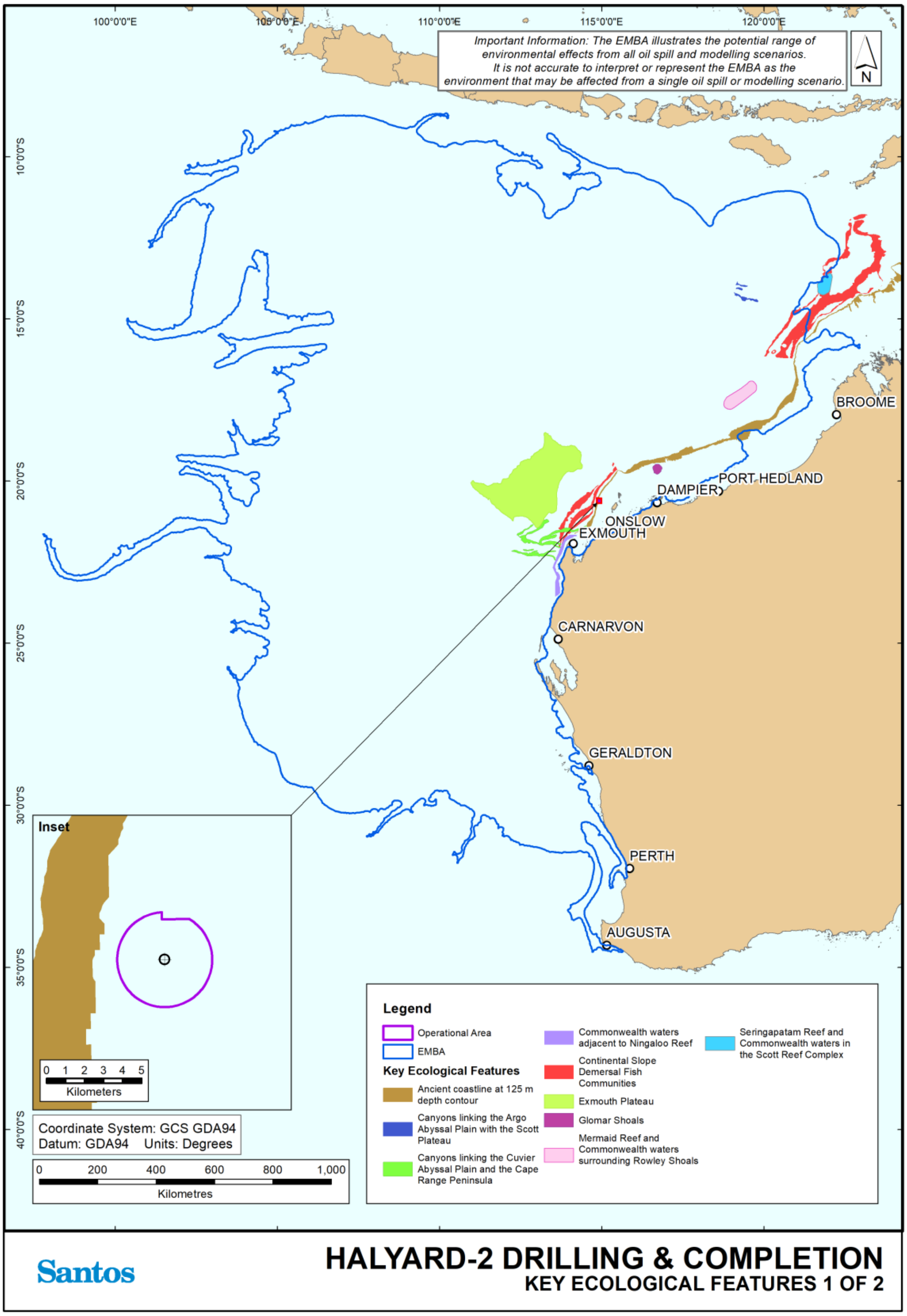

Figure 3.5: Key Ecological Features in relation to the EMBA and operational area (Figure 1 of 2)

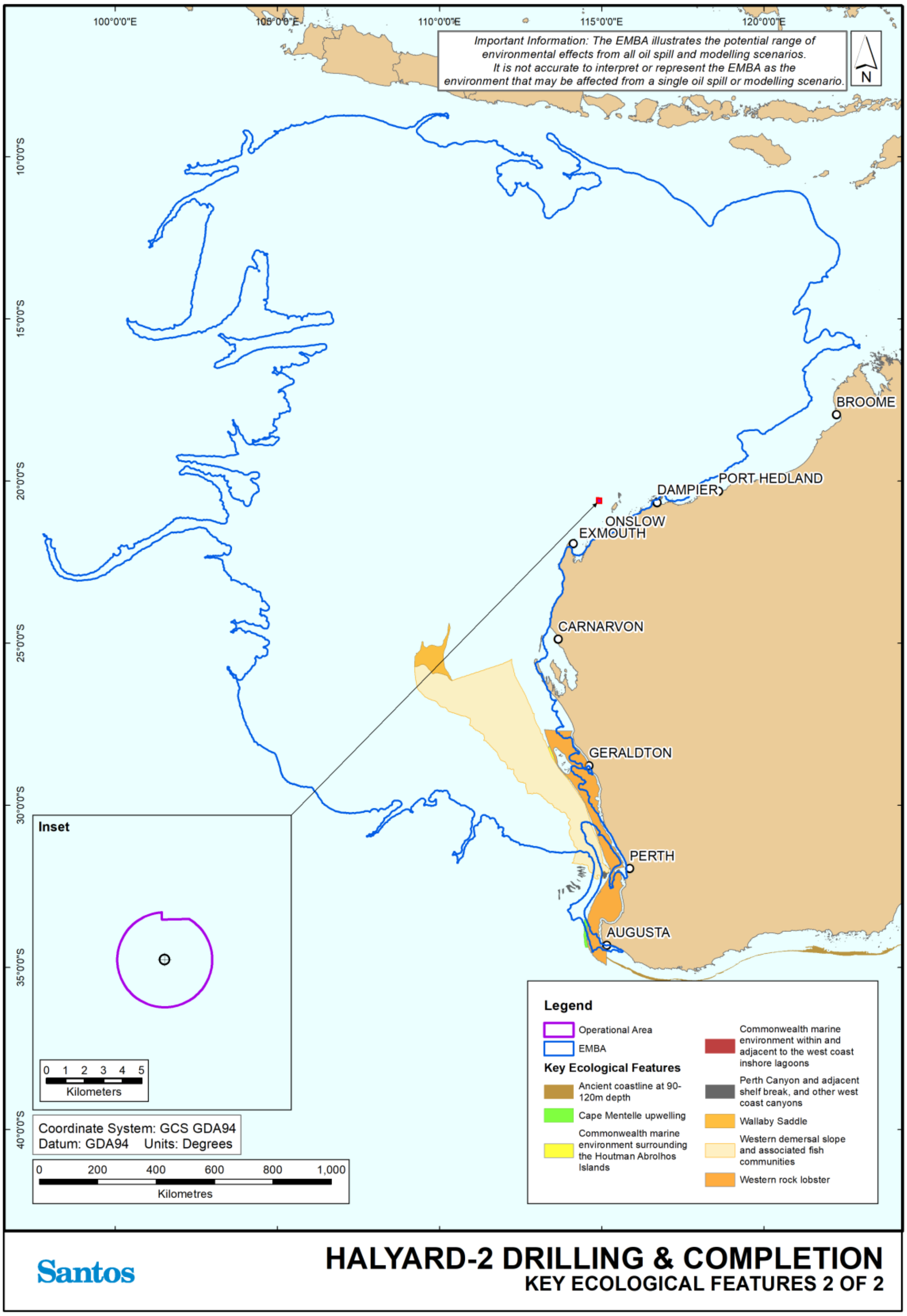

Figure 3.6: Key Ecological Features in relation to the EMBA and operational area (Figure 2 of 2)

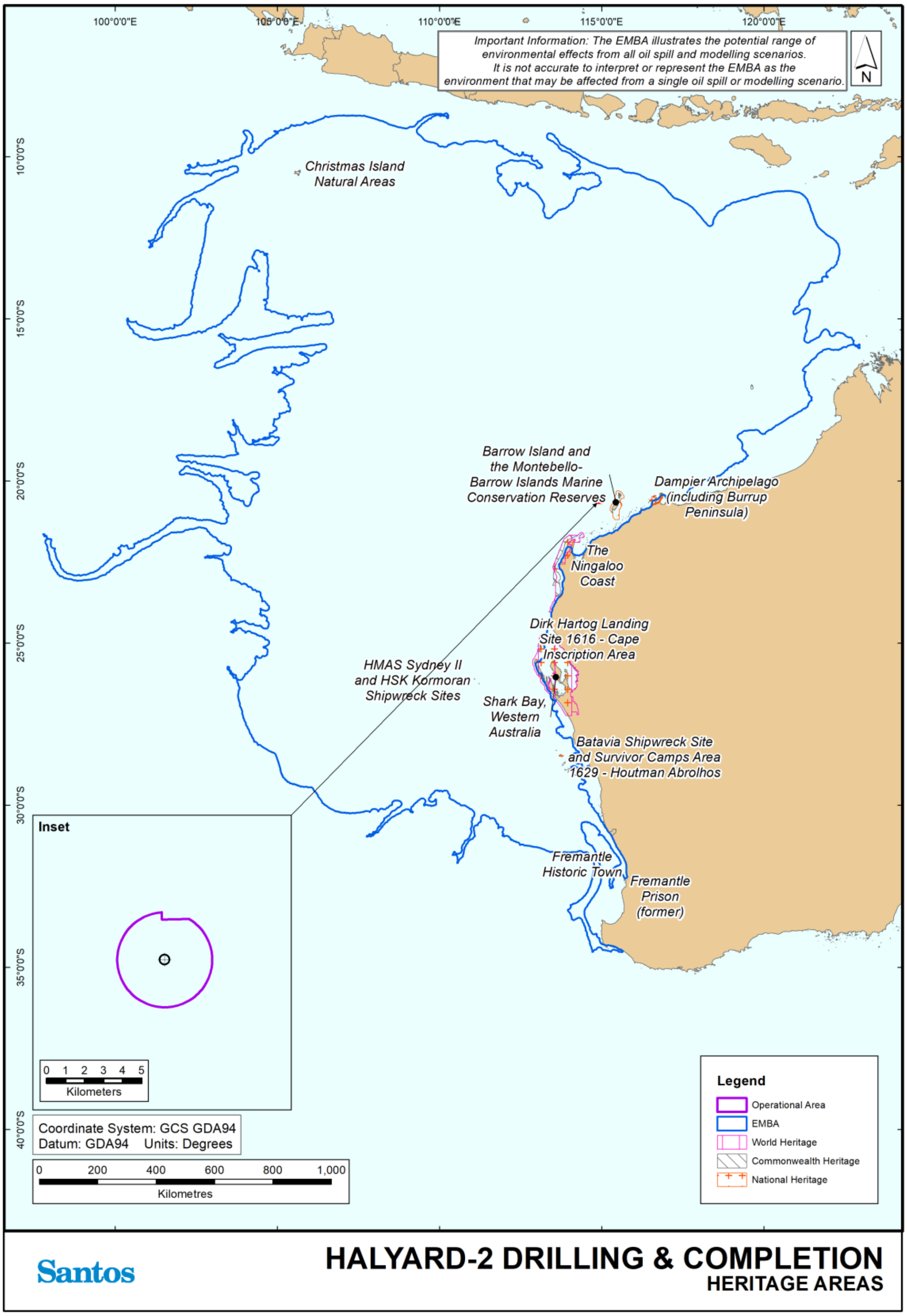

Figure 3.7: Heritage areas in relation to the EMBA and operational area

3.2.5 Threatened and Migratory fauna

Table 3-10 presents the threatened and migratory species within the operational area and EMBA. These include all relevant MNES protected under the EPBC Act as identified in the PMST report for the operational area and EMBA **(Appendix D**). For each species identified, their status under the Western Australia *Biodiversity Conservation Act 2016* (BC Act 2016) is also provided as well as the extent of likely presence, including any overlap with designated biologically important areas (BIAs). BIAs such as an aggregation, breeding, resting, nesting or feeding areas or known migratory routes for these species are shown in **Figure 3.8** to **Figure 3.18** and described in Santos' Values and Sensitivities of the Western Australian Marine Environment (EA-00-RI-10062; **Appendix C**).

The PMST report for the operational area identified 20 marine fauna species listed as 'threatened' and 32 marine fauna species listed as 'migratory'. In the EMBA there were 130 listed marine fauna comprising both 'threatened' and 'migratory' species, these are detailed in **Table 3-10.** Note that terrestrial species that appear in the PMST report for the EMBA but do not interact with the marine environment are not relevant to the activity impacts and risks and therefore have been excluded from **Table 3-10**.

3.2.5.1 Biologically important areas

BIAs are areas that have been identified where threated or migratory species protected under the EPBC Act carry out critical lifecycle activities. In addition to BIAs, habitat critical for the survival of the species has also been identified for marine turtles and these are areas in addition to BIAs where marine turtles carry out critical lifecycle activities.

There is no habitat critical for the survival of the species within the operational area, however the following BIAs are present:

+ Flatback turtle (internesting buffer);
+ Whale shark (foraging);
+ Pygmy blue whale (distribution);
+ Humpback whale (migration north and south); and
+ Wedge-tailed shearwater (breeding).

Figure 3.8 to **Figure 3.18** show BIAs and habitat critical to the survival of the species in the operational area and EMBA. The BIAs and habitats critical to the survival of a species are also described in Santos' Values and Sensitivities of the Western Australian Marine Environment EA-00-RI-10062; **Appendix C.**

Table 3-10: Threatened and migratory species within the EMBA and operational area

Value/sensitivity		EPBC Act Threatened Status	EPBC Act Migratory Status	BC Act 2016 Threatened Status	BC Act 2016 Migratory Status	Operational area presence	Particular values or sensitivities within operational area	MEVA presence	Particular values or sensitivities within MEVA	EMBA Presence	Particular values or sensitivities within EMBA	Relevant events
Scientific name	**Common name**											
Fish and sharks												
Anoxypristis cuspidata	Narrow Sawfish, Knifetooth Sawfish	-	Migratory	-	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	Planned Light emissions; Noise emissions; Operational discharges Drilling discharges Seabed infrastructure discharges Spill response operations Unplanned Release of solid objects Marine fauna interactions Non-hydrocarbon unplanned releases Hydrocarbon spills
Carcharhinus longimanus	Oceanic Whitetip Shark	-	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	
Carcharias taurus (west coast population)	Grey Nurse Shark (west coast population)	Vulnerable	-	Vulnerable	-	✓	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	
Carcharodon carcharias	White Shark, Great White Shark	Vulnerable	Migratory	Vulnerable	Migratory	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Foraging, feeding or related behaviour known to occur within area	
Centrophorus zeehaani	Southern Dogfish, Endeavour Dogfish, Little Gulper Shark	Conservation Dependent	-	-	-	✗	-	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Galeorhinus galeus	School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark	Conservation Dependent	-	-	-	✗	-	✗	-	✓	Species or species habitat may occur within area	
Glyphis garricki	Northern River Shark, New Guinea River Shark	Endangered	-	Priority 1	-	✗	-	✗	-	✓	Species or species habitat may occur within area	
Hoplostethus atlanticus	Orange Roughy, Deep-sea Perch, Red Roughy	Conservation Dependent	-	-	-	✗	-	✗	-	✓	Species or species habitat likely to occur within area	
Isurus oxyrinchus	Shortfin Mako, Mako Shark	-	Migratory	-	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	
Isurus paucus	Longfin Mako	-	Migratory	-	Migratory	✗	-	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	

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Lamna nasus	Porbeagle, Mackerel Shark	-	Migratory	-	Migratory	✗	-	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Mobula alfredi	Reef Manta Ray, Coastal Manta Ray	-	Migratory (as *Manta alfredi*)	-	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	
Mobula birostris	Giant Manta Ray	-	Migratory (as *Manta birostris*)	-	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	
Pristis clavata	Dwarf Sawfish, Queensland Sawfish	Vulnerable	Migratory	Priority 1	Migratory	✗	-	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Pristis pristis	Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish	Vulnerable	Migratory	-	-	✓	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	
Pristis zijsron	Green Sawfish, Dindagubba, Narrowsnout Sawfish	Vulnerable	Migratory	-	-	✓	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	
Rhincodon typus	Whale Shark	Vulnerable	Migratory		Migratory	✓	Foraging, feeding or related behaviour known to occur within area	✓	Foraging, feeding or related behaviour known to occur within area	✓	Foraging, feeding or related behaviour known to occur within area	
Sphyrna lewini	Scalloped Hammerhead	Conservation Dependent	-	-	-	✓	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	
Thunnus maccoyii	Southern Bluefin Tuna	Conservation Dependent	-	-	-	✓	Breeding known to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area	
Marine Mammals												
Balaenoptera bonaerensis	Antarctic Minke Whale, Dark-shoulder Minke Whale	-	Migratory	-	Migratory	✗	-	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	Planned Light emissions;

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Scientific name	Common name											
Balaenoptera borealis	Sei Whale	Vulnerable	Migratory	Endangered	-	✓	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	✓	Foraging, feeding or related behaviour likely to occur within area	Noise emissions; Operational discharges Drilling discharges Seabed infrastructure discharges Spill response operations <u>Unplanned</u> Release of solid objects Marine fauna interactions Non-hydrocarbon unplanned releases Hydrocarbon spills
Balaenoptera edeni	Bryde's Whale	-	Migratory	-	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	
Balaenoptera musculus	Blue Whale	Endangered	Migratory	Endangered	-	✓	Species or species habitat likely to occur within area	✓	Migration route known to occur within area	✓	Foraging, feeding or related behaviour known to occur within area Migration route known to occur within area	
Balaenoptera physalus	Fin Whale	Vulnerable	Migratory	Endangered	-	✓	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	✓	Foraging, feeding or related behaviour likely to occur within area	
Caperea marginata	Pygmy Right Whale	-	-	-	Migratory	✗	-	✗	-	✓	Foraging, feeding or related behaviour likely to occur within area	
Dugong dugon	Dugong	-	Migratory	-	Migratory	✗	-	✓	Species or species habitat known to occur within area, Breeding known to occur within area	✓	Breeding known to occur within area	
Eubalaena australis	Southern Right Whale	Endangered	Migratory (as *Balaena glacialis australis*)	Vulnerable	-	✗	-	✓	Species or species habitat may occur within area	✓	Breeding known to occur within area	
Lagenorhynchus obscurus	Dusky Dolphin	-	Migratory	-	Migratory	✗	-	✗	-	✓	Species or species habitat likely to occur within area	
Megaptera novaeangliae	Humpback Whale	-	Migratory	Conservation Dependent	Migratory	✓	Species or species habitat known to occur within area	✓	Breeding known to occur within area	✓	Foraging, feeding or related behaviour known to occur within area Breeding known to occur within area	

Value/sensitivity												
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Neophoca cinerea	Australian Sea-lion, Australian Sea Lion	Endangered	-	Endangered	-	✗	-	✗	-	✓	Breeding known to occur within area	
Orcaella heinsohni	Australian Snubfin Dolphin	-	Migratory	Priority 4	Migratory	✗	-	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Orcinus orca	Killer Whale, Orca	-	Migratory	-	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	
Physeter macrocephalus	Sperm Whale	-	Migratory	Vulnerable	-	✓	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	
Sousa sahulensis	Australian Humpback Dolphin	-	Migratory (as *Sousa chinensis*)	Priority 4	Migratory	✓	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	
Tursiops aduncus (Arafura/Timor Sea populations)	Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	-	Migratory	-	-	✓	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	
Marine reptiles												
Aipysurus apraefrontalis	Short-nosed Seasnake	Critically Endangered	-	Critically Endangered	-	✗	-	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	Planned Light emissions; Noise emissions; Operational discharges Drilling discharges Seabed infrastructure discharges Spill response operations Unplanned Release of solid objects Marine fauna interactions Non-hydrocarbon unplanned releases Hydrocarbon spills
Aipysurus foliosquama	Leaf-scaled Seasnake	Critically Endangered	-	Critically Endangered	-	✗	-	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Caretta	Loggerhead Turtle	Endangered	Migratory	Endangered	-	✓	Species or species habitat known to occur within area	✓	Breeding known to occur within area	✓	Foraging, feeding or related behaviour known to occur within area Breeding known to occur within area	
Chelonia mydas	Green Turtle	Vulnerable	Migratory	Vulnerable	-	✓	Species or species habitat known to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area Foraging, feeding or related behaviour known to occur within area	
Crocodylus porosus	Salt-water Crocodile, Estuarine Crocodile	-	Migratory	-	Migratory	✗	-	✗	-	✓	Species or species habitat likely to occur within area	
Dermochelys coriacea	Leatherback Turtle, Leathery Turtle, Luth	Endangered	Migratory	Vulnerable	-	✓	Species or species habitat likely to occur within area	✓	Breeding likely to occur within area Foraging, feeding or related behaviour	✓	Foraging, feeding or related behaviour likely to occur within area	

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Scientific name	Common name											
									known to occur within area			
Eretmochelys imbricata	Hawksbill Turtle	Vulnerable	Migratory	Vulnerable	-	✓	Species or species habitat known to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area Foraging, feeding or related behaviour known to occur within area	
Lepidochelys olivacea	Olive Ridley Turtle, Pacific Ridley Turtle	Vulnerable	Migratory	Endangered	-	✗	-	✗	-	✓	Foraging, feeding or related behaviour likely to occur within area	
Natator depressus	Flatback Turtle	Vulnerable	Migratory	Vulnerable	-	✓	Congregation or aggregation known to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area Congregation or aggregation known to occur within area	
Birds												
Accipiter hiogaster natalis	Christmas Island Goshawk	Endangered	-	-	-	✗	-	✗	-	✓	Species or species habitat known to occur within area	<u>Planned</u> Light emissions; Noise emissions; Spill response operations <u>Unplanned</u> Marine fauna interactions Non-hydrocarbon unplanned releases Hydrocarbon spills
Actitis hypoleucos	Common Sandpiper	-	Migratory	-	Migratory	✓	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	
Anous stolidus	Common Noddy	-	Migratory	-	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	
Anous tenuirostris melanops	Australian Lesser Noddy	Vulnerable	-	Endangered		✗	-	✓	Species or species habitat may occur within area	✓	Breeding known to occur within area Foraging, feeding or related behaviour known to occur within area	
Apus pacificus	Fork-tailed Swift	-	Migratory	-	Migratory	✗	-	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Ardenna carneipes	Flesh-footed Shearwater, Fleshy-footed Shearwater	-	Migratory	Vulnerable	-	✗	-	✓	Foraging, feeding or related behaviour likely to occur within area	✓	Breeding known to occur within area	
Ardenna grisea	Sooty Shearwater	-	Migratory		Migratory	✗	-	✗	-	✓	Species or species habitat may occur within area	

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Ardenna pacifica	Wedge-tailed Shearwater	-	Migratory	-	Migratory	✗	-	✓	Breeding known to occur within area	✓	Breeding known to occur within area	
Arenaria interpres	Ruddy Turnstone	-	Migratory	-	Migratory	✗	-	✗	-	✓	Roosting known to occur within area	
Botaurus poiciloptilus	Australasian Bittern	Endangered	-	Endangered	-	✗	-	✗	-	✓	Species or species habitat known to occur within area	
Calidris acuminata	Sharp-tailed Sandpiper	-	Migratory	-	Migratory	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Roosting known to occur within area	
Calidris alba	Sanderling	-	Migratory	-	Migratory	✗	-	✗	-	✓	Roosting known to occur within area	
Calidris canutus	Red Knot, Knot	-	Migratory	Endangered	-	✓	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	
Calidris ferruginea	Curlew Sandpiper	Critically Endangered	Migratory	Critically Endangered	-	✓	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	
Calidris melanotos	Pectoral Sandpiper	-	Migratory	-	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	
Calidris ruficollis	Red-necked Stint	-	Migratory	-	Migratory	✗	-	✗	-	✓	Roosting known to occur within area	
Calidris subminuta	Long-toed Stint	-	Migratory	-	Migratory	✗	-	✗	-	✓	Species or species habitat known to occur within area	
Calidris tenuirostris	Great Knot	Critically Endangered	Migratory	Critically Endangered	-	✗	-	✗	-	✓	Roosting known to occur within area	
Calonectris leucomelas	Streaked Shearwater	-	Migratory	-	Migratory	✓	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	
Cecropis daurica	Red-rumped Swallow	-	Migratory	-	Migratory	✗	-	✗	-	✓	Species or species habitat known to occur within area	
Chalcophaps indica natalis	Christmas Island Emerald Dove, Emerald Dove (Christmas Island)	Endangered	-	-	-	✗	-	✗	-	✓	Species or species habitat known to occur within area	
Charadrius bicinctus	Double-banded Plover	-	Migratory	-	Migratory	✗	-	✗	-	✓	Roosting known to occur within area	
Charadrius dubius	Little Ringed Plover	-	Migratory	-	Migratory	✗	-	✗	-	✓	Species or species habitat known to occur within area	

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Charadrius leschenaultii	Greater Sand Plover, Large Sand Plover	Vulnerable	Migratory	Vulnerable	-	✗	-	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Charadrius mongolus	Lesser Sand Plover, Mongolian Plover	Endangered	Migratory	Endangered	-	✗	-	✗	-	✓	Roosting known to occur within area	
Charadrius veredus	Oriental Plover, Oriental Dotterel	-	Migratory	-	Migratory	✗	-	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Diomedea amsterdamensis	Amsterdam Albatross	Endangered	Migratory	Critically Endangered	-	✗	-	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Diomedea dabbenena	Tristan Albatross	Endangered	Migratory	Critically Endangered	-	✗	-	✗	-	✓	Species or species habitat likely to occur within area	
Diomedea epomophora	Southern Royal Albatross	Vulnerable	Migratory	Vulnerable	-	✗	-	✗	-	✓	Species or species habitat may occur within area	
Diomedea exulans	Wandering Albatross	Vulnerable	Migratory	Vulnerable	-	✗	-	✓	Species or species habitat may occur within area	✓	Foraging, feeding or related behaviour likely to occur within area	
Diomedea sanfordi	Northern Royal Albatross	Endangered	Migratory	Endangered	-	✗	-	✗	-	✓	Species or species habitat may occur within area	
Erythrotriorchis radiatus	Red Goshawk	Vulnerable	-	Vulnerable	-	✗	-	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Fregata andrewsi	Christmas Island Frigatebird, Andrew's Frigatebird	Endangered	Migratory	Migratory	-	✗	-	✗	-	✓	Breeding known to occur within area	
Fregata ariel	Lesser Frigatebird, Least Frigatebird	-	Migratory	-	Migratory	✓	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	
Fregata minor	Great Frigatebird, Greater Frigatebird	-	Migratory	-	Migratory	✗	-	✓	Species or species habitat may occur within area	✓	Breeding known to occur within area Foraging, feeding or related behaviour likely to occur within area	
Gallinago megala	Swinhoe's Snipe	-	Migratory	-	Migratory	✗	-	✗	-	✓	Roosting likely to occur within area	
Gallinago stenura	Pin-tailed Snipe	-	Migratory	-	Migratory	✗	-	✗	-	✓	Roosting likely to occur within area	

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Glareola maldivarum	Oriental Pratincole	-	Migratory	-	Migratory	X	-	√	Species or species habitat may occur within area	√	Species or species habitat known to occur within area	
Halobaena caerulea	Blue Petrel	Vulnerable	-			X	-	X	-	√	Species or species habitat may occur within area	
Hydroprogne caspia	Caspian Tern	-	Migratory	-	Migratory	X	-	√	Breeding known to occur within area	√	Breeding known to occur within area	
Limicola falcinellus	Broad-billed Sandpiper	-	Migratory	-	Migratory	X	-	X	-	√	Species or species habitat known to occur within area	
Limnodromus semipalmatus	Asian Dowitcher	-	Migratory	-	Migratory	X	-	√	Species or species habitat known to occur within area	√	Species or species habitat known to occur within area	
Limosa lapponica	Bar-tailed Godwit	-	Migratory	-	Migratory	X	-	√	Species or species habitat known to occur within area	√	Species or species habitat known to occur within area	
Limosa lapponica menzbieri	Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit	Critically Endangered	-	Critically Endangered	-	X	-	√	Species or species habitat known to occur within area	√	Species or species habitat known to occur within area	
Limosa limosa	Black-tailed Godwit	-	Migratory	-	Migratory	X	-	X	-	√	Roosting known to occur within area	
Macronectes giganteus	Southern Giant-Petrel, Southern Giant Petrel	Endangered	Migratory	-	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	
Macronectes halli	Northern Giant Petrel	Vulnerable	Migratory	-	Migratory	X	-	√	Species or species habitat may occur within area	√	Foraging, feeding or related behaviour likely to occur within area	
Malurus leucopterus edouardi	White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren	Vulnerable	-	Vulnerable	-	X	-	√	Species or species habitat likely to occur within area	√	Species or species habitat likely to occur within area	
Malurus leucopterus	White-winged Fairy-wren (Dirk Hartog Island), Dirk Hartog Black-and-White Fairy-wren	Vulnerable	-	Vulnerable	-	X	-	X	-	√	Species or species habitat likely to occur within area	
Motacilla cinerea	Grey Wagtail	-	Migratory	-	Migratory	X	-	√	Species or species habitat may occur within area	√	Species or species habitat known to occur within area	
Motacilla flava	Yellow Wagtail	-	Migratory	-	Migratory	X	-	√	Species or species habitat may occur within area	√	Species or species habitat known to occur within area	

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Scientific name	Common name											
Ninox natalis	Christmas Island Hawk-Owl, Christmas Boobook	Vulnerable	-	-	-	✗	-	✗	-	✓	Species or species habitat known to occur within area	
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	Critically Endangered	Migratory	Critically Endangered	-	✓	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	
Numenius minutus	Little Curlew, Little Whimbrel	-	Migratory	-	Migratory	✗	-	✗	-	✓	Roosting likely to occur within area	
Numenius phaeopus	Whimbrel	-	Migratory	-	Migratory	✗	-	✗	-	✓	Roosting known to occur within area	
Onychoprion anaethetus	Bridled Tern	-	Migratory	-	Migratory	✗	-	✓	Breeding known to occur within area	✓	Breeding known to occur within area	
Pandion haliaetus	Osprey	-	Migratory	-	Migratory	✗	-	✓	Breeding known to occur within area	✓	Breeding known to occur within area	
Papasula abbotti	Abbott's Booby	Endangered	-	-	-	✗	-	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	
Phaethon lepturus	White-tailed Tropicbird	-	Migratory	-	Migratory	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area Breeding known to occur within area	✓	Breeding known to occur within area	
Phaethon lepturus fulvus	Christmas Island White-tailed Tropicbird, Golden Bosunbird	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	
Phaethon rubricauda	Red-tailed Tropicbird	-	Migratory	Priority 4	Migratory	✗	-	✓	Breeding known to occur within area	✓	Breeding known to occur within area	
Phalaropus lobatus	Red-necked Phalarope	-	Migratory	-	Migratory	✗	-	✗	-	✓	Roosting known to occur within area	
Philomachus pugnax	Ruff (Reeve)	-	Migratory	-	Migratory	✗	-	✗	-	✓	Species or species habitat known to occur within area	
Phoebetria fusca	Sooty Albatross	Vulnerable	Migratory	Endangered	-	✗	-	✗	-	✓	Species or species habitat may occur within area	
Pluvialis fulva	Pacific Golden Plover	-	Migratory	-	Migratory	✗	-	✗	-	✓	Roosting known to occur within area	
Pluvialis squatarola	Grey Plover	-	Migratory	-	Migratory	✗	-	✗	-	✓	Roosting known to occur within area	
Pterodroma mollis	Soft-plumaged Petrel	Vulnerable	-	-	-	✗	-	✗	-	✓	Foraging, feeding or related behaviour known to occur within area	

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Scientific name	Common name											
Rostratula australis	Australian Painted Snipe	Endangered	-	Endangered	-	✗	-	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	
Sterna dougallii	Roseate Tern	-	Migratory	-	Migratory	✗	-	✓	Breeding known to occur within area	✓	Breeding known to occur within area Foraging, feeding or related behaviour likely to occur within area	
Sternula albifrons	Little Tern	-	Migratory	-	Migratory	✗	-	✓	Species or species habitat may occur within area Congregation or aggregation known to occur within area	✓	Congregation or aggregation known to occur within area	
Sternula nereis	Australian Fairy Tern	Vulnerable	-	Vulnerable	-	✓	Foraging, feeding or related behaviour likely to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area	
Sula leucogaster	Brown Booby	-	Migratory	-	Migratory	✗	-	✗	-	✓	Breeding known to occur within area	
Sula sula	Red-footed Booby	-	Migratory	-	Migratory	✗	-	✗	-	✓	Breeding known to occur within area	
Thalassarche carteri	Indian Yellow-nosed Albatross	Vulnerable	Migratory	Endangered	-	✗	-	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	
Thalassarche cauta	Shy Albatross	Endangered	Migratory	Vulnerable	-	✗	-	✓	Species or species habitat may occur within area	✓	Foraging, feeding or related behaviour likely to occur within area	
Thalassarche impavida	Campbell Albatross, Campbell Black-browed Albatross	Vulnerable	Migratory	Vulnerable	-	✗	-	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Thalassarche melanophris	Black-browed Albatross	Vulnerable	Migratory	Endangered	-	✗	-	✓	Species or species habitat may occur within area	✓	Foraging, feeding or related behaviour likely to occur within area	
Thalassarche steadi	White-capped Albatross	Vulnerable	Migratory	-	-	✗	-	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Thalasseus bergii	Greater Crested Tern	-	Migratory	-	Migratory	✗	-	✓	Breeding known to occur within area	✓	Roosting known to occur within area	
Tringa brevipes	Grey-tailed Tattler	-	Migratory	Priority 4	Migratory	✗	-	✗	-	✓	Roosting known to occur within area	

Value/sensitivity		EPBC Act Threatened Status	EPBC Act Migratory Status	BC Act 2016 Threatened Status	BC Act 2016 Migratory Status	Operational area presence	Particular values or sensitivities within operational area	MEVA presence	Particular values or sensitivities within MEVA	EMBA Presence	Particular values or sensitivities within EMBA	Relevant events
Scientific name	Common name											
Tringa glareola	Wood Sandpiper	-	Migratory	-	Migratory	✗	-	✗	-	✓	Species or species habitat known to occur within area	
Tringa nebularia	Common Greenshank, Greenshank	-	Migratory	-	Migratory	✗	-	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank	-	Migratory	-	Migratory	✗	-	✗	-	✓	Roosting known to occur within area	
Tringa totanus	Common Redshank, Redshank	-	Migratory	-	Migratory	✗	-	✗	-	✓	Roosting known to occur within area	

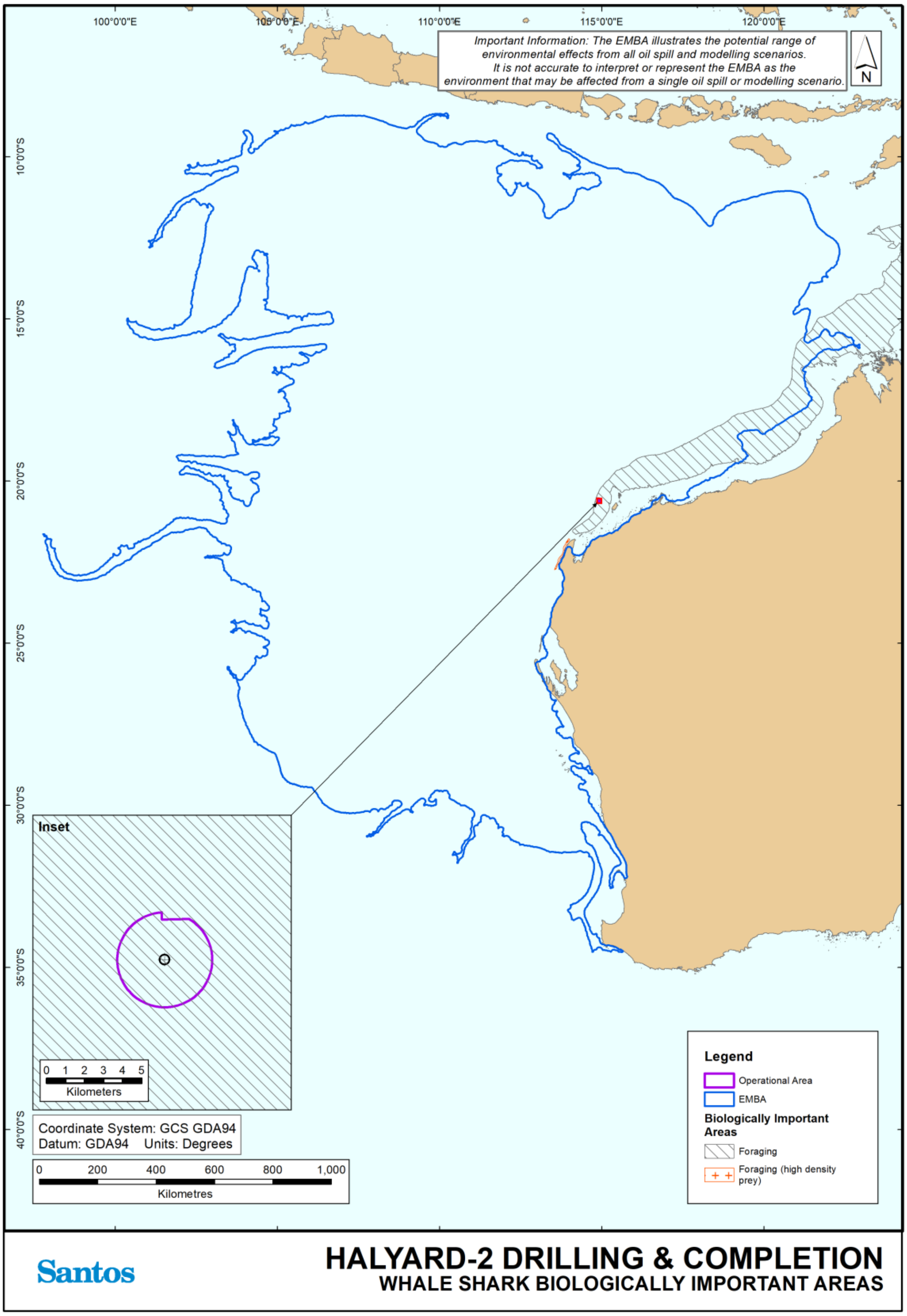


Figure 3.8: Whale shark BIAs in relation to the EMBA and operational areas

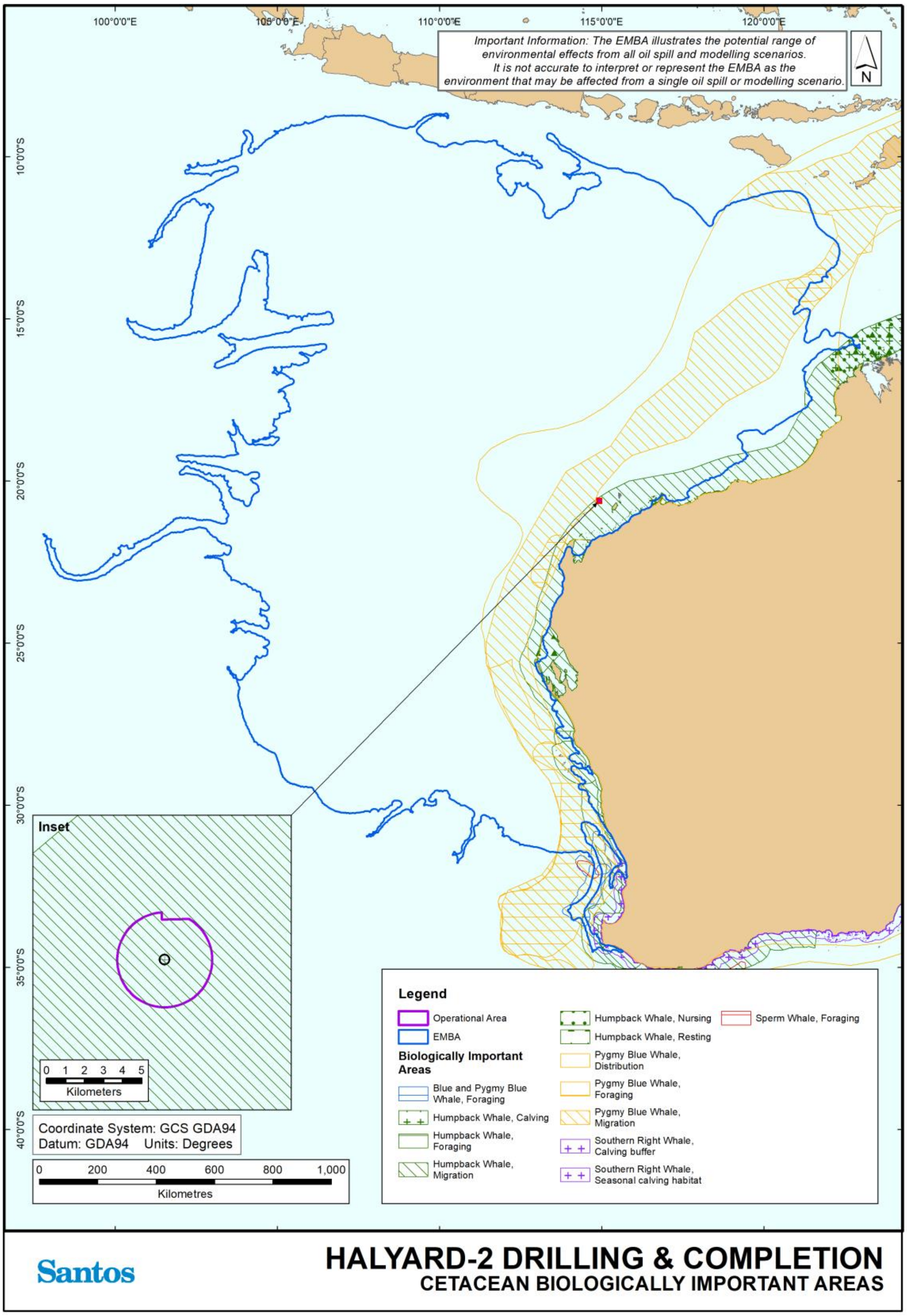


Figure 3.9: Cetacean BIAs in relation to the EMBA and operational area

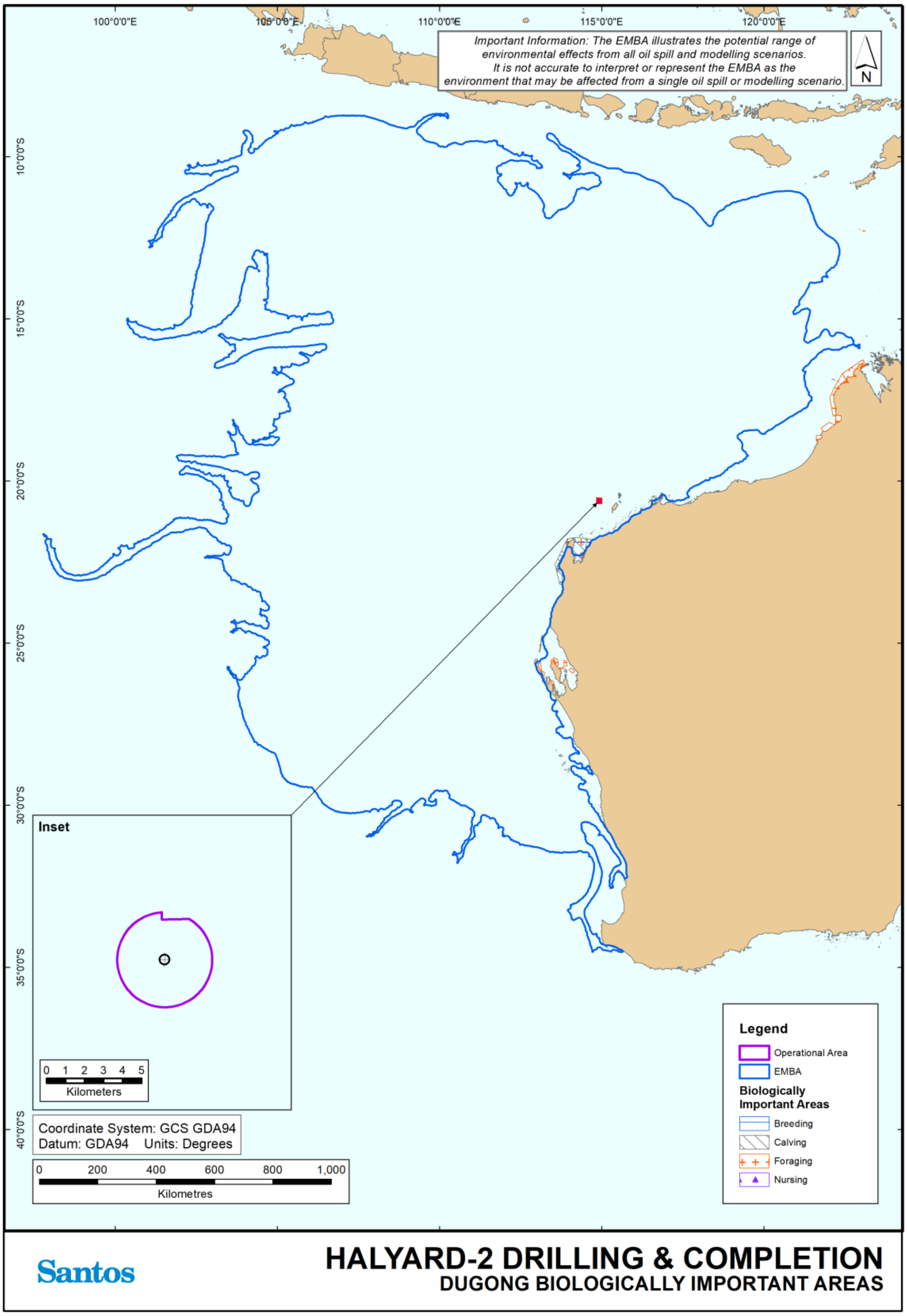


Figure 3.10: Dugong BIAs in relation to the EMBA and operational area

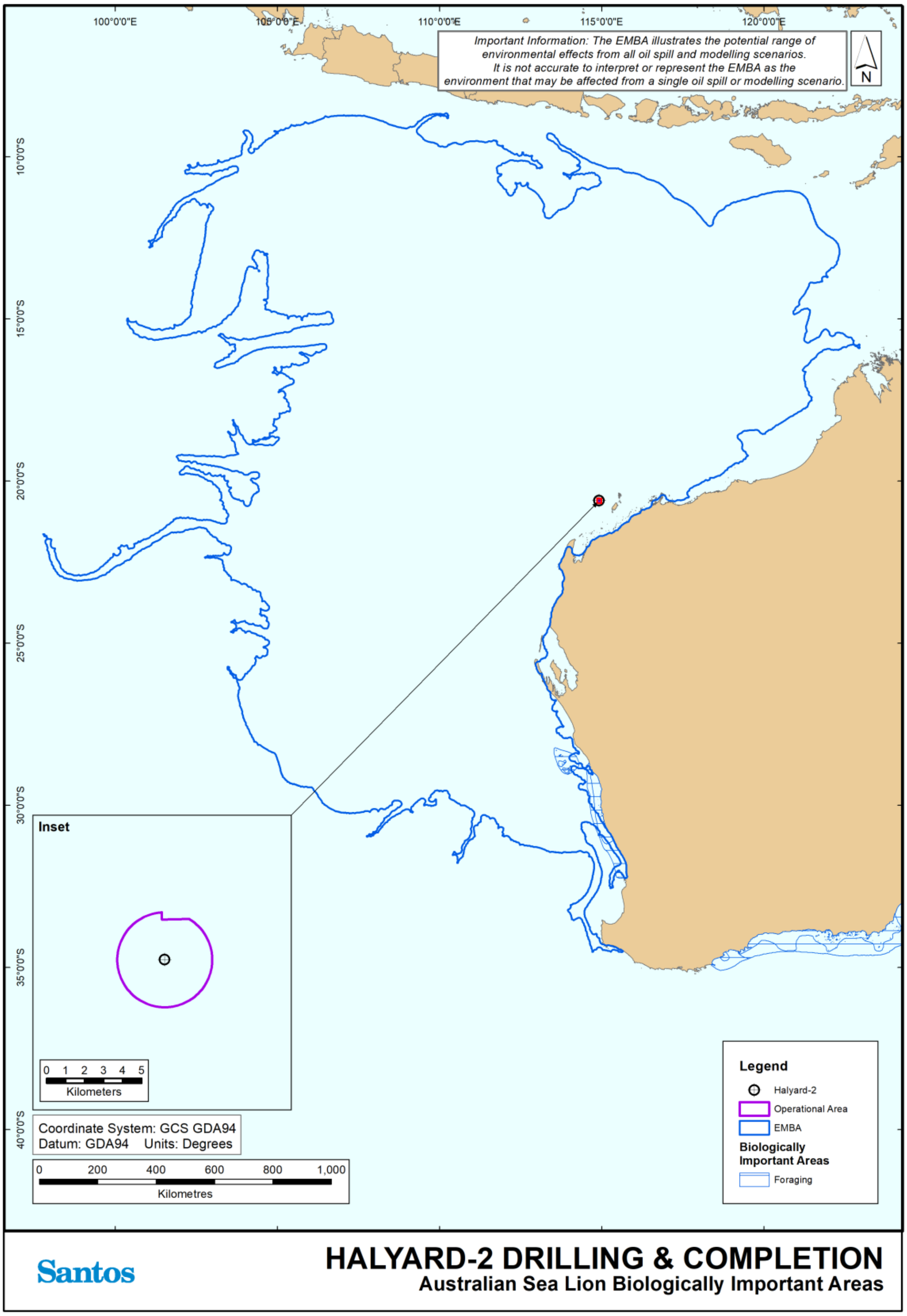


Figure 3.11: Australian Sea Lion BIAs in relation to the EMBA and operational area

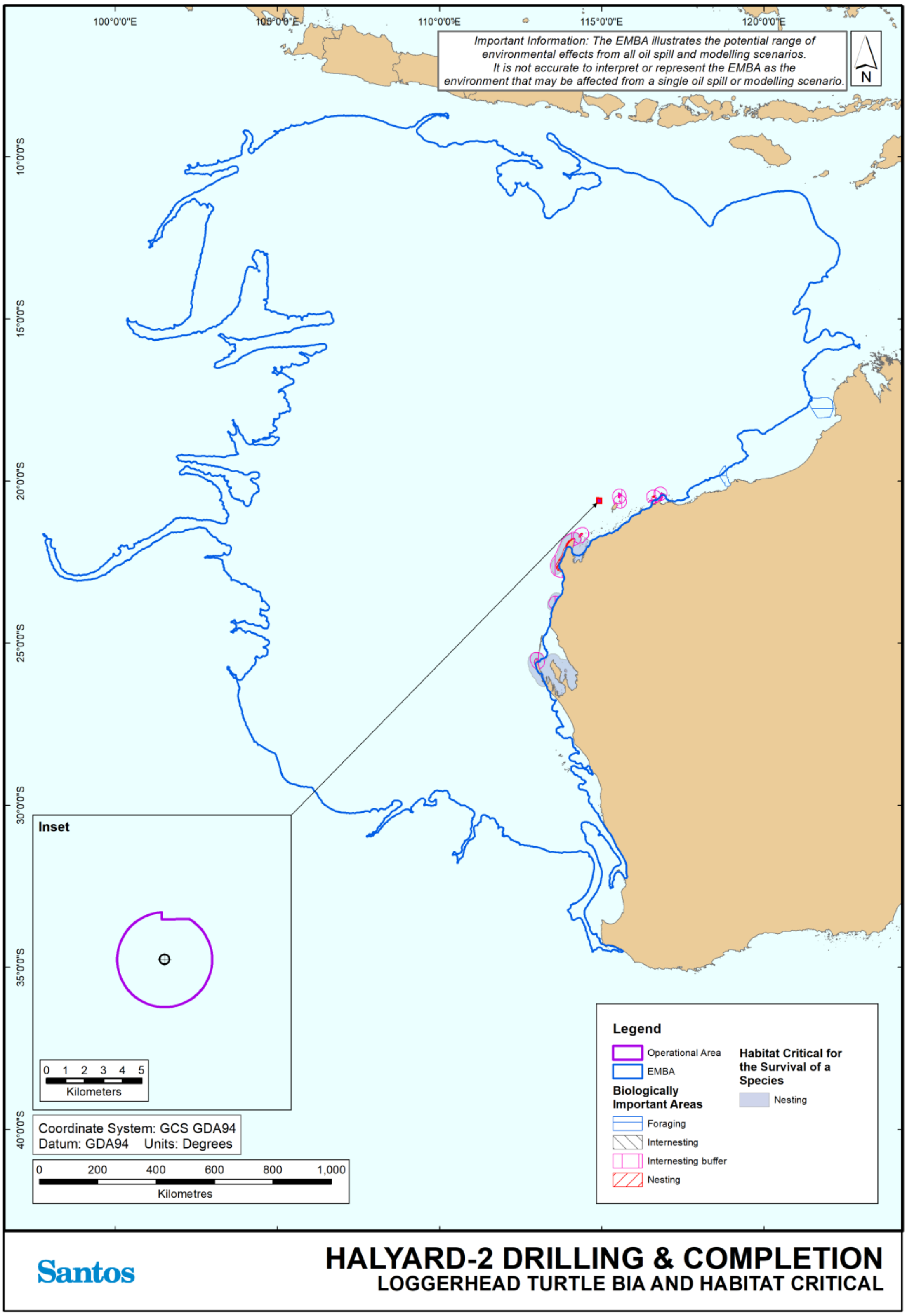


Figure 3.12: Loggerhead turtle habitat critical and BIAs in relation to the EMBA and operational area

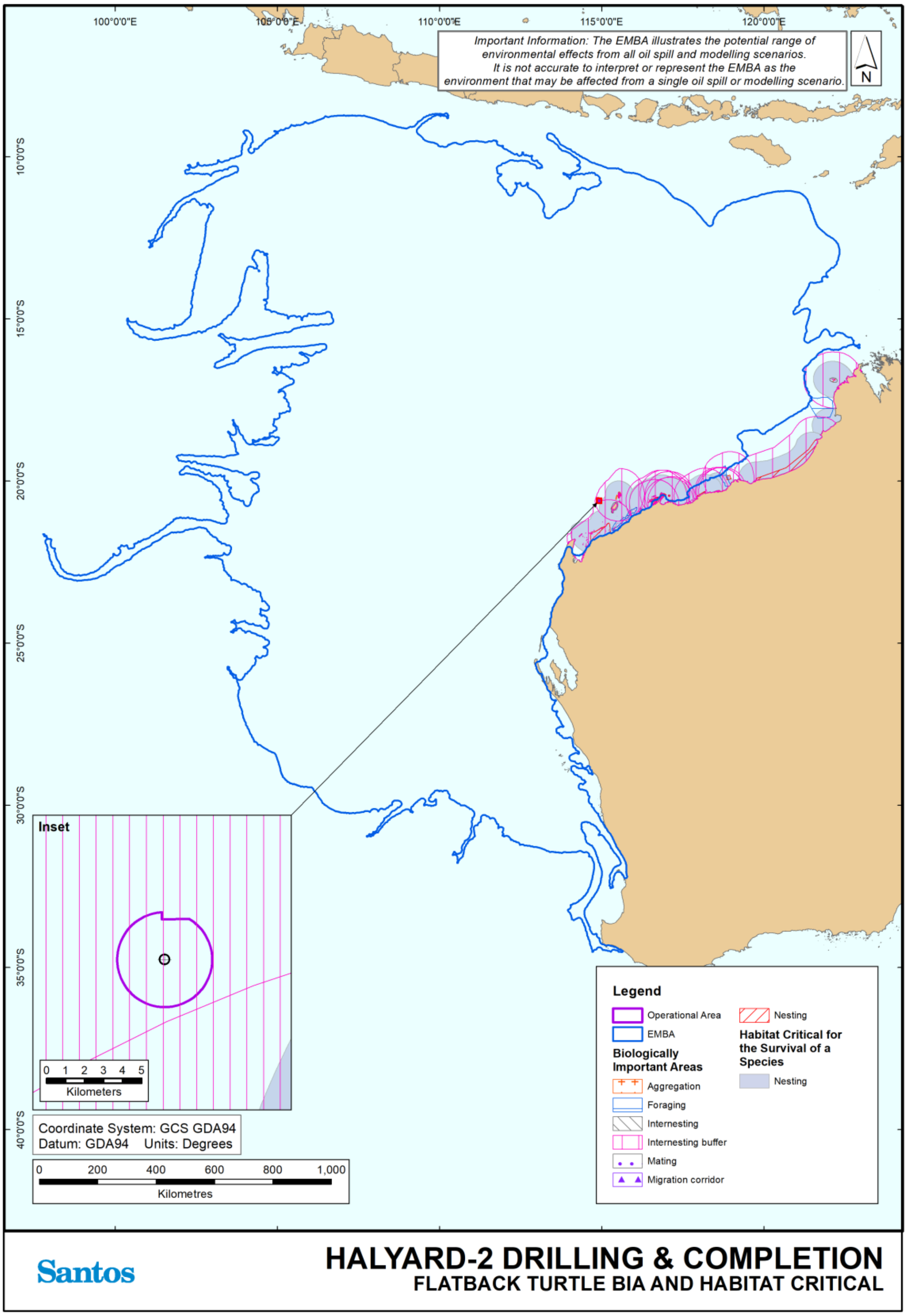


Figure 3.13: Flatback turtle habitat critical and BIAs in relation to the EMBA and operational area

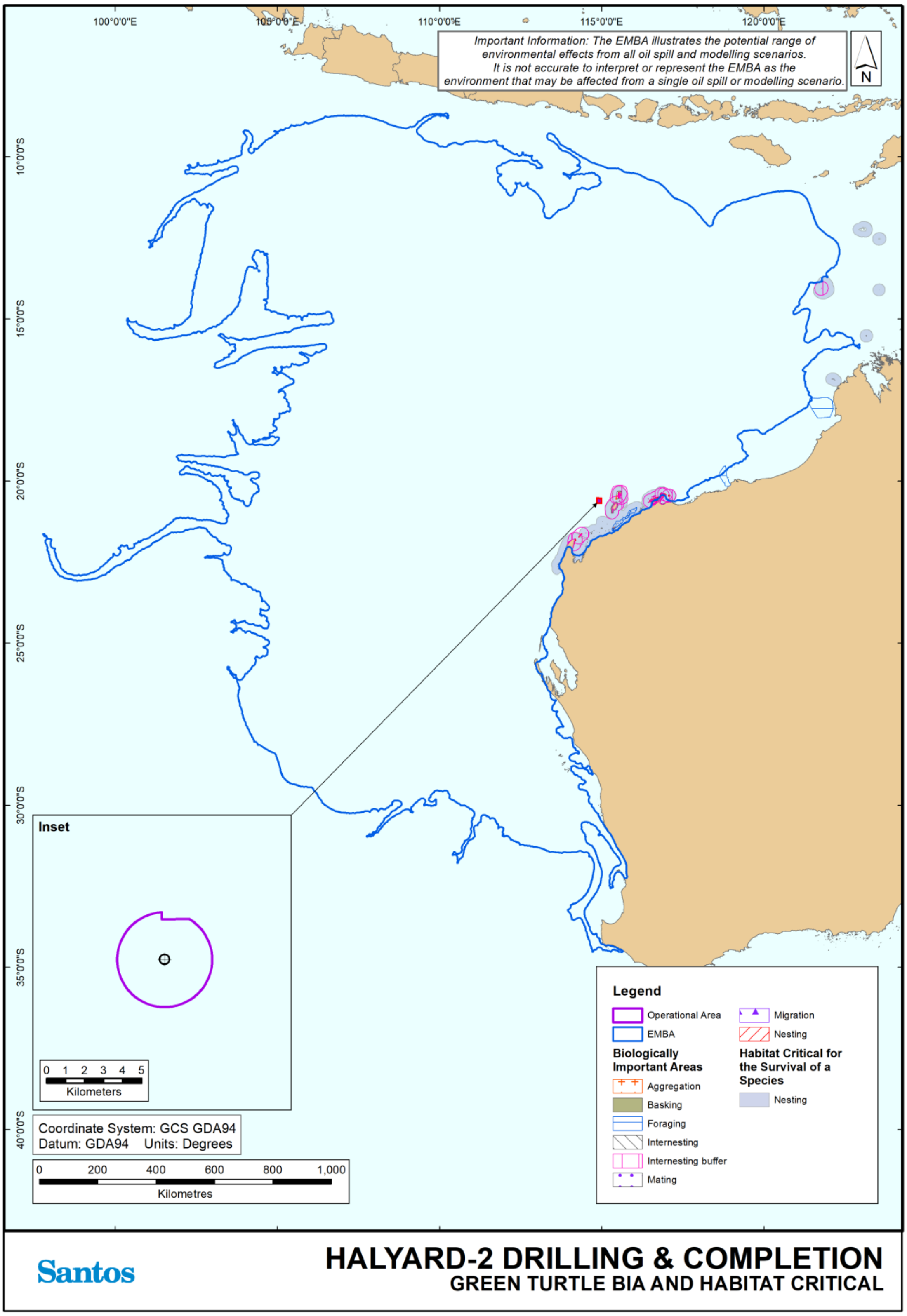


Figure 3.14: Green turtle habitat critical and BIAs in relation to the EMBA and operational area

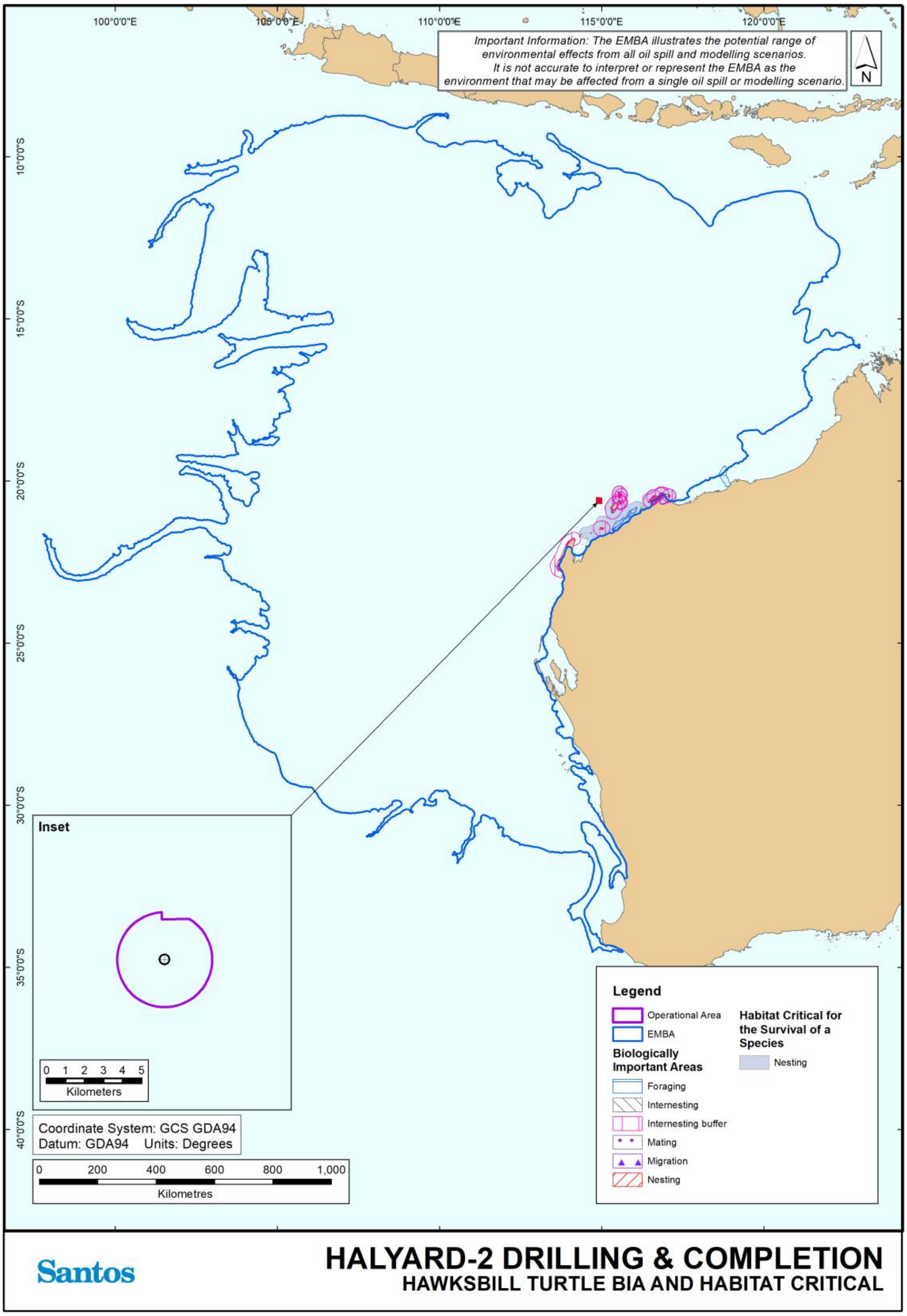


Figure 3.15: Hawksbill turtle habitat critical and BIAs in relation to the EMBA and operational area

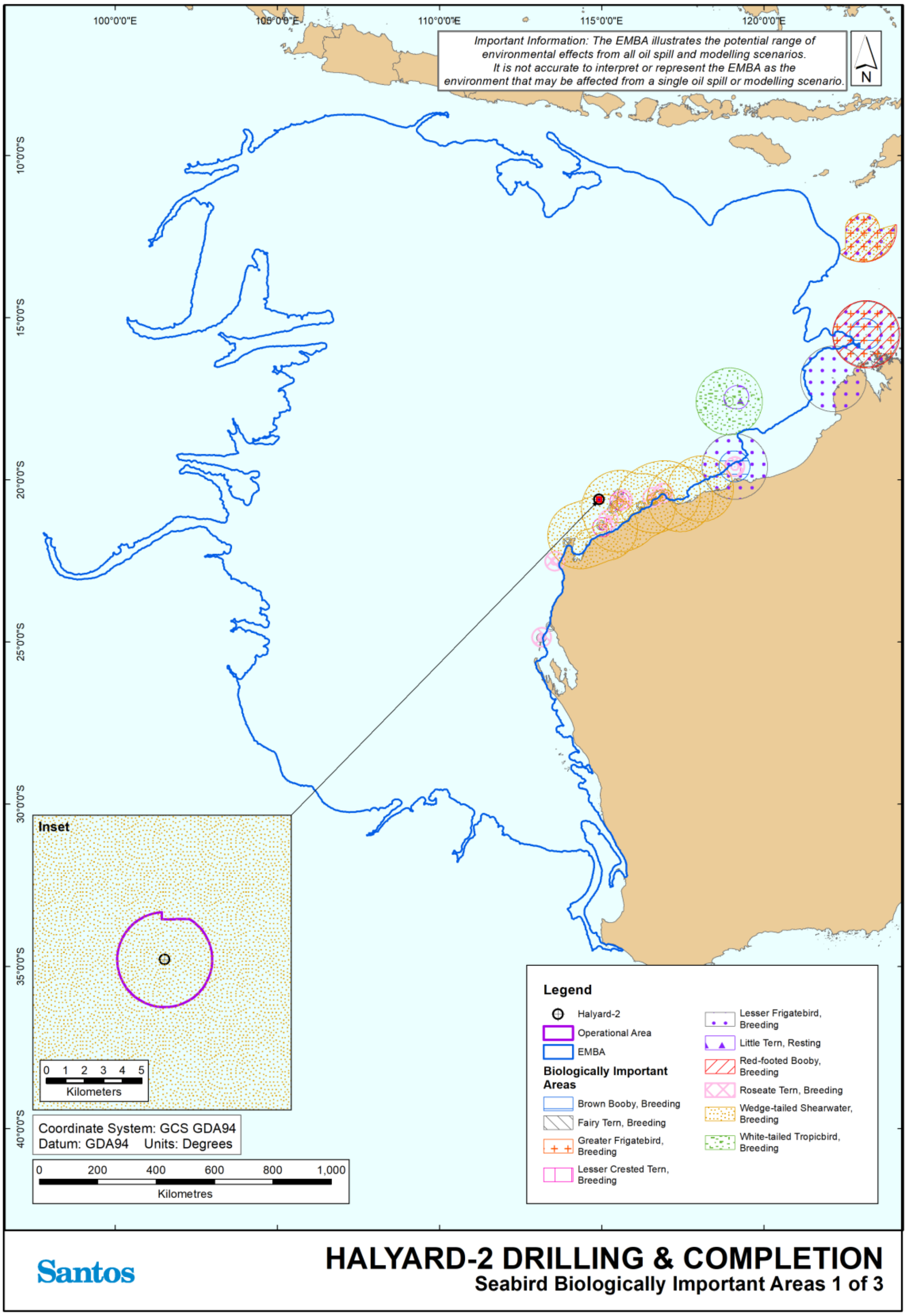


Figure 3.16: Seabird BIAs in relation to the EMBA and operational area (Figure 1 of 3)

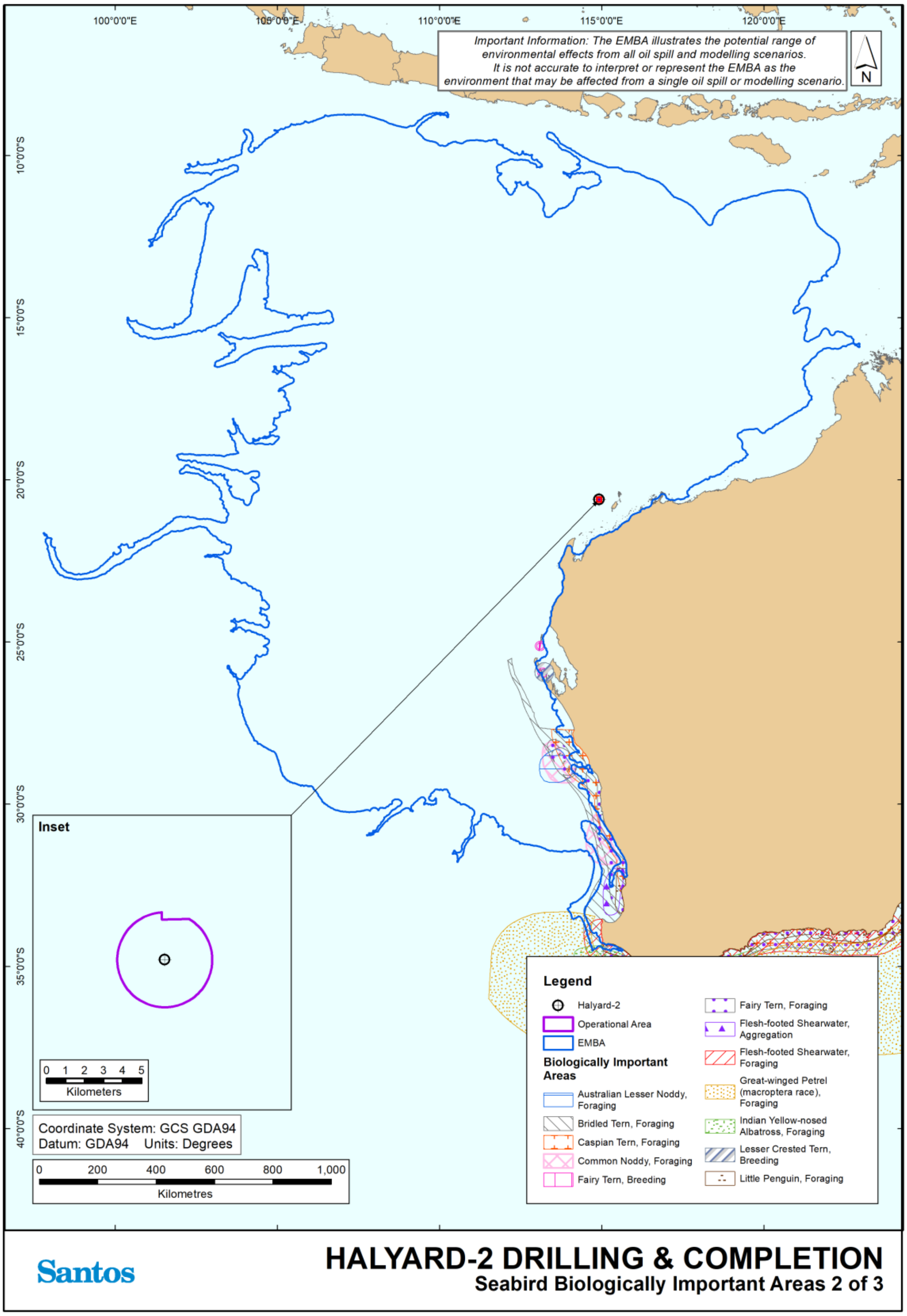
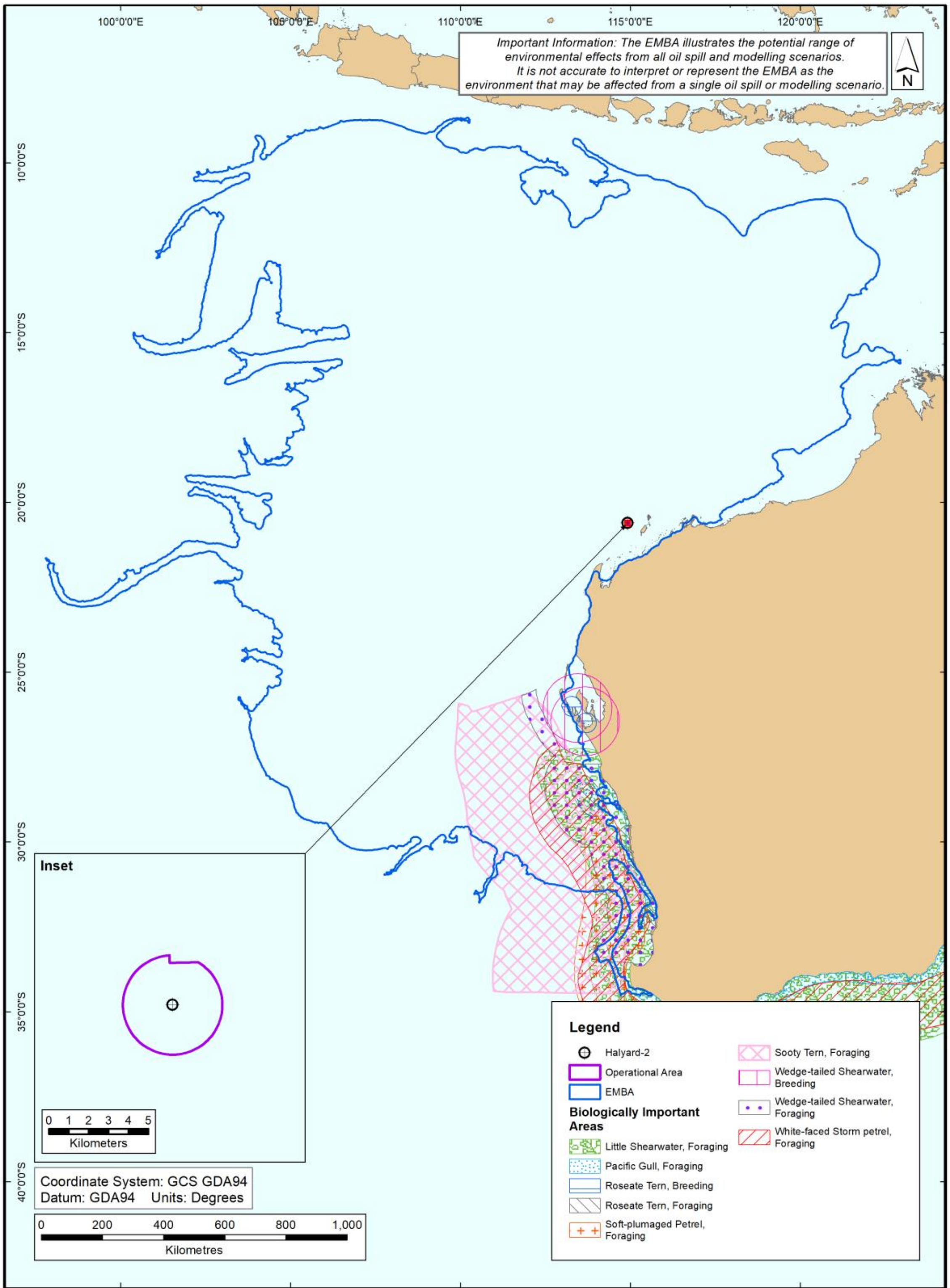


Figure 3.17: Seabird BIAs in relation to the EMBA and operational area (Figure 2 of 3)



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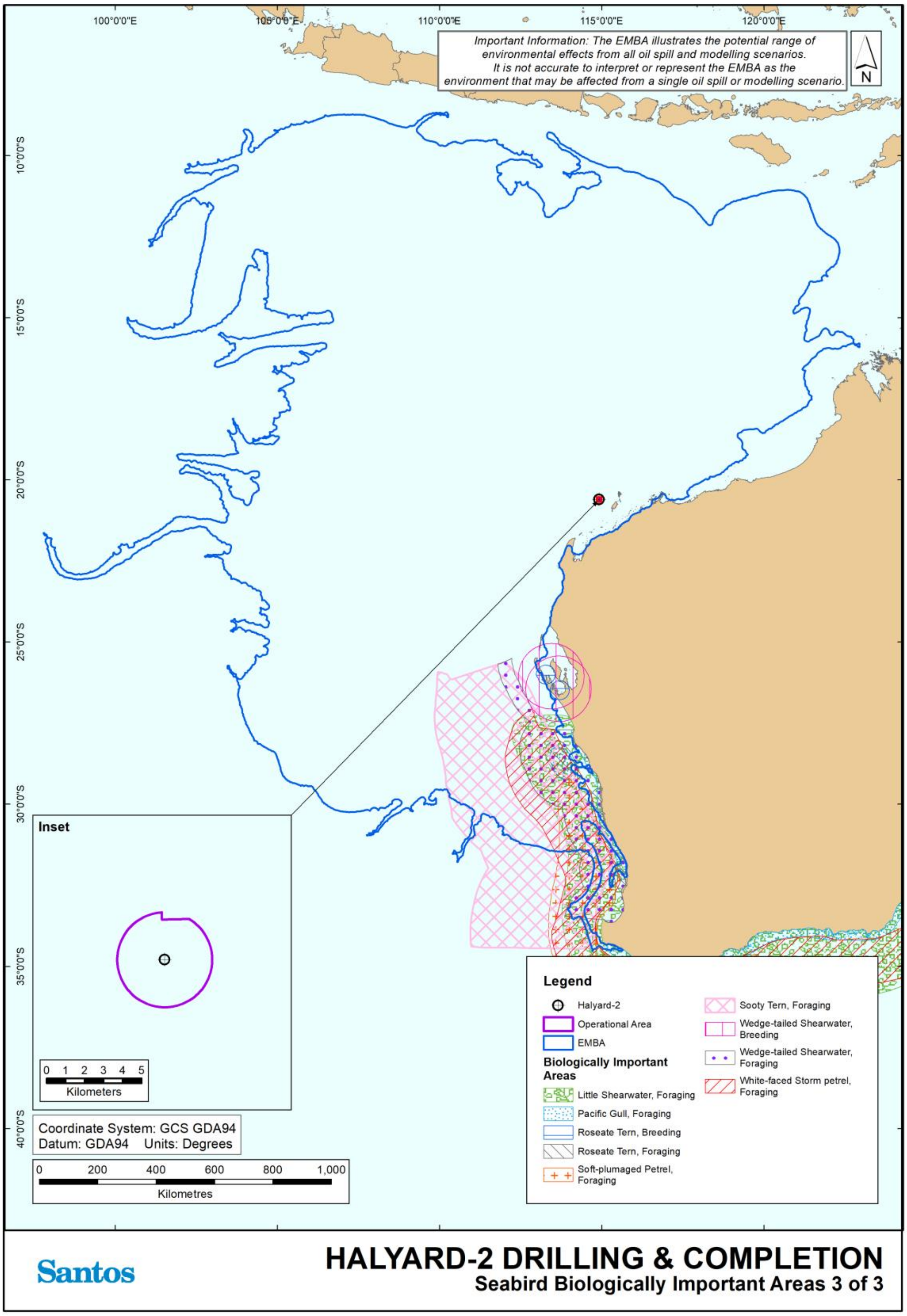

Figure 3.18: Seabird BIAs in relation to the EMBA and operational area (Figure 3 of 3)

3.2.5.2 Recovery plans, conservation advice and species management plans

To support the protection of threatened and migratory species a series of recovery plans, conservation advice and species management plans have been developed by the Commonwealth of Australia. These documents identify threats to the specific species they are associated with and, in some cases, recommend conservation actions that should be undertaken to protect that species.

Table 3-11 summarises the recovery plans, conservation advice and species management plans relevant to the threatened and migratory species that have been identified as potentially occurring within the operational area and EMBA. **Table 3-11** also identifies the actions within these documents that are relevant to the activity.

Table 3-11: Threats and strategies from recovery plans, conservation advice and management plans relevant to the activity

Name	Recovery Plan/Conservation Advice/Management Plan	Threat/Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed (where relevant) in the EP
All Fauna				
All vertebrate fauna	Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (Commonwealth of Australia, 2018a)	Marine debris	No explicit management actions for non-fisheries related industries (note that management actions in the plan relate largely to management of fishing waste (for example 'ghost' gear), and State and Commonwealth management through regulation.	**7.1**
Fish and Sharks				
Dwarf Sawfish, Queensland Sawfish	Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015a)	Habitat degradation and modification	Identify risks to important sawfish and river shark habitat and measures needed to reduce those risks.	**6.4, 7.6, 7.7**
Green Sawfish, Dindagubba, Narrowsnout Sawfish	Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015a) Approved Conservation Advice for Green Sawfish (Threatened Species Scientific Committee, 2008a)	Habitat degradation and modification	Identify risks to important sawfish and river shark habitat and measures needed to reduce those risks	**6.4, 7.6, 7.7**
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish	Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015a)	Habitat degradation and modification	Identify risks to important sawfish and river shark habitat and measures needed to reduce those risks	**6.4, 7.6, 7.7**

Name	Recovery Plan/Conservation Advice/Management Plan	Threat/Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed (where relevant) in the EP
Northern River Shark, New Guinea River Shark	Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015a)	Habitat degradation and modification	Identify risks to important sawfish and river shark habitat and measures needed to reduce those risks.	**6.4, 7.6, 7.7**
	Approved Conservation Advice for *Glyphis garriki* (northern river shark) (Threatened Species Scientific Committee, 2014a).	Habitat degradation and modification		**6.4, 7.6, 7.7**
Great white shark	Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities, 2013a)	Ecosystem effects as a result of habitat modification and climate change	No explicit relevant management actions; habitat modification and climate identified as a threat.	**6.4, 7.6, 7.7**
Grey Nurse Shark (west coast population)	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (Department of the Environment, 2014)	Pollution and disease	Review and assess the potential threat of introduced species, pathogens and pollutants.	**6.4, 7.6, 7.7**
		Ecosystem effects – habitat degradation/modification and climate change	+ Review the level and spatial extent of protection measures at key aggregation sites to ensure appropriate levels of protection, and a consistent approach to the designation and implementation of protective measures, are applied. + Use BIAs to help inform the development of appropriate conservation measures, including through the application of advice in the marine bioregional plans on the	

Name	Recovery Plan/Conservation Advice/Management Plan	Threat/Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed (where relevant) in the EP
			types of actions which are likely to have a significant impact on the species and updating such conservation measures as new information becomes available.	
		Ecosystem effects – climate change	No explicit relevant management actions; climate change identified as a threat.	
Whale Shark	Conservation Advice *Rhincodon typus* Whale Shark (Threatened Species Scientific Committee, 2015a)	Vessel strike, habitat modification	+ Minimise offshore developments and transit time of large vessels in areas close to marine features likely to correlate with Whale Shark aggregations along the northward migration route that follows the northern Western Australian coastline along the 200 m isobath (as set out in the Conservation Values Atlas). + Implement measures to reduce adverse impacts of habitat degradation and/or modification.	**6.4, 7.1, 7.3, 7.6, 7.7**
Marine Mammals				
Blue Whale	Conservation Management Plan for the blue whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999*	Noise Interference, vessel strike, marine debris	Assess and address anthropogenic noise: shipping, industrial and seismic noise.	**6.1, 6.4, 7.3, 7.6, 7.7**

Name	Recovery Plan/Conservation Advice/Management Plan	Threat/Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed (where relevant) in the EP
	2015-2025(Commonwealth of Australia, 2015b)			
	Guidance on key terms within the Blue Whale Conservation Management Plan (Department of Agriculture, Water and the Environment, 2021)	Vessel disturbance	Minimise vessel collisions: + Develop a national vessel strike strategy that investigates the risk of vessel strike on blue whales and also identifies potential mitigation measures. + Ensure all vessel strike incidents are reported in the National Ship Strike Database. Ensure the risk of vessel strikes on blue whales is considered when assessing actions that increase vessel traffic in areas where blue whales occur and, if required, appropriate mitigation measures are implemented.	**7.3**
Australian Sea-lion	Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) (Department of Sustainability, Environment, Water, Population and Communities, 2013b)	Marine debris	No explicit management actions that relate to the activity (related to entanglement in marine fishing debris, e.g. fragments of fishing rope), however small and microplastics may relate to the activity. Refer to release of solid objects management.	**6.1, 6.4, 7.3, 7.6, 7.7**
Southern Right Whale	Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the *Environment Protection and Biodiversity Act 1999* 2011-2021	Noise interference, vessel strike, marine debris	No explicit relevant management actions; entanglement in marine debris identified as a threat.	**6.1, 6.4, 7.3, 7.6, 7.7**

Name	Recovery Plan/Conservation Advice/Management Plan	Threat/Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed (where relevant) in the EP
	(Department of Sustainability, Environment, Water, Population and Communities, 2012)		Assess and address anthropogenic noise: shipping, industrial and seismic noise. Address vessel collisions: Develop a national ship strike strategy that quantifies vessel movements within the distribution ranges of southern right whales and outlines appropriate mitigation measures that reduce impacts from vessel collisions.	
Fin Whale	Conservation Advice for *Balaenoptera physalus* (fin whale) (Threatened Species Scientific Committee, 2015b)	Noise interference, vessel strike, marine debris	Once the spatial and temporal distribution (including biologically important areas) of Fin Whales is further defined, assess the impacts of increasing anthropogenic noise (including seismic surveys, port expansion, and coastal development). Develop a national vessel strike strategy that investigates the risk of vessel strikes on Fin Whales and identifies potential mitigation measures. Ensure all vessel strike incidents are reported in the National Vessel Strike Database. No explicit management measures for marine debris.	**6.1, 6.4, 7.3, 7.6, 7.7**

Name	Recovery Plan/Conservation Advice/Management Plan	Threat/Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed (where relevant) in the EP
Sei Whale	Conservation Advice for *Balaenoptera borealis* (sei whale) (Threatened Species Scientific Committee, 2015c)	Noise interference, vessel strike	Once the spatial and temporal distribution (including biologically important areas) of Sei Whales is further defined, assess the impacts of increasing anthropogenic noise (including seismic surveys, port expansion, and coastal development).	**6.1, 6.4, 7.3, 7.6, 7.7**
Reptiles				
Leaf-scaled Sea Snake	Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake) (Threatened Species Scientific Committee, 2010a)	Habitat degradation and modification	No explicit relevant management actions	**6.1, 6.2, 6.6, 7.6, 7.7**
Short-nosed Sea Snake	Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake). (Threatened Species Scientific Committee, 2010b)	Habitat degradation and modification	Monitor known populations to identify key threats. Ensure there is no anthropogenic disturbance in areas where the species occurs, excluding necessary actions to manage the conservation of the species.	**6.1, 6.2, 6.6, 7.6, 7.7**
All turtles	National Light Pollution Guidelines for Wildlife. Department of Climate Change, Energy, the Environment and Water, Canberra (Commonwealth of Australia, 2023)	Light pollution	Minimise light pollution: + Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats. + Develop and implement best practice light management	**6.2**

Name	Recovery Plan/Conservation Advice/Management Plan	Threat/Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed (where relevant) in the EP
			guidelines for existing and future developments adjacent to marine turtle nesting beaches. Identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution.	
	Recovery Plan for Marine Turtles in Australia 2017 – 2027 (Commonwealth of Australia, 2017)	Marine debris	Reduce impacts from marine debris: + Support the implementation of the EPBC Act Threat Abatement Plan for the impacts of marine debris on vertebrate marine life.	**7.1**
		Vessel disturbance	Vessel interactions identifies as a threat; no specific management actions in relation to vessels prescribed in the plan.	**7.3**
		Light pollution	Minimise light pollution: + Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats. + Develop and implement best practice light management guidelines for existing and future developments adjacent to marine turtle nesting beaches. + Identify the cumulative impact on turtles from multiple sources of	**6.2**

Name	Recovery Plan/Conservation Advice/Management Plan	Threat/Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed (where relevant) in the EP
			onshore and offshore light pollution.	
Seabirds				
All migratory shorebirds	Wildlife Conservation Plan for Migratory Shorebirds (Commonwealth of Australia, 2015c)	Anthropogenic Disturbance	+ Ensure all areas of important habitat for seabirds are considered in the development assessment process. + Manage the effects of anthropogenic disturbance to seabird breeding and roosting areas.	**6.1, 6.2, 6.6, 7.6, 7.7**
All seabirds	Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2020b)	Habitat modification, marine debris	No explicit relevant management actions	**6.6, 7.6, 7.7**
All albatross and petrels	Threat Abatement Plan for the Incidental Catch (or Bycatch) of Seabirds During Oceanic Longline Fishing Operations (Commonwealth of Australia, 2018b)	Direct mortality	No explicit relevant management actions; oil pollution recognised as a threat.	**6.6, 7.6, 7.7**
	National Recovery Plan for Albatrosses and Petrels (Commonwealth of Australia, 2022b)	Marine debris, habitat degradation and modification	No explicit relevant management actions; oil pollution recognised as a threat.	**6.6, 7.6, 7.7**
Abbott's booby	Conservation Advice for Abbott's Booby - *Papasula abbotti* (Threatened Species Scientific Committee, 2020b)	Marine debris	No explicit relevant management actions; oil pollution recognised as a threat.	**7.1**

Name	Recovery Plan/Conservation Advice/Management Plan	Threat/Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed (where relevant) in the EP
Australasian bittern	Conservation Advice *Botaurus poiciloptilus* Australasian Bittern (Threatened Species Scientific Committee, 2019)	Habitat degradation	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
	National Recovery Plan for the Australasian Bittern *Botaurus poiciloptilus* (Commonwealth of Australia, 2022a)	Habitat modification	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
Australian lesser noddy	Conservation Advice *Anous tenuirostris melanops* Australian lesser noddy (Threatened Species Scientific Committee, 2015d)	Habitat degradation and modification	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
Australian painted snipe	Approved Conservation Advice for *Rostratula australis* (Australian Painted Snipe) (Threatened Species Scientific Committee, 2013)	Habitat loss and degradation	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
	National Recovery Plan for the Australian Painted Snipe (*Rostratula australis*) (Commonwealth of Australia, 2022c)	Habitat loss and degradation Habitat degradation	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
Blue petrel	Conservation Advice *Halobaena caerula* Blue Petrel (Threatened Species Scientific Committee, 2015f)	Habitat loss and modification	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
Christmas Island emerald dove, emerald dove	Approved Conservation Advice for *Chalcophaps indica natalis* Christmas Island Emerald Dove (Threatened Species Scientific Committee, 2014b)	Habitat loss	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**

Name	Recovery Plan/Conservation Advice/Management Plan	Threat/Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed (where relevant) in the EP
(Christmas Island)				
Christmas Island frigatebird, Andrew's frigatebird	Conservation Advice for the Christmas Island Frigatebird - *Fregata andrewsi* (Threatened Species Scientific Committee, 2020a)	Habitat loss and degradation, marine debris	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
Christmas Island goshawk	Conservation Advice *Accipiter hiogaster natalis* (Christmas Island Goshawk) (Threatened Species Scientific Committee, 2016a)	Habitat degradation and modification	No explicit relevant management actions that relate to the activity.	**7.6, 7.7**
Christmas Island hawk-owl, Christmas Island boobook	Conservation Advice *Ninox natalis* Christmas Island Hawk-Owl (Threatened Species Scientific Committee, 2016f)	Habitat loss	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
Christmas Island white-tailed tropicbird, golden bosunbird	Conservation Advice *Phaethon lepturus fulvus* white-tailed tropicbird (Christmas Island) (Threatened Species Scientific Committee, 2014c)	Habitat disturbance (feeding)	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
Curlew sandpiper	Conservation Advice *Calidris ferruginea* curlew sandpiper (Threatened Species Scientific Committee, 2015e)	Habitat degradation and modification	No explicit relevant management actions; oil pollution recognised as a threat.	**6.4,7.6, 7.7**
Eastern curlew, far eastern curlew	Conservation Advice *Numenius madagascariensis* Eastern Curlew (Threatened Species Scientific Committee, 2015g)	Habitat loss and degradation	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**

Name	Recovery Plan/Conservation Advice/Management Plan	Threat/Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed (where relevant) in the EP
Fairy tern	Approved Conservation Advice for *Sternula nereis nereis* (Fairy Tern) (Threatened Species Scientific Committee, 2011)	Habitat loss and degradation Habitat degradation	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
	National Recovery Plan for the Australian Fairy Tern *Sternula nereis* (Commonwealth of Australia, 2020c)	Habitat loss and degradation	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
Great knot	Conservation Advice *Calidris tenuirostris* Great Knot (Threatened Species Scientific Committee, 2016b)	Habitat loss and degradation	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
Greater sand plover, large sand plover	Conservation Advice *Charadrius leschenaultia* Greater Sand Plover (Threatened Species Scientific Committee, 2016g)	Habitat loss and degradation	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
Lesser sand plover, Mongolian plover	Conservation Advice *Charadrius mongolus* Lesser Sand Plover (Threatened Species Scientific Committee, 2016d)	Habitat loss and degradation	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
Northern Siberian bar-tailed godwit, Russkoye bar-tailed godwit	Conservation Advice *Limosa lapponica menzbieri* Bar-tailed Godwit (Northern Siberian) (Threatened Species Scientific Committee, 2016e)	Habitat loss and degradation	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
Red goshawk	National Recovery Plan for the Red Goshawk *Erythrotriorchis radiatus* (Department of Environment and Resource Management, 2012)	Habitat loss and degradation	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**

Name	Recovery Plan/Conservation Advice/Management Plan	Threat/Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed (where relevant) in the EP
	Conservation Advice *Erythrotriorchis radiatus* (Red Goshawk) (Threatened Species Scientific Committee, 2023)	Habitat loss and degradation	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
White-winged fairy-wren (Barrow Island), Barrow Island black-and-white fairy-wren	Approved Conservation Advice for *Malurus leucopterus edouardi* (White-winged Fairy-wren (Barrow Island)) (Threatened Species Scientific Committee, 2008b)	Habitat degradation or modification	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**
White-winged fairy-wren (Dirk Hartog Island), Dirk Hartog black-and-white fairy-wren	Approved Conservation Advice for *Malurus leucopterus* (White-winged Fairy-wren (Dirk Hartog Island)) (Threatened Species Scientific Committee, 2008c)	Habitat loss, degradation and modification	No explicit relevant management actions; oil pollution recognised as a threat.	**7.6, 7.7**

3.2.6 Socio-economic Environment

3.2.6.1 Cultural Heritage

Introduction

Santos acknowledges that the tradition of the First Nations people of Australia includes a cultural and spiritual connection to their land and waters. These connections are rooted in 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.

The cultural heritage of First Nations peoples includes a vast array of tangible and intangible 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 heritage to Australia is evidenced and given force by a range of factors, including laws, regulations and institutions that are designed to protect First Nations rights and interests in relation to sacred sites and other aspects of First Nations cultural heritage.

Country is an important concept to First Nations people and the term is often used to describe family origins and associations with particular parts of Australia, both land and sea (Smyth, 2007). The expressions ‘country’ and ‘sea country’ are used to refer to the land and waters which constitute Aboriginal traditional areas as ancestrally distinct and linguistically bounded geographic areas (Kearney et al, 2023 p106).

Country is inclusive of many environments that are ecologically, geographically, ancestrally and socially configured (Kearney et al 2023). For First Nations people, Country is a combination of the land, sea, rivers and islands and all that they contain and sustain. “Country refers to more than just a geographical area: it is shorthand for all the values, places, resources, stories and cultural obligations associated with that geographical area.” (Smyth, 2007).

First Nations people in northwest WA continue to rely on coastal and marine environments and resources of the region for their cultural identity, health and wellbeing, and their domestic and commercial economies (Smyth, 2007).

Sea country

The Australian Marine Parks North-west Marine Parks Network Management Plan 2018 defines sea country as “the areas of the sea that Aboriginal and Torres Strait Islander groups are particularly affiliated with through their traditional lore and customs”. Sea country is valued for Aboriginal cultural identity, health and wellbeing. Aboriginal people of north-western Australia have been sustainably using and managing their sea country for tens of thousands of years, in some cases since before rising sea levels created these marine environments (Director of National Parks, 2018).

A common feature of coastal Aboriginal cultures is the connectedness of land and sea: together they form a country of significant cultural sites and dreaming tracks of the creation ancestors (NOO, 2002). As a result, coastal environments are an integrated cultural landscape/seascape that is conceptually different from the broader Australian view of land and sea (NOO, 2002).

Animals can be totems for Aboriginal people. Aboriginal people share the land and water with animals and their relationship with totem animals is fundamental to continued practice and cultural responsibility; for food, health, shelter, cultural expression and spiritual wellbeing (VAHC, 2021). Caring for plants, animals and their habitats is therefore seen as a key way of expressing culture (VAHC, 2021).

Aboriginal people use and actively manage the coastal and marine environments as a resource and to maintain cultural identity, health and wellbeing. Fishing, hunting and the maintenance of culture and heritage through ritual, stories and traditional knowledge continue as important uses of nearshore and adjacent areas.

Sea country is described in both State, Territory and Commonwealth Marine Park Management Plans. The Australian Marine Park Management Plans include the objective to provide for the protection and conservation of biodiversity and other natural, cultural and heritage values of marine parks. The plans define cultural values as "living and cultural heritage recognising Indigenous beliefs, practices and obligations for country, places of cultural significance and cultural heritage sites" (Director of National Parks, 2018). Australian Marine Park Management Plans list the Aboriginal people who have responsibilities for sea country in the Marine Parks, and the Native Title Representative Body for the region.

The PMST Report determined the EMBA for this EP overlaps with features of the North and Northwest Marine Park networks and management plans in respect of these networks identify natural, cultural and spiritual features.

The EMBA of this EP overlap the Northwest Marine Park and the following information is considered correct at the time of writing, from the North-west Marine Parks Network Management Plan 2018 (Director of National Parks, 2018).

+ The Gnulli and Malgana people have responsibilities for sea country in the Shark Bay Marine Park.
  - The Yamatji Marlpa Aboriginal Corporation is the Native Title Representative Body for the Yamatji region.
+ The Gnulli people have responsibilities for sea country in the Shark Bay and Gascoyne Marine Park.
  - The Yamatji Marlpa Aboriginal Corporation is the Native Title Representative Body for the Yamatji region.
+ There is limited information about the cultural significance of the Montebello Marine Park.
  - The Yamatji Marlpa Aboriginal Corporation is the Native Title Representative Body for the Pilbara region.
+ The Ngarluma, Yindjibarndi, Yaburara, and Mardudhunera people have responsibilities for sea country in the Dampier Marine Park.
  - The native title holders for these people are represented by Wirrawandi Aboriginal Corporation, Ngarluma Aboriginal Corporation and Yindjibarndi Aboriginal Corporation. These Prescribed Body Corporates represent traditional owners with native title over coastal area adjacent to the Marine Park are the points of contact for their respective areas of responsibility for sea country in the Marine Park.
  - The Yamatji Marlpa Aboriginal Corporation is the Native Title Representative Body for the Pilbara and Yamatji regions.

- The Nyangumarta, Karajarri and Ngarla people have cultural values attached to the following fauna:
  - saltwater fish;
  - turtles;
  - dugong;
  - crabs;
  - oysters.

The Ngarla people are represented by Wanparta Aboriginal Corporation. This Corporation notes on its web site that the Ngarla People are the traditional owners who speak for the 80 Mile Beach Marine Park. The Halyard-2 EMBA extends into the very western part of the Commonwealth Marine Park. The Wanparta Aboriginal Corporation web site also states that the adjacent eastern portion of the 80 Mile Beach Marine Park extends into the traditional lands of the Karajarri and Nyangumarta People. The Halyard-2 EMBA does not extend over the Karajarri and Nyangumarta Native Title determined areas.

Relevant people/groups have been consulted via representative Prescribed Body Corporates, as outlined in **Section 4**.

<u>Indigenous Land use Agreements</u>

An 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. The Register of ILUAs is kept by the Native Title Registrar in accordance with s199A of the NTA and includes a description of the ILUA area, the parties' names, the term of the ILUA and other information as the Registrar considers is appropriate (s199B of the NTA).

Registration confers a contractual effect on the ILUA and binds all persons holding native title regardless as to whether they are already parties to the ILUA (s24EA of the NTA).

A search of the Native Title Register found the following:

- There are no Native Title or Indigenous Land Use Agreements (ILUAs) within the operational area; and
- Eight Native Title and eleven certified ILUAs overlap the EMBA.

Native Title:

- Kariyarra People;
- Ngarluma / Yindjibarndi;
- Yaburara and Marduhunera People;

+ Thalanyji;
+ Gnulli, Gnulli #2 and Gnulli #3 - Yinggarda, Baiyungu and Thalanyji People;
+ Malgana Part A;
+ Yamatji Nation; and
+ South West Settlement.

ILUAs:

+ FMG – Kariyarra Land Access ILUA;
+ Anketell Port, Infrastruture Corridor and Industrial Estates Agreement;
+ RTIO Ngarluma Indigenous Land Use Agreement (Body Corporate Agreement);
+ Kuruma Marthudunera and Yaburara and Coastal Mardudhunera Indigenous Land Use Agreement;
+ Macedon ILUA;
+ Ningaloo Conservation Estate ILUA Yamatji Nation Agreement;
+ Yued Indigenous Land Use Agreement;
+ Whadjuk People Indigenous Land Use Agreement;
+ Gnaala Karla Booja Indigenous Land Use Agreement; and
+ South West Boojarah #2 Indigenous Land Use Agreement.

Indigenous Protected Areas

Indigenous Protected Areas (IPAs) are areas of land and sea Country managed by First Nations groups in accordance with Traditional Owners' objectives. IPAs deliver biodiversity conservation outcomes for the benefit of all Australians, through voluntary agreements with the Australian Government.

The IPA Program has been supporting First Nations communities to voluntarily dedicate and manage their land as protected areas since 1997. In addition to environmental resilience and cultural heritage protection, IPA program participants report benefits of empowerment, cultural connection and wellbeing, as well as broader socio-economic benefits for local communities.

Some areas of IPA land are recognised as part of the National Reserve System, for protection of the nation's biodiversity and cultural heritage.

Most IPAs are dedicated under International Union for Conservation of Nature (IUCN) Categories 5 and 6, which promote a balance between conservation and other sustainable uses to deliver social, cultural and economic benefits for local Indigenous communities.

IPAs provide a framework for First Nations communities to combine traditional and contemporary knowledge to collaboratively manage their land and sea Country, leverage partnerships with conservation and commercial organisations and provide employment, education and training opportunities for First Nations people..

A search of the Native Title Register identified there are no IPAs within the operational area or EMBA.

Aboriginal Cultural Heritage Inquiry System

The Aboriginal Cultural Heritage Inquiry System (ACHIS) provides information about Aboriginal cultural heritage (ACH) in Western Australia. The ACHIS provides information about Aboriginal sites (as defined under the *Aboriginal Heritage Act 1972 (WA)*) in Western Australia. To identify Aboriginal sites that may be affected by the activities, a search of the ACHIS was completed. To overcome data processing limitations of the ACHIS web app, the EMBA was split into six polygons, to generate a series of smaller queries and reports. The results of this search are appended at **Appendix E**.

Figure 3.19 demonstrates the EMBA as six polygons that were used to generate the series of ACHIS search reports. The search of the Aboriginal Heritage Inquiry System identified:

- no registered Aboriginal sites within the operational area.
- 466 registered Aboriginal sites are within the EMBA. Based on the figures provided with the search output, all of these are at least 45km from the Operational Area and most appear to be located on islands or on the mainland. None of these Aboriginal sites will be disturbed by planned activities. In the unlikely event of a hydrocarbon release, which is assessed as low risk, (Refer Section7.6.7), it is not anticipated that shoreline impact to cultural features would arise.

Santos has consulted with First Nations groups within the EMBA and no feedback or concerns regarding impacts to Aboriginal sites within the Operational Area or EMBA were raised.

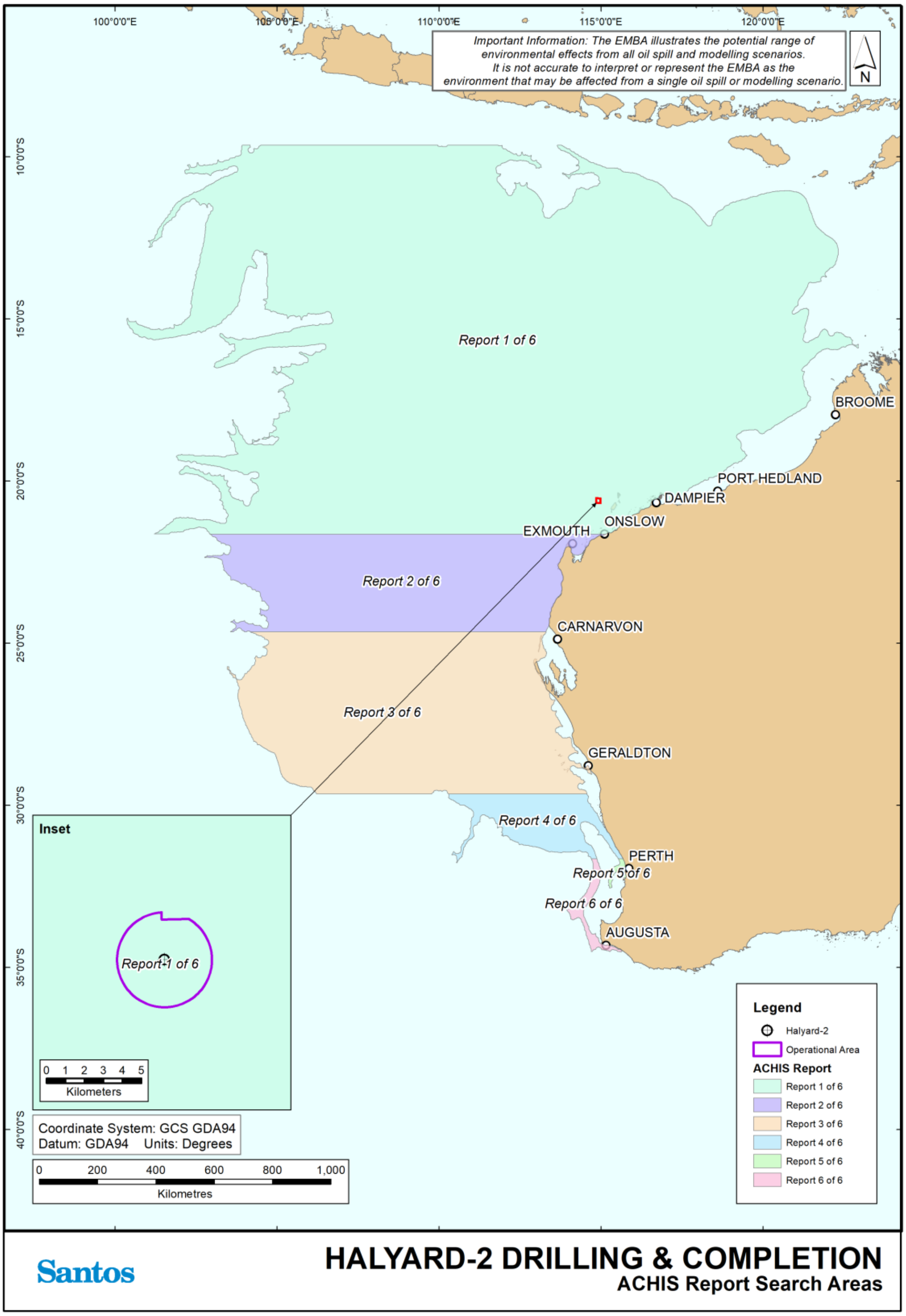

Figure 3.19: Halyard-2 Drilling & Completions EMBA Aboriginal Cultural Heritage Inquiry System (ACHIS) Report Search Areas

3.2.6.2 Underwater Heritage

On 24 August 2018 the Australian Parliament passed the *Underwater Cultural Heritage Act 2018* (UCH Act). The UCH Act came into effect on 1 July 2019, replacing the *Historic Shipwrecks Act 1976* (Historic Shipwrecks Act).

The UCH Act continues the protection of Australia's shipwrecks, and has broadened protection to sunken aircraft and other types of underwater cultural heritage including Australia's Aboriginal and Torres Strait Islander Underwater Cultural Heritage in Commonwealth waters.

No known sites of underwater heritage have been identified within the operational area. The closest known site to the operational area is the Perentie shipwreck which was wrecked in 1976 on Barrow Island.

3.2.6.3 Commercial fisheries

Offshore and coastal waters in the North West Marine Region support a valuable and diverse commercial fishing industry. The major fisheries in the Pilbara region target tropical finfish, large pelagic fish, crustaceans (prawns and scampi) and pearl oysters (Patterson et al., 2019).

These NWS region fisheries are managed by either the Department of Primary Industries and Regional Development (DPIRD) (State fisheries) with specific management plans, regulations and a variety of subsidiary regulatory instruments under the *Fish Resources Management Act 1994*; or by Australian Fisheries Management Authority (AFMA) that manages Commonwealth fisheries (within the 200 nautical mile Australian Fishing Zone).

Commonwealth and State fishery management areas overlapping with the operational area and the EMBA are illustrated in **Figure 3.20** to **Figure 3.24**. **Table 3-12** describes each of these fisheries.

Table 3-12: Commonwealth and State Managed Fisheries permitted within the operational area and EMBA

Fishery	Description[1]	Fishery License Area overlap		Fishing activity reported within the operational area
		Operational area	EMBA	
Commonwealth Managed Fisheries				
Western Tuna and Billfish Fishery	Extends west from Cape York Peninsula (Queensland) to 34° S off the Western Australian coast. The fishery also extends east across the Great Australian Bight to 141° E. Fishing effort concentrated off south-west Western Australia (WA). Since 2005, there has been fewer than five vessels active in the Western Tuna and Billfish Fishery each year, which has reportedly declined from 50 active vessels in 2000. Fishing activity in the Western Tuna and Billfish Fishery concentrates in waters off southwest Western Australia, and off South Australia.	✓	✓	No active commercial fishing in or near the operational area in the past 5 years
Southern Bluefin Tuna Fishery	Consists of all Australian waters to 200 nm from the coast. Fishing activity concentrated off South east Australia and in the Great Australian Bight.	✓	✓	No active commercial fishing effort reported in WA, as fishing efforts are concentrated off South Australia.
Western Skipjack Tuna Fishery	Separated into two sectors (east and west). Fishery is located in all Australian waters west of 142° 30’ 00ºE, out to 200 nm from the coast.	✓	✓	There has been no effort in the fishery since the 2008-09 fishing season.
North West Slope Trawl Fishery	Fishery extends from 114° E to approximately 125° E off the WA coast between the 200 m isobath and the outer limit of the Australian	✓	✓	No active commercial fishing in or near the operational area in the past 5 years

Fishery	Description[1]	Fishery License Area overlap		Fishing activity reported within the operational area
		Operational area	EMBA	
	Fishing Zone (AFZ). Demersal crustacean trawl occurs seaward of the 200m isobath.			
Western Deepwater Trawl Fishery	Extends in the north from the boundary of the AFZ to 114° E, to the southern boundary of the AFZ to 115°08’ E. Fishing occurs from the 200 m isobath to the edge of the AFZ.	✗	✓	No active commercial fishing in or near the operational area in the past 5 years
Small Pelagic Fishery	Extends from Queensland to southern WA (near Lancelin) operating mostly with mid-water trawl and purse seine gear. The major landing ports are both in New South Whales and the fishing season lasts for 12 months.	✗	✓	No active commercial fishing in or near the operational area in the past 5 years
Southern Tuna and Billfish Fishery	Included within the Western Tuna and Billfish Fishery	✗	✓	No active commercial fishing in or near the operational area in the past 5 years
State Managed Fisheries				
Exmouth Gulf Prawn Managed Fishery	This fishery operates in sheltered waters on the western half of the Exmouth Gulf. The Muiron Islands and Point Murat provide western boundary; Serrurier Island provides northern limit.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Nickol Bay Prawn Managed Fishery	Operates along the western part of the North-West Shelf in coastal shallow waters. The boundaries of the NBPMF are ‘all the waters of the Indian Ocean and Nickol Bay between	State Managed Fisheries		FishCube data shows no active fishing in the operational area in the past 5 years.

Fishery	Description[1]	Fishery License Area overlap		Fishing activity reported within the operational area
		Operational area	EMBA	
	116°45' east longitude and 120° east longitude on the landward side of the 200 m isobath' The fishery incorporates the Nickol Bay, Extended Nickol Bay, Depuch and De Gray size managed fish grounds.			
Onslow Prawn Limited Entry Fishery	The boundaries of this fishery are 'all the WA waters between the Exmouth Prawn Fishery and the Nickol Bay Prawn Fishery east of 114°39.9' on the landward side of the 200 m depth isobath'. Prawn trawling activities focus on inshore areas between Onslow and Karratha.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Pearl Oyster Fishery	The Pearl Oyster Fishery licence area extends from 114°10' E near Exmouth to the WA/Northern Territory border, and out to the edge of the Australian Fishing Zone (200 nautical miles). The Pearl Oyster Fishery operates in shallow coastal waters.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Pilbara Demersal Scalefish Fisheries (includes trap and trawl fisheries)	Comprised of the Pilbara Fish Trawl (Interim) Managed Fishery occupying the waters north of latitude 21°35'S and between longitudes 114°9'36"E and 120°E. Seaward of the 50 m isobath and landward of the 200 m isobath, consists of two zones. Includes the Pilbara Trap Managed Fishery, permitted to operate between 21°56´ S latitude and the high water mark on the western side of the North West Cape.	✓	✓	The operational area intersects trap and trawl fisheries. The operational area overlaps the closed zone (Zone 1) of the Pilbara Fish Trawl Interim Managed Fishery, however, this area is open to trap fishing. FishCube data shows that less than three vessels have operated in the operational area each year since 2015.

Fishery	Description[1]	Fishery License Area overlap		Fishing activity reported within the operational area
		Operational area	EMBA	
Pilbara Line Fishery	The fishery lies north of latitude 21°44´ S and between longitudes 114°9´36´´ E and 120° E on the landward side of a boundary approximating the 200 m isobath and seaward of a line following the 30 m isobath.	✗	✓	FishCube data shows that up to 4 vessels have been present in the operational area each year since 2015.
Pilbara Developmental Crab Managed Fishery	Concentrated in coastal embayment's and estuaries between Geographe Bay and Nickol Bay. Fishing in the Pilbara coast primarily occurs from Onslow to Port Hedland in inshore waters.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Mackerel Managed Fishery	Trolling or handline. Near-surface trolling gear from vessels in coastal areas around reefs, shoals and headlands.	✓	✓	FishCube data shows that less than three vessels were operating in the operational area in 2016, and no other activity has been recorded since then.
West Coast Rock Lobster Managed Fishery	This fishery targets the western rock lobster between Shark Bay and Cape Leeuwin. Baited traps (pots) and with a commercial and recreational fishing season.	✓	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
West Coast Demersal Scalefish (Interim) Managed Fishery	Handline and dropline fishery. The fishery operates from south of Shark Bay (26°30' S) to east of Augusta (115°30'E) extending seaward to the 200nm boundary of the Australian Fishing Zone. Divided into five management areas (four inshore and one offshore area).	✓	✓	FishCube data shows no active fishing in the operational area in the past 5 years.

Fishery	Description[1]	Fishery License Area overlap		Fishing activity reported within the operational area
		Operational area	EMBA	
West Australian Sea Cucumber Fishery	Fishing occurs in the northern half of the State from Exmouth Gulf to the Northern Territory border.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Shark Bay Scallop and Prawn Managed Fishery	The boundaries of the fishery are in and near the waters of Shark Bay. Low operating otter trawls.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Shark Bay Crab Interim Managed Fishery	The fishery operates in Shark Bay waters north of Cape Inscription to Bernier and Dorre Islands and Quobba Point. Trawl and trap methods used. Two local fishers are permitted to fish in the waters south of Cape Inscription.	✓	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Gascoyne Demersal Scalefish Managed Fishery	The fishery operates between latitudes 23°07’30”S and 26°30’S in the waters of the Indian Ocean and Shark Bay. Vessels not permitted to fish in inner Shark Bay. Merchandised handlines.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Abrolhos Islands and Mid West Trawl Limited Entry Fishery	This fishery operates between 27°51´ south latitude and 29°03´ south latitude on the landward side of the 200 m isobath’. Low opening and otter trawl systems targeting saucer scallops and western king prawn.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.

Fishery	Description[1]	Fishery License Area overlap		Fishing activity reported within the operational area
		Operational area	EMBA	
Broome Prawn Managed Fishery	This fishery operates within a designated trawl zone near Broome. Boundaries are all Western Australian waters of the Indian Ocean east of 120°E and west of 123°45'E on the landward side of the 200 m isobath.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Cockburn Sound Crab, Mussel Fish Net and Line and Pot Managed Fishery	Encompasses the inner waters of Cockburn Sound, from South Mole at Fremantle to Stragglers Rocks, through Mewstone to Carnac Island and Garden Island, along the eastern shore of Garden Island and back to John Point on the mainland.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Kimberley Developing Mud Crab Managed Fishery	This fishery operates between Broome and Cambridge Gulf. Commercial operators permitted to fish from King Sound to the Northern Territory border. Includes closed areas around communities and fishing camps. Two Aboriginal Corporations are permitted to fish in select areas. Fishing is prohibited in Roebuck Bay and in an area within King Sound.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Northern Demersal Scalefish Managed Fishery	This fishery operates off the northwest coast of Western Australia in the waters east of 120° E longitude. These waters extend out to the edge of the Australian Fishing Zone (200 nautical miles). Consists of three zones; Zone A (inshore area), Zone B (most active fishing area) and Zone C	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.

Fishery	Description[1]	Fishery License Area overlap		Fishing activity reported within the operational area
		Operational area	EMBA	
	(offshore deep slope developmental area). Further divided into two sections consisting of an offshore and inshore sector.			
Shark Bay Beach Seine and Mesh Net Fishery	Has been operating since the 1960s and provides a significant proportion of the snapper and whiting catch for the state. In 2020 eight vessels operated within this fishery using beach seine and mesh net gear.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
South Coast Crustacean Managed Fishery	Comprises four pot based fisheries operating in the south west of WA. In 2019/2020 catch data indicates that 52.5 tonne was landed.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
South Coast Line and Fish Trap Managed Fishery	Management plan for this fishery has been operational since June 2021 and covers all WA waters off the southern coast between 115° 30' east longitude and 129° 00' east longitude but excluding all waters of the south coast estuarine managed fishery (Schedule 1, South Coast Line and Fish Trap Managed Fishery Management Plan 2020). No recent catch data was available at the time of writing this EP.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
South Coast Nearshore Net Fishery	This is a beach based fishery using beach seines, haul nets and gill nets, predominantly targeting herring (WAFIC, n.d.). This fishery was operational in 2020 and reported a total catch of 334 t.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.

Fishery	Description[1]	Fishery License Area overlap		Fishing activity reported within the operational area
		Operational area	EMBA	
South Coast Purse Seine Fishery	This fishery predominantly operates in the waters between cape Leeuwin and the WA/South Australia border using purse seine nets. The target species is pilchards and reported a total catch of 1,498 t in the 2019/2020 reporting year.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
South West Trawl Fishery	Predominantly targets scallops around Fremantle and Geographe Bay. Although the fishery comprises a large area, fishing efforts are concentrated in areas of high scallop abundance.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
South West Coast Salmon Managed Fishery	Operates from 18 designated beaches south of the Perth metropolitan areas using seine nets to target Australian salmon. It forms part of the West Coast Nearshore and Estuarine Finfish Resource which reported a total catch in 2019/2020 of 246.8 t.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Southern Demersal Gillnet and Demersal Longline Managed Fishery and West Coast Demersal Gillnet and Demersal	Operates in continental shelf waters using demersal gillnets and power-hauled reels, predominantly targeting sharks and scalefish. It also forms part of the Temperate Demersal Gillnet and Demersal Longline Fisheries which reported a total catch in 2019/2020 of 774 t of sharks and rays and 117 t of scalefish.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.

Fishery	Description[1]	Fishery License Area overlap		Fishing activity reported within the operational area
		Operational area	EMBA	
Longline Interim Managed Fishery				
West Coast (Beach Bait Fish Net) Fishery	One of the 10 fisheries encompassing the West Coast Nearshore and Estuarine Finfish Resource which had a combined reported catch of 246.8 t in 2019/2020. The West Coast (Beach Bait Fish Net) Fishery operates on various beaches along the WA coast between Moore River and Tim's Thicket.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
West Coast Purse Seine Fishery	Primarily targets pilchards and tropical sardine in the west coast bioregion, using purse seine (WAFIC, n.d.). It reported a total catch of 504 t in 2020/2021 (Newman et al, 2023).	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Roe's Abalone Fishery	This fishery operates in shallow coastal waters between Shark Bay and the South Australia border. Divided into 8 management areas.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
State Managed Fisheries (whole of the state)				
Marine Aquarium Fish Managed Fishery	Operates in Western Australian state waters. Restricted by diving depths. Commercial operators are permitted to take over 250 species of finfish as well as coral, live rock, algae, seagrass and invertebrates.	✓	✓	FishCube data shows no active fishing in the operational area in the past 5 years.

Fishery	Description[1]	Fishery License Area overlap		Fishing activity reported within the operational area
		Operational area	EMBA	
Specimen Shell Managed Fishery	Dive based fishery, operates all year through Western Australian waters between the high water mark and the 200m isobath'. Hand harvest method used, an exemption method being employed is using a remote controlled underwater vehicle between depths of 60-300 m.	✓	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
West Coast Deep Sea Crustacean Managed Fishery	This fishery operates north of latitude 34° 24' S (Cape Leeuwin) and west of the Northern Territory border on the seaward side of the 150 m isobath out to the extent of the AFZ, mostly in 500 to 800 m of water. Baited pots operate in a longline formation in the shelf edge waters (>150 m).	✓	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Abalone Managed Fishery	Shallow coastal waters off the coast of Western Australia. Divided into eight management areas, commercial fishing for greenlip/brownlip abalone is managed in three sectors.	✓	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
South-West Coast Salmon Fishery	There are currently six licences. Licensees are not restricted to specific beaches but in practice only a few beaches are fished. In 2018 there were three active vessels in this fishery.	✓	✓	FishCube data shows no active fishing in the operational area in the past 5 years.
Octopus Interim Managed Fishery	Fishery in development phase, four main categories in Western Australian waters. Catch primarily occurs within boundaries of the fishery between 26°30'S and Esperance.	✗	✓	FishCube data shows no active fishing in the operational area in the past 5 years.

Fishery	Description[1]	Fishery License Area overlap		Fishing activity reported within the operational area
		Operational area	EMBA	
1. All descriptions based on Newman et al. (2023) and Patterson et al. (2022) unless otherwise cited				

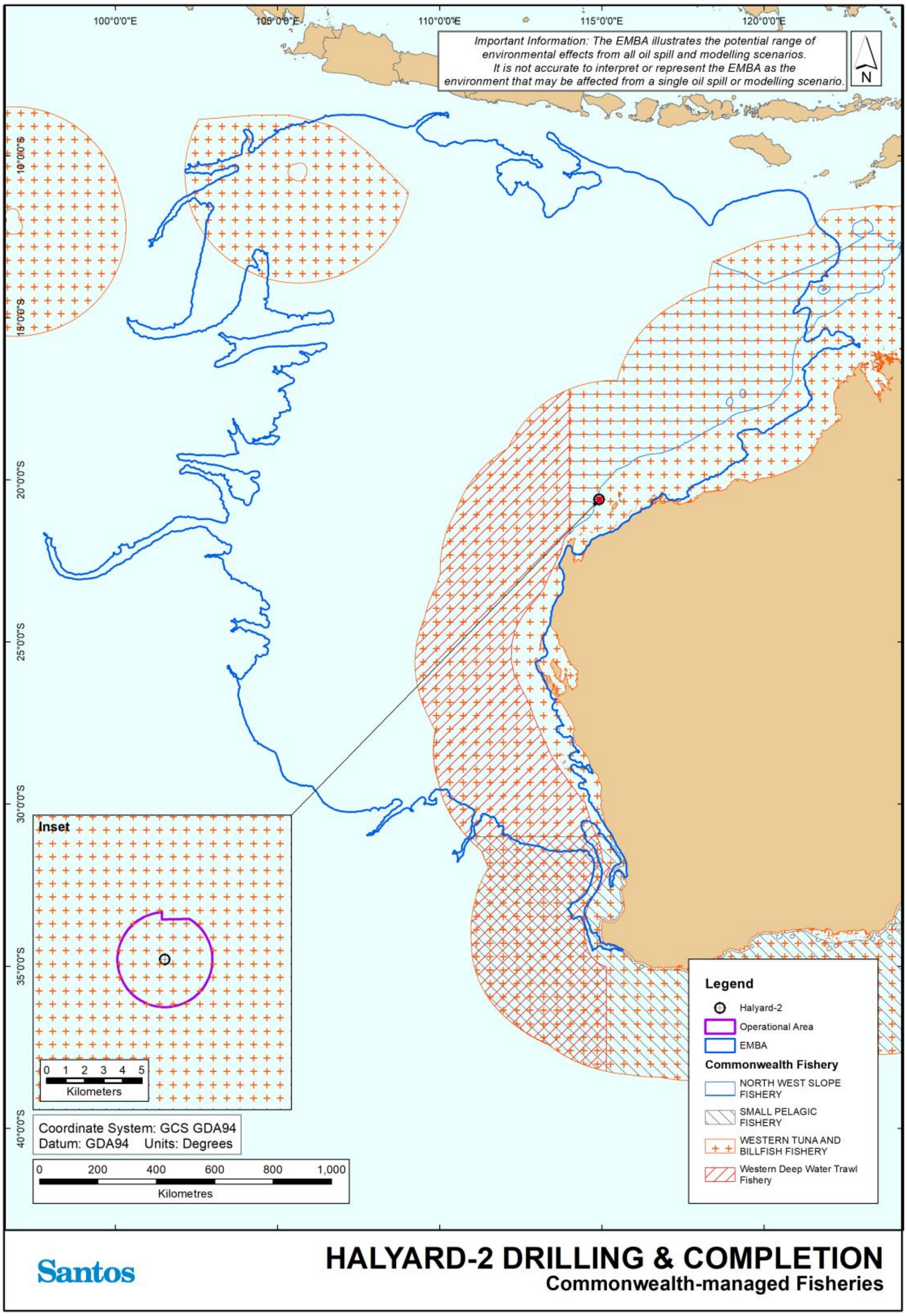

Figure 3.20: Commonwealth-managed fisheries in relation to the EMBA and operational area

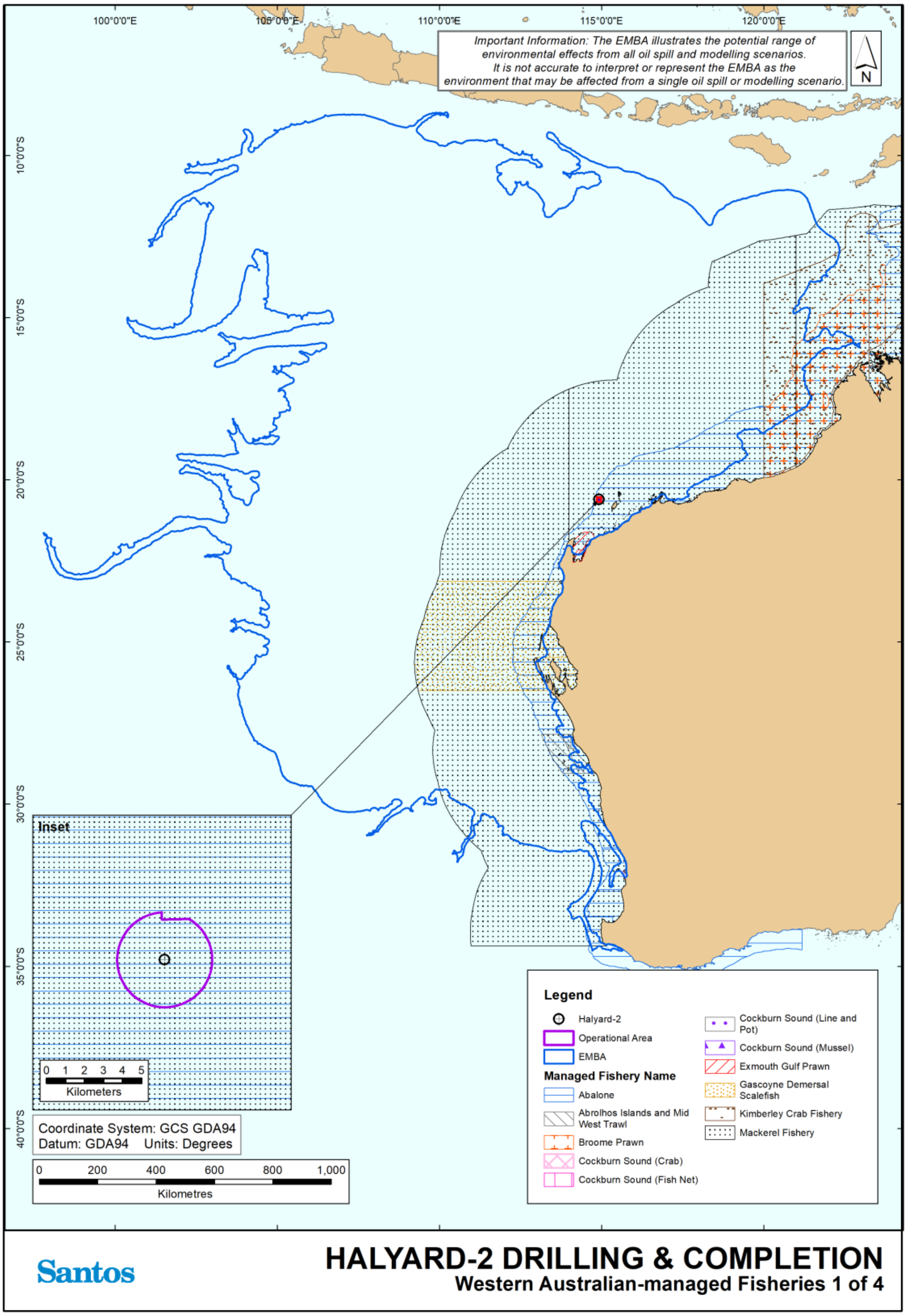

Figure 3.21: State-managed fisheries in relation to the EMBA and operational area (Figure 1 of 4)

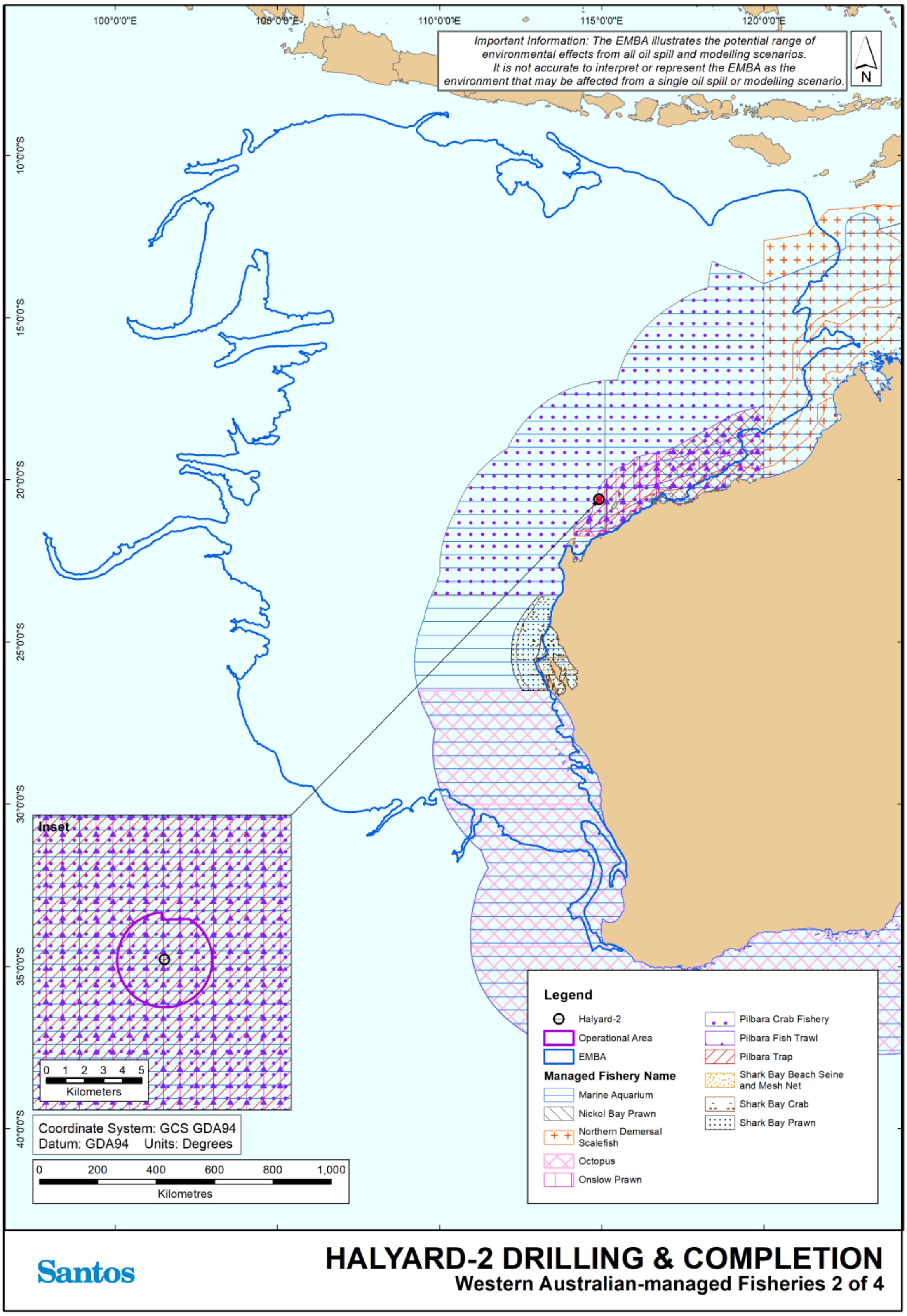

Figure 3.22: State-managed fisheries in relation to the EMBA and operational area (Figure 2 of 4)

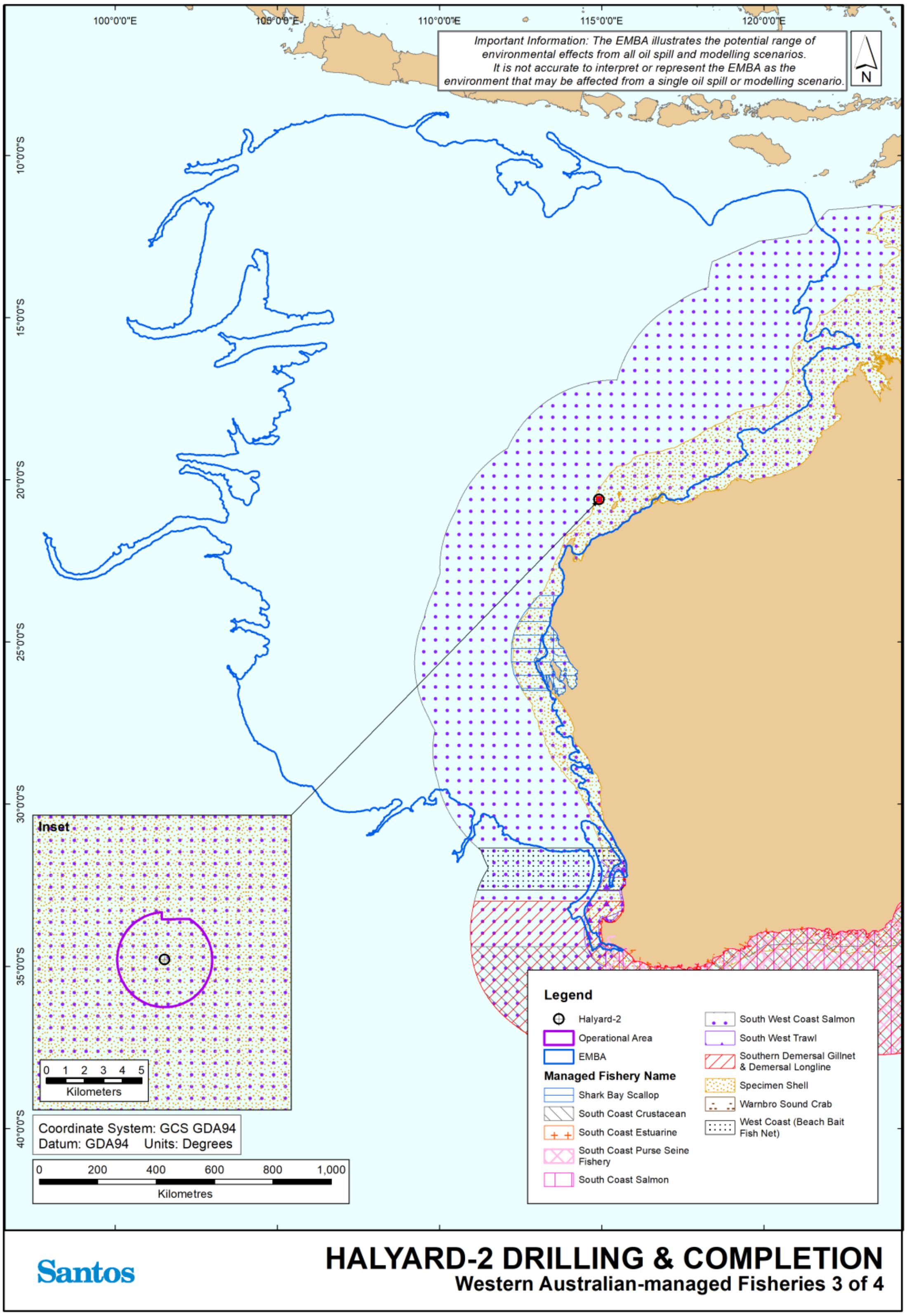

Figure 3.23: State-managed fisheries in relation to the EMBA and operational area (Figure 3 of 4)

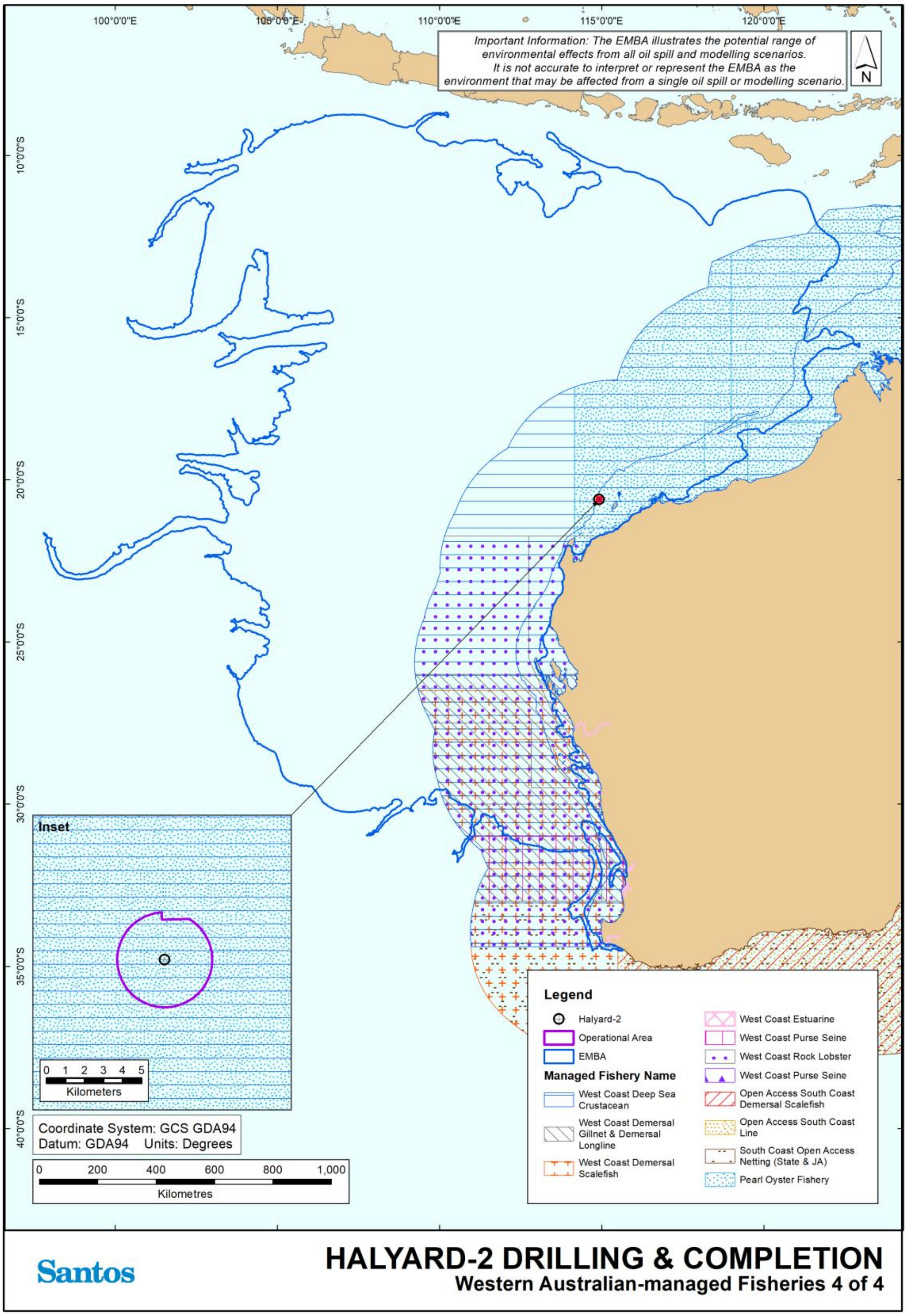

Figure 3.24: State-managed fisheries in relation to the EMBA and operational area (Figure 4 of 4)

3.2.6.4 Recreational fisheries

Given the depth of the operational area (ranging from approximately 95 m – 125 m) and its distance from land, it is unlikely recreational fishing will occur.

The closest recreational fishing activities are expected to occur within the EMBA around Varanus Island and the Montebello Islands. The Montebello Islands are known to support diverse and abundant marine life and are considered a highly valued recreational fishing location. Montebello Islands are well known among avid fishers for the productive fishing and host various fishing charter businesses. Recreational fishing also occurs on the west side of Barrow Island, approximately 40 km from the operational area, and on the islands and reef systems between Barrow Island and the Montebello Islands, approximately 60 km from the operational area. The region's reefs, sheltered lagoons and deep channels offer recreational fishing opportunities for demersal, reef and pelagic species, all in one venture.

The EMBA also includes a number of other recreational fishing sites including Glomar Shoals, the Ningaloo coast and Rowley Shoals.

3.2.6.5 Petroleum industry

Petroleum-related activities are located within the Carnarvon Basin, which is a highly developed petroleum province. Activities are undertaken as a regular occurrence in the waters surrounding the operational area. All petroleum-related activities within WA-13-L and W-45-L, are Santos-operated. The closest non-Santos WA operating petroleum field is the Barrow Island oil field, operated by Chevron Australia Pty Ltd. **Figure 2.1** shows petroleum pipeline infrastructure near the operational area.

3.2.6.6 Shipping

The operational area does not overlap any designated shipping routes, with the nearest shipping fairway more than 50 km away. Commercial shipping moves through the offshore waters enroute to or from the marine terminals at Barrow and Varanus Islands. Shipping using NWS waters includes iron ore carriers, oil tankers and other vessels proceeding to or from the ports of Dampier, Port Walcott and Port Hedland. Large cargo vessels carrying freight bound or departing from Fremantle, transit along the WA coastline heading north and south in deeper waters. **Figure 3.25** shows shipping fairways and vessel movements near the operational area.

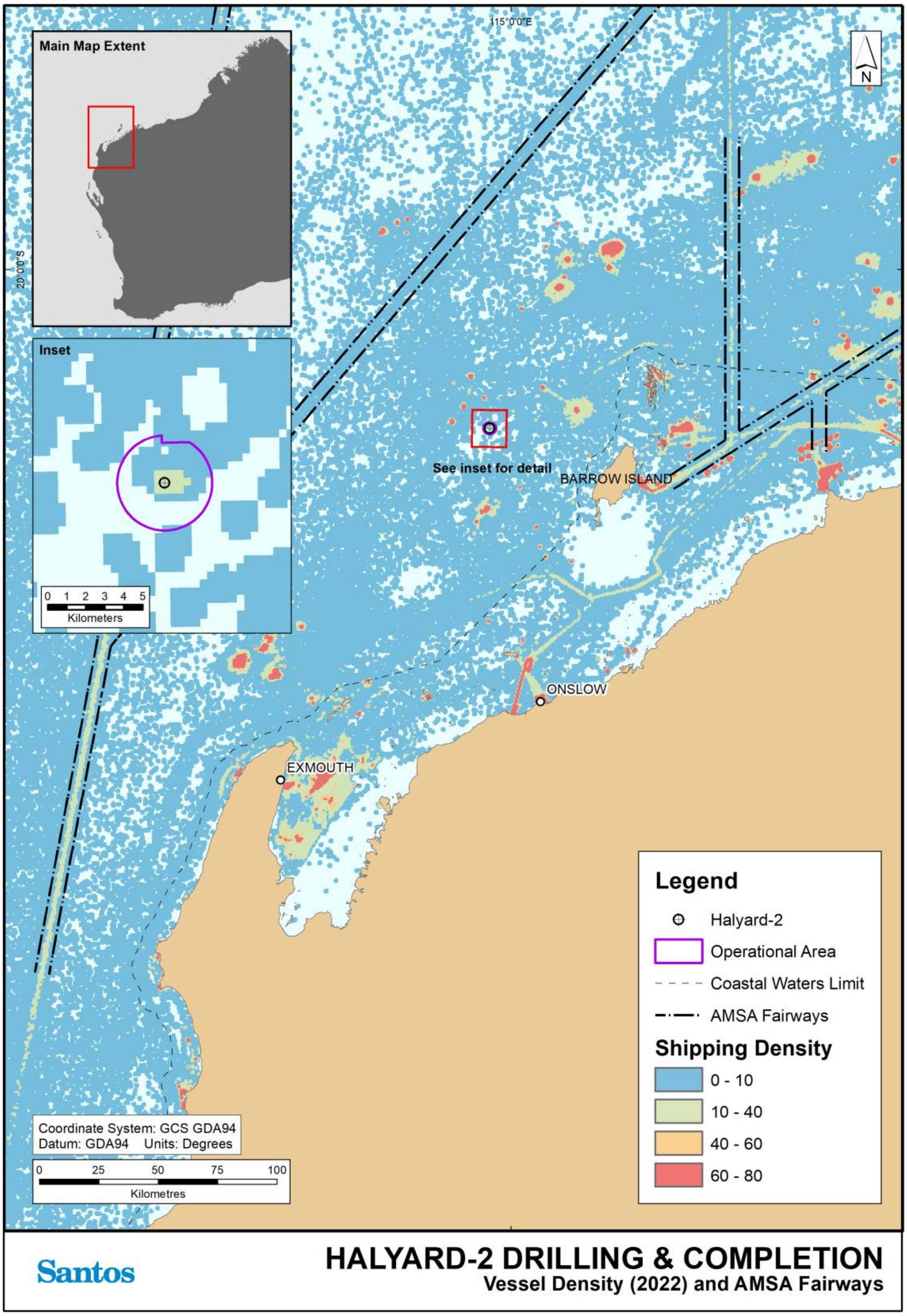

Figure 3.25: Commercial shipping and AMSA fairways in relation to the EMBA and operational area

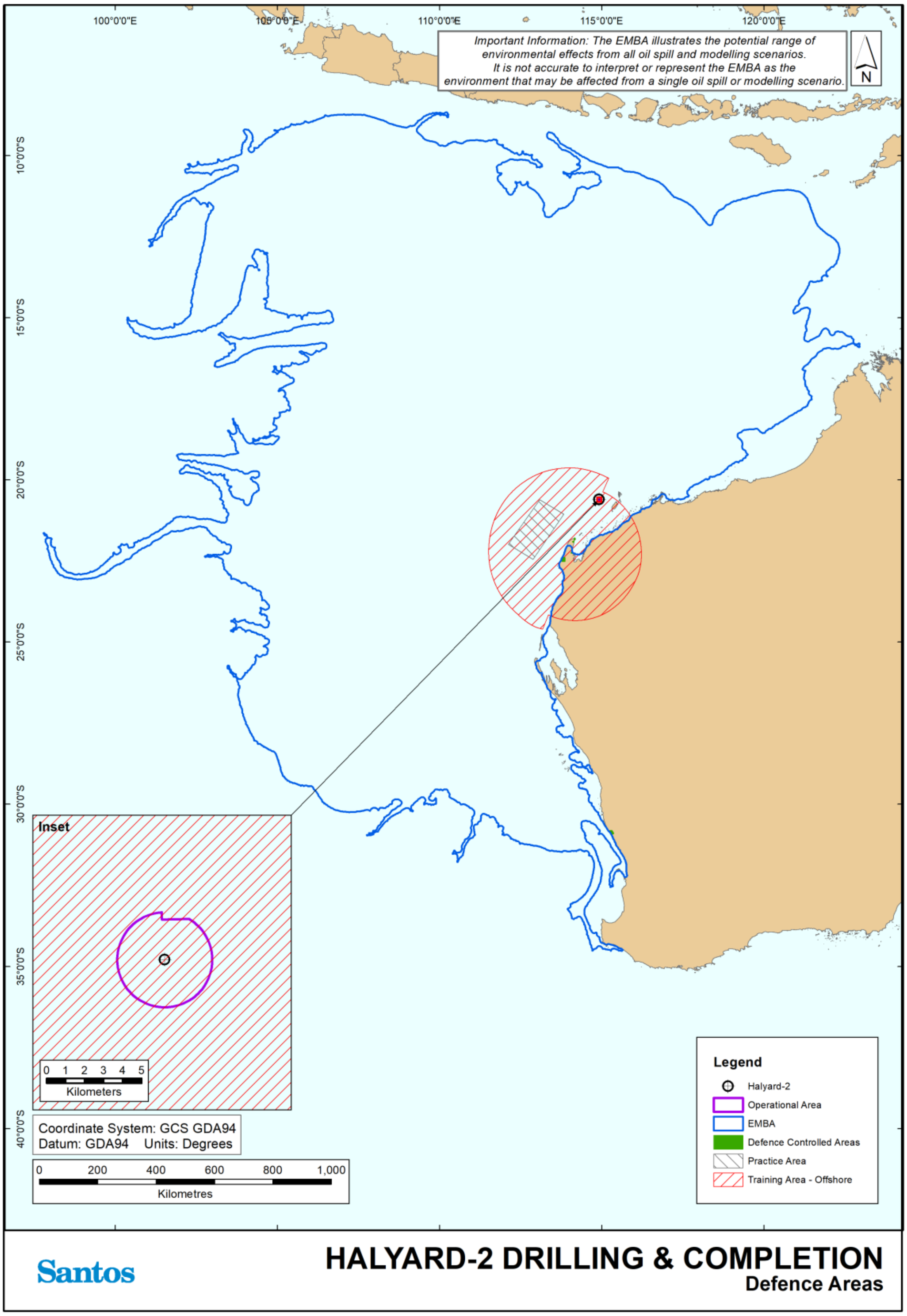

Figure 3.26: Defence training areas in relation to the EMBA and operational area

3.2.6.7 Tourism

Given the water depths of the operational area (ranging from approximately 95 m – 125 m) and the lack of notable seabed features, there are no known tourism-based activities in the surrounding waters of the operational area.

Popular water-based activities that may occur in the EMBA include fishing, swimming, snorkelling, diving, surfing, windsurfing, kiting and boating. Within the EMBA these activities are concentrated in the vicinity of the population centres such as Exmouth, Dampier, Onslow, Point Samson and Port Hedland. Seasonal nature-based tourism, such as humpback whale watching, whale shark encounters and tours of turtle hatching, mainly occurs around Ningaloo Reef and Cape Range National Park.

Given the water depths of the operational area and the lack of notable seabed features, there are unlikely to be any tourism-based activities in the surrounding waters of the operational area. The nearest area where recreation is likely to occur is the Montebello Islands, which are located approximately 60 km from the operational area.

3.2.6.8 Defence

A Defence Training Area (RAAF Base Learmonth) overlaps with operational area. Designated military exercise areas occur over waters and airspace of the operational area and may be activated following the required notifications.

Relevant existing defence areas within the EMBA are shown in **Figure 3.26** and other Defence areas within the region are described in **Appendix C**.

3.2.7 Windows of Sensitivity

Timing of peak sensitivity or activity for values and sensitivities relevant to this EP are summarised in **Table 3-13.**

Table 3-13: Windows of sensitivity in the vicinity of the operational area and environment that may be affected

Receptors (critical life cycle stages)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
All shoreline habitats												
Coral (spawning periods)												
Macroalgae	Growing				Shedding fronds				growing			
Other benthic and terrestrial habitats												
Fish/Sharks and fisheries species												
Whale Shark			Aggregations at Ningaloo Coast									
Fisheries species spawning/aggregation times												
Marine Mammals												
Dugong (breeding)	breeding								breeding			
Humpback whale (migration)						Northern			southern			
Blue whale (migration)					Northern						southern	
Marine Reptiles												
Hawksbill turtle's resident adult and juveniles[2]	Widespread throughout NWS waters, highest density of adults and juveniles over hard bottom habitat (coral reef, rocky reef, pipelines, etc)											
Hawksbill turtle (mating aggregations[2])												
Hawksbill turtle (nesting and internesting[2])												
Hawksbill turtle (hatching[1])												
Flatback turtles (resident adult and juveniles[2])	Widespread throughout NWS waters, increased density over soft bottom habitat 10-60 m deep, post hatchling age classes and juveniles spread across shelf waters											
Flatback turtle (mating aggregations[2])												
Flatback turtle (nesting and internesting[2])												

Receptors (critical life cycle stages)	JAN	FEB	MAR	AP R	MAY	JUN	JUL	AUG	SEP	OC T	NOV	DE C
Flatback turtle (hatching[2])												
Flatback turtle (nesting[2])												
Green turtles (resident adult and juveniles[2])	Widespread throughout the NWS waters, highest density associated with seagrass beds and macro algae communities, high density juveniles in shallow waters off beaches, amongst mangroves and in creeks											
Green turtle (mating aggregations[2])												
Green turtle nesting and internesting[2])												
Green turtle (hatching[2])												
Loggerhead turtles (resident adult and juveniles[2])	Widespread throughout the NWS waters, increased density associated with soft bottom habitat supporting their bivalve food source, juveniles associated with nearshore reef habitat											
Loggerhead turtle (mating aggregations[2])												
Loggerhead turtle (nesting and internesting[2])												
Loggerhead turtle (hatching[2])												
Leatherback turtles	Can occur at low densities across the NWS year-round											
Short-nosed seasnake	Can occur at low densities across the NWS year-round											
Sea Birds												
Terns, shearwaters, petrels (nesting)												
Socio Economic												
Commercial Managed Fisheries												
Oil and gas												
Shipping												
Tourism/ recreational												
Defence												

Receptors (critical life cycle stages)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
KEY / NOTES												
	Peak activity, presence reliable and predictable	1. Information provided from Department of Fisheries consultation										
	Lower level of abundance/activity/presence	2. Information provided by K. Pendoley										
	Very low activity/presence											
	Activity can occur throughout year											
	Proposed timing of activity											

4 Stakeholder Consultation

OPGS(E)R 2023 Requirements
Regulation 28(1)
If NOPSEMA provisional decision under Regulation 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.
Regulation 25
(1) In the course of preparing an environment plan, or a revision of an Environment Plan, 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, or the revision of 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, or the revision of 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.
Regulation 22(15)
The implementation strategy must provide for appropriate consultation with: (a) relevant authorities of the Commonwealth, a State or Territory; and (b) other relevant interested persons or organisations.
Regulation 24

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;

4.1 Consultation Background

Consultation with relevant persons under regulation 25 for proposed activities commenced in May 2023, building on Santos' long history of consultation in the region for its Varanus Island Hub Operations and related developments and activities.

Recent engagement has included:

+ Consultation for the drilling of the Spartan-2 development well and tie-in into the VI Hub operations.

In addition, a number of the relevant persons identified in this EP receive Santos' regular WA Quarterly Consultation Update, which provides an overview of Santos' proposed, planned, current and completed activities offshore WA.

Santos' consultation methodology for this EP is outlined in **Section 4.5**, with consultation activities undertaken in two phases:

+ **Preliminary consultation (29 May – 26 June 2023)** – this included:
  - activities to allow authorities, persons and organisations opportunities to self-identify as relevant persons; and
  - engagement with potential relevant persons to confirm consultation expectations. Potential relevant persons that did not provide any feedback during preliminary consultation were carried into the consultation phase.
+ **Consultation (26 June – 26 July 2023)** – activity-based consultation activities seeking feedback from relevant persons to inform development of this EP.

A summary report of the consultation carried out under regulation 25 is included at **Table 4-8**.

Section 8.13includes Santos' post acceptance consultation implementation strategy for the Activities covered by this EP in accordance with regulation 22(15) of the OPGGS(E)R.

4.2 Regulatory Requirements

Table 4-1 outlines the applicable regulatory requirements for consultation with relevant persons for this EP.

Table 4-1: Applicable regulatory requirements

Regulation	Relevant Extract of Regulation
Section 280(2) of the OPGGS Act	(2) A person (the **first person**) carrying on activities in an offshore area under the permit, lease, licence, authority or consent must carry on those activities in a manner that does not interfere with: (a) navigation; or (b) fishing; or (c) the conservation of the resources of the sea and seabed; or (d) any activities of another person being lawfully carried on by way of: (i) exploration for, recovery of or conveyance of a mineral (whether petroleum or not); or (ii) construction or operation of a pipeline; or (iii) offshore infrastructure activities (within the meaning of the Offshore Electricity Infrastructure Act 2021); or (5) the enjoyment of native title rights and interests (within the meaning of the Native Title Act 1993); to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the first person.
Regulation 5 of the OPGGS(E)R	***environment*** means: (a) ecosystems and their constituent parts, including people and communities; and (b) natural and physical resources; and (c) the qualities and characteristics of locations, places and areas; and (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).
Regulation 26(8) of the OPGGS(E)R	(8) All sensitive information (if any) in an environment plan, and the full text of any response by a relevant person to consultation under regulation 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.
Regulation 34 of the OPGGS(E)R	For the purposes of section 33, the criteria for acceptance of an Environment Plan for an activity are that the plan:… (g) demonstrates that: (i) the titleholder has carried out the consultations required by regulation 25; and (ii) the measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate;
Regulation 25(1) of the OPGGS(E)R	(1) In the course of preparing an environment plan, or a revision of an Environment Plan, 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

Regulation	Relevant Extract of Regulation
	affected by the activities to be carried out under the environment plan, or the revision of the environment plan; (e) any other person or organisation that the titleholder considers relevant. (f)
Regulation 25(2) of the OPGGS(E)R	(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.
Regulation 25(3) of the OPGGS(E)R	(3) The titleholder must allow a relevant person a reasonable period for the consultation.
Regulation 25 (4) of the OPGGS(E)R	(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.
Regulation 21(2)-(3) of the OPGGS(E)R	*Description of the environment* (2) The Environment Plan must: (a) describe the existing environment that may be affected by the activity; and (b) include details of the particular relevant values and sensitivities (if any) of that environment. Note: The definition of *environment* in regulation 5 includes its social, economic and cultural features. (3) Without limiting paragraph (2)(b), particular relevant values and sensitivities may include any of the following: (a) the world heritage values of a declared World Heritage property within the meaning of the EPBC Act; (b) the national heritage values of a National Heritage place within the meaning of that Act; (c) the ecological character of a declared Ramsar wetland within the meaning of that Act; (d) the presence of a listed threatened species or listed threatened ecological community within the meaning of that Act; (e) the presence of a listed migratory species within the meaning of that Act; (f) any values and sensitivities that exist in, or in relation to, part or all of: (i) a Commonwealth marine area within the meaning of that Act; or (ii) Commonwealth land within the meaning of that Act.
Regulation22(15) of the OPGGS(E)R	(9) The implementation strategy must provide for appropriate consultation with: 1. relevant authorities of the Commonwealth, a State or Territory; and other relevant interested persons or organisations.
Regulation 24(b) of the OPGGS(E)R	The Environment Plan must contain: (b) a report on all consultations under regulation 25 of any relevant person by the titleholder, that contains:

Regulation	Relevant Extract of Regulation
	(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;

4.3 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 – May 2023;*
- *GL1887 – Consultation with Commonwealth agencies with responsibilities in the marine area – January 2023;*
- *GL1721 – Environment Plan decision making – December 2022;*
- *GN1344 – Environment plan content requirement – December 2022; and*
- *GN1488 – Oil Pollution Risk Management – July 2021.*

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;*
- Commonwealth Department of Agriculture, Fisheries and Forestry: *Fisheries and the Environment – Offshore Petroleum and Greenhouse Gas Act 2006 and Offshore Installations Biosecurity Guide;*
- Commonwealth 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;*
- 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; and*
- Western Australian Fishing Industry Council: *Commercial Fishing Consultation Framework for the Offshore Oil and Gas Sector and Consultation Approach for Unplanned Events.*

4.4 Applicable Case Law and Guidance

In addition to considering the regulatory requirements and guidance set out above, in developing 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); and
- Justice Calvin in *Cooper v National Offshore Petroleum Safety and Environmental Management Authority (No 2)* [2023] FCA 1158.

The EP Consultation Guideline referred to above provides a summary of the Full Federal Court's interpretation of "functions", "activities" and "interests" referenced in regulation 25(1)(d), adopted by NOPSEMA to assist in informing who may be a relevant person and how relevant persons may be identified, as follows:

Table 4-2: Relevant person terms and definitions

Term	Definition
Functions	Refers to "a power or duty to do something"
Activities	To be read broadly and is broader than the definition of "activity" in Regulation 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, 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 regulation 25.

4.5 Santos' Consultation Methodology

4.5.1 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 *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*);
- by which the environmental impacts and risks of the activity will be reduced as low as reasonably practicable (ALARP); and
- by which the environmental impacts and risks of the activity will be of an acceptable level.

The consultation process is designed to assist Santos to further ascertain, understand and assess values and sensitivities of the environment 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 potential relevant person categories;
+ identifying relevant persons;
+ providing opportunities for relevant persons to identify themselves if they wished to be consulted (e.g. through advertising);
+ consultation planning and preliminary consultation activities;
+ consulting relevant persons;
+ assessing the merits of objections or claims made by relevant persons about the adverse impact of each activity to which the EP relates; and
+ providing responses to queries, requests and feedback.

As described below, Santos considered the spatial extent of the environment that may be affected by the Activity and the particular aspects of the relevant environment as part of its process for identifying relevant persons.

4.5.2 Identifying Relevant Persons

This section outlines the methodology and steps that Santos has used to identify relevant persons.

As described in **Table 4-4**, Santos considered the spatial extent of the environment that may be affected by the activity and the particular aspects of the relevant environment as part of its process for identifying relevant persons.

Table 4-3: Relevant person identification process steps.

Process steps
1. Identify the impacts of the planned activities and the risks and impacts of unplanned events.
2. Consider the spatial extent of the environment that may be affected by the Activity impacts and risks.
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).

4.	Identify relevant person categories, having regard to: (a) aspects of the environment identified at Item 3 (b) the departments or agencies of Commonwealth and Western Australian 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. Update during consultation based on new information, if appropriate.
5.	Identify relevant persons within relevant person categories, having regard to items 1-4 above.

Santos considered the nature of the Activity (and key component activities) (described in **Section 2**), the location of the Activity (described and depicted in **Section 2.1**), the impacts of planned activities and the risks and impacts of unplanned events (described in **Section 7**).

Santos also considered the spatial extent of the environment that may be affected by the Activity impacts and risks (described **Section 3** and **Appendix C**).

Table 4-5 outlines the environmental aspects (described in detail in **Section 3**) Santos considered 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
Physical environment	**Section 3.2** of this **EP**
Provincial Bioregions	**Section 3.2.2**of this **EP**
Benthic habitats	**Section 3.2.3** of this **EP**
Australian marine parks and state marine parks, management areas, reserves	**Section 3.2.4.1** of this **EP**
Key Ecological Features	**Section 3.2.4.2** of this **EP**
Commonwealth Heritage Areas (Indigenous and Non- Indigenous)	**Section 3.2.4.3** of this **EP**
Wetlands of International and National Significance	**Section 3.2.4.4** of this **EP**
Biologically Important Areas and Critical Habitat	**Section 3.2.5.1** of this **EP**
Recovery Plans	**Section 3.2.5.2** of this **EP**
Commercial fisheries	**Section 3.2.6.3** of this **EP**
Energy industry	**Section 3.2.6.5** of this **EP**
Telecommunication cables	**NA**

Defence activities	**Section 3.2.6.8**of this **EP**
Shipping	**Section 3.2.6.6** of this **EP**
Recreation and tourism	**Section 3.2.6.4** and **Section 3.2.6.7** of this **EP**
Cultural Features	**Section 3.2.6.1of this EP**

Consideration of the above environmental aspects resulted in the identification of the following relevant person categories:

Section 25(1)(a)

- Commonwealth Government Departments/Agencies.

Section 25(1)(b) and (c)

- Western Australian Government Departments/Agencies.

Section 25(1)(d)

- Academic and research organisations;
- Commercial fishing (Commonwealth-managed);
- Commercial fishing (Western Australian-managed);
- Energy industry titleholders / operators;
- Environmental conservation organisations;
- First Nations peoples and groups;
- Infrastructure operators;
- Industry associations;
- Local government and recognised community reference/liaison groups;
- Recreational fishing;
- Shipping; and
- Tourism operators.

Santos then undertook the actions outlined below to identify relevant persons within those categories**.**

Table 4-5: Actions for identifying relevant persons by category.

Relevant person category	Actions to identify relevant persons
All relevant person categories	+ Review of Santos' historical consultation in the region. + Review of identified relevant persons in publicly available EPs submitted by other Operators that may be relevant to proposed activities to be managed under this EP. + Conducting key-word searches using online search engines and reviewing media coverage and organisation websites to identify persons and organisations with reasonably ascertainable

Relevant person category	Actions to identify relevant persons
	functions, interests and activities that may be affected by the activities under this EP. + Regional and State-wide advertising as outlined in **Table 4-7.**
Section 25(1)(a)	
Commonwealth Government Departments/Agencies	+ Review of government agency websites and directories to understand agency roles, functions and responsibilities. + Review of NOPSEMA and government agency guidance on consultation expectations.
Section 25(1)(b) and (c)	
Western Australian Government Departments/Agencies	+ Review of government agency websites and directories to understand agency roles, functions and responsibilities. + Review of NOPSEMA and government agency guidance on consultation expectations.
section 25(1)(d)	
Academic and research organisations	+ Desktop review of publicly available and reasonably ascertainable published research having regard to the region, activities or risks/impacts under this EP.
Commercial fishing	+ Review of EMBA overlap with commercial fisheries. + Review of WA commercial fishery activity in the Operational Area to inform consultation as per WA industry association guidance.
Energy industry	+ Review of EMBA overlap with petroleum, greenhouse gas and any other NOPTA issued titles.
Environmental conservation organisations	+ Conduct key-word searches of publicly available online search engines, review media coverage and review organisation websites to identify organisations with reasonably ascertainable functions, interests and activities that may be affected, having regard to the region, activities or risks/impacts under this EP. + Review of other publicly available information, e.g. websites of conservation organisations whose functions, interests or activities within the EMBA may be affected.
First Nations peoples and groups	+ Review of the Judgment and the Appeal Judgment. + Review of publicly available studies, reports and/or other information sources that may assist in identifying or mapping relevant cultural features interests in the EMBA. + Review of EMBA overlap with Native Title determined areas and claims, Indigenous Land Use Agreements and Indigenous Protected Areas to identify areas over which a First Nations group may have functions, interests or activities that may be affected.

Relevant person category	Actions to identify relevant persons
	+ Review of Representative Aboriginal/Torres Strait Island Bodies (RATSIBs) on Native Title website. + Review of prescribed bodies corporate on the Native Title website. + Conducting searches of public cultural heritage databases relevant to the EMBA. + Review of marine park management plans relevant to the EMBA. + Engagement with government departments/agencies with relevant knowledge or relevant responsibilities.
Industry associations	Review of industry representation of the following relevant person groups: + Commercial fishing; + Local Government Authorities; + Local industry; + Recreational fishing; + Shipping; and + Tourism operators.
Infrastructure operators	+ Review of EMBA overlap with offshore and onshore infrastructure, such as submarine telecommunications cables or ports. + Review of potential presence in the Operational Area.
Local government and recognised community reference/liaison groups	+ Review of EMBA overlap with boundaries of Local Government Areas. + Review of community reference/liaison groups where EMBA overlaps the 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 Operational Area. + Review of website information of relevant agencies/organisations that represent recreational fishing interests.
Shipping	+ Review of EMBA overlap with shipping fairways or areas of high marine traffic.
Tourism operators	+ Review of EMBA overlap with areas of interest to charter and tourism operators. + Review of potential presence in the Operational Area. + Review of website information of relevant operators/organisations that represent commercial tourism interests.

4.5.3 Identification and Consultation of First Nations people and groups

Santos has developed a comprehensive process for identifying and undertaking effective consultation with First Nations Relevant Persons, which includes, but is not limited to:

Active steps to identify First Nations people and groups who may be Relevant Persons as per actions outlined in Table 4-5**;** including 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.

Providing opportunities for Relevant Persons to provide input to EP development, including:

+ Registered Native Title Prescribed Bodies Corporate (PBCs), groups associated with Native Title Determinations and groups in active Native Title Claims;
+ Native Title Representative Bodies;
+ groups who may be parties to Indigenous Protected Areas, or named in Indigenous Land Use Agreements; existing liaison committees or reference groups, where these committees or groups have been established between Native Title Parties, Native Title Representative Bodies and industry/government; and
+ Individual First Nations people that self-identify as relevant (if any).

For this EP, consultation effort has focused in particular on providing opportunities for PBCs to provide input, given their responsibilities under the *Native Title Act 1993* (Cth) for representing Native Title holders who have been recognised by Australian law of their rights and interests to traditional land and waters[1].

Santos recognises that PBCs are bound by the traditional laws and customs of the native title group they represent. This includes, among other things, management and protection of cultural values.

Santos provided consultation opportunities and supporting information to PBCs where the EMBA intersects Native Title Determined Areas, allowing them to participate in the consultation process.

The significant geographical extent of the EMBA (Refer Section 3.1.2), has resulted in Santos providing information to PBCs with coastal interests stretching from the Southwest of Western Australian to the Western Kimberley region (see Table 4-6). The EMBA, however, includes large areas where only unplanned activities such as a spill event with an unlikely probability of occurrence, could have any impact on the environment.

There is significant conservatism associated with the EMBA based on low exposure values (as described in Section 3.1.2) which Santos has used in identifying the EMBA, and especially given the modelling process combines a large number of individual spill simulations (120). As such, Santos' methodology has provided for a very broad capture of potential relevant persons and provided ample opportunities

[1] https://nativetitle.org.au/learn/role-and-function-pbc/about-pbcs

for them to provide input on the development of the EP if they feel they may be impacted by the activities.

The modelling at low exposure values is also primarily used to inform Santos preparedness for potential spill response. The EMBA as modelled does not take into account any spill response activities by Santos which would be implemented and reduce the EMBA extent in event of a spill.

There is also a low likelihood of impacts to cultural values by unplanned events. In the unlikely event of a worst-case oil spill (Section 7.6.4.) the risk for those groups with Natives Title interests at the extremities of the EMBA is considered to be low, given the significant distances from the activity location.

Therefore, while Santos' methodology has provided for very broad consultation, Santos has given particular focus to those PBCs that are most proximate to the activity location, including PBCs with interests in lands and waters of the Pilbara region. Santos has been, since mid-2023, actively working with PBCs in this region to establish consultation agreements to support ongoing, regular and effective consultation and engagement activities. In addition to direct consultation, Santos also undertakes a range of communications to promote opportunities for other First Nations people and groups, and other organisations or individuals, to self-identify as potential Relevant Persons if they feel that their functions, interests or activities may be affected. These promotional activities include widespread public information campaigns using a range of appropriate media, including, radio, print media, and targeted social media. Details of the public information campaign for this EP are included in Table 4-7 and Table 4-8**,** a schedule of advertising is included in Table 4-9. Advertisements used during this widespread campaign also noted that further information is available on the Santos Consultation Hub website.

Santos also has an online self-nomination form on its Consultation Hub website, where fact sheets and other consultation materials are published and available for download.

Such activities provide a more than reasonable opportunity for First Nations people to self-identify as a Relevant Person for the purpose of Section 25 consultation, where they considered themselves to have interests, functions or activities that may be affected by the planned activities and for Relevant Persons to provide their input.

Santos' process involves the provision of reasonable timeframes for the self-identification or nomination of others as Relevant Persons for Relevant Persons to consider consultation information, ask questions and give their input, and for Santos' consideration and assessment of the merits of objections and claims.

4.5.4 Relevant Persons

A list of potential relevant persons was developed through application of the above methodology for the purposes of undertaking preliminary consultation to confirm consultation expectations.

This consultation phase was supported by an advertising campaigned outlined in **Table 4-9** to raise public awareness about the proposed Activity and provide opportunities for authorities, persons or organisations to identify themselves as relevant persons.

For this EP no authorities, persons or organisations self-nominated as relevant persons.

Relevant persons consulted for this EP are listed **Table 4-6**.

Table 4-6: Relevant persons for this EP

Relevant person	Summary of relevance
Regulation 25(1)(a): Agencies or authorities of the Commonwealth to which the activities to be carried out under the environment plan may be relevant	
Australian Fisheries Management Authority (AFMA)	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. 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 Notice 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	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.
Australian Maritime Safety Authority (AMSA) – marine pollution	AMSA is the statutory and control agency for maritime safety and vessel emergencies in Commonwealth Waters. AMSA is a relevant agency when proposed offshore activities may impact on the safe navigation of commercial shipping in Australian waters.
Department of Agriculture, Forestry and Fisheries (DAFF) – Fisheries	DAFF (fisheries) has primary policy responsibility for promoting the biological, economic and social sustainability of Australian fisheries. The Department is the relevant agency where the Activity has the potential to negatively impact fishing operations and/or fishing habitats in Commonwealth waters.
Department of Defence (DoD)	DoD manages the development, maintenance and disposal of the Defence estate, including unexploded ordinance (UXO).
Department of Foreign Affairs and Trade (DFAT)	DFAT promotes and protects Australia's international interests to support our security and prosperity. DFAT works with international partners and other countries to tackle global challenges, increase trade and investment opportunities, protect international rules, keep our region stable and help Australians overseas.

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 storage.
Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA)	DITRDCA administers the Indian Ocean Territories of the Commonwealth Government.
Director of National Parks (DNP)	DNP is the statutory authority responsible for administration, management and control of Commonwealth marine reserves (CMRs). 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.
Regulation 25(1)(a): Agencies or authorities of Western Australia to which the activities to be carried out under the environment plan may be relevant	
Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA is a relevant State agency responsible for the management of State marine parks and reserves and the management of protected marine fauna and flora.
Department of Jobs, Tourism, Science and Innovation (JTSI)	JTSI is a Western Australian Government statutory authority responsible for promoting Western Australia as a holiday destination.
Department of Planning, Lands and Heritage (DPLH)	DPLH is responsible for WA state level land use planning and management, and oversight of Aboriginal cultural heritage and built heritage matters.
Department of Primary Industries and Regional Development (DPIRD)	DPIRD is responsible for managing West Australian fisheries.
Department of Transport (DoT)	DoT is the control agency for marine pollution emergencies in Western Australian State waters.
Department of Water and Environmental Regulation (DWER)	DWER is responsible for environment and water regulation.
Gascoyne Development Commission (GDC)	GDC is a statutory authority of the WA Government that partners with communities, government, business and industry to identify and support projects that benefit its region of interest.
Mid West Development Commission (MWDC)	MWDC is a statutory authority of the WA Government that partners with communities, government, business and industry to identify and support projects that benefit its region of interest.
Ningaloo Coast World Heritage Advisory Committee (NCWHAC)	The NCWHAC provides advice to the Commonwealth and State Environment Ministers on the protection, conservation and

	management of the Outstanding Universal Value of the World Heritage area.
Pilbara Development Commission (PDC)	PDC is a statutory authority of the WA Government that partners with communities, government, business and industry to identify and support projects that benefit its region of interest.
Pilbara Ports Authority (PPA)	PPA manages port land and waters for the Ports of Dampier, Port Hedland, Ashburton, Varanus Island and Cape Preston West.
Shark Bay World Heritage Advisory Committee (SBWHAC)	The SBWHAC provides advice to the Commonwealth and State Environment Ministers on the protection, conservation and management of the Outstanding Universal Value of the World Heritage area.
South West Development Commission (SDC)	SDC is a statutory authority of the WA Government that partners with communities, government, business and industry to identify and support projects that benefit its region of interest.
Western Australian Museum (WAM)	WAM maintains a database of shipwrecks off the Western Australian coast.
Wheatbelt Development Commission (WDC)	WDC is a statutory authority of the WA Government that partners with communities, government, business and industry to identify and support projects that benefit its region of interest.
Regulation 25(1)(b): Department of the responsible Western Australian Minister	
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)	DEMIRS is the department of the relevant State Minister and is required to be consulted under subregulation 25 (1) of the Environment Regulations.
Regulation 25(1)(d): Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan	
Academic and research organisations	
Australian Marine Sciences Association (WA Branch)	Marine research organisation
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Marine research organisation
Geoscience Australia (GA)	Marine research organisation
Charles Darwin University (CDU)	Marine research organisation
University of Tasmania - Marine Biodiversity Hub (UTAS)	Marine research organisation
University of Western Australia (UWA)	Marine research organisation

Western Australian Marine Science Institution (WAMSI)	Marine research organisation
Commercial fishing – Commonwealth managed	
Commonwealth fisheries that overlap the EMBA (based on AFMA guidance): + Australian Southern Bluefin Tuna Fishery; + North West Slope Trawl Fishery; + Small Pelagic Fishery; + Western Deep Water Trawl Fishery; + Western Skipjack Fishery; and + Western Tuna and Billfish Fishery.	Licence holders of these fisheries are entitled to fish within the EMBA and should be consulted based on published AFMA guidance. Licence holders of Commonwealth fishery overlapping the EMBA.
Commercial fishing – Western Australian managed	
State fisheries that overlap the EMBA and are active in the Operational Area (based on WAFIC guidance). + Mackerel Managed Fishery (Area 2); + Onslow Prawn Managed Fishery; + Pilbara Line Fishery (Condition); + Pilbara Trap Managed Fishery; and + West Coast Deep Sea Crustacean Managed Fishery	Licence holders of these fisheries are active at the activity location and should be consulted based on published WAFIC guidance.
Energy industry – Petroleum titleholders and GHG permit holders	
3D Oil Ltd	Titleholder within the EMBA
Beagle No. 1	Titleholder within the EMBA
BP Developments Australia	Titleholder within the EMBA
Carnarvon Energy	Titleholder within the EMBA
Chevron Australia	Titleholder within the EMBA
Coastal Oil & Gas	Titleholder within the EMBA
Eni Australia	Titleholder within the EMBA
Finder	Titleholder within the EMBA
INPEX	Titleholder within the EMBA

Jadestone Energy	Titleholder within the EMBA
KATO Energy	Titleholder within the EMBA
KUFPEC	Titleholder within the EMBA
Mobil Australia	Titleholder within the EMBA
Pathfinder Energy	Titleholder within the EMBA
Skye Energy	Titleholder within the EMBA
Vermilion Oil & Gas Australia	Titleholder within the EMBA
Western Gas	Titleholder within the EMBA
Woodside Energy Ltd	Titleholder within the EMBA
Environmental conservation organisations	
Australian Conservation Foundation (ACF)	ACF is a peak conservation body with an interest in activities that may affect the marine environment
Cape Conservation Group	CCG is a volunteer, not-for-profit organisation that is involved in protecting the terrestrial and marine environment of the North West Cape.
Care for Hedland	Care for Hedland is an independent environmental interest group, that pursues a shared vision of environmental awareness and improvements for the townships of Port and South Hedland, along with the wider Pilbara region.
Conservation Council of WA (CCWA)	CCWA is a peak conservation body with an interest in activities that may affect the marine environment
Greenpeace Australia Pacific (GAP)	GAP is a peak conservation body with an interest in activities that may affect the marine environment
International Fund for Animal Welfare (IFAW)	IFAW is a peak conservation body with an interest in activities that may affect the marine environment
Protect Ningaloo	The Protect Ningaloo campaign aims to protect Exmouth Gulf from the threat of industrialisation, and conserve its outstanding natural, cultural and social values.
Wilderness Society (WS)	WS is a peak conservation body with an interest in activities that may affect the marine environment
World Wildlife Fund (WWF)	WWF is a peak conservation body with an interest in activities that may affect the marine environment
First Nations peoples and groups	
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 across the Pilbara region to provide opportunity for individuals whose functions, interests and activities may be affected by the proposed activity to self identify as relevant persons. No groups or individuals self-identified as relevant persons and none were identified via consultation with the following organisations.	
Representative organisations – Regional	
South West Aboriginal Land And Sea Council	Native Title Representative Body, which facilitates native claims on behalf of First Nations people and groups, as well as acting in the interests of Native Title Prescribed Body Corporates, where directed by Corporation Directors.
Yamatji Marlpa Aboriginal Council	Native Title Representative Body, which facilitates native claims on behalf of First Nations people and groups, as well as acting in the interests of Native Title Prescribed Body Corporates, where directed by Corporation Directors.
Murujuga Aboriginal Corporation	Body Corporate that represents the interests of five language groups with interest in the lands and waters of the Burrup Peninsula.
Native Title Prescribed Bodies Corporate – Pilbara region	
Buurabalayji Thalanyji Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation’s membership who may have interests or activities at the activity location.
Kariyarra Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation’s membership who may have interests or activities at the activity location.
Nganhurra Thanardi Garrbu Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation’s membership who may have interests or activities at the activity location.
Ngarluma Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation’s membership who may have interests or activities at the activity location.
Wanparta Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation’s membership who may have interests or activities at the activity location.
Wirrawandi Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation’s membership who may have interests or activities at the activity location.
Yinggarda Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation’s membership who may have interests or activities at the activity location.
Native Title Prescribed Bosy Corporate – Gascoyne region	

Malgana Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation’s membership who may have interests or activities at the activity location.
Native Title Prescribed Body Corporate – Mid West region	
Bundi Yamatji Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation’s membership who may have interests or activities at the activity location.
Industry associations - Commercial fishing	
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	ASBTIA represents the interests of 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
South East Trawl Fishing Industry Association (SETFIA)	SETFIA represents the interests of represents the interests of the Small Pelagic Fishery
Tuna Australia (TA)	TA represents the interests of the Western Tuna and Billfish Fishery
Western Australian Fishing Industry Council (WAFIC)	WAFIC represents the interests of the WA commercial fishing, pearling and aquaculture sector.
Western Rock Lobster (WRL)	WRL is the peak industry body representing the interests of the western rock lobster fishery.
Industry associations - Energy industry	
Australian Energy Producers (AEP), (previously known as Australian Petroleum Production and Exploration Association (APPEA))	AEP represents the interests of oil and gas explorers and producers in Australia and companies providing goods and services to those explorers and producers.
Industry associations - Local government	
Western Australian Local Government Association (WALGA)	WALGA is an independent, member based, not for profit organisation representing and supporting the WA Local Government sector.
Industry associations - Local industry	
Manjimup Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business.
Augusta Chamber of Commerce and Margaret River Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business.
Bunbury Geographe Chamber of Commerce	Regional representative organisation representing the interests of local business.
Capel Chamber of Commerce	Regional representative organisation representing the interests of local business.

South West Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business in the Shire of Harvey.
Chamber of Commerce and Industry WA	Regional representative organisation representing the interests of local business in Perth metropolitan areas.
Lancelin Chamber of Commerce	Regional representative organisation representing the interests of local business in the Shire of Gingin.
Jurien Bay Chamber of Commerce	Regional representative organisation representing the interests of local business in the Shire of Dandaragan.
Mid West Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business in the City of Geraldton-Greenough.
Carnarvon Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business in the Shires of Shark Bay and Carnarvon.
Exmouth Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business.
Onslow Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business.
Karratha and Districts Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business.
Industry associations – Recreational fishing	
Recfishwest	Recfishwest represents the interests of Western Australia's recreational fishing sector.
Western Australian Game Fishing Association (WAGFA)	WAGFA co-ordinates the activities of game fishing throughout Western Australia, maintains State game fishing records and data concerning open game fishing tournaments of its member clubs. WAGFA members are: + *Broome Fishing Club;* + *Cockburn Power Boats;* + *Exmouth Game Fishing Club;* + *Fremantle Sailing Club;* + *Geraldton and District Offshore Fishing Club;* + *King Bay Game fishing Club;* + *Marmion Angling and Aquatic Club;* + *Naturaliste Game and Sports Fishing Club;* + *Nor-West Game Fishing Club; and* + *Perth Game Fishing Club.*
Industry associations - Commercial shipping	
Maritime Industry Australia Ltd (MIAL)	MIAL is Australia's national shipping industry peak body.
Industry Associations – Tourism	

Australian Tourism Industry Council (ATIC)	ATIC is the national representative body for tourism.
Tourism Council of Western Australia (TCWA)	Tourism Council WA is the peak body representing tourism businesses, industries and regions in Western Australia.
Marine Tourism WA (MTWA)	The MTWA is an association made up of charter industry owners and operators.
Western Australian Indigenous Tourism Operators Council (WAITOC)	WAITOC is the peak representative for Aboriginal tours and experiences in Western Australia.
Infrastructure operators	
Vocus	Operator of the following infrastructure, which is in the EMBA: + *Darwin-Jakarta-Singapore Cable (DJSC)* + *North West Cable System (NWCS)*
Local Government and Community Liaison Groups	
Shire of Manjimup	The Shire of Manjimup is a local government area in the South West region of Western Australia.
Shire of Augusta Margaret River	The Shire of Augusta Margaret River is a local government area in the South West region of Western Australia.
Shire of Capel	The Shire of Capel is a local government area in the South West region of Western Australia.
City of Bunbury	The City of Bunbury is a local government area in the South West region of Western Australia.
Shire of Harvey	The Shire of Harvey is a local government area in the South West region of Western Australia.
City of Rockingham	The City of Rockingham is a local government area in the southern suburbs of the Western Australian capital city of Perth.
City of Kwinana	The City of Kwinana is a local government area in the southern suburbs of the Western Australian capital city of Perth.
City of Cockburn	The City of Cockburn is a local government area in the southern suburbs of the Western Australian capital city of Perth.
City of Fremantle	The City of Fremantle is a local government area in the suburbs of the Western Australian capital city of Perth.
Town of Mosman Park	The Town of Mosman Park is a local government area in the western suburbs of the Western Australian capital city of Perth.
Town of Cottesloe	The Town of Cottesloe is a local government area in the western suburbs of the Western Australian capital city of Perth.
City of Nedlands	The City of Nedlands is a local government area in the western suburbs of the Western Australian capital city of Perth.

Town of Cambridge	The Town of Cambridge is a local government area in the western suburbs of the Western Australian capital city of Perth.
City of Stirling	The City of Stirling is a local government area in the northern suburbs of the Western Australian capital city of Perth.
City of Joondalup	The City of Joondalup is a local government area in the northern suburbs of the Western Australian capital city of Perth.
City of Wanneroo	The City of Wanneroo is a local government area in the northern suburbs of the Western Australian capital city of Perth.
Shire of Gingin	The Shire of Gingin is a local government area in the Wheatbelt region of Western Australia.
Shire of Dandaragan	The Shire of Dandaragan is a local government area in the Wheatbelt region of Western Australia.
City of Greater Geraldton	The City of Greater Geraldton is a local government area in the Mid West region of Western Australia.
Shire of Shark Bay	The Shire of Carnarvon is a local government area in the Gascoyne region of Western Australia.
Shire of Carnarvon	The Shire of Carnarvon is a local government area in the Gascoyne region of Western Australia.
Shire of Exmouth	The Shire of Exmouth is a local government area in the Gascoyne region of Western Australia.
Shire of Ashburton	The Shire of Ashburton is a local government area in the Pilbara region of Western Australia.
City of Karratha	The Shire of Karratha is a local government area in the Pilbara region of Western Australia.
Exmouth Community Liaison Group	The Exmouth Community Liaison Group convenes three times a year in Exmouth, in collaboration with neighbouring oil and gas operators. The membership of this group is diverse and currently includes about 40 community representatives. Santos consults with the CLG as part of informing good environmental management practices.
Recreational fishers	
Exmouth Game Fishing Club (EGFC)	EGFC is an Exmouth based fishing club that represents local fishers who may be active in the EMBA Area.
Ashburton Anglers	Ashburton Anglers is an Onslow based fishing club that represents local fishers who may be active in the Operational Area.
King Bay Game Fishing Club (KBFC)	KBFC is a Dampier based fishing club that represents local fishers who may be active in the Operational Area.

Nickol Bay Sportsfishing Club (NBSC)	NBSC is a Dampier based fishing club that represents local fishers who may be active in the Operational Area.
Tourism operators	
Exmouth-based operators Dampier / Karratha operators	Marine tourism operators active within the EMBA.

4.5.5 Provision of Sufficient Information

Santos provides 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 the obligation of the titleholder not to publish particular information if so requested by the relevant person; and
+ How to provide feedback.

At a minimum, this information was available on the Santos website and also included in the fact sheets which Santos sent to relevant persons by email or made available during consultation sessions.

Relevant persons were provided access to information using different mediums and platforms, including by telephone, email, website (www.santos.com/offshoreconsultation), hard copy and electronic materials, and in person and virtual meetings.

Examples of the consultation materials used are included in **Appendix C.**

4.5.6 Consultation Approach

In developing this EP Santos has sought to work with authorities, persons and organisations on pragmatic and practical approaches to Regulation 25 consultation.

Santos sought feedback about consultation methods and information needs in its correspondence and via its website. Santos also sought information as to functions, interests or activities that may be affected by the Activity.

This approach has included:

+ Providing relevant persons access to information using different mediums and platforms, including by telephone, email, website, electronic materials, in person and virtual meetings.

- Making information about proposed activities to be managed under this EP available on the Santos website at www.santos.com/offshoreconsultation. Provision of hyperlinks to this website in consultation emails.
- Recognising WAFIC's published guidance that petroleum titleholders consult directly with those licence holders historically active in Operational Areas, while providing a list of all entitled fisheries that overlap the EMBA. This approach acknowledges previous feedback from WAFIC regarding consultation fatigue among Western Australia's estimated 1,500 fishing boat licence holders.
- Using WAFIC fee-for-service arrangements to circulate Santos' consultation information via email to licence holders.
- Making information available to potentially affected commercial fishing licence holders in Western Australian managed fisheries on the WAFIC web site at https://www.wafic.org.au/what-we-do/access-sustainability/oil-gas/consultationhubtrial/ for the duration of the consultation period.
- Recognising previous feedback from Recfishwest that petroleum titleholders consult directly with those fishing clubs with regional proximity to Operational Areas, while providing information on activity EMBA's that may have broader implications for recreational fishers. This approach acknowledges DPIRD's estimated 620,000 recreational fishers in Western Australia.

Santos also circulated information to subscribers of the *WA Offshore Quarterly Update (July 2023)* during the consultation period for this EP, including to some relevant persons identified in this EP. This Update provides subscribers with a regular update on proposed, planned, current and completed activities.

All authorities, persons and organisations engaged during the preliminary consultation and consultation phases were provided a link to the NOPSEMA brochure: *Consultation on offshore petroleum environment plans*.

A schedule of consultation activities is included at **Table 4-7** and a schedule of advertising is included at **Table 4-8**.

4.5.7 Reasonable Period for Consultation

Santos directly contacted relevant persons notifying them of the consultation process and consultation period. Emails were sent to relevant persons to invite feedback for the EP, confirming the date by which feedback was sought.

Santos provided approximately 30 days from the date of initial consultation information being provided, to review and respond with feedback about the proposed activities. In some cases, more time was provided. Santos also sought to accommodate reasonable requests for additional time.

For most identified relevant persons, the consultation period followed a 30-day preliminary consultation period.

4.5.8 Consultation Opportunities

Santos offered multiple avenues and mediums for consultation, including:

- Provision of a toll free 1800 number
- Dedicated email address

+ In-person or virtual meetings, as appropriate.

4.5.9 Ongoing Consultation

Santos carries out ongoing consultation during the life of an EP, including after an EP has been accepted by NOPSEMA.

Santos' post EP acceptance consultation implementation strategy is described in **Section 8.13** and Activity notifications are outlined in **Table 8-5**.

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 Management of Change process outlined in **Section 8.11.2**

Table 4-7: Summary of Consultation Activities

Activity	Purpose	Timing
Preliminary Consultation		
Website Website content and Activity fact sheets developed and made available at https://www.santos.com/offshoreconsultation/	Provide relevant persons with: + *Information about Santos' consultation obligations and approach.* + *Descriptions of proposed activities, including potential activity impacts and risks, and proposed management measures.* + *Contact information 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 Western Australia privacy notice.*	From 29 May 2023
Advertising Advertisements in the following publications: + *The West Australian* + *Mid West Times and Geraldton Guardian* + *Pilbara News* + *North West Telegraph*	Promote awareness of proposed activities to create opportunities for relevant persons to self-identify and seek feedback from relevant persons in addition to those identified by Santos as part of its initial public review process.	From 29 May 2023 (publication details are included in **Table** 4-8)
Consultation materials Email to identified relevant persons with a link to the fact sheet for this EP	+	From 29 May 2023

One-to-one meetings Meetings held with authorities, persons and organisations	Provide relevant persons with details on proposed Activities and establish consultation expectations.	From 29 May 2023
Consultation		
Consultation materials Email to identified relevant persons advising the commencement of consultation	Reminder to Santos identified relevant persons of the commencement and closing dates for consultation.	From 26 June 2023
Advertising Advertisement confirming commencement of consultation in the following publications: + *The West Australian* + *Mid West Times and Geraldton Guardian* + *Pilbara News* + *North West Telegraph*	Promote awareness of proposed Activities and seek feedback from relevant persons.	From 26 June 2023 (additional publication details are included in **Table 4-8**)
Consultation email Reminder email to identified relevant persons advising pending closure of consultation period	Reminder to Santos identified relevant persons of the closing dates for consultation.	From 19 July 2023
Community meetings *Exmouth Community Liaison Group meeting*	Information provided to the Group on a number of Santos proposed Activities, including for this EP.	27 July 2023

Table 4-8: Additional consultation advertising (May – June 2023)

Publication date	Advertising type	Towns / Communities	Reach
Preliminary consultation			
Tuesday, 29 May 2023	Press ad – The West Australian	WA State-wide	341,000
Wednesday, 31 May 2023	Press ad – Midwest Times and Geraldton Guardian	Carnamah, Carnarvon, Chapman Valley, Coorow, Coral Bay, Cue, Dongara, Eneabba, Geraldton, Greenough, Jurien, Kalbarri, Leeman, Meekatharra, Mingenew, Moonyoonooka, Morowa, Mount Magnet, Mullewa, Northampton, Perenjori, Port Denison, Shark Bay, Tardun, Tenindewa, Three Springs, Useless Loop, Walkaway, Wandina and Yalgoo	16,739

Publication date	Advertising type	Towns / Communities	Reach
Wednesday, 31 May 2023	Press ad – Pilbara News	Dampier, Karratha, Onslow, Pannawonica, Paraburdoo, Point Samson, Port Hedland, Roebourne, South Hedland, Tom Price and Wickham	11,545
Wednesday, 31 May 2023	Press ad – North West Telegraph	Marble Bar, Newman, Nullagine, Port Hedland, South Hedland and Wedgefield	5,485
Tuesday, 6 June 2023	Press ad – The West Australian	As above	341,000
Wednesday, 7 June 2023	Press ad – Midwest Times	As above	16,739
Wednesday, 7 June 2023	Press ad – Pilbara News	As above	11,545
Wednesday, 7 June 2023	Press ad – North West Telegraph	As above	5,485
Consultation			
Monday, 26 June 2023	Press ad – The West Australian	As above	415,000
Wednesday, 28 June 2023	Press ad – Midwest Times	As above	16,739
Wednesday, 28 June 2023	Press ad – Pilbara News	As above	11,545
Wednesday, 28 June 2023	Press ad – North West Telegraph	As above	5,485
Friday, 30 June 2023	Press ad – Geraldton Guardian	As above	10,012

4.6 Consultation Report

Santos has considered and responded to feedback from relevant persons, which is summarised in **Table 4-9**. Santos has also included in this table feedback that was received during the preliminary consultation phase.

Table 4-9: Summary of consultation activities

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Australian Fisheries Management Authority (AFMA)			
+ On 29 May 2023, Santos emailed Australian Fisheries Management Authority (AFMA) and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and included a link to an information fact sheet about proposed activities in this EP. [Con-2133] + On 31 May 2023, AFMA emailed Santos advising it would like to meet to discuss the proposed activities outlined in this EP. [Con-2110] + On 7 June 2023, Santos met with AFMA regarding the proposed activities and discussed opportunities to adopt pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries. [Con-2027] + On 12 June 2023, Santos responded to AFMA, in follow-up to the conversation the previous week. Santos noted its consultation principles and requested AFMA suggest a contact at DAFF. [Con-2134] + On 29 June 2023, Santos emailed AFMA seeking feedback on activities outlined in this EP and advised it had directly consulted licence holders entitled to fish in the EMBA for this activity and had also provided information to organisations that represent these fisheries. [Con-1778] + On 30 June 2023, AFMA emailed Santos advising it had no feedback. [Con-1773]			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
AFMA confirmed at the meeting of 7 June 2023 that it required pre-start and activity completion notifications	*Santos notes AFMA's feedback.*	*Santos will send AFMA activity notifications.*	*Activity notifications are included in **Table 8-5**.*
Australian Hydrographic Office (AHO)			
+ On 26 June 2023, Santos emailed AHO seeking feedback on a number of proposed activities outlined in this EP and included a link to an information fact sheet about proposed activities in this EP. [Con-1646] + On 27 June 2023, Santos received a standard response email from AHO stating that the data supplied will be registered, assessed, prioritised and validated in preparation for updating Santos' Navigational Charting products. [Con-1768]			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
AHO provided its standard response on activity notifications that is issued to an operator developing an EP .	*Santos noted AHO's advice.*	*As per advice from AMSA, Santos will notify the AHO no less than four weeks before operations commence where*	*Activity notifications are included in **Table 8-5.***

		practicable. *Santos will notify AHO on any changes to the intended operations.*	
Australian Institute of Marine Science (AIMS)			
+ On 12 June 2023, Santos emailed AIMS and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2135] + On 26 June 2023, Santos emailed AIMS seeking feedback on proposed activities outlined in this EP. [Con-1657] + On 19 July 2023, Santos emailed AIMS by way of reminder on the timeframe for providing feedback. [Con-1666] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Australian Maritime Safety Authority (AMSA) – maritime safety			
+ On 30 May 2023, Santos emailed AMSA and provided information on a number of proposed activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2136] + On 29 June 2023, Santos emailed AMSA seeking feedback on proposed activities outlined in this EP. [Con-1659] + On 19 July 2023, Santos emailed AMSA by way of reminder on the timeframe for providing feedback. [Con-1667] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
While no feedback has been received from AMSA, Santos notes feedback from previous regional consultation activities, including: + *Contacting the AHO at*	*Santos notes previous feedback provided by AMSA.*	*Santos will notify the AHO no less than four weeks before operations commence where practicable.* *Santos will notify AMSA's JRCC at least 24–48 hours before operations*	*Activity notifications are included in **Table 8-5.***

datacentre@hydro.gov.au no less than four weeks before operations, with details relevant to the operations to promulgate the appropriate Notice to Mariners. + Notify AMSA's Joint Rescue Coordination Centre (JRCC) by email rccaus@amsa.gov.au for promulgation of radio-navigation warnings at least 24-48 hours before operations commence. + Provide updates to both the Australian Hydrographic Office and the JRCC on progress and, importantly, any changes to the intended operations. + Exhibit appropriate lights and shapes to reflect the nature of operations. + Set navigation status correctly in the ship's Automatic Identification System (AIS) unit.		*commence for each activity and advise when operations start and end.* *Santos will notify both AHO and AMSA's JRCC on any changes to the intended operations.* *Santos noted the advice on obligations to comply with COLREGs, in particular, the use of appropriate lights and shapes to reflect the nature of operations and this is addressed in* ***Section 6.5.***	
Australian Maritime Safety Authority (AMSA) – marine pollution			
+ On 29 June 2023, Santos emailed AMSA seeking feedback on proposed activities outlined in this EP. [Con-1658] + On 19 July 2023, Santos emailed AMSA by way of reminder on the timeframe for providing feedback. [Con-2461] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*AMSA's roles and responsibilities are defined in the [National Plan for Maritime Environmental Emergencies](#).*	*NA*	*No additional EP controls required.*

Department of Agriculture, Forestry and Fisheries (DAFF) – Fisheries

- On 29 May 2023, Santos emailed DAFF and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2138]
- On 15 June 2023, Santos met with DAFF (domestic fisheries branch) regarding the proposed activities and discussed opportunities to adopt pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries. [Con-2032]
- On 29 June 2023, Santos emailed DAFF seeking feedback on proposed activities outlined in this EP. [Con-1671]
- On 23 July 2023, Santos emailed DAFF by way of reminder on the timeframe for providing feedback. [Con-1672]
- On 31 July 2023, DAFF emailed Santos and provided the following feedback: [Con-2121]
    - AFMA could provide information on fishing effort in areas likely to be directly impacted by proposed activities.
- DAFF had no comment in relation to the activity location, further to Santos engaging AFMA on fishing effort and activity implications for licence holders.
- DAFF noted more broadly that there were increasing activities occurring in the marine space with numerous consultation processes, with the fishing industry reporting significant consultation fatigue and a lack of capacity to adequately respond to all consultations. DAFF suggested keeping this in mind when Santos conducts its consultations with the fishing industry.
- On 9 August 2023, Santos emailed DAFF to notify that Santos had engaged AFMA for activity consultation, reviewed AFMA fishing effort publications, and had provided consultation information to licence holders and representative organisations. Santos also confirmed it was working with a number of government authorities and representative organisations to develop consultation methods that met Regulatory requirements, while minimising fatigue to licence holders. [Con-2216]

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
DAFF confirmed at the meeting of 29 May 2023 that it required pre-start and activity completion notifications	*Santos notes DAFF's feedback.*	*Santos will send DAFF activity notifications.*	*Activity notifications are included in **Table 8-5**.*
DAFF advised that AFMA could provide fishing effort data on areas that were likely to be impacted by proposed activities.	*Santos notes DAFF advice on sourcing fishing effort data.*	*Santos has reviewed ABARES fishery status reports in the development of this EP.*	*See **Section 3.2.6.3**.*
DAFF had no additional comments on proposed activities.	*Santos notes DAFF feedback.*	*NA*	*NA*
DAFF commented on consultation fatigue in the fishing industry.	*Outside the consultation scope of this EP.*	*NA*	*NA*

Department of Defence (DoD)			
+ On 29 May 2023, Santos emailed DoD and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2238] + On 26 June 2023, Santos emailed DoD seeking feedback on proposed activities outlined in this EP. [Con-1662] + On 7 July 2023, DoD emailed Santos with feedback regarding the proposed activities, noting the activity areas are located within the North Australian Exercise Area (NAXA) and restricted airspace. DoD advised Santos must inform itself as to the risks associated with conducting activities in the NAXA and restricted airspace. DoD requested continued liaison with Australian Hydrographic Service for Notices to Mariners (NOTMAR) and to ensure the AHS (AHO) is notified at least three weeks prior to the commencement of activities. [Con-1796] + On 24 July 2023, Santos emailed DoD to confirm Santos will notify DoD for any activities and also confirm the AHS (AHO) is being consulted. Santos acknowledged DoD's advice in regard to location, identification, removal or damage to equipment from UXOs. [Con-1798]			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
DoD advised Santos that the activities will occur within an area designated for military exercises and provided advice on the responsibilities of an Operator in the area.	*Santos noted DoD's advice.*	*Santos will confirm restricted air space status with the Department as part of its commencement of activity notification.*	*Activity notifications are included in **Table 8-5**.*
DoD confirmed it required pre-start and activity completion notifications.	*Santos noted DoD's advice.*	*Santos confirmed activity notifications.*	*Activity notifications are included in **Table 8-5**.*
Department of Foreign Affairs and Trade (DFAT)			
+ On 8 June 2023, Santos emailed DFAT to advise of preliminary consultation regarding proposed activities outlined in this EP. [Con-2368] + On 14 June 2023, DFAT noted activities are proposed to be conducted in Australian waters and that environmental management is a matter for Australian regulators. DFAT provided contact details for DFAT personnel should there be a need to contact the governments of Timor-Leste or Indonesia. DFAT also stated that AMSA will normally inform DFAT when a maritime incident involves another country. However, DFAT provided contact details should Santos wish to contact DFAT direct in the event of an emergency - GlobalWatchOffice@dfat.gov.au. [Con-2111] + On 20 June 2023, Santos emailed DFAT thanking them for their feedback and sought additional information about DFAT's role with respect to international engagements and sought a meeting with DFAT. [Con 2513] + On 23 June 2023 Santos sent a follow up meeting request. [Con 2514]			

- On 7 July 2023, Santos provided information to DFAT relating to proposed activities, including information about worst case spill scenarios and international implications, seeking confirmation that DFAT will undertake country-to-country discussions for oil spill response should a spill leave Australian waters where AMSA does not have authority for planning and response. [Con-1782]
- On 7 July 2023, DFAT emailed Santos confirming that AMSA should remain the primary contact point in an emergency. AMSA will inform DFAT as soon as the emergency becomes a matter for DFAT. DFAT again provided contact details for DFAT personnel should there be a need to discuss matters relating to Timor-Leste or Indonesia. [Con-1788]
- On 13 July 2023, Santos emailed DFAT and acknowledged the contact details provided and will include these in Santos' contacts directory. [Con-1791]]

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
DFAT advised that AMSA should be the primary contact in the event of an emergency and that AMSA would contact DFAT if the matter became a matter for DFAT. *DFAT provided contact details for DFAT personnel should there be a need to contact the governments of Indonesia or Timor-Leste.*	*With the exception of hydrocarbon spill's environmental risks and impacts from the EP are localized and remain within Australia's Exclusive Economic Zone. The likelihood of an unmitigated spill reaching the territorial lands and waters of other countries is low for this activity.* *In the unlikely event that a hydrocarbon spill enters international or neighboring country waters, Santos will seek direction and assistance from the DFAT.* *Santos has established communications channels and protocols with DFAT in the event of an emergency that would require country-to-country engagements.* *Santos also notes that response planning and priortisitation of areas for protection outside of Australian territorial waters would be undertaken by the respective country under its respective spill response arrangements.*	*Santos will include contact details provided by DFAT in its contacts directory in the event that country-to-country engagement is required for emergency response planning.* *Santos acknowledges the role that DFAT would play more broadly in country-to-country discussions in the event that a marine pollution incident had implications for other nation interests.*	*The risk assessment and controls for hydrocarbon spills are described in Sections 7.6 and 7.7.*

Department of Industry, Science and Resources (DISR)			
+ On 26 June 2023, Santos emailed DISR seeking feedback on proposed activities outlined in this EP. [Con-1665] + On 19 July 2023, Santos emailed DISR by way of reminder on the timeframe for providing feedback. [Con-1669] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA)			
+ On 26 June 2023, Santos emailed DITRDCA seeking feedback on proposed activities outlined in this EP. [Con-1663] + On 18 July 2023, DITRDCA emailed Santos advising it has no specific comments at this stage. [Con-1799] + On 26 July 2023, Santos emailed DITRDCA acknowledging it had no comments. [Con-1800]			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NIL	*NA*	*NA*	*NA*
Director of National Parks (DNP)			
+ On 30 May 2023, Santos emailed DNP and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2140] + On 26 June 2023, Santos emailed DNP seeking feedback on proposed activities outlined in this EP. [Con-1664] + On 19 July 2023, Santos emailed DNP by way of reminder on the timeframe for providing feedback. [Con-1670] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
While no feedback has been received	*Santos notes previous feedback provided*	*All previously advised considerations*	*DNPs notification requirements. These can be*

from DNP, Santos notes feedback from previous regional consultation activities, including: + *Consideration of activity overlap with Australian Marine Parks.* + *Consideration of Biologically Important Areas and Key Ecological Features.* + *Consideration of Australian marine parks and their representativeness.* + *In the case of an emergency response, the DNP should be made aware of oil/gas pollution incidences which occur within a marine park or are likely to impact on a marine park as soon as possible. Notification should be provided to the 24-hour Marine Compliance Duty Officer.*	*by DNP.*	*are included in the relevant sections of the EP.*	*found in **Table 8-5.***
Regulation 25(1)(b): 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 (DBCA)			
+ On 30 May 2023, Santos emailed DBCA and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2144] + On 26 June 2023, Santos emailed DBCA seeking feedback on proposed activities outlined in this EP. [Con-1647] + On 19 July 2023, Santos emailed DBCA by way of reminder on the timeframe for providing feedback. [Con-1723] + On 26 July 2023, DBCA emailed Santos with feedback regarding the proposed activities as per the table below. [Con-2147] + On 14 Aug 2023, Santos emailed DBCA with feedback to address their queries. [Con-2281]			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***

DBCA noted that the information provided indicated that Santos' proposed offshore activities were located in proximity to the Barrow Island Marine Management Area and other associated marine parks and island reserves. *DBCA also noted that there were a number of ecologically important areas within the area of the Environment that May Be Affected (EMBA) by the proposed activities if there was a substantial hydrocarbon release.* *DBCA noted that baseline values of the EMBA should be understood and documented prior to any operations commencing that have the potential to lead to hydrocarbon releases.*	*Santos notes feedback provided by DBCA.*	*Santos acknowledges DBCA's comments in relation to baseline survey data. Our existing baseline data is reviewed every two years. In areas where limited baseline data is available, post spill pre-impact monitoring for the relevant receptors will be carried out in line with Santos' Operational and Scientific Monitoring Plan (OSMP). However, the ability to undertake this monitoring will depend on the arrival time for the oil to contact the sensitive receptors. The predicted arrival time for oil to contact key sensitive receptors is outlined in Section 7.6 (Hydrocarbon Spill – Loss of Well Control) and Section 7.7 (Hydrocarbon Spill – Marine Diesel Oil) of the EP.*	*No additional EP controls required.*
DBCA noted that the potential impact to conservation significant species should also be assessed, accounting for the scale, location and biological significance of the proposed activities. *DBCA recommended that vessel lighting should be designed to align with the standard of the National Light Pollution Guidelines for Wildlife (DCCEEW 2023) as far as practicable.*	*Santos notes feedback provided by DBCA.*	*Santos acknowledges there are ecologically important areas located in the vicinity of the proposed operations and these values and sensitivities are documented in Section 3 (Existing Environment) of the EP. In addition, the potential area to be affected by a hydrocarbon releases risk and impact assessed in Section 7 6 (Hydrocarbon Spill – Loss of Well Control) and Section 7.7 (Hydrocarbon Spill – Marine Diesel Oil) of the EP Section 5 (Environment Risk and Impact Assessment) of the EP outlines the process Santos follows to determine the risk and impact of an activity.* *Santos has addressed the impacts of lighting from vessels and 24-hour operations within Section 6.2 (Light*	*No additional EP controls required.*

		Emissions) of the EP. Santos has committed to reduce impacts to marine fauna from lighting on vessels and MODU through limiting lighting to that required by safety and navigational lighting requirements. Implementation of the National Light Pollution Guidelines has been assessed in Section 6.2 (Light Emissions) of the EP. *Santos has addressed the risk of operational activities and interactions with marine fauna, within Section 7.3 (Marine Fauna Interactions) of the EP. Santos has committed to no injury or mortality to EPBC Act 1999 and WA Biodiversity Conservation Act 2016 listed fauna during activities and proposed.*	
DBCA recommended that Santos assess what baseline information was required commensurate with the level of risk associated with the proposed activities and identify suitable sources/methods to attain that information such that Santos can ensure any impacts on ecological values and recovery of these values can be clearly identified, monitored and remediated.	*Santos notes feedback provided by DBCA.*	*Santos acknowledges DBCA's comments in relation to baseline survey data. Our existing baseline data is reviewed every two years. In areas where limited baseline data is available, post spill pre-impact monitoring for the relevant receptors will be carried out in line with Santos' Operational and Scientific Monitoring Plan (OSMP). However, the ability to undertake this monitoring will depend on the arrival time for the oil to contact the sensitive receptors. The predicted arrival time for oil to contact key sensitive receptors is outlined in Section 7 of the EP. Section 5 (Environment Risk and Impact Assessment) of the EP outlines the process Santos follows to determine the risk and impact of an activity. Further, Section 7 of the EP details the risk and impact assessment on*	*No additional EP controls required.*

		High Environment Value areas and the OPEP identifies Priority Protection Areas for response arrangements. Santos is confident that its risk and impact assessment process, baseline survey data review, and OSMP, addresses potential impacts on ecological values and recovery of these values.	
DBCA advised that published DBCA marine park monitoring may not be suitable to provide all baseline information required for oil spill risk assessment and management planning. *DBCA encouraged Santos to acquire necessary information to implement a Before-After, Control-Impact (BACI) framework in planning and evaluating its management response.*	*Santos notes feedback provided by DBCA.*	*Santos acknowledges the monitoring reports available from the DBCA website. Santos notes DBCAs comments in relation to the BACI framework and advise the required responses to satisfy the BACI framework are contained within the Scientific Monitoring Plans attachment included in the OPEP.*	*No additional EP controls required.*
DBCA provided contact details and communications expectations in the event of an actual or impending hydrocarbon release. *DBCA also advised it would not implement an oiled wildlife management response on behalf of a petroleum operator except as part of a whole of government response mandated by regulatory decision makers, and any advice or assistance from DBCA would occur on a full cost recovery basis.* *DBCA recommended Santos commit to the monitoring and clean-up of any DBCA interests affected by an oil spill in consultation with DBCA.*	*Santos notes feedback provided by DBCA.*	*Santos confirms in the event of a hydrocarbon release, it will notify DBCA's Pilbara office as soon as practicable on telephone number 08 9182 2000. Santos will also work with the Department of Transport to ensure effective management, monitoring and clean-up of any DBCA interests if affected by an oil spill, in consultation with DBCA.* *Santos also acknowledges DBCA's advice that it will not implement an oiled wildlife management response on behalf of a petroleum operator except as part of a whole of government response mandated by regulatory decision makers led by DoT (state's Hazard Management Agency) and any advice or assistance from DBCA, at any*	*Activity notifications are included in **Table 8-5**.*

		scale, will occur on a full cost recovery basis. Santos' also commits to consult with DBCA as required on monitoring and clean-up activity in the event of an oil spill and this commitment will be reflected in the OPEP.	

Department of Jobs, Tourism, Science and Innovation (JTSI)

- On 30 May 2023, Santos emailed JTSI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2239]
- On 26 June 2023, Santos emailed JTSI seeking feedback on proposed activities outlined in this EP. [Con-1645]
- On 19 July 2023, Santos emailed JTSI by way of reminder on the timeframe for providing feedback. [Con-1720]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Department of Planning, Lands and Heritage (DPLH)

- On 30 May 2023, Santos emailed DPLH and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2240]
- On 26 June 2023, Santos emailed DPLH seeking feedback on proposed activities outlined in this EP. [Con-1648]
- On 28 July 2023, DPLH emailed Santos to notify that it had undertaken a review of the proposed project area against the Aboriginal Cultural Heritage Directory. It confirmed the project area does not intersect with any known Aboriginal Cultural Heritage. [Con-1765]
- On 31 July 2023, Santos emailed DLPH acknowledging it had no feedback. [Con-1754]

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NIL	*NA*	*NA*	*NA*

Department of Primary Industries and Regional Development (DPIRD)			
+ On 30 May 2023, Santos emailed DPIRD and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and included a link to an information fact sheet about proposed activities in this EP. [Con-2148] + On 9 June 2023, Santos met with DPIRD regarding the proposed activities and discussed opportunities to adopt pragmatic and practical approaches for the consultation of licence holders entitled to fish in Western Australian fisheries. [Con-2035] + On 29 June 2023, Santos emailed DPIRD seeking feedback on proposed activities outlined in this EP. [Con-1710] + On 19 July 2023, Santos emailed DPIRD by way of reminder on the timeframe for providing feedback. [Con-1742] + On 20 July 2023, DPIRD emailed Santos and advised it noted Santos' advice that it was actively consulting with relevant commercial fishing sectors and had no further comments at this time regarding proposed activities. [Con-1759] + On 26 July 2023, Santos emailed DPIRD acknowledging DPIRD had no comments on proposed activities. [Con-1749]			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
DPIRD confirmed at the meeting of 9 June 2023 that it required pre-start and activity completion notifications	*Santos notes DPIRD's feedback.*	*Santos will send DPIRD activity notifications.*	*Activity notifications are included in **Table 8-5**.*
Department of Transport (DoT)			
+ On 29 June 2023, Santos emailed DoT seeking feedback on proposed activities outlined in this EP. [Con-1711] + On 5 July 2023, DoT emailed Santos advising if there is a risk of a spill impacting State waters from any of the proposed activities, please ensure the DoT is consulted as outlined in the Department of Transport Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (July 2020). [Con-1757] + On 26 July 2023, Santos emailed DoT acknowledging its request via email on 5 July 2023. In accordance with this guidance, Santos will provide draft OPEPs for respective activities, noting that we have already received feedback for those Environment Plans currently under assessment by the Regulator. [Con-1750] + On 14 August 2023, Santos emailed DoT confirming an update to the OPEP for the VI Hub Asset Removal Operations EP and sought further feedback from DoT [Con-2305] + On 21 August 2023, DoT emailed Santos stating if there is no change in risk to State waters, then it does not need to see the updated draft OPEP. [Con-2309] + On 30 October 2023, Santos emailed DoT regarding the Halyard-2 Drilling & Completion, advising some changes had been made to the VI Hub OPEP. Santos asked DoT if it would like to review the latest draft or would prefer to receive a copy of the accepted version of the OPEP. [Con-2574] + On 3 November 2023, DoT emailed Santos advising based on the information provided, including confirmation that the addition of the Halyard-2 Drilling & Completion			

doesn't constitute an increased risk to State waters outside of what is already covered in the VI Hub OPE. DoT does not need to review the Rev 15 version of the VI Hub OPEP at this stage. DoT would like a copy of the final OPEP. [Con-2616]

- On 3 November 2023, Santos emailed DoT acknowledging its reply and its request to see the accepted version of the OPEP. [Con-2618]

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
Nil	*NA*	*NA*	*Varanus Island Hub Operations OPEP and Halyard-2 Drilling & Completion EP **Section 6.9**.*

Department of Water and Environmental Regulation (DWER)

- On 30 June 2023, Santos emailed Department of Water and Environmental Regulation (DWER) regarding consultation for proposed Carnarvon Basin activities outlined in this EP. [Con-1673]
- On 23 July 2023, Santos emailed DWER a reminder of proposed Carnarvon Basin activities for consultation. [Con-1716]
- On 26 July 2023, DWER emailed Santos in response to an email on 24 July 2023. DWER requested an extension to 4 August 2023 in order to provide feedback regarding proposed Carnarvon Basin activities. [Con-1763]
- On 31 July 2023, Santos emailed DWER and confirmed an extension had been provided. [Con-1753]
- On 4 August 2023, DWER emailed Santos with feedback for this EP, requesting: [Con-2153]
  - Compliance with National Light Pollution Guidelines – considering recommendations within these guidelines and relevant actions committed to.
  - Notification in the event of a spill.
- On 18 August 2023 Santos emailed DWER and provided a response to its feedback of 4 August 2023. [Con-2300]

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
DWER advised compliance with National Light Pollution Guidelines is not a control measure. The recommendations within these guidelines should be considered and relevant actions committed to.	*Santos has considered DWER's feedback.*	*Santos has addressed the impacts of lighting from vessels and 24-hour operations within Section 6.2 of the EP. Santos has committed to reduce impacts to marine fauna from lighting on vessels and MODU through limiting lighting to that required by safety and navigational lighting requirements. Additionally, Santos has also committed to not displace marine*	*No additional controls required.*

		turtles from habitat critical to the survival of the species or disrupt biologically important behaviours from occurring within biologically important areas. Implementation of the National Light Pollution Guidelines has been assessed in Section 6.2 of the EP .	
DWER requested to be notified in the event of a spill.	*Santos has considered DWER's feedback*	*Santos will notify DWER in the event of a reportable spill incident as soon as practicable. Santos will contact DWER on the 24-hour pollution watch hotline 1300 784 782 and email: pollutionwatch@dwer.wa.gov.au consistent with the requirements of the Environmental Protection Act 1986 (Section 72) and Environmental Protection (Unauthorised Discharge) Regulations 2004. Please advise if there have been any changes to the contact details you wish to be included in the EP.*	*Activity notifications are included in **Table 8-5.***

Gascoyne Development Commission (GDC)

- On 30 May 2023, Santos emailed Gascoyne Development Commission and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2278]
- On 27 June 2023, Santos emailed Gascoyne Development Commission seeking feedback on proposed activities outlined in this EP. [Con-1655]
- On 19 July 2023, Santos emailed Gascoyne Development Commission by way of reminder on the timeframe for providing feedback. [Con-1734]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Mid West Development Commission (MWDC)			
+ On 2 June 2023, Santos emailed MWDC and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2469] + On 27 June 2023, Santos emailed MWDC seeking feedback on proposed activities. [Con-1654] + On 19 July 2023, Santos emailed MWDC by way of reminder on the timeframe for providing feedback. [Con-1732] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA.*	*No additional EP controls required.*
Ningaloo Coast World Heritage Advisory Committee (NCWH AC)			
+ On 30 May 2023, Santos emailed NCWHAC and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and included a link to an information fact sheet about proposed activities in this EP. [Con-2277] + On 27 June 2023, Santos emailed NCWHAC seeking feedback on proposed activities outlined in this EP. [Con-1649] + On 19 July 2023, Santos emailed NCWHAC by way of reminder on the timeframe for providing feedback. [Con-1725] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA.*	*No additional EP controls required.*
Pilbara Development Commission (PDC)			
+ On 30 May 2023, Santos emailed PDC and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation			

and included a link to an information fact sheet about proposed activities in this EP. [Con-2150]

- On 27 June 2023, Santos emailed PDC seeking feedback on proposed activities outlined in this EP. [Con-1656]
- On 19 July 2023, Santos emailed PDC by way of reminder on the timeframe for providing feedback. [Con-1736]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Pilbara Ports Authority (PPA)

- On 29 June 2023, Santos emailed PPA seeking feedback on proposed activities outlined in this EP. [Con-1714]
- On 19 July 2023, Santos emailed PPA by way of reminder on the timeframe for providing feedback. [Con-1743]
- On 20 July 2023, PPA emailed Santos advising all marine activities within port waters must be presented to their office for review. [Con-1760]
- On 20 July 2023, Santos emailed PPA advising it would like to arrange a meeting to discuss planned activities and emergency response implications. [Con-1746]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NIL	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Shark Bay World Heritage Advisory Committee (SBWHAC)

- On 30 May 2023, Santos emailed SBWHAC and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and included a link to an information fact sheet about proposed activities in this EP. [Con-2472]
- On 27 June 2023, Santos emailed SBWHAC seeking feedback on proposed activities outlined in this EP. [Con-1650]
- On 19 July 2023, Santos emailed SBWHAC by way of reminder on the timeframe for providing feedback on activities outlined in this EP. [Con-1727]

- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

South West Development Commission (SWDC)

- On 30 May 2023, Santos emailed SWDC and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and included a link to an information fact sheet about proposed activities in this EP. [Con-2471]
- On 27 June 2023, Santos emailed SWDC seeking feedback on proposed activities outlined in this EP. [Con-1652]
- On 19 July 2023, Santos emailed SWDC by way of reminder on the timeframe for providing feedback. [Con-1729]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Western Australian Museum (WAM)

- On 30 May 2023, Santos emailed the WA Museum and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2275]
- On 27 June 2023, Santos emailed WA Museum seeking feedback on proposed activities outlined in this EP. [Con-1651]
- On 17 July 2023, WA Museum emailed Santos with feedback regarding the proposed Carnarvon Basin activities. [Con-2137]
- On 18 August 2023, Santos emailed WA Museum with responses to their feedback on 17 July 2023. [Con-2302]

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***

WA Museum requested Santos consult the Department of Climate Change, Energy, the Environment and Water (underwater heritage branch) with respect to matters concerning the Underwater Cultural Heritage Act 2018 (Cwth). Santos should then engage the WA Museum as its Delegate, if deemed necessary.	*Santos notes WA Museum's guidance.*	*Santos confirms it has provided consultation information to the Department of Climate Change, Energy, the Environment and Water (underwater heritage branch) about proposed activities.*	*No additional EP controls required.*
WA Museum stated that Santos should not undertake activities that will have, or are likely to have, direct or indirect adverse impact on protected underwater cultural heritage (UCH) without a permit.	*Santos notes WA Museum's guidance.*	*Santos will comply with the Underwater Cultural Heritage Act 2018, and will not undertake activities that will have, or are likely to have, direct or indirect adverse impact on protected underwater cultural heritage (UCH) without an appropriate risk assessment and a permit.*	*Underwater Cultural Heritage Aspects are included in **Section 3.2.6.2** of the EP.* *No additional EP controls required.*
WA Museum stated that Santos should observe the requirements of protected zones and obtain a permit to enter or operate in a protected zone if it is required.	*Santos notes WA Museum's guidance.*	*Santos will observe the requirements of protected zones and obtain a permit to enter or operate in a protected zone if it is required.*	*No additional EP controls required.*
WA Museum stated that Santos should notify regulators of the discovery of any suspected UCH identified during the planning, development, operation, or decommissioning phases of a project within 21 days of the discovery.	*Santos notes WA Museum's guidance.*	*Santos will comply with the Underwater Cultural Heritage Act 2018, and will not undertake activities that will have, or are likely to have, direct or indirect adverse impact on protected underwater cultural heritage (UCH) without an appropriate risk assessment and a permit.* *Santos will observe the requirements of protected zones and obtain a permit to enter or operate in a protected zone if it is required; and will also notify regulators of the discovery of any suspected UCH identified during the planning, development, operation, or decommissioning phases of a project*	*Underwater Cultural Heritage Aspects are included in **Section 3.2.6.2** of the EP.* *Activity notifications are included in **Table 8-5**.* *No additional EP controls required.*

		within 21 days of the discover	
WA Museum stated that proponents should consider engaging a suitably qualified and experienced maritime archaeologist to undertake a UCH Desktop Assessment to identify Aboriginal and non-Aboriginal UCH within the project area.	*Santos notes WA Museum's guidance.*	*Santos has consulted the Department of Planning, Lands and Heritage for proposed activities, which has confirmed that the projects areas for proposed activities do not intersect with any known submerged Aboriginal Cultural Heritage.*	*No additional EP controls required.*
WA Museum stated that proponents should consult with Traditional Owners where appropriate.	*Santos notes WA Museum's guidance.*	*Santos has provided consultation information to Traditional Owners, where appropriate, for proposed activities. Consultation with these groups is ongoing.*	*No additional EP controls required.*
Wheatbelt Development Commission (WDC)			
+ On 27 June 2023, Santos emailed WDC seeking feedback on proposed activities outlined in this EP. [Con-1708] + On 19 July 2023, Santos emailed WDC by way of reminder on the timeframe for providing feedback. [Con-1740] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Regulation 25(1)(c): Department of the responsible Western Australian Minister			
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)			
+ On 19 June 2023 Santos met with DEMIRS to discuss clarification on the notifications DEMIRS like to receive on our EPs. Feedback is: - DEMIRS advised that historically, DEMIRS has asked for us to notify them with a commencement and cessation notification (without specifying a timeframe). - Moving forwards Santos will provide DEMIRS a commencement and cessation notification on EPs in C'wlth waters that may impact state waters (but might be easier to run notifications as a default given size of EMBAs).			

- In terms of timing of notifications, alignment to the NOPSEMA ten day notification would be useful for all Santos' EPs (C'wlth and State (noting that the State regs dot specify a timeframe so the 10 day one provides consistency). [Con-2115]

+ On 29 June 2023 Santos emailed DEMIRS to advise it of proposed Carnarvon Basin activities for consultation. [Con-1712]
+ On 19 July 2023 Santos emailed DEMIRS a reminder of proposed Carnarvon Basin activities for consultation. [Con-1898]
+ No further correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
DEMIRS confirmed at that it required pre-start and activity completion notifications.	*Santos notes DEMIRS feedback.*	*Santos will send DEMIRS activity notifications.*	*Activity notifications are included in* ***Table 8-5***

Regulation 25(1)(d): Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan

Academic and research organisations

Australian Marine Sciences Association (WA Branch)

+ On 12 June 2023, Santos emailed AMSA (WA Branch) and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of AMSA may be affected. [Con-2179]
+ On 27 June 2023, Santos emailed AMSA seeking feedback on proposed activities outlined in this EP. [Con-1674]
+ On 19 July 2023, Santos emailed AMSA by way of reminder on the timeframe for providing feedback. [Con-1681]
+ No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

+ On 12 June 2023, Santos emailed CSIRO and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact

sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of CSIRO may be affected. [Con-2154] + On 27 June 2023, Santos emailed CSIRO seeking feedback on proposed activities outlined in this EP. [Con-1675] + On 29 June 2023, CSIRO emailed Santos and advised it was not able to pursue a collaboration. [Con-1806]			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NIL	*NA*	*NA*	*NA*
Geoscience Australia (GA)			
+ On 12 June 2023, Santos emailed GA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of GA may be affected. [Con-2155] + On 27 June 2023, Santos emailed GA seeking feedback on proposed activities outlined in this EP. [Con-1676] + On 14 July 2023, Santos received a response email from GA, who advised it had no input or feedback. [Con-1808] + On 26 July 2023, Santos responded to the email from GA acknowledging it had no input or feedback for the proposed Carnarvon Basin activities. [Con-1797]			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NIL	*NA*	*NA*	*NA*
Charles Darwin University (CDU)			
+ On 27 June 2023, Santos emailed CDU seeking feedback on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of CDU may be affected. [Con-1680] + On 19 July 2023, Santos emailed CDU by way of reminder on the timeframe for providing feedback outlined in this EP. [Con-1682] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

University of Tasmania - Marine Biodiversity Hub (UTAS)			
+ On 12 June 2023, Santos emailed UTAS and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of UTAS may be affected. [Con-2156] + On 27 June 2023, Santos emailed UTAS seeking feedback on proposed activities outlined in this EP. [Con-1677] + On 19 July 2023, Santos emailed UTAS by way of reminder on the timeframe for providing feedback. [Con-1683] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
University of Western Australia (UWA)			
+ On 12 June 2023, Santos emailed UWA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of UWA may be affected. [Con-2157] + On 27 June 2023, Santos emailed UWA seeking feedback on proposed activities outlined in this EP. [Con-1678] + On 19 July 2023, Santos emailed UWA by way of reminder on the timeframe for providing feedback. [Con-1684] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Western Australian Marine Science Institution (WAMSI)			
+ On 12 June 2023, Santos emailed WAMSI and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact			

sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of WAMSI may be affected. [Con-2158]

- On 27 June 2023, Santos emailed WAMSI seeking feedback on proposed activities outlined in this EP. [Con-1679]
- On 19 July 2023, Santos emailed WAMSI by way of reminder on the timeframe for providing feedback. [Con-1685]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considersSection 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Commercial fishing – Commonwealth managed

Australian Southern Bluefin Tuna Fishery

- As part of preliminary consultation activities Santos sought to engage with AFMA, DAFF and representative organisations on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries.
- On 29 June 2023, Santos emailed licence holders in the Australian Southern Bluefin Tuna Fishery and provided information on a number of proposed Carnarvon Basin activities. Santos provided a link to an information fact sheet about proposed activities in this EP and sought feedback on proposed activities.
- On 28 July 2023, Santos emailed licence holders in the Australian Southern Bluefin Tuna Fishery by way of reminder on the timeframe for providing feedback.
- On 29 June 2023, a licence holder advised Santos refer to the tuna industry association - Tuna Australia – on consultation matters. [Con-2161]
- On 29 June 2023, Santos emailed the licence holder and advised it was consulting Tuna Australia as part of consultation activities. [Con-2166]
- No other correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NIL	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

North West Slope Trawl Fishery

- As part of preliminary consultation activities Santos sought to engage with AFMA, DAFF and representative organisations on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries.
- On 29 June 2023, Santos emailed licence holders in the North West Slope Trawl Fishery and provided information on a number of proposed Carnarvon Basin activities. Santos provided a link to an information fact sheet about proposed activities in this EP and sought feedback on proposed activities.
- On 28 July 2023, Santos emailed licence holders in the North West Slope Trawl Fishery by way of reminder on the timeframe for providing feedback.
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Small Pelagic Fishery

- As part of preliminary consultation activities Santos sought to engage with AFMA, DAFF and representative organisations on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries.
- On 29 June 2023, Santos emailed licence holders in the Small Pelagic Fishery and provided information on a number of proposed Carnarvon Basin activities. Santos provided a link to an information fact sheet about proposed activities in this EP and sought feedback on proposed activities.
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Western Deepwater Trawl Fishery

- As part of preliminary consultation activities Santos sought to engage with AFMA, DAFF and representative organisations on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries.

- On 29 June 2023, Santos emailed licence holders in the Western Deepwater Trawl Fishery and provided information on a number of proposed Carnarvon Basin activities. Santos provided a link to an information fact sheet about proposed activities in this EP and sought feedback on proposed activities.
- On 28 July 2023, Santos emailed licence holders in the Western Deepwater Trawl Fishery by way of reminder on the timeframe for providing feedback.
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Western Skipjack Fishery

- As part of preliminary consultation activities Santos sought to engage with AFMA, DAFF and representative organisations on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries.
- On 29 June 2023, Santos emailed licence holders in the Western Skipjack Fishery and provided information on a number of proposed Carnarvon Basin activities. Santos provided a link to an information fact sheet about proposed activities in this EP and sought feedback on proposed activities.
- On 28 July 2023, Santos emailed licence holders in the Western Skipjack Fishery by way of reminder on the timeframe for providing feedback.
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Western Tuna and Billfish Fishery

- As part of preliminary consultation activities Santos sought to engage with AFMA, DAFF and representative organisations on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries.
- On 29 June 2023, Santos emailed licence holders in the Western Tuna and Billfish Fishery and provided information on a number of proposed Carnarvon Basin activities.

Santos provided a link to an information fact sheet about proposed activities in this EP and sought feedback on proposed activities. + On 28 July 2023, Santos emailed licence holders in the Western Tuna and Billfish Fishery by way of reminder on the timeframe for providing feedback. + No other correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Commercial fishing – Western Australian managed			
Mackerel Managed Fishery (Area 2)			
+ As part of preliminary consultation activities Santos sought to engage with DPIRD and WAFIC on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Western Australian fisheries. Santos followed WAFIC guidance to consult licence holders who may be directly affected. Santos also used WAFIC fee-for-service arrangements to circulate consultation information to fishers. + On 29 June 2023, WAFIC emailed licence holders in the Mackerel Managed Fishery and provided information on a number of proposed Carnarvon Basin activities. WAFIC correspondence included a link to an information fact sheet about proposed activities in this EP and sought feedback on proposed activities. WAFIC also provided a summary of Santos consultation activities on a trial Consultation Hub on its website. [Con-1891] + On 24 July 2023, WAFIC emailed licence holders in the Mackerel Managed Fishery by way of reminder on the timeframe for providing feedback. [Con-2182] + No correspondence or feedback has been received from licence holders.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Onslow Prawn Managed Fishery			
+ As part of preliminary consultation activities Santos sought to engage with DPIRD and WAFIC on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Western Australian fisheries. Santos followed WAFIC guidance to consult licence holders who may be directly affected. Santos also used WAFIC			

fee-for-service arrangements to circulate consultation information to fishers.

+ On 29 June 2023, WAFIC emailed licence holders in the Onslow Prawn Managed Fishery and provided information on a number of proposed Carnarvon Basin activities. WAFIC corresponded included a link to an information fact sheet about proposed activities in this EP and sought feedback on proposed activities. WAFIC also provided a summary of Santos consultation activities on a trial Consultation Hub on its website. [Con-1891]
+ On 24 July 2023, WAFIC emailed licence holders in the Onslow Prawn Managed Fishery by way of reminder on the timeframe for providing feedback. [Con-2182]
+ No correspondence or feedback has been received from licence holders.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Pilbara Line Fishery (Condition)

+ As part of preliminary consultation activities Santos sought to engage with DPIRD and WAFIC on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Western Australian fisheries. Santos followed WAFIC guidance to consult licence holders who may be directly affected. Santos also used WAFIC fee-for-service arrangements to circulate consultation information to fishers.
+ On 29 June 2023, WAFIC emailed licence holders in the Pilbara Line Fishery and provided information on a number of proposed Carnarvon Basin activities. WAFIC correspondence included a link to an information fact sheet about proposed activities in this EP and sought feedback on proposed activities. WAFIC also provided a summary of Santos consultation activities on a trial Consultation Hub on its website. [Con-1891]
+ On 24 July 2023, WAFIC emailed licence holders in the Pilbara Line Fishery by way of reminder on the timeframe for providing feedback. [Con-2182]
+ No correspondence or feedback has been received from licence holders.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Pilbara Trap Managed Fishery

- As part of preliminary consultation activities Santos sought to engage with DPIRD and WAFIC on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Western Australian fisheries. Santos followed WAFIC guidance to consult licence holders who may be directly affected. Santos also used WAFIC fee-for-service arrangements to circulate consultation information to fishers.
- On 29 June 2023, WAFIC emailed licence holders in the Pilbara Trap Managed Fishery and provided information on a number of proposed Carnarvon Basin activities. WAFIC correspondence included a link to an information fact sheet about proposed activities in this EP and sought feedback on proposed activities. WAFIC also provided a summary of Santos consultation activities on a trial Consultation Hub on its web site. [Con-1891]
- On 24 July 2023, WAFIC emailed licence holders in the Pilbara Trap Managed Fishery by way of reminder on the timeframe for providing feedback. [Con-2182]
- No correspondence or feedback has been received from licence holders.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

West Coast Deep Sea Crustacean Managed Fishery

- As part of preliminary consultation activities Santos sought to engage with DPIRD and WAFIC on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Western Australian fisheries. Santos followed WAFIC guidance to consult licence holders who may be directly affected. Santos also used WAFIC fee-for-service arrangements to circulate consultation information to fishers.
- On 29 June 2023, WAFIC emailed licence holders in the West Coast Deep Sea Crustacean Managed Fishery and provided information on a number of proposed Carnarvon Basin activities. WAFIC correspondence included a link to an information fact sheet about proposed activities in this EP and sought feedback on proposed activities. WAFIC also provided a summary of Santos consultation activities on a trial Consultation Hub on its web site. [Con-1891]
- On 24 July 2023, WAFIC emailed licence holders in the West Coast Deep Sea Crustacean Managed Fishery by way of reminder on the timeframe for providing feedback. [Con-2182]
- No correspondence or feedback has been received from licence holders.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25*	*NA*	*No additional EP controls required.*

	consultation complete for this EP.		

Energy industry – Petroleum titleholders and GHG permit holders

3D Oil Ltd

- On 2 June 2023, Santos emailed 3D Oil and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2274]
- On 27 June 2023, Santos emailed 3D Oil seeking feedback on proposed activities outlined in this EP. [Con-1686]
- On 19 July 2023, Santos emailed 3D Oil by way of reminder on the timeframe for providing feedback. [Con-1713]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Beagle No. 1

- On 21 August 2023, Santos emailed Beagle No 1 and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2307]
- On 14 September 2023 Beagle No 1 emailed Santos regarding its proposed Carnarvon Basin activities and advised Santos' activities are not going to impact its activities at WA-542-P and therefore though it acknowledges and thanks Santos for consultation procedure its does not feel it necessary to request further information or provide additional feedback at this time. [Con-2393]

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NIL	*NA*	*NA*	*NA*

BP Developments Australia

- On 2 June 2023, Santos emailed BP and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2273]

Santos

- On 27 June 2023, Santos emailed BP seeking feedback on proposed activities. [Con-1688]
- On 18 July 2023, Santos emailed BP by way of reminder on the timeframe for providing feedback. [Con-1717]
- On 25 July 2023, BP emailed Santos advising it had no comments or objection to the proposed activities. [Con-1762]
- On 26 July 2023, Santos emailed BP acknowledging their feedback received via email on 25 July 2023. [Con-1767]

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NIL	*NA*	*NA*	*NA*

Carnarvon Energy

- On 2 June 2023, Santos emailed Carnarvon Energy and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1882]
- On 12 June 2023, Carnarvon Energy emailed advising it had no further requests for information. [Con-1884]

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NIL	*NA*	*NA*	*NA*

Chevron Australia

- On 2 June 2023, Santos emailed Chevron and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1879]
- On 12 June 2023, Chevron emailed Santos advising all consultation emails are to go to ABUConsultation@chevron.com. Chevron requested Santos provide GIS shape files for the activities. [Con-1885]
- On 26 July 2023, Santos emailed Chevron shape files and requested Chevron provide feedback by 10 August 2023. [Con-1887]
- On 11 August 2023, Chevron emailed Santos regarding the proposed Carnarvon Basin activities. Chevron advised it had no issues with the proposed activities. Chevron requested should any work planned is executed during the cyclone season, please provide cyclone anchor configuration, as well as mooring design, site specific geophysical and geotechnical data, anchor analysis, risk mitigations to inform Chevron Australia of the potential risks to our assets within the affected leases. [Con-2280]
- On 1 September 2023, Santos emailed Chevron with an assessment of potential risks to Chevron assets arising from cyclone conditions. [Con-2334]

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***

While Chevron had no objections or claims about proposed activities, it requested additional information should activities be undertaken during cyclone season to inform potential risks to Chevron assets.	*Santos has assessed Chevron's request and assessed that the Halyard-2 Drilling & Completion EP Operational Area is approximately 1.6 km from the nearest Chevron asset, the Wheatstone pipeline.*	*Santos provided \information regarding anchoring / mooring analysis as requested by Chevron.*	*NA*
Coastal Oil & Gas			
+ On 21 August 2023, Santos emailed Coastal O&G and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2306] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NIL	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Eni Australia			
+ On 2 June 2023, Santos emailed Eni Australia and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2272] + On 27 June 2023, Santos emailed Eni Australia seeking feedback on proposed activities. [Con-1689] + On 19 July 2023, Santos emailed Eni Australia by way of reminder on the timeframe for providing feedback. [Con-1718] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Finder			
+ On 2 June 2023, Santos emailed Finder and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2271] + On 27 June 2023, Santos emailed Finder seeking feedback on proposed activities. [Con-1690] + On 28 June 2023, Finder emailed notifying Santos that it has no objection or feedback on proposed activities in the Carnarvon Basin. [Con-1756] + On 14 July 2023, Santos emailed Finder acknowledging its email from 28 June 2023. [Con-1751]			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NIL	*NA*	*NA*	*NA*
INPEX			
+ On 27 June 2023, Santos emailed INPEX and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1691] + On 19 July 2023, Santos emailed INPEX by way of reminder on the timeframe for providing feedback. [Con-1719] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Jadestone Energy			
+ On 2 June 2023, Santos emailed Jadestone and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2270] + On 27 June 2023, Santos emailed Jadestone seeking feedback on proposed activities. [Con-1693] + On 19 July 2023, Santos emailed Jadestone by way of reminder on the timeframe for providing feedback. [Con-1722] + No correspondence or feedback has been received.			

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.*	*NA*	*No additional EP controls required.*

Kato Energy

- On 2 June 2023, Santos emailed Kato Energy and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2269]
- On 27 June 2023, Santos emailed Kato Energy seeking feedback on proposed activities. [Con-1694]
- On 19 July 2023, Santos emailed Kato Energy by way of reminder on the timeframe for providing feedback. [Con-1724]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.*	*NA*	*No additional EP controls required.*

KUFPEC

- On 2 June 2023, Santos emailed KUFPEC and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2268]
- On 27 June 2023, Santos emailed KUFPEC seeking feedback on proposed activities. [Con-1695]
- On 19 July 2023, Santos emailed KUFPEC by way of reminder on the timeframe for providing feedback. [Con-1726]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Mobil Australia			
+ On 2 June 2023, Santos emailed Mobil Australia and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2267] + On 27 June 2023, Santos emailed Mobil Australia seeking feedback on proposed activities. [Con-1697] + On 19 July 2023, Santos emailed Mobil Australia by way of reminder on the timeframe for providing feedback. [Con-1728] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Pathfinder Energy			
+ On 2 June 2023, Santos emailed Pathfinder Energy and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2266] + On 27 June 2023, Santos emailed Pathfinder Energy seeking feedback on proposed activities. [Con-1698] + On 19 July 2023, Santos emailed Pathfinder Energy by way of reminder on the timeframe for providing feedback. [Con-1730] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Skye Energy			

- On 21 August 2023, Santos emailed Skye Energy and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2308]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Vermilion Oil & Gas Australia

- On 2 June 2023, Santos emailed Vermilion Oil & Gas Australia and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2265]
- On 27 June 2023, Santos emailed Vermilion Oil & Gas Australia seeking feedback on proposed activities. [Con-1703]
- On 19 July 2023, Santos emailed Vermilion Oil & Gas Australia by way of reminder on the timeframe for providing feedback. [Con-1741]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Western Gas

- On 2 June 2023, Santos emailed Western Gas and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2264]
- On 27 June 2023, Santos emailed Western Gas seeking feedback on proposed activities. [Con-1704]
- On 19 July 2023, Santos emailed Western Gas by way of reminder on the timeframe for providing feedback. [Con-1745]
- On 8 August 2023, Western Gas emailed Santos and advised it will not be directly impacted by the proposed activities and had no feedback. [Con-2224]

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NIL	*NA*	*NA*	*NA*

Woodside Energy Ltd

- On 2 June 2023, Santos emailed Woodside Energy Ltd and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2263]
- On 27 June 2023, Santos emailed Woodside Energy Ltd seeking feedback on proposed activities. [Con-1705]
- On 19 July 2023, Santos emailed Woodside Energy Ltd by way of reminder on the timeframe for providing feedback. [Con-1747]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Environmental conservation organisations

Australian Conservation Foundation (ACF)

- On 2 June 2023 Santos emailed ACF and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of ACF may be affected. [Con-2159]
- On 27 June 2023, Santos emailed ACF seeking feedback on proposed activities. [Con-1769]
- On 19 July 2023, Santos emailed ACF by way of reminder on the timeframe for providing feedback. [Con-1783]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.*	*NA*	*No additional EP controls required.*

	Santos considers Sectio 25 consultation complete for this EP.		

Cape Conservation Group (CCG)

- On 2 June 2023, Santos emailed CCG and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2262]
- On 27 June 2023, Santos emailed CCG seeking feedback on proposed activities. [Con-1770]
- On 19 July 2023, Santos emailed CCG by way of reminder on the timeframe for providing feedback. [Con-1784]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Care for Hedland

- On 2 June 2023, Santos emailed Care for Hedland and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2261]
- On 12 June 2023, Care for Hedland emailed Santos advising it would like to be involved in the preliminary consultation for proposed Carnarvon Basin activities. [Con-2104]
- On 6 July 2023, Santos met with Care for Hedland to provide an overview of the proposed Carnarvon Basin activities; learn more about Care for Hedland and their purpose and objectives; listen to any concerns Care for Hedland had with the proposed activities; and to discuss how it wanted to be consulted and if it wanted to receive activity notifications and emergency communications. Care for Hedland confirmed it required pre-start and activity completion notifications. [Con-2026]
- On 14 July 2023, Santos emailed Care for Hedland thanking it for the meeting and providing information including the AMSA National Emergency Response Plan and DoT Hazard Maritime Emergency Plan. Santos confirmed it would add Care for Hedland onto the emergency communication list for the Carnarvon Basin activities. [Con-1781]
- On 21 July 2023, Santos emailed Care for Hedland requesting additional feedback for the proposed Carnarvon Basin activities. [Con-1795]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***

Care for Hedland confirmed at the meeting of 6 July 2023 that it required pre-start and activity completion notifications.	*Santos notes Care for Hedland's feedback.*	*Santos will send Care for Hedland activity notifications.*	*Activity notifications are included in* ***Table 8-5.***
Conservation Council of WA (CCWA)			
+ On 2 June 2023, Santos emailed CCWA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of CCWA may be affected. [Con-2160] + On 27 June 2023, Santos emailed CCWA seeking feedback on proposed activities. [Con-1771] + On 19 July 2023, Santos emailed CCWA by way of reminder on the timeframe for providing feedback. [Con-1785] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Greenpeace Australia Pacific (GAP)			
+ On 2 June 2023, Santos emailed GAP and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of GAP may be affected. [Con-2162] + On 27 June 2023, Santos emailed GAP seeking feedback on proposed activities. [Con-1774] + On 19 July 2023, Santos emailed GAP by way of reminder on the timeframe for providing feedback. [Con-1787] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

International Fund for Animal Welfare (IFAW)			
+ On 2 June 2023, Santos emailed IFAW and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of IFAW may be affected. [Con-2163] + On 27 June 2023, Santos emailed IFAW seeking feedback on proposed activities. [Con-1775] + On 19 July 2023, Santos emailed IFAW by way of reminder on the timeframe for providing feedback. [Con-1789] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Protect Ningaloo			
+ On 2 June 2023, Santos emailed Protect Ningaloo and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2260] + On 27 June 2023, Santos emailed Protect Ningaloo seeking feedback on proposed activities. [Con-1780] + On 19 July 2023, Santos emailed Protect Ningaloo by way of reminder on the timeframe for providing feedback. [Con-1790] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Wilderness Society (WS)			
+ On 2 June 2023, Santos emailed WS and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet			

about proposed activities in this EP and sought feedback on whether the functions, interests or activities of WS may be affected. [Con-2164] + On 27 June 2023, Santos emailed WS seeking feedback on proposed activities. [Con-1777] + On 19 July 2023, Santos emailed WS by way of reminder on the timeframe for providing feedback. [Con-1793] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
World Wildlife Fund (WWF)			
+ On 2 June 2023, Santos emailed WWF and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of WWF may be affected. [Con-2165] + On 27 June 2023, Santos emailed WWF seeking feedback on proposed activities. [Con-1779] + On 19 July 2023, Santos emailed WWF by way of reminder on the timeframe for providing feedback. [Con-1794] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
First Nations peoples and group: **Representative organisations – regional**			
South West Aboriginal Land And Sea Council (SWALSC)			
+ On 26 June 2023, Santos emailed SWALSC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of SWALSC may be affected. [Con-2097]			

- On 20 July 2023, Santos sent a follow up email to SWALSC by way of reminder on the timeframe for providing feedback on activities outlined in this EP. [Con-2070]
- On 8 September 2023, Santos emailed SWALSC a reminder of proposed Carnarvon Basin activities for consultation requesting feedback if it believed that its functions, interests, or activities may be affected by Santos' proposed activities, including consideration of potential impacts to or risks associated with:
    - Traditional lands and waters
    - Sea country interests
    - Totemic species
    - Other values or sensitivities of importance [Con-2377]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NIL	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Yamatji Marlpa Aboriginal Council (YMAC) – Please also refer to NTGAC entries which reference YMAC

- On 29 May 2023, Santos emailed YMAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of YMAC may be affected. [Con-2181]
- On 12 June 2023, Santos sent a follow up email to YMAC to discuss consultation expectations for proposed activities. [Con-2183]
- On 19 June 2023, YMAC sent Santos an email with a proposed draft consultation framework in regard to oil and gas projects. YMAC also provided a letter to Santos stating it would contact Santos to discuss the framework and its administration. [Con-2106]
- On 20 July 2023, Santos sent an email to YMAC acknowledging the provision of the draft consultation framework. Santos suggested an initial meeting to progress discussions in accordance with YMAC's expectations, including recognition and contribution for consultation of Rep Bodies and PBCs, as well as processes for the identification and protection of areas of cultural importance that may be affected by Santos' proposed activities. [Con-2075]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for*	*NA*	*No additional EP controls required.*

	consultation. *Santos considers Section 25 consultation complete for this EP.*		
Murujuga Aboriginal Corporation (MAC)			
+ On 29 May 2023, Santos emailed MAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of MAC and its members may be affected. [Con-2184] + On 30 May 2023, MAC emailed Santos and advised it didn't have the capacity to be involved in the consultation process. [Con-2105] + On 27 June 2023, Santos emailed MAC seeking feedback on proposed activities. [Con-2095] + On 20 July 2023, Santos emailed MAC by way of reminder on the timeframe for providing feedback. [Con-2067] + On 21 July 2023, MAC emailed Santos advising it did not consider itself a relevant person for consultation. [Con-2058] + On 21 July 2023, Santos emailed MAC thanking it for its response. [Con-2198]			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
Nil	*NA*	*NA*	*NA*
Native Title interests – Pilbara Region			
Buurabalayji Thalanyji Aboriginal Corporation (BTAC)			
+ On 29 May 2023, Santos emailed BTAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of BTAC and its members may be affected. [Con-2185] + On 12 June 2023, Santos sent a follow up email to BTAC to discuss consultation expectations for proposed activities. [Con-2186] + On 21 June 2023, BTAC sent Santos a letter via email setting out its expectations for consultation, including entering into an engagement framework. [Con-2108] + On 20 July 2023, Santos emailed BTAC in response to their email on 21 June 2023 proposing a meeting to discuss how best to approach consultation for the proposed Carnarvon Basin activities. [Con-2074] + On 7 August 2023, Santos called BTAC's nominated representative to progress consultation discussions. Santos sent a follow-up email on 8 August 2023 to set up a preliminary meeting with BTAC. [Con-2218] + On 10 September 2023, Santos emailed BTAC a reminder of proposed Carnarvon Basin activities for consultation requesting feedback if it believed that its functions, interests, or activities may be affected by Santos' proposed activities, including consideration of potential impacts to or risks associated with:			

- Traditional lands and waters
- Sea country interests
- Totemic species
- Other values or sensitivities of importance [Con-2381]

+ On 11 September 2023, BTAC emailed Santos to confirm they wished to be consulted on this EP. BTAC indicated its preferred position was to enter into a framework agreement with Santos to ensure meaningful and appropriately resourced ongoing engagement for these and other activities and EPs that may require consultation in future. [Con-2382]
+ On 12 September 2023, BTAC emailed Santos advising it could meet with Santos on 21 September 2023, providing an estimated cost for the meeting [Con-2385]
+ On 18 September 2023, Santos emailed BTAC's nominated representative confirming it could meet on 21 September 2023. [Con-2434]
+ On 18 September 2023, BTAC's nominated representative confirmed the meeting date. [Con-2436]
+ On 18 September 2023, BTAC's nominated representative further advised that the meeting would need to be deferred due to community matters. [Con-2441]
+ On 18 September 2023, Santos emailed BTAC's nominated representative confirming BTAC's advice. [Con-2446]
+ On 29 September 2023, Santos emailed BTAC's nominated representative seeking an update on a potential meeting date. [Con-2445]
+ On 29 September 2023, BTAC's nominated representative advised that a meeting would not be likely until mid-October 2023 due to limited capacity. [Con-2447]
+ On 5 October 2023, Santos emailed BTAC's nominated representative a commitment to the codesign of a consultation agreement, as well as list of proposed Santos activities in the Carnarvon Basin, with planned EP and EP submission and activity commencement dates. [Con-2488]
+ On 25 October 2023, Santos emailed BTAC with a request for feedback on the proposed Carnarvon Basin activities by 30 October 2023 given pending EP submission to NOPSEMA. Santos included an engagement protocol to support the consultation. [Con-2561]
+ On 30 October 2023, BTAC emailed Santos advising it would like to be consulted on an ongoing basis and would like to enter into a holistic agreement with Santos. In the absence of any agreed resourcing by Santos, BTAC has not been able to meaningfully share information or undertake consultation with its members in relation to the above proposed activities and EPs. [Con-2575]
+ On 31 October 2023, Santos emailed BTAC thanking BTAC's correspondence in relation to our proposed consultation activities for activities offshore Western Australia. Santos advised it is still keen to meet to progress discussions on the development of a framework agreement, including support of meaningful ongoing engagement, information sharing, and capacity building. Santos requested BTAC advise if and when it can meet. [Con-2601]
+ On 23 November 2023, Santos emailed BTAC following up on the proposed resourcing protocol, general report, and to request a meeting before the end of 2023. Santos also asked for a list of the Board meetings were planned in 2024 so Santos could forward plan. [Con-2803]
+ On 23 November 2023, BTAC emailed Santos advising it would get to them as soon as possible. BTAC requested a Word doc version of the draft engagement protocol as

BTAC was likely to have some edits to that document. [Con-2804]

- On 22 January 2024, Santos emailed BTAC with minor edits to the engagement protocol [Con-3088]
- On 8 February 2024, Santos emailed BTAC to confirm the engagement protocol was being finalised. [Con-3845]
- On 9 February 2024 Santos emailed BTAC to advise the engagement protocol had been finalised. BTAC acknowledged the email from Santos regarding the finalising of the engagement protocol. [Con-3846]
- No further correspondence of feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
At the time of EP submission to NOPSEMA, BTAC had not provided any concerns in relation to proposed activities relating to this EP.	*The consultation process for this EP has been running for more than eleven months, since the first engagement on 29 May 2023.* *In order for the EP to meet the drilling schedule of April 2024, the EP was submitted to NOPSEMA in December 2023 to allow for NOPSEMA's assessment to commence.* *BTAC was advised before the EP was submitted to allow them an opportunity for any feedback.* *Santos has made considerable and significant efforts to date to try and engage and consult with BTAC and within a reasonable timeframe to obtain their feedback.* *Santos considers Section 25 consultation complete for this EP.*	*In response to BTAC's request to be consulted, Santos has provided BTAC with the following information for consultation:* + *Santos' consultation materials specific to the activity.* + *Follow up emails and calls as per the NOPSEMA sensitive information report to endeavour to close out EP consultation.* + *A prioritised list of Carnarvon Basin activities and EP submission dates, including an emphasis on the pending submission of this EP.* + *An email and letter providing a final opportunity to provide feedback prior to EP submission.* *With respect to the development of a holistic agreement Santos has:*	*All information and communication with BTAC has been included in the NOPSEMA sensitive information report for this EP.*

		+ *Concluded with BTAC a consultation protocol and supporting schedule of rates.* *Santos will continue to engage with BTAC to conclude a holistic agreement.*	
Kariyarra Aboriginal Corporation (KAC)			
+ On 29 May 2023, Santos emailed KAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of KAC may be affected. [Con-2187] + On 26 June 2023, Santos emailed KAC to discuss consultation expectations for proposed activities outlined in this EP. [Con-2042] + On 20 July 2023, Santos emailed KAC by way of reminder on the timeframe for providing feedback. [Con-2077] + On 30 July 2023, KAC emailed Santos advising it requires full consultation for proposed Carnarvon Basin activities. [Con-2044] + On 31 July 2023, Santos emailed KAC advising it would like to meet to discuss the proposed activities. [Con-2062] + On 8 August 2023, Santos emailed KAC a reminder to discuss proposed activities. [Con-2180] + On 8 August 2023, KAC emailed Santos advising it would be in touch shortly. [Con-2236] + On 14 August 2023, Santos emailed KAC to advise it would be in Port Hedland on 16 August 2023 and would be available to meet. [Con-2478] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Nganhurra Thanardi Garrbu Aboriginal Corporation (NTGAC)			
+ On 29 May 2023, Santos emailed YMAC on behalf of NTGAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of NTGAC may be affected. [Con-2188] + On 19 June 2023, YMAC emailed Santos on behalf of NTGAC and referred Santos to YMAC's draft consultation framework. [Con-2107]			

- On 20 July 2023, Santos emailed YMAC on behalf of NTGAC proposing a meeting to discuss how to approach consultation for proposed Carnarvon Basin activities [Con-2075]
- On 7 August 2023, Santos called YMAC by way of a follow-up to set a meeting date. YMAC confirmed that Santos would receive advice by email for a proposed meeting date with NTGAC in September 2023. [Con-2189]
- On 21 August 2023, YMAC on behalf of NTGAC sent Santos an email with a draft budget estimate for a proposed meeting with the NTGAC Board of Directors in September 2023. [Con-2313]
- On 22 August 2023, Santos emailed NTGAC advising it would consider the proposed meeting budget estimate. [Con-2397]
- On 4 September 2023, YMAC emailed Santos advising it would like to meet with Santos on 11/09/23 to discuss the agenda for the proposed meeting regarding future consultation. [Con-2335]
- On 7 September 2023, Santos emailed YMAC confirming attendance at the meeting. Santos requested if it would be online or in person. [Con-2371]
- On 8 September 2023, NTGAC emailed Santos following up on the proposed meeting budget. [Con-2379]
- On 11 September 2023, Santos responded to NTGACs email from 8 September 2023 confirming it accepts the proposed budget for the meeting on 28 September 2023. [Con-2383]
- On 28 September 2023, Santos met with NTGAC to discuss Santos activities and consultation expectations, including the development of a consultation agreement and supporting consultation materials. [Con-2645]
- On 5 October 2023, Santos emailed NTGAC a commitment to the codesign of a consultation agreement, as well as list of proposed Santos activities in the Carnarvon Basin, with planned EP submission and activity commencement dates. [Con-2487]
- On 25 October 2023 Santos emailed YMAC on behalf of NTGAC with a request for feedback on the proposed Carnarvon Basin activities by 30 October 2023 given pending EP submission to NOPSEMA. Santos included an engagement protocol to support the consultation. [Con-2560]
- On 1 November 2023 Santos emailed YMAC (NTGAC) to follow up on the opportunity to discuss a way forward on the Draft Agreement, Rates Schedule and the General Report, the latter of which Santos have in draft. Santos advised it would be pleased to meet. [Con-2604]
- On 3 November 2023 YMAC (on behalf of NTGAC) emailed Santos advising it has been a busy period. YMAC advised it would be in touch later in November to discuss and proposed the 20 November 2023 for a meeting. [Con-2613]
- On 10 November 2023 Santos emailed NTGAC to confirm a meeting the week of 20 November 2023 to progress consultation. Santos provided a draft general report for NTGAC to review and provide feedback to finalise a consultation agreement. [Con-2649]
- On 10 November 2023, Santos emailed NTGAC to advise of additional resources to support consultation and engagement with NTGAC, including an introduction from Santos' new team member. [Con-2656]
- On 27 November 2023, Santos emailed NTGAC to follow up on the General Report emailed through on 10/11/23, requesting feedback. Santos advised it was available to

talk through the report with relevant stakeholders as required, as well as answer any questions. [Con-2784]

- On 29 January 2024 Santos emailed NTGAC to again follow up on the provision of the Santos NTGAC General Report final, seek feedback, and progress the consultation agreement, with a view to then organisation consultation meetings. [Con-3090]
- On the 20 February 2024, Santos again emailed NTGAC with a copy of the General Report (Final), to seek to progress meetings and consultation. [Con-3848]
- On 21 February 2024, NTGAC emailed Santos acknowledging receipt of the email of 20 February [Con-3849]
- On 7 March 2024, Santos phoned NTGAC to seek progress on consultations and emailed NTGAC with a copy of the General Report (Final), to seek to progress meetings and consultation. [Con-3850]
- No further correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
At the time of EP submission to NOPSEMA, NTGAC had not provided any concerns in relation to proposed activities relating to this EP.	*The consultation process for this EP has been running for more than eleven months, since the first engagement on 29 May 2023.* *In order for the EP to meet the drilling schedule of April 2024, the EP was submitted to NOPSEMA in December 2023 to allow for NOPSEMA's assessment to commence.* *NTGAC was advised before the EP was submitted to allow them an opportunity for any feedback.* *Santos has made considerable and significant efforts to date to try and engage and consult with NTGAC and within a reasonable timeframe to obtain their feedback.* *Santos considers Section 25 consultation complete for this EP.* *Santos will continue to engage with NTGAC to conclude a holistic agreement*	*In response to NTGAC's request to be consulted, Santos has provided NTGAC with the following information for consultation:* + *Santos' consultation materials specific to the activity.* + *Follow up emails and calls as per the NOPSEMA sensitive information report to endeavour to close out EP consultation.* + *A prioritised list of Carnarvon Basin activities and EP submission dates, including an emphasis on the pending submission of this EP.* + *An email and letter providing a final opportunity to provide feedback prior to EP submission.*	*All information and communication with NTGAC has been included in the NOPSEMA sensitive information report for this EP.*

	to support future engagement and consultation on future EPs.	*With respect to the development of consultation framework Santos has:* + *Attended relationship meeting on 28 September 2023 to discuss consultation expectations.* + *Provided a draft consultation protocol and supporting schedule of rates.* + *Provided a draft general report containing plain English descriptions of Santos' existing, planned and proposed activities that are regionally proximate to NTGAC's interests.* *Santos will continue to engage with NTGAC to conclude a consultation framework.*	
Ngarluma Aboriginal Corporation (NAC)			
+ On 29 May 2023, Santos emailed NAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of NAC and its members may be affected. [Con-2190] + On 30 May 2023, Santos emailed NAC to coordinate an in-person meeting as Santos was planning meetings in Karratha in early June. [Con-2191] + On 31 May 2023, NAC emailed Santos to advise that a Karratha-based meeting was not possible due to the availability of attendees. [Con-2192] + On 31 May 2023, Santos emailed NAC thanking NAC for its feedback. [Con-2193] + On 8 June 2023, Santos emailed NAC advising that its planning early June meetings did not proceed as planned and that Santos would be in Karratha later in June. Santos sought feedback if NAC me available at this time. [Con-2194] + On 26 June 2023, Santos emailed NAC to discuss consultation expectations for proposed activities. [Con-2103] + On 20 July 2023, Santos emailed NAC by way of reminder to set a meeting date. [Con-2079] + On 21 July 2023, NAC confirmed a meeting would be arranged for 28 August 2023. [Con-2066]			

- On 25 July 2023, Santos emailed NAC requesting a Teams meeting to discuss proposed activities. [Con-2064]
- On 1 August 2023, NAC emailed Santos to suggest a meeting on August 4. [Con-3096]
- On 1 August 2023, Santos confirmed that date by email and NAC advised an invitation would be sent. [Con-3097]
- On 4 August, Santos met with NAC to discuss proposed activities. Discussion centered on an appropriate pathway for consultation given Santos had a number of proposed activities in the region, including those to be managed under this EP. The following action items were agreed:
    - NAC to confirm in writing its consultation expectations for EP consultation.
    - Santos to provide feedback to NAC on its consultation expectations.
    - Meeting to be held in September 2023 to discuss next steps on consultation and potential presentation to the NAC Board of Directors.
- On 18 September 2023, NAC emailed Santos and proposed for Santos' consideration the establishment of a joint working group to progress consultation for this EP and other Santos proposed activities. [Con-2495]
- On 28 September 2023, NAC emailed Santos following up on its email of 18 September 2023. [Con-2435]
- On 3 October 2023, Santos emailed NAC seeking clarification on proposed working group arrangements. [Con-2465]
- On 4 October 2023, NAC emailed Santos and provided clarification on proposed working group arrangements, as well as proposing an initial working group meeting for mid-October 2023. [Con-2467]
- On 5 October 2023, Santos emailed NAC's nominated representative a commitment to the codesign of a consultation agreement, as well as list of proposed Santos activities in the Carnarvon Basin, with planned EP submission and activity commencement dates. [Con-2490]
- On 13 October 2023, Santos emailed Ngarluma Aboriginal Corporation information regarding proposed Carnarvon Basin activities for review as part of consultation, following a relationship meeting earlier that day. [Con-2545]
- On 25 October 2023, Santos emailed NAC with a request for feedback on the proposed Carnarvon Basin activities by 30 October 2023 given pending EP submission to NOPSEMA. Santos included an engagement protocol to support the consultation. [Con-2563]
- On 30 October 2023, NAC emailed Santos advising Santos readdress the letter as the previous CEO is no longer at NAC. It also provided costings for meetings. [Con-2576]
- On 9 November 2023, NAC emailed Santos advising in advance of next Thursday's meeting the protocol musty be in place and NAC will need to invoice Santos. The NAC schedule of fees and process for paying is consistent across all of similar external engagements for the NAC working Group. NAC's lawyers have drafted the standard engagement agreement suited to the Santos consultations and consistent with your terms in your protocol document. NAC asked Santos to prioritise getting comments back and get the agreement closed out ASAP. [Con-2646]
- On 13 November 2023, NAC emailed Santos advising it required feedback on the consultation protocol prior to the meeting on 16 November 2023. [Con-2663]
- On 13 November 2023, Santos emailed NAC advising it had received the rates and protocol and was in the process of reviewing. Santos also provided a draft agenda for the meeting scheduled for 16 November 2023. [Con-2667]

- On 22 November 2023, NAC emailed Santos requesting an update on the Santos review of the Consultation protocol, and request for confirmation if Santos would want to proceed with a December meeting. [Con-2817]
- On 23 November 2023, Santos emailed NAC responding to the update request, advising that Santos is still reviewing the Consultation Protocol, and affirming that a meeting would be desirable if it can be held the week of the 18 to 21 December 2023. [Con-2819]
- On 27 November 2023, Santos spoke to NAC on the phone. NAC advised no meeting is possible week of 18 December 2023; and that without a Consultation Protocol no meetings would go ahead. Santos advised NAC that Santos did need to respond to submission deadlines, but that this in no way reflects a cessation of engagement with NAC; simply that the ongoing relationship and external EP deadlines are two separate event streams. Discussion about the opportunity to meet early 2024 and affirmation that meeting was likely towards the end of Jan 2024, assuming the Consultation Protocol is in place. [Con-2824]
- On 21 December 2023, Santos emailed NAC in regard to planned projects around Ngarluma country seeking consultation meetings with the groups and individuals that may be affected by such projects. [Con-3074]
- On 22 December 2023 Santos emailed Ngarluma Aboriginal Corporation to affirm that a revised resourcing protocol will be arranged in early 2024 referencing NAC suggested draft. [Con-3080]
- On 16 January 2024, Santos emailed NAC CEO suggesting late January for a possible meeting and indicating that having resourcing protocols in place before then would be desirable. [Con-3085]
- On 22 January 2024, NAC emailed Santos regarding meeting costs and a draft schedule of rates. [Con-3087]
- On 29 January 2024, Santos phoned NAC to discuss progression of consultation agreement, and to arrange first meeting for 2024 for the purpose of relationship building. [Con-3091]

No further correspondence or feedback has been received

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
At the time of EP submission to NOPSEMA, NAC had not provided any concerns in relation to proposed activities relating to this EP.	*The consultation process for this EP has been running for more than eleven months, since the first engagement on 29 May 2023.* *In order for the EP to meet the drilling schedule of April 2024, the EP was submitted to NOPSEMA in December 2023 to allow for NOPSEMA's assessment to commence.* *NAC was advised before the EP was submitted to allow them an opportunity*	*In response to NAC's request to be consulted, Santos has provided NAC with the following information for consultation:* + *Santos' consultation materials specific to the activity.* + *Follow up emails and calls as per the NOPSEMA sensitive information report to*	*All information and communication with NAC has been included in the NOPSEMA sensitive information report for this EP.*

	for any feedback. *Santos has made considerable and significant efforts to date to try and engage and consult with NAC and within a reasonable timeframe to obtain their feedback.* *Santos considers Section 25 consultation complete for this EP.* *Santos will continue to engage with NAC to conclude a holisitic agreement to support future engagement and consultation on future EPs.*	*endeavour to close out EP consultation.* + *A prioritised list of Carnarvon Basin activities and EP submission dates, including an emphasis on the pending submission of this EP.* + *An email and letter providing a final opportunity to provide feedback prior to EP submission.* *With respect to the development of a holistic agreement Santos has:* + *Attended a NAC working group meeting on 12 October 2023 to discuss consultation expectations.* + *Provided a draft consultation protocol and supporting schedule of rates.* *Santos will continue to engage with NAC to conclude a holistic agreement.*	
Wirrawandi Aboriginal Corporation (WAC)			

- In May 2023, Santos confirmed a meeting with WAC CEO and Directors in Karratha on 6 June 2023. The meeting did not proceed due to weather constraints for attendees travelling to the meeting.
- On 2 June 2023, Santos emailed the WAC CEO to coordinate a follow up meeting, with a focus on introducing Santos, its people and its activities ahead of formal consultation. [Con-3102]
- On 6 June 2023, WAC CEO emailed Santos to advise of a rescheduled date of 21 June 2023 for a meeting in Karratha. [Con-3102]
- On 21 June 2023, Santos met with WAC CEO and Directors. The purpose of the meeting was to introduce Santos and provide an overview of a number of proposed Carnarvon Basin activities. [Con- 4444] The meeting resulted in the following actions:

- WAC and Santos to develop a consultation framework to support ongoing consultation.

+ On 17 August 2023, WAC emailed a subsequent acceptance letter for consideration to support a range of activities, including Environment Plan consultation. [Con-2314]
+ On 20 August 2023, Santos responded to WAC and advised that the consultation letter was being considered. [Con-2315]
+ On 23 August 2023, WAC emailed Santos advising it is open to modifying the letter to ensure costs are agreed by Santos in advance before being incurred by WAC. WAC outlined costs. [Con-2327]
+ On 10 September 2023 Santos emailed WAC regarding consultation for the proposed offshore activities. [Con-2380]
+ On 5 October 2023, Santos emailed WAC a commitment to the codesign of a consultation agreement, as well as list of proposed Santos activities in the Carnarvon Basin, with planned EP submission and activity commencement dates. [Con 2493]
+ On 25 October 2023, Santos emailed WAC with a request for feedback on the proposed Carnarvon Basin activities by 30 October 2023 given pending EP submission to NOPSEMA. Santos included an engagement protocol to support the consultation. [Con-2562]
+ On 4 November 2023, WAC emailed Santos providing an executed Cost Acceptance Letter and NOPSEMA activities engagement letter. [Con-2621]
+ On 30 November 2023, Santos emailed WAC in response to their email from 4 November 2023. Santos advised it had provisionally accepted the costs outlined in the documentation provided by WAC, with Legal review pending. Santos also advised it was finalising a General Report. Santos provided a copy of the engagement protocol in Word format as requested. Santos requested a meeting. [Con-2808]
+ On 30 November 2023, WAC emailed Santos advising it would be happy to meet in January 2024. [Con-2809]
+ On 1 December 2023, Santos emailed WAC advising it would be happy to meet in January. Santos said it would be good to get the resourcing protocols in place before the new year to enable the structure and confidence to proceed. Santos advised it would provide the General Report to WAC in the next week. [Con-2810]
+ On 3 December 2023, WAC emailed Santos requesting a Word version of the rates schedule for WAC to make amendment to, consistent with its earlier letter. [Con-2825]
+ On 4 December 2023, Santos emailed WAC the Word version of the Resourcing Protocol rates as requested on 3 December 2023. [Con-2826]
+ On 21 December 2023 Santos provided WAC a General Report to WAC in response to a request (within email dated 4 November 2023 [Con-2621], including maps and detail on project activities. [Con-3075]
+ On 2 January 2024, WAC emailed Santos suggesting a meeting in Perth between 23/1 and 25/1 2024. [Con-3081]
+ On 2 January 2024, Santos emailed WAC and agreed to meet during the proposed time period. [Con-3082]
+ On 15 January 2024, Santos emailed WAC and indicated that the purpose of the meeting was not for consultation but to informally meet (the new CEO). [Con-3084]
+ On 18 January 2024, WAC emailed Santos and agreed with proposed meeting objectives. [Con-3086]

- On 29 January 2024, Santos emailed WAC to thank them for the meeting on 23 January 2024 with the WAC CEO where the project as described in the Santos WAC General Report v2 was reviewed and advised that final copies of engagement and resourcing protocols were almost complete. [Con-3092]
- On 29 January WAC acknowledged the email from Santos sent on 29 January 2024. [Con-3487]
- No further correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
At the time of EP submission to NOPSEMA, WAC had not provided any concerns in relation to proposed activities relating to this EP.	*The consultation process for this EP has been running for more than eleven months, since the first engagement on 21 June 2023.* *In order for the EP to meet the drilling schedule of April 2024, the EP was submitted to NOPSEMA in December 2023 to allow for NOPSEMA's assessment to commence.* *WAC was advised before the EP was submitted to allow them an opportunity for any feedback.* *Santos has made considerable and significant efforts to date to try and engage and consult with WAC and within a reasonable timeframe to obtain their feedback.* *Santos considers Section 25 consultation complete for this EP.* *Santos will continue to engage with WAC to conclude a consultation agreement to support engagement and consultation on future EPs.*	*In response to WAC's request to be consulted, Santos has provided WAC with the following information for consultation:* + *Santos' consultation materials specific to the activity.* + *Follow up emails and calls as per the NOPSEMA sensitive information report to endeavour to close out EP consultation.* + *A prioritised list of Carnarvon Basin activities and EP submission dates, including an emphasis on the pending submission of this EP.* + *An email and letter providing a final opportunity to provide feedback prior to EP submission.* *With respect to the development of a consultation agreement Santos has:* + *Attended a relationship meeting on 21 June 2023 to*	*All information and communication with WAC has been included in the NOPSEMA sensitive information report for this EP.*

		+ *discuss consultation expectations.* + *Provided a draft consultation protocol and supporting schedule of rates.* *Santos will continue to engage with WAC to conclude a consultation agreement.*	

Yinggarda Aboriginal Corporation (YAC)

- On 26 June 2023, Santos emailed YAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of YAC may be affected. [Con-2102]
- On 20 July 2023, Santos emailed YAC by way of reminder to set a meeting date. [Con-2073]
- On 8 September 2023, Santos emailed Yinggarda Aboriginal Corporation a reminder of proposed Carnarvon Basin activities for consultation requesting feedback if it believed that its functions, interests, or activities may be affected by Santos' proposed activities, including consideration of potential impacts to or risks associated with:
  - Traditional lands and waters
  - Sea country interests
  - Totemic species
  - Other values or sensitivities of importance. [Con-2372]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Wanparta Aboriginal Corporation (WAC)

- On 29 May 2023, Santos emailed WAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of WAC and its members may be affected. [Con-2190]

- On 29 February 2024, Santos emailed WAC contact person to seek a consultation meeting. [Con-4327]
- On 8 March 2024, WAC was emailed by Santos, reiterating the request for a meeting and providing additional information on upcoming activities. [Con-4328]
- On 28 March 2024, WAC confirmed by telephone that a meeting with the Board of Directors could be arranged for 8 May 2024.
- On 2 April 2024 WAC advised Santos that the meeting for 8 May would need to be rescheduled. [Con-4330] Santos acknowledged this email [Con-4331]
- On 4 April 2024 WAC offered Santos a meeting on 17 May 2024. [Con-4332]
- On 4 April 2024 Santos confirmed the meeting on 17 May 2024 [Con-4333]
- On 8 April 2024 WAC advised it was waiting on another organisation to confirm the 17 May 2024 for a half day consultation meeting. [Con-4334]
- On 17 April 2024 WAC advised Santos this meeting would need to be postponed. [Con-4335]
- On 17 April 2024 Santos acknowledged the meeting postponement and requested the meeting be rescheduled with WAC. [Con-4345]
- On 17 April 2024 WAC offered a date in August for a meeting [Con-4362]
- On 17 April 2024 Santos emailed WAC advising that meeting in August would be too late for most activities of relevance to Wanparta as consultation would have closed by that time [Con-4384]
- On 24 April 2024 Santos emailed WAC requesting the date of 17 May for a full day meeting. [Con-4336]
- On 26 April 2024, WAC emailed Santos advising the 17 May was not available at all. [Con-4337]
- On 29 May 2024 WAC emailed Santos offering a meeting on the 10 or 12 June 2024 [Con-4338]
- On 30 May 2024 Santos emailed WAC confirming that the 10 June was acceptable for a meeting and forwarded details of the agenda. [Con-4339]
- On 30 May 2024 WAC confirmed that the meeting would go ahead on 10 June 2024. [Con-4340]
- On 4 June WAC emailed Santos confirming the agenda [Con-4341]
- On 7 June 2024 Santos emailed WAC providing a full copy of the presentation prior to the meeting of the 10 June, including information that consultation on Halyard 2 would take place at the meeting. [Con-4385]
- On 10 June 2024 Santos representatives met with Board Directors of WAC and Ngarla Elders. Directors and Elders requested information on implications to their functions, interests and activities in the event of a spill. WAC Directors and Ngarla Elders also requested to be notified in the event of a spill that had potential to impact WAC functions, interests and activities. [Con-4343]
- On 17 June 2024 Santos responded via email to WAC, attaching a letter responding to information requests from the meeting of 10 June 2024 and advising that the EP would be submitted on 21 June 2024 [Con-4343]
- On 18 June Santos emailed WAC with the full minutes of the meeting from the 10 June, including advice that the EP would be submitted on 21 June 2024. [Con-4386]

Summary of Feedback, Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
WAC Directors and Ngarla Elders requested information spill modelling predictions and potential impacts to Ngarla coastline, 80 Mile Beach Marine Park, Bedout and other islands within the Ngarla Native Title Determined Area.	*Santos noted the request from WAC Directors and Ngarla Elders.*	*Santos confirmed that the EMBA for the Activity intersected the 80 Mile Beach Marine Park, but did not intersect mainland and island (Bedout, North Turtle, Little Turtle) coastlines.* *Santos also confirmed that the EMBA was*	*No additional EP controls required.*

		an overly conservative representation of the potential extent of a spill and did not take into account implementation of spill response mitigation measures, which would reduce the size of the EMBA.	
WAC Directors and Ngarla Elders requested to be notified in the event of a spill that had potential to impact WAC functions, interests and activities.	*Santos noted the request from WAC Directors and Ngarla Elders.*	*Santos confirmed it will notify WAC in the event of a spill that has potential to impact the functions, interests, or activities of Ngarla people.*	*Activity notifications are included in* **Table 8-5.**
A meeting attendee suggested that Ngarla Rangers could assist with spill response.	*Santos noted the suggestion from the meeting attendee.*	*Santos confirmed at the meeting that the DoT has responsibility in WA waters for spill response, with planning and decision making undertaken in conjunction with other government agencies and liaison officers/advisors (where appropriate), including the identification of areas for protection.* *Santos confirmed it will, separate to the development of the Halyard-2 EP, liaise with the DoT on opportunities for WAC to engage with DoT on spill response, including use of Ngarla Rangers in the event a spill could impact the functions, interests or activities of Ngarla people.*	*No additional EP controls required.*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Native Title interests – Gascoyne region			
Malgana Aboriginal Corporation (MAC)			

- On 26 June 2023, Santos emailed MAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of MAC may be affected. [Con-2100]
- On 20 July 2023, Santos emailed MAC by way of reminder to set a meeting date. [Con-2072]
- On 21 July 2023, Malgana emailed Santos advising it requests Santos attends the next Board meeting in Sept/Oct 2023. [Con-2055]
- On 31 July 2023, Santos emailed Malgana advising it would be pleased to present at the next Board meeting. [Con-2061]
- On 31 July 2023, Malgana emailed Santos advising it would lock a time in at the next meeting and would be in touch to confirm the timing and provide an invoice. [Con-2122]
- No further correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
Nil	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Native Title interests – Mid West region

Bundi Yamatji Aboriginal Corporation (BYAC)

- On 27 June 2023, Santos emailed BYAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of BYAC may be affected. [Con-2096]
  - On 20 July 2023, Santos sent a follow up email to BYAC to discuss consultation expectations for proposed activities. [Con-2068]
  - On 08 September 2023, Santos emailed BYAC a reminder of proposed Carnarvon Basin activities for consultation requesting feedback if it believed that its functions, interests, or activities may be affected by Santos' proposed activities, including consideration of potential impacts to or risks associated with:
    - Traditional lands and waters
    - Sea country interests
    - Totemic species
    - Other values or sensitivities of importance [Con-2374]
  - No correspondence or feedback has been received.

- On 20 July 2023, Santos emailed BYAC by way of reminder to set a meeting date. [Con-2068]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Industry associations - Commercial fishing

Australian Southern Bluefin Tuna Industry Association (ASBTIA)

- On 30 May 2023, Santos emailed ASBTIA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of ASBTIA may be affected, as well as consideration of ASBTIA's expectation for consultation of licence holders. [Con-2291]
- On 8 June 2023, Santos emailed ASBTIA regarding consultation for proposed Carnarvon Basin activities. [Con-2292]
- On 29 June 2023, Santos emailed ASBTIA seeking feedback on proposed activities. [Con-1900]
- On 28 July 2023, Santos emailed ASBITA as a reminder its consultation for proposed Carnarvon Basin activities. [Con-1915]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA.*	*No additional EP controls required.*

Commonwealth Fisheries Association (CFA)

- On 30 May 2023, Santos emailed CFA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of CFA may be affected, as well as consideration of CFA's expectation for consultation of licence holders. [Con-2170]

- On 29 June 2023, Santos emailed CFA seeking feedback on proposed activities. [Con-1899]
- On 25 July 2023, Santos emailed CFA by way of reminder on the timeframe for providing feedback. [Con-1906]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA.*	*No additional EP controls required.*

South East Trawl Fishing Industry Association (SETFIA)

- On 7 June 2023, Santos emailed SETFIA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of TA may be affected, as well as consideration of TA's expectation for consultation of licence holders. [Con-2345]
- On 25 July 2023, Santos emailed CFA by way of reminder on the timeframe for providing feedback [Con-1864]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA.*	*No additional EP controls required.*

Tuna Australia (TA)

- On 30 May 2023, Santos emailed TA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of TA may be affected, as well as consideration of TA's expectation for consultation of licence holders. [Con-2172]
- On 31 May 2023, TA emailed Santos advising it required a service agreement to enable it to effectively manage its member base for consultation. [Con-2117]
- On 1 June 2023, Santos met with TA to provide information on proposed activities. [Con-2028]

Santos

- On 29 June 2023, Santos emailed TA regarding consultation for proposed Carnarvon Basin activities. [Con-1896]
- On 28 July 2023, Santos emailed TA and proposed an alternative approach to the service agreement and sought feedback on whether this approach would be acceptable to TA. [Con-1920]
- On 31 July 2023, TA emailed Santos and advised a TA representative would respond. [Con-1923]
- On 1 August 2023, Santos emailed TA and advised it would discuss proposed consultation approaches with the TA representative. [Con-1926]
- On 1 August 2023, TA provided feedback to Santos advising it was disappointed that Santos was unable to enter a service agreement with Tuna Australia. [Con-2123]
- On 1 August 2023, Santos called the TA representative to provide further context on the service agreement and the alternate consultation approach. Santos committed to further reviewing the matter and its intent for meaningful consultation of tuna fishery licence holders.
- On 23 August 2023, Santos emailed Tuna Australia informing them that the Santos contracts team would like to discuss the potential amendments to the proposed T&Cs given Santos' particular needs. Santos will wait until it receives consent from Tuna Australia before passing contact details to the Contracting team. [Con-2316]
- On 23 August 2023, Tuna Australia emailed Santos giving their consent to forward their details to the Santos Contracting team. [Con-2317]
- On 24 August 2023, Santos emailed Tuna Australia with mark ups to their services agreement for their review. [Con-2323]
- On 29 August 2023, Tuna Australia emailed Santos advising it does not agree with the proposed changes by Santos to its service agreement. [Con-2326]
- On 3 September 2023, Santos emailed Tuna Australia to discuss the service agreement. [Con-2390]
- On 13 September 2023, Tuna Australia emailed Santos to confirm a meeting via phone to discuss the service agreement. [Con-2391]
- On 13 September 2023, Santos emailed Tuna Australia following a call with an updated service agreement for their review. [Con-2392]
- On 18 September 2023, Tuna Australia emailed Santos, stating that Tuna Australia has discussed internally the rationale for the joint interest / joint venture and public indemnity insurance clauses Santos would like to keep included in the agreement. Tuna Australia have no concerns with agreeing to this latest draft and happy for Santos to take the lead of progressing the agreement to signing. [Con-2426]
- On 19 September 2023, Santos emailed Tuna Australia, requesting that there is a minor addition to the Agreement, which is the inclusion of an Agreement number (indicates that it is an negotiated Agreement); Santos asks if Tuna Australia is acceptable of this addition? Santos also requests for contact details of someone who can provide vendor details, so Santos can create a new vendor in the system. [Con-2450]
- On 19 September 2023, Tuna Australia emailed Santos, confirming that they are happy for the Agreement number to be added to the document. Tuna Australia also provided contact details of whom Santos should contact to set-up Tuna Australia as a vendor in the system. [Con-2451]
- On 5 October 2023, Tuna Australia emailed Santos the agreement executed by Tuna Australia. [Con-2473]
- On 5 October 2023, Santos acknowledged receipt of the executed agreement from Tuna Australia. [Con-2474]

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
TA has requested Santos to support the development of a consultation agreement in order to undertake consultation activities.	*Santos notes the intention of TA to consult is dependant on co-design of consultation arrangements.* *Santos and TA have finalised arrangements.* *Santos has not received any comments on the activities associated with this EP.* *Santos considers Section 25 consultation complete for this EP.*	*Santos is committed securing consultation arrangements with TA.*	*NA*

Western Australian Fishing Industry Council (WAFIC)

- On 7 June 2023, Santos met with WAFIC regarding the proposed activities and discussed opportunities to adopt pragmatic and practical approaches for the consultation of licence holders, noting WAFIC's published guidance on this matter. [Con-2037]
- On 29 June 2023, Santos emailed WAFIC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of WAFIC may be affected, as well as consideration of WAFIC's expectation for consultation of licence holders. [Con-1901]
- On 27 July 2023, WAFIC emailed Santos with feedback regarding proposed activities and sought additional information on the following topics: [Con-2149]

General comments

- Prohibition of recreational fishing within the Operational Area.

Halyard-2 Drilling & Completion comments

- Physical presence and interaction with other marine users – there are no management measures in place to address fishing displacement.
- Seabed disturbance – what assessment has Santos made to ensure all equipment can be fully removed in the future?

- On 9 August 2023, Santos emailed WAFIC and provided a response as summarised below [Con-2212].
- On 24 August 2023, WAFIC emailed Santos with feedback in response to the email from Santos on 9 August 2023. [Con-2324]
- On 6 October 2023, Santos emailed WAFIC with feedback to address their queries from 24 August 2023 regarding this EP. [Con-2517]

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*

WAFIC requested the prohibition of recreational fishing within the Operational Areas for proposed activities.	*Santos has considered WAFIC's feedback.*	*Santos prohibits recreational fishing within the Operational Area and it is already included as a control in the EPs WAFIC listed, even if not listed as a "key management measure" in the fact sheets.*	***Section 6.5*** *Relevant control* measure (H2-DC-CM-019) can be found within Section 6.5.3 *No additional EP controls required.*
WAFIC noted that there are no management measures in place to address fishing displacement.	*Santos has considered WAFIC's feedback.*	*Santos has assessed the potential risks and impacts associated with physical presence and interactions with other marine users in **Section 6.5** (Interaction with other Marine Users) of the EP, and applied controls considered appropriate to manage the potential impacts and risks of the activity to ALARP and acceptable levels.* *Short-term temporary displacement may be encountered by fishers over the approximately 65 days of the activity. However, as the activity is being conducted next to existing infrastructure trap and trawl fishers are unlikely to be historically targeting this area due to the increased risk of gear entanglement, damage and loss. Line fishers may be displaced for a very short time, and once the activity is completed in approximately 65 days, fishing activities can resume.* *In addition, a 500 m temporary safety exclusion zone will be established around the ISV. Other navigational controls, as relevant and specified in the Navigation Act, will also be implemented (e.g. Lighting, communication aids and charting)*	***Section 6.5.*** *No additional EP controls required.*

		during the activity and for permanent infrastructure to reduce potential hazards and potential for collisions.	
WAFIC asked that considering all decommissioning end states within this consultation package propose partial removal, what assessment has Santos made to ensure all equipment can be fully removed in the future?	*Santos has considered WAFIC's feedback.*	*Santos has assessed the potential risks and impacts associated with seabed disturbance in **Section 6.4** of the EP, and applied controls considered appropriate to manage the potential for impacts and risks to the seabed from the activity to ALARP and acceptable levels.* *Additionally, Santos has adopted an additional control in the EP whereby all equipment installed on the seabed is designed such that it can be fully removed during decommissioning. This will minimise ongoing impacts to the seabed beyond operations.*	***Section 6.4*** *No additional EP controls required.*

Western Rock Lobster (WRL)

- On 31 May 2023, Santos emailed Western Rock Lobster and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2259]
- On 19 June 2023, Santos met with Western Rock Lobster to provide information about the proposed Carnarvon Basin activities. Western Rock Lobster confirmed it required pre-start and activity completion notifications. [Con-2030]
- On 20 June 2023, Santos emailed information to Western Rock Lobster regarding proposed Carnarvon Basin activities and oil pollution management plans. [Con-2120]
- On 30 June 2023, Santos emailed Western Rock Lobster seeking feedback on proposed activities. [Con-1904]
- On 25 July 2023, Santos emailed Western Rock by way of reminder on the timeframe for providing feedback. [Con-1910]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
Western Rock Lobster confirmed at the meeting of 19 June 2023 that it required pre-start and activity completion notifications.	*Santos notes Western Rock Lobster's feedback.*	*Santos will send Western Rock Lobster activity notifications.*	*Activity notifications are included in **Table 8-5**.*

Industry associations - Energy industry			
Australian Energy Producers (AEP) (Previously known as Australian Petroleum Production and Exploration Association (APPEA))E			
+ On 31 May 2023, Santos emailed APPEA and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2168] + On 29 June 2023, Santos emailed APPEA seeking feedback on proposed activities. [Con-1880] + On 21 July 2023, Santos emailed APPEA by way of reminder on the timeframe for providing feedback. [Con-1809] + No correspondence or feedback has been received			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA.*	*No additional EP controls required.*
Industry associations - Local government			
Western Australian Local Government Association (WALGA)			
+ On 1 June 2023, Santos emailed WALGA and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2257] + On 30 June 2023, Santos emailed WALGA seeking feedback on proposed activities. [Con-1807] + On 21 July 2023, Santos emailed WALGA by way of reminder on the timeframe for providing feedback. [Con-1810] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA.*	*No additional EP controls required.*

Industry associations - Local industry			
Manjimup Chamber of Commerce and Industry			
+ On 7 June 2023, Santos emailed Manjimup CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2346] + On 27 June 2023, Santos emailed Manjimup CCI seeking feedback on proposed activities. [Con-1826] + On 19 July 202,3 Santos emailed Manjimup CCI by way of reminder on the timeframe for providing feedback. [Con-1852] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Augusta Chamber of Commerce and Industry and Margaret River Chamber of Commerce and Industry			
+ On 7 June 2023, Santos emailed Augusta and Margaret River CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2347 and 2348] + On 27 June 2023, Santos emailed Augusta and Margaret River CCI seeking feedback on proposed activities. [Con-1822 and 1823] + On 19 July 2023, Santos emailed Augusta and Margaret River CCI by way of reminder on the timeframe for providing feedback. [Con-1853 and 1840] + On 19 July 2023, MRCCI emailed Santos asking how the South West region will be affected by the project. [Con-1873] + On 26 July 2023, Santos emailed Margaret River CCI and provided information regarding why it needed to consult and to provide any feedback. [Con-1857] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25*	*NA*	*No additional EP controls required.*

	consultation complete for this EP.		

Bunbury Geographe Chamber of Commerce and Industry

- On 7 June 2023, Santos emailed Bunbury Geographe CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2350]
- On 27 June 2023, Santos emailed Bunbury Geographe CCI seeking feedback on proposed activities. [Con-1827]
- On 19 July 2023, Santos emailed Bunbury Geographe CCI by way of reminder on the timeframe for providing feedback. [Con-1842]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Capel Chamber of Commerce and Industry

- On 7 June 2023, Santos emailed Capel CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2349]
- On 27 June 2023, Santos emailed Capel CCI seeking feedback on proposed activities. [Con-1819]
- On 19 July 2023, Santos emailed Capel CCI by way of reminder on the timeframe for providing feedback. [Con-1839]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25*	*NA*	*No additional EP controls required.*

	consultation complete for this EP.		

South West Chamber of Commerce and Industry

- On 27 June 2023, Santos emailed South West CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1877]
- On 19 July 2023 Santos emailed South West CCI by way of reminder on the timeframe for providing feedback. [Con-1844]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Chamber of Commerce and Industry WA (CCIWA)

- On 30 June 2023, Santos emailed CCIWAE and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1829]
- On 19 July 2023, Santos emailed CCIWA a reminder of proposed Carnarvon Basin activities for consultation. [Con-1847]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Lancelin Chamber of Commerce and Industry

- On 7 June 2023, Santos emailed Lancelin CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2351]

- On 27 June 2023, Santos emailed Lancelin CCI seeking feedback on proposed activities. [Con-1820]
- On 19 July 2023, Santos emailed Lancelin CCI by way of reminder on the timeframe for providing feedback. [Con-1855]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Jurien Bay Chamber of Commerce and Industry

- On 7 June 2023, Santos emailed Jurien Bay CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2352]
- On 27 June 2023, Santos emailed Jurien Bay CCI seeking feedback on proposed activities. [Con-1818]
- On 19 July 2023, Santos emailed Jurien Bay CCI by way of reminder on the timeframe for providing feedback. [Con-1838]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Mid West Chamber of Commerce and Industry

- On 07 June 2023, Santos emailed Mid West CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2353]
- On 27 June 2023, Santos emailed Mid West CCI seeking feedback on proposed activities. [Con-1816]
- On 19 July 2023, Santos emailed Mid West CCI by way of reminder on the timeframe for providing feedback. [Con-1837]

- No correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Carnarvon Chamber of Commerce and Industry

- On 31 May 2023, Santos emailed Carnarvon CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2256]
- On 27 June 2023, Santos emailed Carnarvon CCI seeking feedback on proposed activities. [Con-1814]
- On 19 July 2023, Santos emailed Carnarvon CCI by way of reminder on the timeframe for providing feedback. [Con- 1835]
- No correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Exmouth Chamber of Commerce and Industry

- On 31 May 2023, Santos emailed Exmouth CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2255]
- On 27 June 2023, Santos emailed Exmouth CCI seeking feedback on proposed activities. [Con-1813]
- On 19 July 2023, Santos emailed Exmouth CCI by way of reminder on the timeframe for providing feedback. [Con-1834]
- No correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference

NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Onslow Chamber of Commerce and Industry

- On 31 May 2023, Santos emailed Onslow CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2254]
- On 27 June 2023, Santos emailed Onslow CCI seeking feedback on proposed activities. [Con-1812]
- On 19 July 2023, Santos emailed Onslow CCI by way of reminder on the timeframe for providing feedback. [Con-1833]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Karratha and Districts Chamber of Commerce and Industry

- On 31 May 2023, Santos emailed Karratha CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2253]
- On 27 June 2023, Santos emailed Karratha CCI seeking feedback on proposed activities. [Con-1811]
- On 19 July 2023, Santos emailed Karratha CCI by way of reminder on the timeframe for providing feedback. [Con-1832]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25*	*NA*	*No additional EP controls required.*

	consultation complete for this EP.		
Industry associations – Recreational fishing			
Recfishwest			
+ On 30 May 2023, Santos emailed Recfishwest and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of Recfishwest may be affected, as well as consideration of Recfishwest's expectation for consultation of regional fishing clubs for proposed activities. [Con-2211] + On 30 June 2023, Santos emailed Recfishwest regarding consultation for proposed Carnarvon Basin activities. [Con-1902] + On 25 July 2023, Santos emailed Recfishwest as a reminder its consultation for proposed Carnarvon Basin [Con-1913] + On 27 July 2023, a representative from Recfishwest called Santos asking for an extension of time to provide feedback. Santos confirmed that an extension was acceptable. + On 16 August 2023, Recfishwest emailed Santos with based on the information provided, Recfishwest has no objections to the proposed activities with feedback regarding the proposed Halyard-2 Drilling & Completion activities as per the table below. [Con-2298] + On 22 August 2023, Santos emailed Recfishwest acknowledging its feedback regarding the proposed Halyard-2 Drilling & Completion activities. [Con-2311]			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
Recfishwest noted that the area was accessed by the charter industry and recreational fishers in larger vessels and requested to be kept informed on the progress of the proposal.	*Santos has noted this information.*	*Santos acknowledges the feedback provided and Santos will ensure Recfishwest is kept informed of the progress of the project through activity notifications and provision of the Santos WA Quarterly Update. Santos also acknowledges that Recfishwest has no objections to the proposed activities.*	*Activity notifications are included in **Table 8-5**..*
Western Australian Game Fishing Association (WAGFA)			
+ On 31 May 2023, Santos emailed WGFA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this EP and sought feedback on whether the functions, interests or activities of WGFA may be affected, as well as consideration of WGFA 's expectation for consultation of regional fishing clubs for proposed activities. [Con-2294] + On 30 June 2023, Santos emailed WGFA regarding consultation for proposed Carnarvon Basin activities. [Con-1903]			

- On 25 July 2023, Santos emailed WGFA as a reminder its consultation for proposed Carnarvon Basin [Con-1909]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Industry associations - Commercial shipping

Maritime Industry Australia Ltd (MIAL)

- On 1 June 2023, Santos emailed Maritime Industry Australia and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2251]
- On 7 June 2023, Maritime Industry Australia advised it was sharing information about the proposed Carnarvon Basin activities with its members on 7 June 2023. [Con-2119]
- On 27 June 2023, Santos emailed Maritime Industry Australia seeking feedback on proposed activities. [Con-1861]
- On 21 July 2023, Santos emailed Maritime Industry Australia by way of reminder on the timeframe for providing feedback. [Con-1862]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Industry Associations - Tourism

Australian Tourism Industry Council (ATIC)

- On 1 June 2023, Santos emailed Australia Tourism Industry Council and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2250]
- On 27 June 2023, Santos emailed Australia Tourism Industry Council seeking feedback on proposed activities. [Con-1865]
- On 25 July 2023, Santos emailed Australia Tourism Industry Council by way of reminder on the timeframe for providing feedback. [Con-1868]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Tourism Council of Western Australia (TCWA)

- On 1 June 2023, Santos emailed Tourism Council of Western Australia and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2249]
- On 27 June 2023, Santos emailed Tourism Council of Western Australia seeking feedback on proposed activities. [Con-1866]
- On 25 July 2023, Santos emailed Tourism Council of Western Australia by way of reminder on the timeframe for providing feedback. [Con-1869]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Marine Tourism WA (MTWA)

- On 29 June 2023, Santos emailed Marine Tourism WA seeking feedback on proposed activities outlined in this EP. [Con-1878]

- On 25 July 2023, Santos emailed Marine Tourism WA by way of reminder on the timeframe for providing feedback. [Con-1872]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Western Australian Indigenous Tourism Operators Council (WAITOC)

- On 1 June 2023, Santos emailed WAITOC and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2248]
- On 27 June 2023, Santos emailed WAITOC seeking feedback on proposed activities. [Con-1867]
- On 25 July 2023, Santos emailed WAITOC by way of reminder on the timeframe for providing feedback. [Con-1870]
- On 26 July 2023, WAITOC emailed Santos requesting it considers the newly endorsed Whadjuk climate change declaration. [Con-2139]
- On 21 August 2023, Santos emailed WAITOC confirming it had considered the declaration. [Con-2310]

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*NA*	*NA*	*NA*

Infrastructure operators

Vocus

- On 1 June 2023, Santos emailed Vocus and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2247]
- On 27 June 2023, Santos emailed Vocus seeking feedback on proposed activities. [Con-1817]
- On 21 July 2023, Santos emailed Vocus by way of reminder on the timeframe for providing feedback. [Con-1821]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Local Government Authorities			
Shire of Manjimup			

- On 5 June 2023, Santos emailed Shire of Manjimup and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2365]
- On 9 June 2023, Shire of Manjimup advised it has no functions, interests or activities that may be affected. [Con-2113]
- On 26 June 2023, Santos emailed Shire of Manjimup providing information and requesting feedback by 26 July 2023. [Con-2354]
- No further consultation required.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Shire of Augusta Margaret River			

- On 27 June 2023, Santos emailed Shire of Augusta Margaret River and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1939]
- On 19 July 2023, Santos emailed Shire of Augusta Margaret River by way of reminder on the timeframe for providing feedback [Con-1986]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for*	*NA*	*No additional EP controls required.*

	consultation. *Santos considers Section 25 consultation complete for this EP.*		
Shire of Capel			
+ On 27 June 2023, Santos emailed Shire of Capel and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1941] + On 19 July 2023, Santos emailed Shire of Capel by way of reminder on the timeframe for providing feedback [Con-1991] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
City of Bunbury			
+ On 27 June 2023, Santos emailed City of Bunbury and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EPE. [Con-1942] + On 19 July 2023, Santos emailed City of Bunbury by way of reminder on the timeframe for providing feedback [Con-1989] + On 25 July 2023, City of Bunbury emailed Santos advising it has no feedback for consideration. [Con-1951] + On 26 July 2023, Santos emailed City of Bunbury and acknowledged it had no feedback for consideration. [Con-1977] + No further consultation required.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*NA*	*NA*	*NA*
Shire of Harvey			
+ On 27 June 2023, Santos emailed Shire of Harvey and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1943]			

- On 19 July 2023, Santos emailed Shire of Harvey by way of reminder on the timeframe for providing feedback [Con-1987]
- On 20 July 2023, Shire of Harvey called requesting it be taken off the distribution list for consultation emails. [Con-2355]
- On 26 July 2023, Santos emailed Shire of Harvey acknowledging it does not want to receive any more correspondence, but reminded Shire of Harvey of regulatory requirements for consulting. [Con-1972]
- No further consultation required.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

City of Rockingham

- On 27 June 2023, Santos emailed City of Rockingham and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1934]
- On 19 July 2023, Santos emailed City of Rockingham by way of reminder on the timeframe for providing feedback [Con-1999]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

City of Kwinana

- On 27 June 2023, Santos emailed City of Kwinana and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1933]
- On 19 July 2023, Santos emailed City of Kwinana by way of reminder on the timeframe for providing feedback [Con-2001]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

City of Cockburn

- On 27 June 2023, Santos emailed City of Kwinana and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1932]
- On 19 July 2023, Santos emailed City of Kwinana by way of reminder on the timeframe for providing feedback [Con-2002]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

City of Fremantle

- On 5 June 2023, Santos emailed City of Fremantle to advise it of preliminary consultation regarding proposed Carnarvon Basin activities for consultation. [Con-2364]
- On 8 June 2023, City of Fremantle advised someone from the relevant team will be in touch should it need more information. City of Fremantle advised Santos to liaise with the Port Authority, Department of Transport and Main Roads regarding this EP. [Con-2112]
- On 26 June 2023, Santos emailed City of Fremantle confirming that Santos has taken note of feedback received during preliminary consultation and stated that should you wish to provide feedback at later date please note that we are now asking for relevant persons to provide any feedback on proposed activities by 26 July 2023 [Con-2356]
- No further consultation required.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*NA*	*NA*	*NA*

Town of Mosman Park			
+ On 27 June 2023, Santos emailed Town of Mosman Park and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1930] + On 19 July 2023, Santos emailed Town of Mosman Park by way of reminder on the timeframe for providing feedback [Con-2004] + On 20 July 2023, Town of Mosman Park emailed Santos advising it had no objection to the proposed activities. [Con-1952] + On 26 July 2023, Santos emailed Town of Mosman Park confirming requirements to consult and acknowledged they had no further comments. [Con-1974] + No further consultation required.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*NA*	*NA*	*NA*
Town of Cottesloe			
+ On 27 June 2023, Santos emailed Town of Cottesloe and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1931] + On 19 July 2023, Santos emailed Town of Cottesloe by way of reminder on the timeframe for providing feedback [Con-2005] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
City of Nedlands			
+ On 27 June 2023, Santos emailed City of Nedlands and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1929] + On 19 July 2023, Santos emailed City of Nedlands by way of reminder on the timeframe for providing feedback [Con-2007] + No correspondence or feedback has been received.			

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Town of Cambridge

- On 27 June 2023, Santos emailed Town of Cambridge and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1928]
- On 19 July 2023, Santos emailed Town of Cambridge by way of reminder on the timeframe for providing feedback [Con-2009]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

City of Stirling

- On 27 June 2023, Santos emailed City of Stirling and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1927]
- On 19 July 2023, Santos emailed City of Stirling by way of reminder on the timeframe for providing feedback [Con-2011]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

City of Joondalup			
+ On 27 June 2023, Santos emailed City of Joondalup and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1925] + On 28 June 2023, City of Joondalup requested Santos to clarify how the proposed activities may impact the City of Joondalup. [Con-1964] + On 19 July 2023, Santos emailed City of Joondalup providing information about the proposed activities and the regulations and requirements Santos needs to follow regarding consultation. [Con-1983] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
City of Wanneroo			
+ On 27 June 2023, Santos emailed City of Wanneroo and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1924] + On 19 July 2023, Santos emailed City of Wanneroo by way of reminder on the timeframe for providing feedback [Con-2012] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Shire of Gingin			
+ On 27 June 2023, Santos emailed Shire of Gingin and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1922]			

- On 19 July 2023, Santos emailed Shire of Gingin by way of reminder on the timeframe for providing feedback [Con-2014]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Shire of Dandaragan

- On 27 June 2023, Santos emailed Shire of Dandaragan and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1921]
- On 19 July 2023, Santos emailed Shire of Dandaragan by way of reminder on the timeframe for providing feedback [Con-2015]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

City of Greater Geraldton

- On 27 June 2023, Santos emailed City of Greater Geraldton and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1918]
- On 19 July 2023, Santos emailed City of Greater Geraldton by way of reminder on the timeframe for providing feedback [Con-2017]
- No correspondence or feedback has been received.

Summary of Objection or Claim	*Assessment of Merits*	*Santos' Response Statement*	*EP Reference*
NA	*Santos considers it has provided sufficient time and opportunity for*	*NA*	*No additional EP controls required.*

	consultation. *Santos considers Section 25 consultation complete for this EP.*		
Shire of Shark Bay			
+ On 27 June 2023, Santos emailed Shire of Shark Bay and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-1916] + On 19 July 2023, Santos emailed Shire of Shark Bay by way of reminder on the timeframe for providing feedback [Con-2019] + On 19 July 2023, Shire of Shark Bay emailed Santos advising it has no feedback to the proposed Carnarvon Basin activities. [Con-1956] + On 26 July 2023, Santos emailed Shark Bay and acknowledged it had no feedback. [Con-1978] + No further consultation required.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*NA*	*NA*	*NA*
Shire of Carnarvon			
+ On 31 May 2023, Santos emailed Shire of Carnarvon and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2246] + On 27 June 2023, Santos emailed Shire of Carnarvon seeking feedback on proposed activities. [Con-1914] + On 19 July 2023, Santos emailed Shire of Carnarvon by way of reminder on the timeframe for providing feedback. [Con-2020] + On 19 July 2023, Shire of Carnarvon emailed Santos updating the contact list for future consultation. Shire of Carnarvon requested more information about the projects and potential impacts on Shire of Carnarvon. [Con-1954] + On 1 August 2023, Santos emailed Shire of Carnarvon with information regarding the project and potential impacts. [Con-1965] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25*	*NA*	*No additional EP controls required.*

	consultation complete for this EP.		
Shire of Exmouth			
+ On 31 May 2023, Santos emailed Shire of Exmouth and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2245] + On 27 June 2023, Santos emailed Shire of Exmouth seeking feedback on proposed activities. [Con-1912] + On 28 June 2023, Shire of Exmouth emailed Santos advising the email was received and forwarded to the relevant departments. [Con-2279] + On 19 July 2023, Santos emailed Shire of Exmouth by way of reminder on the timeframe for providing feedback. [Con-2021] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Shire of Ashburton			
+ On 31 May 2023, Santos emailed Shire of Ashburton and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2244] + No correspondence or feedback has been received. + On 27 June 2023, Santos emailed Shire of Ashburton seeking feedback on proposed activities. [Con-1911] + On 12 July 2023, Shire of Ashburton provided feedback regarding the emergency response actions and queries to address. It did not raise any objectives to the planned activities. [Con-1958] + On 26 July 2023, Santos emailed Shire of Ashburton providing information requested and answering its queries. [Con-1981] + On 2 August 2023, Shire of Ashburton emailed Santos acknowledging response and requesting it receive activity notifications and other information as required. [Con-2151] + On 7 August 2023, Santos emailed Shire of Ashburton confirming it would add it to the activity notifications and emergency notifications lists for the proposed Carnarvon Basin activities. [Con-2152]			

- On 7 August 2023, Shire of Ashburton emailed Santos a list of names to add to the activity notifications and emergency notification lists. [Con-2235]
- On 10 August 2023, Santos emailed Shire of Ashburton confirming it would add the emails to the activity notifications and emergency contacts list. [Con-2237]

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
Shire of Ashburton requested pre-start and activity completion notifications.	*Santos notes Shire of Ashburton's feedback.*	*Santos will send Shire of Ashburton activity notifications.*	*Activity notifications are included in* ***Table 8-5****.*

City of Karratha

- On 31 May 2023, Santos emailed City of Karratha and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP. [Con-2243]
- On 27 June 2023, Santos emailed City of Karratha seeking feedback on proposed activities. [Con-1908]
- On 29 June 2023, City of Karratha emailed Santos stating that it had no comment for this activity, however if in event of an emergency that may impact on the City's functions, interests or activities to forward correspondence to CEO. [Con-1959]
- On 14 July 2023, Santos emailed City of Karratha acknowledging it's feedback. [Con-1945]
- No further consultation required.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
City of Karratha requested to be notified in the event of an emergency that may impact on the City's functions, interests or activities.	*Santos has considered the City's feedback.*	*Santos will notify City of Karratha in the event of an emergency that may impact on the City's functions, interests or activities.*	*Activity notifications are included in* ***Table 8-5****.*

Exmouth Community Liaison Group (ECLG)

- On 12 June 2023, Santos emailed ECLG and provided information on a number of proposed Carnarvon Basin activities. [Con-4410]
- On 30 June 2023, Santos emailed ECLG and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this EP.[Con-4411]
- On 19 July 2023, Santos emailed ECLG by way of reminder on the timeframe for providing feedback.[Con-4413]
- On 27 July 2023, Santos met with the ECLG and provided an overview of the proposed Carnarvon Basin activities. No questions or feedback were raised in the meeting.[Con-4414]

- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Recreational fishers

Exmouth Game Fishing Club (EGFC)

- On 29 June 2023, Santos emailed Exmouth Game Fishing Club feedback on proposed activities. [Con-1860]
- On 19 July 2023, Santos emailed Exmouth Game Fishing Club by way of reminder on the timeframe for providing feedback. [Con-1843]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

Ashburton Anglers

- On 29 June 2023, Santos emailed Ashburton Anglers feedback on proposed activities. [Con-1863]
- On 19 July 2023, Santos emailed Ashburton Anglers by way of reminder on the timeframe for providing feedback. [Con-1846]
- No correspondence or feedback has been received.

Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.*	*NA*	*No additional EP controls required.*

	Santos considers Section 25 consultation complete for this EP.		
King Bay Game Fishing Club (KBFC)			
+ On 29 June 2023, Santos emailed King Bay Game Fishing Club seeking feedback on proposed activities. [Con-1871] + On 19 July 2023, Santos emailed King Bay Game Fishing Club by way of reminder on the timeframe for providing feedback. [Con-1848] + No correspondence or feedback has been received			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Nickol Bay Sportsfishing Club (NBSC)			
+ On 29 June 2023, Santos emailed Nickol Bay Sportsfishing Club seeking feedback on proposed activities. [Con-1874] + On 19 July 2023, Santos emailed Nickol Bay Sportsfishing Club by way of reminder on the timeframe for providing feedback. [Con-1851] + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.*	*NA*	*No additional EP controls required.*
Tourism operators			
Exmouth-based operators **Dampier / Karratha operators**			
+ On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. + No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***

NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*

5 Environmental Impact and Risk Assessment

OPGGS(E)R 2023 Requirements
Regulation 21. Environmental assessment
Evaluation of environmental impacts and risks 21(5) The environment plan must include: a) Details of all environmental impacts and environmental risks of the petroleum activity; and b) An evaluation of those 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: a) all operations of the activity; and b) potential emergency conditions, whether resulting from accident or any other reason.

Environmental impact and risk assessment refers to a process whereby planned and unplanned events that will or may occur during an activity are quantitatively and/or qualitatively assessed for their impacts on the environment (physical, biological, and socio-economic) at a defined location and specified period of time. In addition, unplanned events are assessed on the basis of their likelihood of occurrence which contributes to their level of risk.

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 2023.

Provided in this section of the EP is the following information relating to the environmental impact and risk assessment approach:

+ terminology used; and
+ summary of the approach.

A full description of the process applied in identifying, analysing and evaluating the impacts and risks relating to the planned activity is documented in Santos' Offshore Division Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004_5).

5.1 Impact and Risk Assessment Terminology

Common terms applied during the impact and risk assessment process, and used in this EP, are defined in **Table 5-1**. For a more comprehensive listing of the terms and definitions used in environmental impact and risk assessment, refer to Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004_5).

Table 5-1: Impact and Risk Assessment Terms

Name	Definition
Acceptability	Determined for both impacts and risks. Acceptability of events is in part determined by the consequence of the impact following management controls. Acceptability of unplanned events is in part determined from its risk ranking following management controls. For both impacts and risks, acceptability is also determined from a demonstration of the ALARP principle, consistency with Santos Policies, consistency with all applicable legislation and consideration of relevant stakeholder consultation when determining management controls.
Activity	Specific tasks and actions undertaken throughout the life cycle of oil and gas exploration, production and decommissioning.
ALARP	As Low As Reasonably Practicable The term refers to reducing 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 options that could reasonably be adopted to reduce risks further.
Authorised Person	Person with authority to make the decision or take the action. Examples are Vessel Master, Field Superintendent, Supervisor, Person-in-charge, Company Authorised Representative, and Project Manager.
Control Measure	Means a system, an item of equipment, a person or a procedure, that is used as a basis for managing environmental impacts and risks[2].
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety
Environment	Includes the natural and socio-economic values and sensitivities which will or may be affected by the activity. Is defined by NOPSEMA and DEMIRS 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; (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 NOPSEMA[1] as any change to the environment, whether adverse or beneficial, wholly or partly resulting from a planned or unplanned event[1].

[2] Defined by the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023

Name	Definition
	Defined by DEMIRS as any change to the environment, whether adverse or beneficial, that wholly or partly results from a activity of an operator.
ENVID	Environmental hazard identification workshop
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.
Hazard	A situation with the potential to cause harm
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.
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.
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority, the regulator with jurisdiction over the activity.
Planned activity	A description of the activity to be undertaken, including the services, equipment, products, assets, personnel, timing, duration and location and aspect of the activity.
Planned event	An event arising from the activity which is done with intent (i.e. 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 drill cuttings discharge would be examples of planned events.
Receptor	A feature of the environment that may have environmental, social and/or economic values.
Risk	The effect of uncertainty on 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.
SLT	Senior Leadership Team
Unplanned event	An event that results in some level of environmental impact and may occur despite preventive 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 (QE-91-IF-10050). The company Risk Procedure (SMS MS1 ST01) 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 risk management are illustrated in **Figure 5-1**. The forum used to undertake the 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 (EA-91-IG-00004_6).

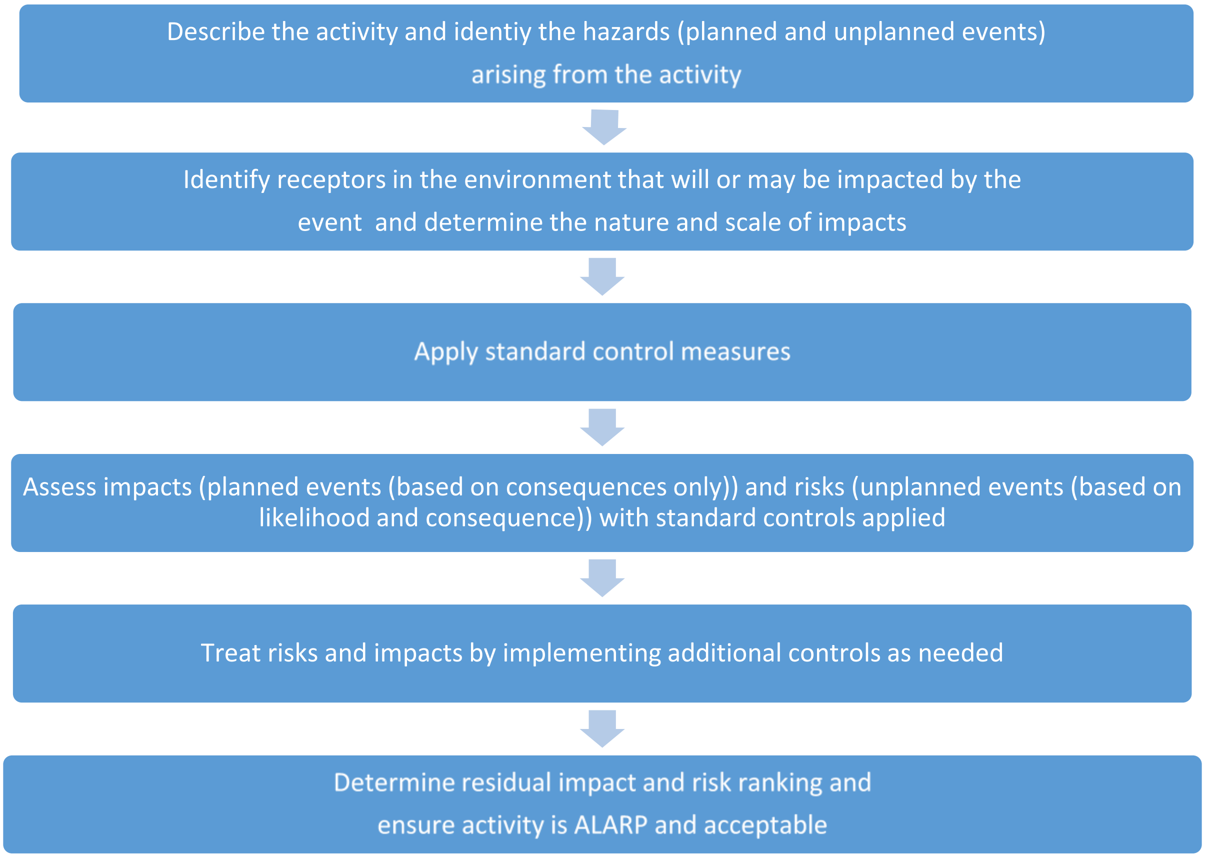

Figure 5.1: Environmental impact and risk assessment process

5.2.2 Context Setting

Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004_5) includes consideration of the following key areas in an impact and risk assessment:

+ description of the Activity (including location and timing);
+ description of the environment (potentially affected by both planned activities and unplanned events);
+ identification of relevant persons;
+ identification of legal requirements ('legislative controls') that apply to the Activity;
+ Santos policy and SMS requirements;

+ principles of Ecologically Sustainable Development (ESD); and
+ Santos acceptable levels of impact and risk.

These factors are considered in environmental impact and risk assessment workshop held on 13 March 2023 in which environmental hazards are identified and assessed (ENVID workshop). The workshop involves participants from Santos' Health, Safety and Environment (HSE), Project and Spill Response departments and specialist environmental consultants. Following NOPSEMA assessment and RFFWI received on 26 March 2024, Santos held a second ENVID workshop on 18 April 2024, in which Loss of Containment (LOC) from either dropped object or anchor drag was assessed for pipeline (**Section 7.7**) and wellhead (**Section 7.8**).

5.2.3 Describe the Activity and Hazards (Planned and Unplanned Events)

A description of the activity is required in order to determine the planned events that will take place and the credible unplanned events that may occur. The location, timing and scope of the activity must be described in order to determine the impacts from planned events, and the impacts and risks from unplanned events since these have a bearing upon the EMBA by the activity.

The outcome of this assessment is detailed in the relevant sub-sections of **Sections 6** and **7**.

5.2.4 Identify Receptors and Determine Nature and Scale of Impacts

The extent of actual or potential impacts from each planned event or unplanned event is assessed using, where required, modelling (e.g., hydrocarbon spills) and scientific reports. A description of the environment (natural and socio-economic) within which hazards from the activity will, or may occur, is required (**Section 3**). This constitutes a crucial stage of the risk assessment, as an understanding of the environment that will or may be affected is required to determine the type and consequence of impacts from the activity are 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 a *Values and Sensitivities of the Western Australian Marine Environment* (EA-00-RI-10062) reference document which describes the existing environment that may be affected by Santos' activities and is reviewed and updated on an annual basis.

Where the existing environment is being reviewed for regulatory approvals, a comparison shall be made against the *Santos' Values and Sensitivities of the Western Australian Marine Environment* (EA-00-RI-10062) (**Appendix D**).A new protected matters search is required to ensure a thorough understanding of the existing environment to ensure all risks are assessed.

The extent of actual impacts from each planned activity or risks from each unplanned activity, are assessed using, where required, modelling (e.g. hydrocarbon spills) and scientific reports. The duration of the event is also described including the potential duration of any impacts should they occur. Receptors identified as potentially occurring within impacted area(s) are detailed in **Section 3** and **Appendix C**.

5.3 Describe the Environmental Performance Outcomes and Control Measures

For each planned and unplanned event, a set of Environmental Performance Outcome(s), Control Measures, Environmental Performance Standards and Measurement Criteria are identified. The definitions of the performance outcomes, control measures, standards and measurement criteria must be consistent with the OPGGS(E)R 2023, and the NOPSEMA Environment Plan Content Requirements Guidance Note (NOPSEMA, 2020).

Additional controls, must also be considered and either accepted for use or rejected based on whether the standard controls reduce impacts and risks to levels that are ALARP and acceptable (refer **Section 5.2.6** and **5.2.7**).

Controls are allocated in order of preference according to **Figure 5-2**.

For this EP, the control measures that will be implemented have been referenced based on the activity it relates to. Control measures to be implemented for drilling and completions have the naming convention H2-DC-CM-XXX, while control measures to be implemented for the subsea installation and pre-commissioning have the convention H2-IC-CM-XXX.

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 and Risk Rankings

This step looks at the causal effect between the aspect/hazard and the identified receptor. Impact mechanisms and any thresholds for impacts are determined and described, using scientific literature and modelling where required. Impact thresholds for different critical life stages are also identified where relevant.

The consequence level of the impact is then determined for each planned and unplanned event using the Corporate Santos Risk Matrix (**Appendix G**).

These detailed environmental consequence descriptions are based on the consequence of the impact to relevant receptors in the following categories:

+ threatened/migratory/local fauna;
+ physical environment/habitat;
+ threatened ecological communities;
+ protected areas; and
+ socio-economic receptors.

This process determines a consequence level, based on set criteria for each receptor category, and takes 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. Refer to **Section 5.5** for determining consequence levels relating to First Nations cultural features.

For unplanned events, a risk ranking is also determined using an assessment of the likelihood (likelihood ranking) of the event as well as the consequence level of the potential impact should that event occur. Likelihood rankings are provided in the Santos risk in **Table 5-3**.

The level of information required to complete the impact or risk assessment depends on the nature and scale of the impact or risk. This process determines a consequence level based on set criteria for each receptor category and takes 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. Impacts to social and economic values are also considered based on existing knowledge and feedback from stakeholder consultation. As the result of historic consultation with stakeholders, the social and economic values in the region that are of interest are evident.

As planned events are expected to occur during the activity, the likelihood of their occurrence is not considered during the risk assessment, and only a consequence level is assigned (**Table 5-2**).

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 is combined with the likelihood of the impact occurring (**Table 5-3**), to determine a residual risk ranking using the corporate Santos risk matrix (**Table 5-4**). For oil spill events, potential impacts to environmental receptors are assessed where they occur within the EMBA using results from modelling.

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 First Nations Cultural Features Assessment

The definition of ‘environment’ under the OPGGS(E) Regulations 2023 Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 is broad, and means:

+ (a) ecosystems and their constituent parts, including people and communities; and
+ (b) natural and physical resources; and
+ (c) the qualities and characteristics of locations, places and areas; and
+ (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).

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 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 about cultural and spiritual beliefs that do not link to a specific place (or physical/tangible feature), 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) people with relevant experience and credentials.
+ Culturally appropriate control measures raised by relevant people, organisations or experts; or proposed by Santos and workshopped with relevant people, organisations or experts.

Impact and risk evaluation of cultural and spiritual beliefs will not form part of an ENVID workshop, and a consequence (or risk) ranking will not be assigned. Instead, 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 will be presented in the Environment Plan as informed by the above considerations.

5.6 Evaluate if Impact and Risks are As Low As Reasonably Practicable

For planned and unplanned events, an ALARP assessment is undertaken to demonstrate that the standard control measures adopted 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/effort in order 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 to a risk ranked as `Low’.

5.7 Evaluate Impact and Risk Acceptability

Santos considers an impact or risk associated with the proposed activity to be acceptable if the following criteria are met:

+ 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 whether further information or studies are required to support or validate the consequence assessment;

- Assessment and management of risks has addressed the principles of ecologically sustainable development;
- The acceptable levels of impact and risks have been informed by relevant species recovery plans, threat abatement plans and conservation advice can be demonstrated;
- Performance standards are consistent with legal and regulatory requirements;
- Performance standards are consistent with the EHS Policy;
- Performance standards are consistent with industry standards and best practice guidance (e.g., National Biofouling Management Guidance Guidelines for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2018) and the Australian Biofouling Management Requirements (Department of Agriculture, Water and the Environment, 2022);
- Performance outcomes and standards are consistent with stakeholder expectations;
- Performance standards have been demonstrated to reduce the impact or risk to ALARP; and
- The consequence and risks associated with the proposed activity are not inconsistent with the outcomes of relevant principles of ecologically sustainable development (ESD) under the EPBC Act.

Review of the five principles of ESD under the *EPBC Act* in relation to acceptability against the activity is detailed in **Table 5-5**.

Table 5-5: Activity Relevant Principles of Ecological Sustainable Development (EA-91-IG-00004)

No.	ESD Principle	Relevance
(a)	Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations	Santos' environmental impact and risk assessment determines impact consequence levels considering the duration and extent of the impact, receptor recovery time and the effect of the impact at a population, ecosystem, or industry level. The Santos Environment Consequence Descriptors highlights the integration of long-term and short-term environmental, and socio-economic considerations (**Appendix G**). The assessment of impact consequence levels for the proposed activity simultaneously assesses of the activity's potential implications against this principle. Additional assessment of this principle in relation to acceptability will not be conducted.
(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	For planned activities, assessment of this ESD principle is inherent in Santos' environmental impact and risk assessment process, as Santos does not proceed with activities if the consequence of a planned event is ranked III (Moderate) or above. For unplanned events, if the residual risk is ranked between Medium and Very High, an assessment against this principle is required. If the residual risk is Medium to Very High and there is significant scientific uncertainty associated with the aspect, additional assessment against this principle is required.
(c)	The principle of inter-generational equity—that the present generation should	For planned activities, assessment of this ESD principle is inherent in Santos' environmental impact and risk assessment process, as

No.	ESD Principle	Relevance
	ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations	Santos does not proceed with activities if the consequence of a planned event is ranked III (Moderate). For an unplanned event, if the residual risk is ranked between Medium and Very High, an assessment against this principle is required. The assessment of this principle is implemented through further details on ALARP assessment highlighting assurance that potential impacts and risks are managed, and the environment is maintained for the benefit of future generations. Evaluation of the importance and relevance of stakeholder interest for this principle, if triggered, is fundamental in demonstrating that the environment is maintained for the benefit of future generations.
(d)	The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making	Evaluate if there is the potential to affect biological diversity and ecological integrity.
(e)	Improved valuation, pricing and incentive mechanisms should be promoted	This principle refers to activities which involve valuation, pricing and/or incentive mechanisms for the production, delivery, distribution or consumption of goods and services, especially those that are derived from natural or social capital or from ecological services. This principle is not relevant to the proposed activity as the proposed activity does not involve the production, delivery, distribution or consumption of goods and services.

6 Planned Activities Risk and Impact Assessment

OPGGS(E)R 2023 Requirements
Regulation 21. Environmental assessment.
Evaluation of environmental impacts and risks 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 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: a) all operations of the activity; and b) potential emergency conditions, whether resulting from accident or any other reason. 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 ENVID workshop was held in January 2023 to identify and manage the environmental impacts and risks that may credibly arise from the activities. This ENVID workshop identified eight planned environmental impacts associated with the activity. The consequence rankings resulting from the environmental assessments are summarised in **Table 6-1**. A comprehensive risk and impact assessment for each of the planned events, and subsequent control measures proposed by Santos to reduce the risk and impacts to ALARP and acceptable levels are details in the following subsections.

Table 6-1: Summary of the Consequence Level Rankings for Hazards Associated with Planned Events

EP Section Reference	Hazard	Residual Consequence Level
6.1	Noise Emissions	I - Negligible
6.2	Light Emissions	II - Minor
6.3	Atmospheric Emissions	I - Negligible
6.4	Seabed Disturbance	II - Minor
6.5	Interactions with Other Marine Users	I - Negligible
6.6	Operational Discharges	I - Negligible

EP Section Reference	Hazard	Residual Consequence Level
6.7	Drilling Discharges	II - Minor
6.8	Subsea Infrastructure Discharges	II - Minor
6.9	Spill Response Operations	I - Negligible

6.1 Noise Emissions

6.1.1 Description of Event

Event	Potential impacts from noise emissions may occur during the drilling and installation activities. Noise emissions in the operational area during drilling activities will be produced from the following sources: + Support vessel activities (e.g. vessel engines, thrusters and other machinery). + MODU activities (e.g. drilling, well construction and machinery). + Helicopter activities. + ROV or AUV operations / survey activities. + Positioning equipment (e.g. USBL, LBL). Noise emissions in the operational area during subsurface installation activities will be produced from the following sources: + ISV and support vessel activities (e.g. vessel engines, thrusters and other machinery). + ROV or AUV operations / survey activities.
Extent	Impacts from potential noise sources will only occur during the drilling and installation activities. The relative extent of various noise sources are as follows: + Noise from vessels holding station using DP is expected to be the noise source with the greatest potential for environmental impacts. This noise is relatively high intensity and broadband in nature. + Machinery noise transmitted through the MODU, ISV and support vessels hulls will have relatively low potential impact. + Impulsive noise will only be generated by positioning equipment, and this is expected to be for a short portion of the activity and noise levels will be low. Noise from acoustic survey equipment may be high intensity but is also relatively high frequency and attenuates rapidly in the water column. + Noise from ROVs/ AUV and construction activities will be of short duration and relatively low intensity. + Impacts from helicopter noise will be limited to when they are taking off and landing. + Flaring will generate noise above the sea, with little noise from flaring being transmitted in the sea. There is no potential for SIMOPS with drilling activities and subsea installation activities and therefore no potential cumulative noise impacts from SIMOPS will occur. Cumulative or additive noise impacts from the activity are not expected to extend beyond the operational area, due to the short term nature of the activities and low sound levels generated by continuous noise sources. There is no potential for additive or cumulative impacts with other operators as consultation did not identify any concurrent activities. The extent of underwater noise is described further below.
Duration	Continuous and intermittent noise while undertaking the activity.

6.1.1.1 Noise Generated by Drilling Activities

The MODU will be a semi-submersible moored rig, which will not emit DP noise. The MODU will generate continuous noise from the operation of on-board machinery, such as diesel engines, pump, ventilation fans (and associated exhaust) and electrical generators. These noise sources all occur above the water, however the MODU hull may transmit some of this noise into the sea. These sources account for most of the acoustic emissions to sea during drilling, with the drill string transmitting relatively little noise (Austin et al., 2018a).

Sound produced from an active moored semi-submersible MODU is predominantly below 2 kHz, with peak frequencies below 500 Hz. McCauley (1998) recorded source noise levels for moored MODUs from 149-154 dB re 1 µPa at 1 m while actively drilling (with support vessel on anchor). There was a significant variation in the broadband noise during non-drilling periods, attributed to the operation of specific types of machinery. Greene (1987) recorded source levels of two moored drillships from 145-158 dB re 1 µPa at 1 m during drilling (with support vessels idling nearby). An acoustic monitoring program commissioned by Santos was conducted during an exploratory drilling program in 2003, which indicated that the drilling operation was not audible from between 8 km to 28 km from the MODU (or beyond) (McCauley, 2005). Austin et al. (2018b) recorded broadband source levels from MODU operations (excluding DP thrusters) to be 170.7 dB re 1 µPa. Studies undertaken in the Arctic on different MODU types (including semi-submersible and drill ships) indicate that noise levels dropped to 117 dB re 1 µPa within 1 km of the MODU and are much lower than those for large commercial vessels operating at normal speeds (Austin et al., 2018a). Hence source levels from the MODU are reasonably assumed to be < 170.7 dB re 1 µPa, concentrated below 2 kHz and reduce rapidly with distance from the MODU.

Flaring during well clean-up generates high intensity noise above the sea radiating from the flare. The underwater noise from flaring has not been estimated, however the concepts of transmission are similar to those for helicopters, with most of the noise energy being reflected by the sea surface and a relatively small portion being transmitted into the sea.

6.1.1.2 Noise Generated by Vessels

Vessels produce low frequency sound (i.e. below 1 kHz) from the operation of machinery, hydrodynamic flow sound around the hull and from propeller cavitation, which is typically the dominant source of sound (Jiménez-Arranz et al., 2020). Machinery on vessels radiates sound through the hull into the water. Sound emitted from support vessels differs significantly depending on factors such as speed, size, load, type and state of propulsion system, and meteorological and oceanographic conditions, such as sea surface and currents (MacGillivray, 2018). A reasonable representation of vessel noise during the activity is a vessel under slow transit

McCauley (1998) measured underwater broadband noise equivalent to about 182 dB re 1 µPa at 1 m (RMS SPL) with a frequency range of 20 Hz to 10 kHz from a support vessel holding station in the Timor Sea; it is expected that similar noise levels will be generated by support vessels used during the activities. The thruster noise dropped below 120 dB re 1 µPa within 3 km to 4 km and was audible above ambient noise up to 20 km away (McCauley, 1998). This has been taken as the greatest noise-generating activity for assessment purposes, as other vessel activities will require the vessel to be idle or moving. McCauley (1998) measured underwater sound levels from the Pacific Ariki, a 64 m long support vessel with 8,000 HP (6,000 kW) main engines during calm conditions in the Timor Sea in

110 m of water while transiting at 11 knots, and found the distance to 120 dB re 1 µPa to be approximately 1 km (i.e., substantially less than when the vessel was holding station using DP).

6.1.1.3 Noise Generated by Helicopters

Helicopters are expected to land/take off from the MODU and ISV several days a week. It is expected that underwater sounds as a result of helicopter activity will only be detectable in the upper water column for very brief periods during landing and take-off. Helicopter engine noise is emitted at various frequencies however, the dominant tones are typically low frequency and below 500 Hz (Richardson et al., 1995). The sea surface is an effective reflector of sound energy and much of the in air noise from a helicopter will be reflected by the sea surface, with a relatively small portion being transmitted into the sea. The noise from the flyover of a Bell 214 helicopter (stated to be one of the noisiest) has been recorded underwater and the sound source was 162 dB re 1 µPa @ 1 m at its peak and had frequency of 155 Hz (Richardson et al., 1995).

6.1.1.4 Noise Generated from ROV Operations

ROVs/AUVs may be used for a variety of activities including, but not limited to survey activities, inspections of the seabed and/or retrieving dropped objects. ROV activity will be undertaken from a vessel or the MODU and the noise generated will typically be of considerably lower intensity than vessel noise. ROVs are often fitted with equipment including, but not limited to cutters, cameras and tools. Some of this equipment could emit pulses of noise, such as sonar equipment.

As underwater sound levels are dependent on the primary (noisiest) sound source rather than being strictly additive, and since ROV operations will be undertaken from a vessel or MODU, they will make little contribution to the overall noise emissions associated with vessel/MODU activities, as described above and are not risk assessed further.

An array of long baseline (LBL) and/or ultra-short baseline (USBL) transponders may be installed on the seabed for metrology and positioning. Transponders typically emit pulses (impulsive noise) of medium frequency sound, generally within the range 21 to 31 kHz. The estimated SPL would be 180 to 206 dB re 1 µPa at 1 m (Jiménez-Arranz et al., 2017). Transmissions are not continuous but consist of short ‘chirps’ with a duration that ranges from 3 to 40 milliseconds. Transponders will not emit any sound when on standby. When required for general positioning they will emit one chirp every five seconds.

6.1.2 Nature and Scale of Environmental Impacts

Potential Receptors: Threatened or migratory fauna (marine mammals, marine turtles, sharks, fish and rays).

Marine fauna use sound for a variety of functions including social interactions, foraging, orientation and responding to predators. Underwater noise may impact on marine fauna through:

+ attraction to the noise source;
+ increased stress levels;
+ disruption to underwater acoustic cues;
+ localised avoidance;
+ disturbance, leading to behavioural changes or displacement from areas;

- masking or interference with other biologically important sounds such as communication or echolocation;
- physical injury to hearing or other organs; and
- indirectly by inducing behavioural and physiological changes in predator or prey species.

The nature and scale of impacts must be considered in the context of the ambient noise environment. Ambient underwater noise levels are dependent on location, and are often dominated by local wind noise, waves, biological noise and ship traffic. Wind speed and seabed conditions have a clear influence on the ambient noise level. Existing anthropogenic underwater noise sources in the region of the proposed activity include shipping, small vessel traffic, and petroleum-production activities.

Responses of marine fauna exposed to underwater noise from anthropogenic sources may vary. Responses depend on many factors, such as sound source characteristics, distance from the sound source, water depth and bathymetry, the animal's hearing sensitivity, type and duration of sound exposure and the animal's activity at time of exposure.

The effects of sound on marine fauna can be broadly categorised as:

- Acoustic masking – anthropogenic sounds may interfere with, or mask, biological signals, therefore reducing the communication and perceptual space of an individual. 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;
- Behavioural response – behavioural impacts will depend on the audible frequency range of each potential receptor in relation to the frequency of the noise, as marine animals will only respond to acoustic signals they can detect, as well as the intensity of the noise. The intensity of behavioural responses of marine mammals to sound exposure ranges from subtle responses, which may be difficult to observe and have little implications for the affected animal, to obvious responses, such as avoidance or panic reactions. The context in which the sound is received by an animal affects the nature and extent of responses to a stimulus. The threshold for elicitation of behavioural responses depends on received sound level, as well as multiple contextual factors such as the activity, state of animals exposed to different sounds, the nature and novelty of a sound, spatial relations between a sound source and receiving animals, and the gender, age and reproductive status of the receiving animal;
- Physiological impacts – auditory threshold shift (temporary and permanent hearing loss) – marine fauna exposed to intense sound may experience a loss of hearing sensitivity, or even potentially mortal injury. Hearing loss may be in the form of a temporary threshold shift (TTS) from which an animal recovers within minutes or hours, or a permanent threshold shift (PTS) from which the animal does not recover; and

Available threshold criteria associated with behavioural and physiological impacts for sensitive receptors have been derived from a number of sources (National Marine Fisheries Service, 2018a; Popper et al., 2014; Southall et al., 2019a). These criteria have been compared with measured and predicted sound levels for different sound sources to assess potential impacts.

6.1.2.1 Marine Mammals

Marine mammals, especially cetaceans, rely on sound for individual recognition, socialising, detecting predators and prey, navigation and reproduction (Erbe, 2012; Erbe et al., 2016; Weilgart, 2007). Underwater noise can affect marine mammals in various ways including interfering with communication (masking), behavioural changes, a shift in the hearing threshold (PTS and TTS), physical damage and stress (Erbe, 2012).

The thresholds that could result in a behavioural response, temporary threshold shift (TTS) and permanent threshold shift (PTS) for cetaceans as a result of continuous and impulsive noise sources are presented in **Table 6-2** and **Table 6-3**. These thresholds have been adopted by the United States National Oceanic and Atmospheric Administration (NOAA) (2019a), National Marine Fisheries Service (NMFS) (2018b) and Southall et al. (2019b).

Table 6-2: Thresholds for PTS, TTS and behavioural response onset for cetaceans and sirenians for continuous noise

Hearing Group	PTS Onset Threshold: SEL_{24h} (dB re 1 µPa².s)	TTS Onset Thresholds SEL_{24h} (dB re 1 µPa².s)	Behavioural Response (dB re 1 µPa)
LF cetaceans	199	179	120
HF cetaceans	198	178	120
VHF cetaceans	173	153	120
Sirenians	206	186	-

Source: NMFS (2018b)*, Southall et al.* (2019b)*, NOAA* (2019a)

Table 6-3: Thresholds for PTS, TTS and behavioural response onset for cetaceans and sirenians for impulsive noise

Hearing Group	NOAA (2019b)	NMFS (2018); Southall *et al.* (2019a)			
	Behaviour	PTS Onset Thresholds (Received Level)		TTS Onset Thresholds (Received Level)	
	SPL (L_p; dB re 1 µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	PK (L_{Pk}; dB re 1 µ Pa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	PK (L_{Pk}; dB re 1 µ Pa)
Low-frequency cetaceans	160	183	219	168	213
High-frequency cetaceans	160	185	230	170	224
Very-high-frequency cetaceans	160	155	202	140	196
Sirenians	-	175	220	190	226

Source: Southall et al. (2019b)*, NOAA* (2019a)

The operational area overlaps the outer part of the humpback whale migration corridor and is approximately 8 km from the pygmy blue whale migration corridor BIAs (**Figure 3-9**). Thums et al. (2022) also suggest that the migration corridor may extend much further west from the shelf edge than the migration BIA established by DCCEEW and therefore is likely to be further from the operational area. Humpback and pygmy blue whales are listed as migratory and pygmy blue whales are also listed as endangered under the EPBC Act. Other species of cetaceans may also be exposed to underwater noise from the activities, however humpback and pygmy blue whales are considered to be the most vulnerable to impacts due to their known seasonal presence in the vicinity of the operational area.

Migrating pygmy blue whales are unlikely to occur in the operational area, with observed and modelled distributions of pygmy blue whales occurring further offshore in deeper water (Double et al., 2014; Thums et al., 2022). The *Conservation Management Plan for the Blue Whale* (Commonwealth of Australia, 2015b), a recovery plan made under the EPBC Act, defines BIAs for pygmy blue whales, with particular emphasis placed on foraging areas and migration corridors. The noise source with the greatest potential for impacts to pygmy blue whales is vessels holding station using DP. As described above in **Section 6.1.1.2**, noise from vessels using DP is expected to be below 120 dB re 1 µPa within 4 km of the source. Given the operational area is approximately 8 km from the pygmy blue whale migration BIA at the closest point, the activities will not credibly result in noise levels in the pygmy blue whale migration corridor above the PTS, TTS or behavioural response thresholds in **Table 6-2**. When considering the *Conservation Management Plan for the Blue Whale* (Commonwealth of Australia, 2015b) and *Guidance on key terms within the Blue Whale Conservation Management Plan* (Department of Agriculture, Water and the Environment, 2021), underwater noise emissions from the activities are consistent with the requirements of the plans.

Humpback whales are seasonally present in the North West Shelf region during their annual migrations to and from breeding areas in northern Western Australia. The migration BIA for humpback whales overlaps the operational area. Aerial surveys and tagging studies of humpback whales indicate that most migrating humpbacks occur in shallower water than the operational area (ranging from approximately 95 m – 125 m) , but considerable numbers of humpback whales have been observed in the region in water depths similar to the operational area (Double et al., 2012, 2010; RPS Environment and Planning, 2010; Thums et al., 2018). It is reasonable to conclude that a portion of the humpback whale population may occur in or near the operational area during seasonal migrations and hence be exposed to underwater noise at levels that may cause impacts. Other known important areas for humpback whales, such as foraging or cow/calf resting areas do not occur in or near the operational area.

Vessels holding station using DP have the greatest potential to cause impacts to humpback whales due to their relatively high source level and broadband nature, which includes low frequency components that overlap the functional hearing range of humpback whales. Other noise sources are less likely to result in impacts due to their lower source levels (e.g., MODU noise), relatively high frequency and consequent rapid attenuation (e.g., positioning equipment noise) or short duration (e.g., helicopter noise). Source levels of noise from vessels using DP will not credibly exceed the PTS threshold for low frequency cetaceans. Noise levels would only credibly exceed the TTS threshold in the immediate vicinity of the source (i.e., 10’s of metres from a thruster) and would require a humpback to remain in this proximity to the noise source for a sustained period of time. Humpback whales receiving sufficient noise for PTS and TTS is not considered credible.

Noise levels that exceed the behavioural impact threshold may extend from vessels to approximately 4 km. Migrating humpback whales within this area may experience behavioural disturbances, such as avoidance of the noise source, increased swimming speed and increased diving frequency. These behavioural responses have been observed in response to the presence of vessels in humpback migration areas, although the effect of the vessel (and seismic source) did not stop migration (Dunlop et al., 2015). Consequently, underwater noise emissions to humpback whales may induce short-term behavioural responses in animals close to vessels, but this will affect a small portion of the population and will not impact migration behaviour.

Vessel noise may also mask humpback whale calls, which may interfere with the perception of communication and result in humpback whales increasing their call volumes. Masking would only credibly occur when vessels are holding station using DP. Adult male humpback whales call most frequently and loudly during migration, with females and calves vocalising more quietly and far less frequently (Gosby et al., 2022; Salgado-Kent et al., 2012).

High and very high frequency cetaceans, such as dolphins and pilot whales, may occur in the operational area. High and very high frequency cetaceans may be impacted by underwater noise generated by the activities, particularly acoustic emissions from positioning equipment (e.g., USBL and LBL) operate in frequencies that overlay the functional hearing range of high-frequency cetaceans. Source levels for acoustic positioning equipment may exceed the TTS and behavioural impact thresholds for high and very high frequency cetaceans (**Table 6-3**). High-frequency noise attenuates rapidly in seawater and the noise emissions from positioning equipment on the seabed (> 100 m water depth) will be substantially lower power for receivers near the sea surface, which is where high frequency cetaceans are most likely to occur. High frequency noise from positioning equipment will be of relatively short duration (e.g., several hours when positioning the MODU) and infrequent during the activities. The operational area is not known to be important habitat for high and very high frequency cetaceans. Consequently, impacts to high frequency cetaceans are likely to be limited to short-term behavioural impacts.

Helicopter noise would only credibly impact upon cetaceans during take-off and landing at the MODU, ISV or support vessels. Cetaceans are unlikely to be close to the MODU, ISV or support vessels MODU, ISV or support vessels during helicopter take-off and landings, as they are likely to be displaced due to the noise generated by the MODU, ISV and support vessels. Given helicopter noise is largely be reflected by the sea surface and take-off and landing operations are short-term, impacts to cetaceans from helicopter noise are very unlikely to occur.

There is no significant habitat or biologically important areas for sirenians in or near the operational area. Although dugongs have been identified in the PMST report to potentially occur within the operational area it is unlikely given the absence of habitat.

6.1.2.2 Marine Turtles

There are five species of marine turtle that may occur in the operational area: loggerhead turtle, green turtle, leatherback turtle, hawksbill turtle, and flatback turtle. The operational area overlaps the flatback turtle internesting BIA and habitat critical for the survival of the species.

Recent tagging studies have identified that waters utilised by flatback turtles during post-nesting migration and foraging are typically less than 50 m deep and less than 66 km from shore (Whittock et al. 2016; Thums et al. 2018). Thums et al. (2018) specifically studied flatback turtles during their post-nesting migration from the Lacepede Islands and during foraging. The study found that flatback turtles migrated along the coast in water depths of 63 ± 5 m, passing near Adele Island on the way to foraging grounds on the Sahul Shelf in the Timor Sea. Based on this, it is unlikely that internesting flatback turtles would be present within the operational area.

The *Recovery Plan for Marine Turtles in Australia* (Commonwealth of Australia, 2017) identifies noise interference from anthropogenic activities as a threat to marine turtles. The plan refers to vessel noise and the operation of some oil and gas infrastructure as sources of chronic (continuous) noise in the marine environment, exposure to which may lead to avoidance of important turtle habitat. The criteria for continuous and impulsive sound sources applies to marine turtles are shown in **Table 6-4**.

Table 6-4: Acoustic effects of continuous noise on marine turtles

Potential Marine Fauna Receptor	Popper et al. (2014)		Finneran et al (2017) Weighted SEL_{24h} ($LE_{,24h}$; dB re 1 μPa2·s)	
	Masking	Behaviour	PTS onset threshold	TTS onset threshold
Marine Turtle	(N) High (I) High (F) Moderate	(N) High (I) Moderate (F) Low	220	200

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 meters, intermediate (I) - hundreds of meters, and far (F) – thousands of meters for Popper et al. (2014).

Table 6-5: Acoustic effects of impulsive noise on marine turtles

NFS (2011)	Moein et al. (1995), McCauley et al. (2000)	Finneran et al (2017)			
Behaviour		PTS onset threshold		TTS onset threshold	
SPL (Lp; dB re 1 μPa)		Weighted SEL_{24h} ($LE_{,24h}$; dB re 1 $\mu Pa^2 \cdot s$)	PK (L_{pk}; dB re 1 μPa)	Weighted SEL_{24h} ($LE_{,24h}$; dB re 1 $\mu Pa^2 \cdot s$)	PK (L_{pk}; dB re 1 μPa)
166	175	204	232	189	226

There is a paucity of data regarding responses of turtles to acoustic exposure, and no studies of hearing loss due to exposure to loud sounds. Popper et al. (2014) suggested thresholds for onset of mortal injury (including PTS) and mortality for sea turtles and, in absence of taxon-specific information, adopted the levels for fish that do not hear well (suggesting that this likely would be conservative for sea turtles).

Finneran et al (2017) proposed revised thresholds for marine turtle injury and hearing impairment (TTS and PTS). Their rationale is that marine turtles have best sensitivity at low frequencies and are known to have poor auditory sensitivity (Ketten and Bartol, 2006). Accordingly, TTS and PTS thresholds for turtles are likely more similar to those of fishes than to marine mammals (Popper et al., 2014).

Studies show that behavioural responses such as an increase in swimming activity occurred with received sound levels of approximately 166 dB re 1 μPa and an avoidance response and behaving erratically occurred at around 175 dB re 1 μPa (McCauley et al., 2000). Source levels from vessels using DP may exceed these levels, and hence may result in behavioural responses in marine turtles.

Based on the criteria detailed within **Table 6-4** and if vessels operating on DP emit approximately 182 dB re 1 µPa at 1 m (RMS SPL) (McCauley 1998), PTS and TTS will not credibly occur. Behavioural changes, for example, avoidance and diving, are only predicted for individuals in close proximity to noise sources, particularly vessels holding station using DP. These are expected to occur in within hundreds of metres of the noise source, and hence may result in a short-term displacement of marine turtles around vessels. Turtles have not been shown to have a reliance on sound for finding food or avoiding predators, hence masking is unlikely to occur.

Injury to marine turtles from impulsive noise sources (i.e., positioning equipment) will not credibly occur. Behavioural changes, for example, avoidance and diving, are only predicted for individuals in close proximity to the noise sources, which are near the seabed where individuals are unlikely to be present.

6.1.2.3 Sharks, rays and fish

All fish species can detect noise sources, although hearing ranges and sensitivities vary substantially between species (Dale et al., 2015). Sensitivity to sound pressure seems to be functionally correlated in fishes to the presence and absence of gas-filled chambers in the sound transduction system. These enable fishes to detect sound pressure and extend their hearing abilities to lower sound levels and higher frequencies (Ladich and Popper, 2004). Based on their morphology, Popper et al. (2014) classified fishes into three animal groups comprising:

+ Fishes with swim bladders whose hearing does not involve the swim bladder or other gas volumes;
+ Fishes whose hearing does involve a swim bladder or other gas volume; and
+ Fishes without a swim bladder that can sink and settle on the substrate when inactive.

Underwater noise impact thresholds for continuous and impulsive noise for the fish categories listed above are provided in **Table 6-6** and **Table 6-7** for continuous and impulsive noise respectively. Given there is no exposure criteria for sharks and rays, the same criteria are adopted, though typically sharks and rays do not possess a swim bladder.

Table 6-6: Continuous noise: Criteria for noise exposure for fish, adapted from Popper et al. (2014)

Potential Marine Fauna Receptor	Mortality and Potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
Fish: No swim bladder (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
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

Potential Marine Fauna Receptor	Mortality and Potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
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 meters, intermediate (I) - hundreds of meters, and far (F) – thousands of meters.

Table 6-7: Impulsive noise: Criteria for noise exposure for fish, adapted from Popper et al. (2014)

Potential Marine Fauna Receptor	Mortality and Potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
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
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
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	(N) Moderate	(N) Low (I) Low	(N) Moderate

		(F) Low	(I) Low (F) Low	(F) Low	(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 meters, intermediate (I) - hundreds of meters, and far (F) – thousands of meters.

Noise effects on fish may result in indirect impacts to fisheries through changes in fish behaviour. Individual demersal fish may be impacted in the vicinity of the activity other mobile pelagic species may transverse the operational area. However, the operational area is not known to be an important spawning or aggregation habitat for commercially caught targeted species. Therefore, no impacts to fish stocks are expected.

Whale sharks could potentially be impacted from operational noise if in the area. Although the operational area does not overlap the foraging high density prey BIA, it does overlap the foraging BIA for whale sharks. Whale sharks would be expected to show avoidance to vessel noise, although they are likely to tolerate low level noise, as they have been observed swimming close to oil and gas platforms on the NWS, as well as charter vessels for tourism purposes during the aggregations at Ningaloo Coast.

Based on criteria developed by Popper et al. (2014) for continuous and impulsive noise impacts on fish, noise from the activities has a low risk of resulting in mortality and TTS impacts, and would only occur if fish remain in very close proximity of the noise sources. 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.

Given the thresholds outlined in **Table 6-6** and **Table 6-7**, it is reasonable to expect that fish, sharks and rays may demonstrate avoidance or attraction behaviour to the noise generated by the activities. However, potential impacts from predicted noise levels from the project vessels (including MODU and support vessels) are not considered to be ecologically significant at a population level.

6.1.2.4 Invertebrates

Benthic invertebrates are unlikely to be negatively impacted from noise generated from vessel operations. There is no convincing evidence of continuous noise consistent with that generated by the activities resulting in harmful effects in benthic invertebrates.

For impulsive noise and benthic invertebrates, the source is an important consideration in the assessment. Research to date has focussed on the effects of noise from seismic surveys, which is substantially higher source levels and lower frequency than the noise sources that will credibly be generated during the activities. Sound energy levels (SEL), 24-hr cumulative SEL and peak-to-peak SEL (PK-PK) for invertebrates from Day et al. (2016) and Payne et al. (2008) derived from seismic noise exposure are provided in **Table 6-8**. These thresholds were shown to result in sub-lethal effects (e.g., delayed righting reflex in lobsters).

Only very high intensity acoustic emissions from positioning equipment would credibly exceed these thresholds. Noise emissions from positioning equipment will be substantially higher frequency than seismic noise and will only be emitted as required during positioning activities. The operational area does not host commercially exploited invertebrate stocks (e.g., pearl oysters, rock lobsters). Given the rapid attenuation of high frequency noise and the short duration of emissions from positioning equipment, impacts to invertebrates will be restricted to non-lethal effects in invertebrates in very close proximity to the positioning equipment, resulting in negligible consequence.

Table 6-8: Impulsive noise: Sound levels relevant to invertebrates

Receptor	Sound Levels
Invertebrates: effect at the seafloor (Day et al., 2016)	186 to 190 dB SEL 192 to 199 dB SEL_{24h} 209 to 212 dB PK-PK
Invertebrates: no effect at the seafloor (Payne et al., 2008)	202 dB PK-PK

6.1.2.5 Seabirds

The operational area overlap the breeding BIA for the wedge-tailed shearwater. Seabirds and migratory shorebirds within the operational area are unlikely to be directly affected by underwater noise generated during the activity. However, they may avoid helicopters and flaring from the MODU during drilling. Given the expected low density of seabirds and migratory shorebirds within the operational area, the relative infrequency of helicopter flights and flaring, and lack of lasting effect of potential behavioural responses to helicopter and flaring noise, impacts are expected to be negligible.

6.1.2.6 Cumulative Impacts

Up to four support vessels may be present in the operational area at any one time. However, all four support vessels would only be in the operational area simultaneously for short periods of time and would only use thrusters to maintain positions for short, intermittent periods of time, and may be carrying out support activities (e.g., delivering equipment and consumables to the MODU or ISV) with spatial separation from each other.

Continuous noise levels from the MODU, helicopters and vessels that may cause behavioural responses are expected to generally be confined to the operational areas and concentrated within a radius of a few hundred metres of the noise source, and as such cumulative impacts from concurrent project activities are not expected. During the activity, there is no potential for SIMOPS with drilling activities and subsea installation activities and therefore no potential cumulative noise impacts from SIMOPS will occur. Consultation with other operators have not identified any concurrent activities, therefore no potential additive or cumulative noise impacts from concurrent activities with other operators will occur.

6.1.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event include:

+ No injury or mortality to EPBC Act 1999 and WA Biodiversity Conservation Act 2016 listed marine fauna during activities [H2-EPO-05]; and
+ Do not displace marine turtles from habitat critical to the survival of the species or disrupt biologically important behaviours from occurring within biologically important areas [H2-EPO-09].

The control measures considered for this event are outlined in **Table 6-9**, and the EPS and measurement criteria for the EPOs are described in **Section 8.4.1**.

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Table 6-9: Control measures evaluation – Noise Emissions

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-DC-CM-001 H2-IC-CM-001	Procedures for interacting with marine fauna	Reduces risk of physical and behavioural impacts to marine fauna from support vessels, helicopters and UAVs. If marine fauna are sighted, then support vessels can slow down or move away, and helicopters can increase distances from sighted fauna if required.	Operational costs to adhere to marine fauna interaction restrictions, such as vessel and helicopter speed and direction, are based on legislated requirements and must be accepted.	**Adopted** – Benefits in reducing impacts to marine fauna outweigh the costs incurred by Santos. Control measure ensures compliance with Part 8 of the EPBC Regulations.
Additional Control Measures				
N/A	Undertake site specific acoustic modelling as per approved conservation advice for cetaceans and marine fauna	The distance at which fauna could experience behavioural impacts can be predicted and compared to literary publications. Additional management controls can then be included if required to support an ALARP justification and reduce potential impacts to marine fauna.	Additional cost to contract consultant to develop a model and produce predicted noise outputs.	**Rejected** – The acoustic emissions from the activity are relatively well understood and no further controls can be implemented to reduce vessel noise other than not undertaking the activity. Given the potential impacts are expected to be negligible and limited to temporary and minor behavioural changes only, and noise levels from vessels will decarapidly. Site specific modelling will not provide

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
				additional information which would alter the current ALARP position. Also, the activity does not occur in a humpback whale resting, foraging, calving or confined migratory pathway.
N/A	Develop a noise management plan as per approved conservation advice for cetaceans and marine fauna	None – area where noise levels are above the noise threshold criteria do not overlap with any BIAs.	No additional cost other than negligible personnel costs of preparing and reviewing the management plan.	**Rejected** – The activity does not occur in any resting, foraging, calving or confined migratory pathway for protected cetacean species, therefore the cost associated with the development of a management plan outweighs the little or no benefit for a short duration activity which has a minor impact (e.g., potential temporary and minor behavioural changes). This EP, including control measures constitutes a management plan, no additional benefits identified.
N/A	Use of passive acoustic monitoring (PAM)	Improve detection of some sensitive receptors.	Costs of PAM operators. Operational costs of shut-downs potentially prolonging the activity.	**Rejected** – Cost disproportionate to increase in environmental benefit given the low level behavioural

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
				response expected. Limited ability of PAM to detect cetaceans (i.e. sensitive receptors including baleen whales) would provide little benefit to the species expected to be present.
N/A	Verification of noise levels	Allow implementation of adaptive management controls should impact be greater than expected.	Costs of deploying noise monitoring equipment and processing of data.	**Rejected** – Cost disproportionate to increase in environmental benefit given the rapid reduction in noise levels from vessels and the low level behavioural response expected.
N/A	Dedicated Marine Mammal Observer (MMO) (as per EPBC Policy Statement 2.1 – Part B.1)	Improved ability to spot and identify marine fauna at risk of impact by vessel noise.	Additional cost of contracting several specialist Marine Fauna Observers while 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.	**Rejected** – Cost disproportionate to increase in environmental benefit, and given that crew members will be observing for marine fauna during activities. EPBC Act Policy Statement 2.1 is intended to apply to seismic surveys, which produce substantially higher source level noise concentrated in the functional hearing range of low-frequency cetaceans. The nature and scale of noise from the activity poses substantially less

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
				risk to cetaceans than a typical seismic survey.
N/A	Operational activities to avoid coinciding with sensitive periods such as the humpback whale migration period (June to November)	Reduce 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	**Rejected** – The operational areas overlap with the humpback whale migration BIA the distribution BIA for pygmy blue whales and foraging BIA for whale sharks and these species could also be present all year round. However, the potential impacts to cetaceans including pygmy blue whales that may be opportunistically foraging are predicted to be low and if they occur would be well within 500 m of the vessel and equipment. With the controls in place to manage interaction with fauna within 500m of the vessel, the potential for impact is significantly reduced. The activity will not restrict the movement of whales or whale sharks within the area as the BIAs and the areas within which they are distributed in

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
				are widespread. Cost is disproportionate to increase in environmental benefit.
N/A	Schedule activities to avoid coinciding with sensitive periods such as flatback turtle nesting, internesting and hatching (September to April)	Potential reduction in impact of noise to some sensitive receptors.	The timing of the activity is subject to MODU and ISV availability and weather windows, and therefore avoidance of activities for this 8 -month period given the low impact can result in the objectives of the drilling program being unable to be met. The risk to all listed marine fauna cannot be reduced due to variability in timing of environmentally sensitive periods	**Rejected** – The operational areas overlap with very small portions of internesting BIAs in place for marine turtles and hence marine turtles may be present all year round. However, the potential impacts to turtles if they occur would be well within 500m of the vessel and equipment (behavioural impacts within tens of metres of the vessel). With the controls in place to manage interaction with fauna within 500 m of the vessel, the potential for impact is significantly reduced. The activity will not restrict the movement of turtles within the area as the BIAs and the areas within which they are distributed in is widespread. Cost is disproportionate to increase in environmental benefit.

6.1.4 Environmental Impact Assessment

Receptor	Consequence Level
Threatened, migratory or local fauna	While the level of noise expected from short-term and intermittent activities has the potential to cause TTS to marine fauna, most species and individuals that may transit through the area are expected to demonstrate avoidance behaviour if noise levels approach those that could cause harmful effects. Avoidance behaviour is likely to be localised within the area of the activity (due to small spatial extent of elevated noise) and temporary; i.e., for the duration of the noise emissions only. The operational area overlaps a humpback whale migration BIA. Due to behavioural responses to noise within the operational area, humpback whales may be displaced from a small proportion of the BIA. However, the area overall represents a small proportion of the BIA width, which is unlikely to present a barrier to movement or disrupt migratory pathways or behaviour. A pygmy blue whale migration BIA lies approximately 8 km beyond the operational area at which only behavioural impacts are likely to occur. PTS and TTS to low-frequency whales (such as humpback and pygmy blue whales) could occur near a vessel, but this scenario is unlikely as animals will move away from harmful levels of continuous noise. Behavioural impacts may occur at up to 4 km from a vessel using DP. However, as whales are always moving and transiting through the area, and are expected to actively avoid the noise source while transiting. Impacts are predicted to be short term due to the short duration of the activity. The *Recovery Plan for Marine Turtles in Australia 2017-2027* (Commonwealth of Australia, 2017) specifies the following priority actions for all stocks of marine turtles: + Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival; and + Manage anthropogenic activities in BIAs to ensure that biologically important behaviours (BIBs) can continue. The boundary for the nearest habitat critical to the survival of the species for flatback turtle (internesting habitat), is approximately 5 km operational area. This distance is greater than the range at which impacts to turtles will credibly occur. Hence turtles will not be displaced from critical habitat. An internesting BIA for internesting flatback turtles overlaps the operational area. Individual turtles may be encountered within the operational area but are unlikely to be internesting females due to the distance from the closest nesting beaches (approximately 45 km) and water depth (95 to 125 m). Hence noise from the activities will not displace turtles from critical habitats or prevent Bathymetry Water depths in the operational area range from approximately 95 m to 125 m, with the deepest water depths situated in the northwest and the shallowest water depths situated in the southwest corner of the survey area (see **Section 3.2.1**). The survey area is adjacent to the 125 m ancient coastline KEF (believed to be an important migratory pathway for cetaceans and other pelagic species such as the whale shark). It is possible that whale sharks could pass through the operational area, as the whale shark foraging BIA overlaps, particularly before and after their annual aggregation off Ningaloo Reef. However, less numbers are expected than within the foraging (high-density prey) BIA, which does not overlap the operational area. Any impacts to whale sharks will be limited to potential short-term behavioural

Receptor	Consequence Level
	impacts given the sensitivity of this species and the nature and scale of the noise emissions from the activities. Impacts to other fish species will be similar and limited to short-term behavioural impacts. Seabirds are also unlikely to be directly affected by noise generated during the activity. Although the operational area overlaps the wedge-tailed shearwater BIA the potential for airborne noise from the activity to cause disturbance to seabirds not credible. Given the nature and scale of noise emissions from the MODU, vessels, helicopters and associated activities, and the relatively short duration of noise emissions, as well as the controls to manage interaction with marine fauna, cumulative impacts to marine fauna from noise emissions associated with concurrent project activities are not expected. Noise impacts will be of relatively short duration and with the implementation of the management controls, impacts to local populations for threatened or migratory species are likely to be negligible. The consequence level is assessed as I-Negligible.
Physical environment or habitat	Not applicable – noise will not impact the physical environment itself, only the species mentioned above utilising it.
Threatened ecological communities	Not applicable – No threatened ecological communities identified in the area over which noise emissions are expected.
Protected areas	Not applicable – No protected areas within immediate vicinity of the operational area.
Socio-economic receptors	Noise levels are not expected to impact on socio-economic receptors due to their low activity level within the vicinity of the operational area. Impacts to fish may result in-indirect impacts to commercial fisheries in the area given the potential for temporary avoidance behaviour. However, given the short duration of the activity, limited impacts from the noise levels emitted from the activity, impacts to fisheries are considered negligible. There are no recreation zones within the area expected to be impacted by noise. EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country. The consequence level is assessed as I – Negligible.
Overall worst-case consequence	I – Negligible

6.1.5 Demonstration of As Low As Reasonably Practicable

The use of vessels and MODU is unavoidable if the operational activities are to proceed. Equipment maintenance will keep the vessel noise levels to within normal operating limits, which will also aid in keeping noise emissions within the boundaries that have been risk assessed.

The vessels are also expected to produce similar noise emissions to other marine vessels that frequent or transit through the vicinity of the operational area (oil and gas industry vessels). The vessels will adhere to the EPBC Regulations (Part 8) to ensure actions are undertaken to avoid marine mammals (and whale sharks) within 100 m of a vessel, and all crews will be inducted into these requirements. It is further expected that the vessels will typically emit sufficient noise for sensitive marine fauna to exhibit avoidance behaviour and move away from the activity to avoid physical impact zones.

The use of helicopters to transfer personnel to and from the vessels and MODU 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 vessels and MODU 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.

Well test flaring done intermittently is an essential part of a safe well test program undertaken to evaluate the resource and prepare it for production.

Management controls are in place to reduce operating noise, including vessel and helicopter operational protocols, through adherence to the Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-II-00003). This requires compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 and includes controls to reduce the risk of disturbance to or collision with EPBC Act listed marine fauna. Santos has considered the actions prescribed in the *Recovery Plan for Marine Turtles in Australia 2017-2027* (Commonwealth of Australia, 2017) when developing these controls to minimise noise impacts on marine turtles.

Any behavioural impact caused by vessel and MODU, activity noise is likely to be localised and temporary, with marine species expected to resume normal behavioural patterns in the open oceanic waters surrounding the operational area in a short timeframe with no significant impact on their normal behaviour, including during sensitive periods such as migration, nesting or foraging.

Avoiding periods of higher sensitivity such as migration or nesting periods for whales and turtles (for example) is not considered feasible for operational purposes. The humpback whale migration BIA overlaps the operational area and humpback whales may be present as they complete their migration between June and October. The distribution BIA for pygmy blue whales also overlaps the operational area and pygmy blue whales may be transient in the area year-round. Foraging whale sharks could occur within the foraging BIA that overlaps the operational area associated with aggregations at the Ningaloo Coast that occur between March and May. Although internesting flatback turtles are unlikely to occur within water as deep as the operational area it is still important to note that internesting activities occur from August to April/May. These sensitivities leave a small window for the activities to occur. Given the low potential for impact to threatened and migratory fauna from noise emissions, the cost of restricting the activity to avoid windows of sensitivity is disproportionate to the environmental benefit that would be gained.

Significant impacts are not expected on fauna, including cetaceans and turtles, and the assessed residual consequence for this impact is Negligible (I). Additional control measures were considered but rejected since the associated cost or effort was grossly disproportionate to any benefit. Therefore, the impact from noise associated with the activities is ALARP.

6.1.6 Demonstration of Acceptability

Table 6-10: Acceptability evaluation – Noise Emissions

Is the consequence ranked as I (Negligible) or II (Minor)	Yes – maximum consequence from noise emissions is I (Negligible)

Is further information required in 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' Environmental Hazard Identification and Assessment Procedure (EA-91-IG-00004), which considers principles of ESD. The residual consequence of the impact for this aspect is negligible and therefore does not affect the outcomes of the principles of ecologically sustainable development as per **Table 5-5**.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – Controls implemented during the activity will minimise the potential impacts to species identified in recovery plans as having the potential to be impacted by noise emissions. Yes –Management consistent with EPBC Regulations (Part 8). Controls implemented will minimise the potential impacts from the activity to species identified in recovery plans and conservation advice as having the potential to be impacted by noise emissions. Relevant species recovery plans, conservation management plans and management actions, including but not limited to the: + *Recovery Plan for Marine Turtles in Australia* (Commonwealth of Australia, 2017) + Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (Threatened Species Scientific Committee, 2015c) + Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (Threatened Species Scientific Committee, 2015b) + *North-west Commonwealth Marine Reserves Network Management Plan 2014-24* (Director of National Parks, 2018) + Conservation Management Plan for the Blue Whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2015-2025 (Commonwealth of Australia, 2015b) + Approved Conservation Advice for *Rhincodon typus* (whale shark) (Threatened Species Scientific Committee, 2015a) + Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2011-2021

	(Department of Sustainability, Environment, Water, Population and Communities, 2012)
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes. DBCA requested the EP give consideration to avoiding impacts to conservation significant marine species listed under the *Biodiversity Conservation Act 2016 Act* that are known to occur in the BIMMA and associated reserves in proximity to the proposed activity. DBCA also requested the EP assesses impacts to conservation significant species, accounting for the scale, location and biological significance of the proposed activities. In particular, large marine fauna such as cetaceans and whale sharks are common migratory species to the BIMMA, and the reserves unique ecosystems provide critical breeding and nesting habitat for significant marine turtle and shorebird species. No feedback has been received from DNP, however Santos notes feedback previous regional consultation: DNP advised the EP should consider activity overlap with AMPs (and their representativeness), BIAs, KEFs. Santos has assessed the impacts of noise from the activity in **Section 6.1** (Noise Emissions) and has committed to reduce physical and behavioural impacts to marine fauna from support vessels, helicopters and UAVs from noise on all project vessels and the MODU through implementing Procedures for interacting with marine fauna. This control measure also ensures compliance with Part 8 of the EPBC Regulations. Santos has considered and assessed noise emissions impacts from the activity and potential overlap with AMPs, BIAs and KEFs and these are addressed in **Section 3** and **Section 6.1.2**. Santos considers these concerns to have been addressed within **Section 3** and **Section 6.1** and in the environmental performance outcomes assessment and control measures assessment (**Section 6.2.3; Table 8-2**), including as per the Activity Notification and Reporting Requirements (**Table 8-5**).
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above

The activities will be conducted over approximately 65 days (drilling and installation activities combined timeframe, dependent on weather delays and operational downtime) in remote offshore locations with a relatively low probability of encountering significant numbers of noise sensitive fauna. The activities that will generate noise are standard offshore industry practice and the potential impacts well documented. With the controls proposed and considering the relatively short duration and characteristics of noise types planned, the potential consequences of impacts to noise sensitive receptors in the area, including internesting flatback turtles, foraging whale sharks, migrating humpback whales, migrating pygmy blue whales and breeding wedge-tailed shearwaters are assessed to be Negligible (I), ALARP and acceptable.

Recovery Plan for Marine Turtles

The Recovery Plan for Marine Turtles in Australia: 2017 to 2027 (Commonwealth of Australia, 2017) highlights noise interference from anthropogenic activities as a threat to marine turtles. The plan refers to vessel noise and the operation of some oil and gas infrastructure as sources of chronic (continuous) noise in the marine environment, exposure of which may lead to avoidance of important turtle habitat.

It specifies the following priority actions related to noise, for all marine turtle stock:

+ manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival; and
+ manage anthropogenic activities in BIAs to ensure that BIB can continue.

Underwater noise emitted from MODUs consists of a combination of drilling operations and on-board machinery, and typically produces low intensity but continuous sound. Vessels will also generate underwater noise. Under normal operating conditions when the vessel is idling or moving between sites, vessel noise would be detectable over a short distance. Higher noise levels occur when the vessel is using the dynamic position system to hold station, such as during transfer operations. Overall, underwater noise levels generated during the activity are expected to be localised, and below the thresholds for PTS and TTS.

Transiting marine turtles may occur within the operational area during the internesting period. Thums et al. (2017) studied flatback turtles during their post-nesting migration from the Lacepede Islands and during foraging. The study found that flatback turtles migrated along the coast in water depths of 63 ± 5 m, passing near Adele Island on the way to foraging grounds on the Sahul Shelf in the Timor Sea. It is unlikely that these turtles will travel greater than 66 km from the coast.

Given the short duration of the activity and the proposed management measures, it is reasonable to conclude that noise emissions will not displace turtles from habitat critical to their survival, affect the conservation status of marine turtles or compromise the objectives of the marine turtle recovery plan and therefore impacts are acceptable.

Management plans and conservation advice for cetaceans:

The operational area intercept BIAs for humpback whales (migration) and pygmy blue whales (distribution).

This activity is consistent with the approved Conservation Advice for *Megaptera novaeangliae* (humpback whale) (TSSC, 2015h), and the Conservation Values Atlas (Department of Agriculture, Water and the Environment, 2021) because:

+ the activity includes the implementation of procedures for interacting with marine fauna as a control to ensure the activity complies with Part 8 of *Environment Protection and Biodiversity Regulations 2000.* These regulations include adaptive management controls which provides opportunity to take action if blue whales are observed; and
+ there will be no injury due to noise emissions to blue whales that may be encountered during the activity. As defined by the Department's guidance on key terms in the conservation management plan (Department of Agriculture, Water and the Environment, 2021), injury is considered to be either PTS or TTS from underwater noise. The received levels from MODU, ISV and support vessels will decline rapidly from the source and be below thresholds for PTS and TTS within approximately 12 to 266 m of the source), The operational area is approximately 8 km from the pygmy blue whale migration corridor BIA, exceeding the noise threshold distance.

On this basis impacts are considered acceptable.

The controls proposed are consistent with relevant standards, including Part A of EPBC Act Policy Statement 2.1, EPBC Regulations Part 8 (Vessels and Aircraft), and aligned with the applicable management actions outlined in relevant recovery plans and approved conservation advice. Therefore, the residual consequence of the impact is Negligible, and considered ALARP and acceptable.

6.2 Light Emissions

6.2.1 Description of Event

Event	Light emissions in the marine environment will occur as a result of: + MODU operations; + Vessel operations; + ROV operations and activities; and + Light from flaring during well testing Vessels will routinely have external lighting to facilitate navigation and safe operations at night. Lighting typically consists of bright white (i.e., metal halide, halogen, fluorescent) lights, and are not dissimilar to other offshore activities in the region, including fishing and shipping. Lighting levels will be determined primarily by operational safety and navigational requirements under relevant legislation, specifically the *Navigation Act 2012*. The vessels undertaking the activity will be required to display navigational lighting at night to indicate their position and as required under the *Navigation Act 2012*, they must indicate their limited ability to manoeuvre during operations. A minimum level of lighting is required for safety and navigational purposes onboard vessels so it cannot be eliminated if the proposed activity is to proceed.
Extent	Limited light 'spill' or 'glow' on surface waters surrounding the MODU, ISV and support vessels. The amount of light produced from flaring during well testing is dependent on the characteristics of the reservoir and the flare flow rate. Flaring will be visible at distances of tens of kilometres, therefore to align with the National Light Pollution Guidelines for Wildlife including Marine Turtles, Seabirds and Migratory Shorebirds (Commonwealth of Australia, 2023), this EP conservatively assesses light impacts within 20 km of the operational area.
Duration	Navigational and safety lighting is required 24 hours a day for the duration of the activity. Flaring is an intermittent source of light emission which typically occurs for an average two to three days during well testing.

6.2.2 Nature and Scale of Environmental Impacts

Potential Receptors: Plankton, Fish (Pelagic) & Sharks, Marine Turtles and Seabirds

This section assesses the potential for impacts from artificial light on listed species and other marine fauna for which artificial light is known to affect, this includes impacts to behaviour, survivorship and/all reproduction, in accordance with the National Light Pollution Guidelines for Wildlife (Commonwealth of Australia, 2023). In accordance with the National Light Pollution Guidelines for Wildlife, this EP has assessed the potential for light impacts to occur within 20 km of the operational area (Commonwealth of Australia, 2023). This is considered conservative considering the level of lighting required for the activities and the duration that the activities are expected to take place.

Light is a form of energy that is emitted over a particular band of frequencies and wavelengths of the electromagnetic spectrum. The visible range (for humans) is typically 400 to 700 nm, with ultraviolet below this wavelength range, and infra-red above it. Fauna perceive light differently to humans, and their visible spectrum can vary between about 300 nm and more than 700 nm depending on the species (Commonwealth of Australia, 2020a); i.e. it can extend into the ultraviolet and infra-red spectra. Therefore, the potential impact from artificial light emissions can vary depending on the specific characteristics of the source (e.g. light intensity, wavelength) and the sensitivities of the receptor.

Artificial lighting can alter critical behaviours in wildlife. For some species, artificial lighting may extend diurnal or crepuscular behaviours by improving an animal's ability to forage (e.g., Hill, 1992). For nocturnal species, artificial light can result in detrimental changes in behaviour.

The severity to which artificial light negatively impacts individuals depends upon the vulnerability, which varies between and within species, depending upon their behaviour, and on the spectral output of the light emissions. The sensitivity of different species to different wavelengths is summarised in **Figure 6-1**, which shows that most species are sensitive to short wavelength light (ultraviolet/violet/blue).

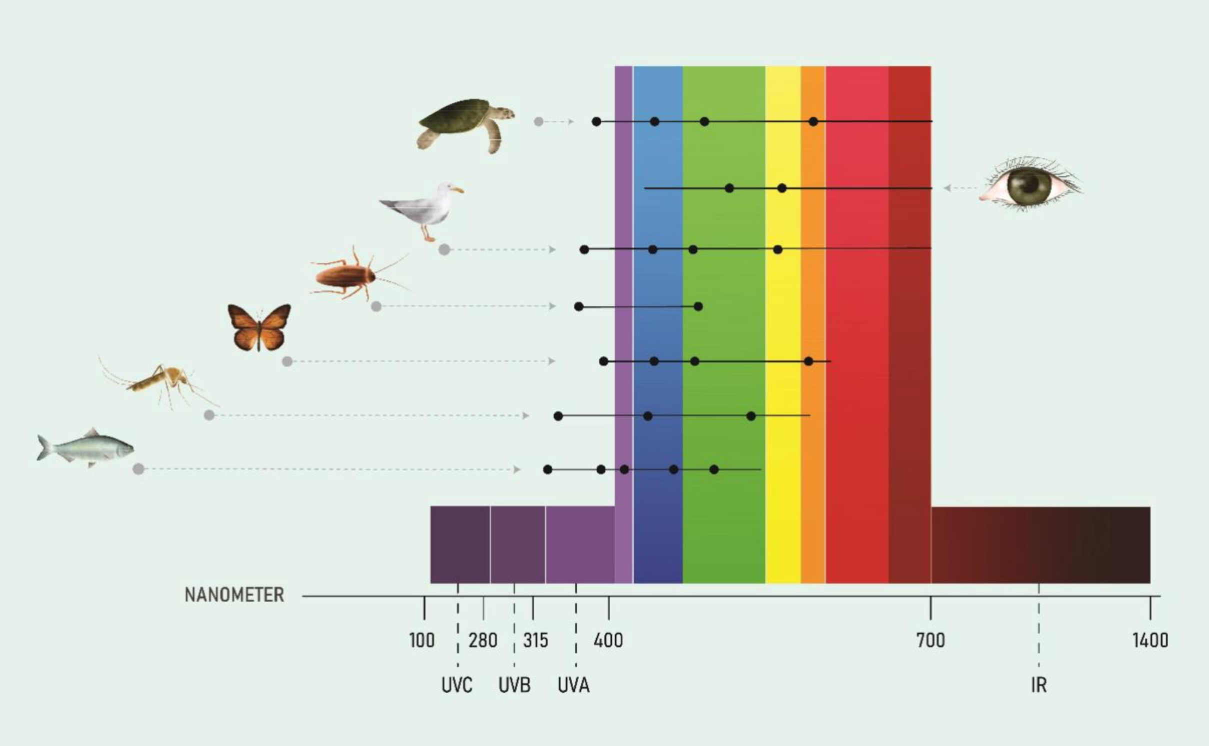

Figure 6.1: Visibility of different wavelengths of light in humans and wildlife is shown by horizontal lines. Black dots represent reported peak sensitivity (Commonwealth of Australia, 2020a)

The characteristics of light emissions will differ depending upon the number, intensity, spectral output and type of light. Historically, vessels and facilities use a combination of high-pressure sodium, fluorescent, metal halide and mercury vapour lights. Recent advances in light emitting diode technology has seen some offshore lighting applications switch to this more efficient and cost-effective technology.

There is limited published information regarding light characteristic of flares. Pendoley (2000) showed that the intensity of two flares (a tower flare and a pit flare) at Thevenard Island, Western Australia, peaked at between 650 to 700 nm. This result is similar to three other flares measured in Australia (Pendoley Environmental, unpublished data). Pendoley (2000) found no significant spectral difference between the two flares types, or when varying flow rates.

The activity will occur approximately 45 km west of Barrow Island, with none of the light sources from the activity directly visible from shore. Light from the MODU, ISV and support vessels is expected to be directly visible at up to approximately 40 km during flaring.

Santos commissioned light modelling for the Dorado Offshore Project Proposal (Pendoley Environmental, 2020), with the modelled scenario similar in nature to the artificial light emissions from the Halyard-2 Drilling & Completion (i.e., operational lighting from a facility and flaring). In the non-flaring scenario, the model results show that radiance has reduced to ambient (less than 0.01 full moon equivalent) at 17.7 km from the source. In the flaring scenario, the flare is no longer directly visible at 42.4 km, when the flare drops below the horizon. At this distance, the radiance is equivalent to 0.25 full moons. As the flare drops below the horizon, radiance declines rapidly and is no longer visible. Note the flare tower modelled by Pendoley Environmental (2020) was higher, and hence visible at greater distance, than the flare tower of a typical semi-submersible MODU.

6.2.2.1 Marine Mammals

There is a paucity of research investigating the effects of artificial lighting on marine mammals and direct effects of artificial lighting on cetaceans have not been reported. Many dolphin species are thought to be diurnal, or at least more active during the day, possibly related to prey availability (Sekiguchi and Kohshima, 2003). Since fish species may pool in areas of light spill, dolphins may be indirectly attracted to lit structures or illuminated marine environments for foraging purposes.

Mammals use variations in the length of day to anticipate environmental changes and time their reproduction. Marine mammals occurring in the area that may be affected by light will be transient, hence no impacts to BIBs will credibly occur. There is potential for opportunistic foraging for odontocetes should prey abundance be increased around light sources.

The humpback whale migration BIA and the pygmy blue whales distribution BIA overlaps the area that may be affected by light emissions and the pygmy blue whale migration BIA is within 20 km of the operational area. However, cetaceans and other marine mammals are not known to be significantly attracted to light sources at sea. Cetaceans predominantly use acoustic senses to monitor their environment rather than visual cues (Simmonds et al., 2004), therefore impacts are thought to be unlikely.

6.2.2.2 Marine Turtles

Marine turtles are particularly sensitive to artificial lighting, which is known to disrupt nesting female turtles, post-emergent hatchlings and hatchlings dispersing in nearshore waters (Salmon, 2003; Salmon et al., 1995a, 1995b; Salmon and Wyneken, 1987; Wilson et al., 2018). However, potential impacts to foraging turtles is limited to local attraction via a secondary response to effects of light on prey distribution (Kebodeaux, 1994). Marine turtles do not feed during the breeding season (Limpus et al., 2013), and light is not a cue for internesting behaviours. Inter-nesting turtles typically occur in water depths < 30 m (Whittock et al., 2016) and hence will not be present within the operational area, which is substantially deeper (water depths ranging from approximately 95 m – 125 m) (Thums et al., 2013).

The *Recovery Plan for Marine Turtles in Australia 2017-2027* (Commonwealth of Australia, 2017) highlights artificial light as a threat to marine turtles. Specifically, the plan indicates that 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; and
+ 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 following their emergence from nests by light spill on beaches, although breeding adult turtles can also be disoriented. This disruption can occur because hatchlings orient themselves to the lowest-elevation light horizon and away from high silhouettes when moving from the nest to the sea. The operational area is >40 km from the nearest turtle nesting beaches, which are on Barrow Island. Light from the activities will not be directly visible from turtle nesting beaches, hence impacts to turtles during nesting and hatching will not occur.

The National Light Pollution Guidelines states that a 20 km buffer (based on sky glow) to important habitat for turtles should be applied when considering possible impacts (Commonwealth of Australia, 2023). However, the demonstrated impacts on which this buffer is based were in response to light emissions associated with a liquified natural gas (LNG) plant. Although details around the individual light sources of the case study and the light sources on the vessels are unknown, it is expected that light emissions associated with the MODU, ISV and support vessels will be notably lower compared to an LNG plant. Given the operational area is located greater than 20 km away from the nearest turtle nesting beach, light emissions will not be visible and any impacts (including cumulative impacts) with respect to hatchling emergence are not expected). Experienced nesting females are unlikely to be disturbed by light, but first-time nesters may be disturbed by light when they are selecting their first nesting beach (Pendoley, 2014). Given that the closest nesting beach is greater than 20 km from the operational area, nesting females should not be disorientated by light emissions. Furthermore, once in the water, turtle hatchlings orientate by wave fronts and do not appear to rely on visual cues (Pendoley, 2014), therefore light emissions are unlikely cause disorientation at that distance (i.e., greater than 20 km). Foraging turtles are adults and not considered as significantly impacted by lighting as hatchlings (refer below).

Given the distance of the operational area to nesting beaches and the predicted range at which light emissions will be observable, no impacts to emergent hatchlings and nesting females are expected. Impacts from light emissions on individual turtles in the area that may be affected by light emissions during the activity are expected to be restricted to localised attraction and temporary disorientation. These impacts are short-term (i.e., during the activity), will not result in population-scale impacts or long-term threats to the survival of marine turtles, and are considered to be negligible. Light emissions from the activity will not compromise the objectives as set out in the marine turtle recovery plan; flatback turtles will not be displaced from habitat critical for their survival.

6.2.2.3 Plankton

Artificial light can influence diel vertical migration patterns of plankton (including planktonic life stages of some fish species) in the surface waters and alter primary productivity (Diamantopoulou et al., 2021). Light may also make plankton more vulnerable to predation. These effects would be localised around light sources during the activity, with no long-term impacts. Planktonic communities are widely represented and impacts from artificial light to these communities will be negligible.

6.2.2.4 Sharks, Fish and Rays

The response of fish to light emissions varies according to species and habitat. Experiments using light traps have found that 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, 1992). Lindquist et al. (2005) concluded from a study that artificial lighting associated with offshore oil and gas 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 for planktivorous fishes. It may also lead to higher rates of predation on planktivorous fishes by predators.

The operational area overlaps the whale shark foraging BIA and therefore artificial light within the operational area could attract foraging whale sharks within 90 m of the operations and affect vertical migration. However, given the short duration of the activity these impacts are not expected to be significant. Furthermore, light from the activity will not extend as far as the whale shark foraging (high density prey) BIA where higher numbers of whale shark individual are expected.

Overall, a short-term, localised change in fish behaviour is expected to occur as a result of lighting from the MODU, ISV and support vessels. However, this will result in negligible impacts to fish assemblages and sharks (including whale sharks) at a regional scale.

6.2.2.5 Birds (Seabirds / Shorebirds)

Artificial lighting can attract and disorient seabird species resulting in species behavioural changes (e.g. circling light sources or disrupted foraging), injury or mortality near the light source (Gaston et al., 2014; Longcore and Rich, 2004). Studies conducted between 1992 and 2002 in the North Sea confirmed that artificial light was the reason that birds were attracted to and accumulated around illuminated offshore infrastructure (Marquenie et al., 2008). Birds may either be attracted by the light source itself or indirectly as structures in deep water environments tend to attract marine life at all tropic levels, creating food sources and providing artificial shelter for seabirds. The most vulnerable life stages for seabirds and migratory shorebirds are nesting adults or fledglings. As the operational area is offshore and away from islands or other emergent features and does not host any permanent infrastructure above the sea, any presence of seabirds or shorebirds is considered likely to be of a transient nature only, such as migrating or foraging.

The operational area overlaps a breeding BIA for the wedge-tailed shearwater, and is approximately 45 km from Barrow Island and the Montebello islands, which are important breeding sites for this species. Tagging studies of wedge-tailed shearwaters in the region by Cannell et al. (2019) showed that most chick-rearing foraging activity was concentrated around nesting islands, although tagged birds were observed foraging widely in the Indian Ocean (often in association with seamounts).

Artificial light can impact behaviour and adult nest attendance, or confuse shearwater species, resulting in injury or mortality as a result of birds colliding with structures (Cianchetti-Benedetti et al., 2018; Rodríguez et al., 2017). Shearwater fledglings are predominantly impacted by onshore lighting sources, which can override sea finding cues and attract fledglings further inland, preventing them from reaching the sea (Mitkus et al., 2018). Artificial light can impact behaviour and adult nest attendance, or confuse shearwater species, resulting in injury or mortality as a result of birds colliding with structures (Cianchetti-Benedetti et al., 2018; Rodríguez et al., 2017). Given the distance from nesting sites (approximately 45 km to the nearest island), impacts to nesting and fledgling wedge-tailed shearwaters are not expected to occur.

Adult shearwaters are vulnerable to artificial lighting during the breeding cycle, when returning to and leaving the nesting colony to maintain nesting sites or forage. Foraging adult wedge-tailed shearwaters may be attracted to sources of light emissions to feed on fish drawn to the light, or may be attracted to vessel light during periods of low visibility, however the species feeds primarily during the day (Catry et al., 2009; Whittow, 2020). Resting periods on the sea surface were also shown to be greater at night than during the day (Weimerskirch et al., 2020), which is consistent with foraging primarily during daylight hours.

Adult wedge-tailed shearwaters (and other species of seabirds) may be temporarily attracted to light from the MODU, ISV or support vessels, ISV or support vessels, or fauna aggregated by light. This behavioural disturbance to is expected to be localised to within the vicinity of the MODU, ISV and support vessels within the operational area. The light source from the MODU, ISV and support vessels within the operational area will be temporary, therefore any impacts are predicted to be at an individual level and not a population level. The temporary behavioural disturbance of birds will be localised around the light sources, and not result in a substantial adverse effect on a population of species or its lifecycle.

Migratory shorebirds may be present in or fly through the region between July and December, and again between March and April as they complete migrations between Australia and offshore locations (Commonwealth of Australia, 2015c). The risk associated with collision from shorebirds attracted to the light is considered to be low, based on the short-term duration (approximately 65 days) and localised nature of the activities in the operational area, as well as the distance offshore. Impacts are expected to be limited to temporary behavioural disturbance to isolated individuals, and is not expected to disrupt migration of seabirds.

6.2.2.6 Cumulative Impacts

During the activity, there is no potential for SIMOPS with drilling activities and subsea installation activities and therefore no potential cumulative light impacts from SIMOPS will occur. Consultation with other operators have not identified any concurrent activities, therefore no potential additive or cumulative lighting impacts from SIMOPS with other operators will occur.

6.2.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event are:

+ Reduce impacts to marine fauna from lighting on vessels and MODU through limiting lighting to that required by safety and navigational lighting requirements [H2-EPO-08]; and
+ Do not displace marine turtles from habitat critical to the survival of the species or disrupt biologically important behaviours from occurring within biologically important areas [H2-EPO-09].

The control measures considered for this event are outlined in **Table 6-9**, and the EPS and measurement criteria for the EPOs are described in **Section 8.4.1**.

Table 6-11: Control measures evaluation – Light Emissions

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-DC-CM-002 H2-IC-CM-002	Lighting will be used as required for safe work conditions and	Would result in reduced light spill from internal lighting onto the sea surface,	Cost associated with training MODU, ISV and support vessels staff to	**Adopted** - Cost is considered acceptable for the benefit that may be realised.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
	navigational purposes	potentially reduce overall light emissions, and reduce the consequence of any seabird interactions.	minimise lighting.	
Additional Control Measures				
N/A	Manage the timing of the activity to avoid sensitive periods at the location (e.g., wedge-tailed shearwater breeding, and turtle nesting/ hatching season (October – April inclusive))	Reduce risk of impacts from light emissions during environmentally sensitive periods for listed marine fauna (e.g. wedge-tailed shearwater breeding).	Potential high cost in moving or delaying activity schedule for operational reasons depending on final measures included in the procedures. 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.	**Rejected** – Impacts are expected to be limited to temporary behavioural disturbance to individuals, with no lasting effect or displacement from important habitat. Given the minimal risk of impacts to listed marine species (e.g., wedge-tailed shearwater, turtles) occurring due to lighting, the financial and environmental costs of extending the activity duration are deemed grossly disproportionate to negligible environmental benefits. The wedge-tailed shearwater are migratory, and individuals may be present in the operational area during the breeding season.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
				Impacts to breeding seabirds and turtles from operational lighting are expected to be restricted to localised attraction and temporary disorientation (turtles), but with no long-term or residual impact due to the activity's short-term nature (i.e., approximately 65 days). Therefore, impacts are not expected on a population level or to impact on turtle habitat.
N/A	Review lighting design, including type (colour, intensity, frequency) that has less impact, in accordance with the National Light Pollution Guidelines	Could reduce potential impacts of artificial light on certain fauna.	High cost to complete lighting change out on MODU, ISV and support vessels in area of low sensitivity. Navigational lighting colours are stipulated by law.	**Rejected** - Cost outweighs the benefit. The operational area is approximately 45 km from the nearest seabird rookeries and turtle nesting beaches (west coast of Barrow Island). The 20 km light assessment boundary for the operational area intersects with internesting, nesting and/or mating BIAs for flatback, green and hawksbill turtles, and the

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
				breeding BIA for wedge-tailed shearwater. Impacts from operational lighting are expected to be restricted to localised attraction and temporary disorientation, but with no long-term or residual impact due to the activity's short-term nature (i.e., approximately 65 days). Therefore, impacts are not expected on a population level or to impact on habitat.
N/A	Limit or exclude night time operations	Would eliminate potential impacts of artificial light during hours of darkness when light sources are more apparent and potential impacts are greatest.	Would double 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 lighting will still be required on-board the MODU, ISV and support vessels on a 24-hour	**Rejected** - Given the minimal risk of impacts to turtles occurring, the financial and environmental costs by requiring all works to be undertaken during daylight hours only are not considered appropriate given the extended duration of the activity that would occur.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			basis for safety reasons.	
N/A	Use of dark, matte surfaces to reduce sky glow across all activities	Reduce potential for impacts on wedge-tailed shearwater, and turtles from light emissions during hours of darkness when light sources are more apparent and potential impacts are greatest.	Additional cost to repaint vessel surfaces	**Rejected** - The operational area is approximately 45 km from the nearest seabird rookeries and turtle nesting beaches (west coast of Barrow Island). The 20 km light assessment boundary for the operational area intersects with internesting, nesting and/or mating BIAs for flatback, green and hawksbill turtles, and the breeding BIA for wedge-tailed shearwater. Impacts from operational lighting are expected to be restricted to localised attraction and temporary disorientation, but with no long-term or residual impact due to the activity's short-term nature (i.e., approximately 65 days). Therefore, impacts are not expected on a population level or to impact on habitat.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
N/A	Use of shrouding on external lights	Reduce potential for impacts on turtles from light emissions during hours of darkness when light sources are more apparent and potential impacts are greatest.	Cost associated with retro fitting external lighting with shrouding/shielding. Can only be done for lighting that does not impact on navigational requirements or safety.	**Rejected** - Operational area is approximately 45 km from the nearest nesting beaches. Modelling of light spill pipelay and construction vessels indicates that light levels reduce to ambient levels within 11 km. Therefore, no environmental benefit would be obtained from installing shrouding.
N/A	Implement light management actions recommended in the National Light Pollution Guidelines, including: + Switch off outdoor/deck lights when not in use + Use available block-out blinds on portholes and windows not necessary for safety and/or navigation at night + Manage and report seabird interactions	Would result in reduced light spill from internal lighting onto the sea surface, potentially reduce overall light emissions, and reduce the consequence of any seabird interactions.	Cost of maintaining records and to train staff. Potential re-engineering of vessel (lighting management systems and blackout blinds).	**Rejected** – Although the operational area is located within internesting BIAs for marine turtles, it is more than 45 km from the nearest nesting beaches, and therefore the management actions would not change the potential environmental impacts. 24 hour/day activities require a safe standard of lighting.
N/A	No flaring	Eliminates artificial light associated with flaring	There is no safe and feasible alternative to flaring to complete well	**Rejected -** Not practical or feasible to eliminate flaring

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			testing. Flaring is an essential element for safe well testing.	during well testing.

6.2.4 Environmental Impact Assessment

Receptor	Consequence Level
Threatened, migratory or local fauna	Continuous lighting in the same location for an extended period of time may result in alterations to normal marine fauna behaviour. Sensitive receptors that may be impacted include fish at surface, seasnakes, marine turtles, and seabirds. A localised increase in fish activity as a result of MODU, ISV or support vessels lighting is expected to occur as a result of the proposed activity within the operational area. Light pollution is recognised as potential threat to marine turtles in recovery plan for marine turtles in Australia. Light emissions may be visible to turtles transiting, foraging or internesting in surrounding areas, but they are unlikely to affect nesting or hatchling sea finding and dispersal activity. It is considered that the activity will not compromise the objectives as set out in the marine turtle recovery plan, flatback turtles will not be displaced from habitat critical for their survival and therefore, the impact of lighting associated with the activity to turtles is negligible. The operational area overlaps the breeding BIA for the wedge-tailed shearwater. Individuals may forage in the waters surrounding the islands during nesting seasons. However, the operational area is 45 km from Barrow Island that may provide seabird roosting or breeding habitat. This is outside the 20 km buffer suggested by the *National Light Pollution Guidelines for Wildlife including Marine Turtles, Seabirds and Migratory Shorebirds* (Commonwealth of Australia, 2020a), and breeding behaviour is unlikely to be affected. In general, young fledglings are more likely to become disorientated by artificial light sources. Fledglings have been observed being affected by lights up to 15 km away; and fledgling seabirds may also not take their first flight if their nesting habitat never becomes dark (Commonwealth of Australia, 2020a). Foraging and breeding behaviours may occur in the operational area, in low densities during the breeding season. Marine mammals are not known to be significantly attracted to light sources at sea therefore, behavioural disturbance is unlikely. Indirect impacts on food sources or habitats also unlikely (see below). Fish, sharks and birds have been shown to be attracted to artificial light sources however, the activity is unlikely to lead to large-scale changes in species abundance or distribution. Impacts to transient fish, sharks and seabirds will therefore be limited to short-term behavioural effects with no decrease in local population size or area of occupancy of species, loss or disruption of critical habitat, or disruption to the breeding cycle. Due to management controls in place, and the distance from shorelines the artificial lighting associated with the activity is considered to have minor impacts on fauna, including the breeding success of seabird and marine turtle populations.

Receptor	Consequence Level
	Impacts to marine fauna are expected to be detectable but is unlikely to cause significant change to a local population through localised attraction and temporary disorientation. The consequence level is assessed as II – Minor.
Physical environment or habitat	Not applicable – No impacts to physical environments and/or 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	The operational area is approximately 32 km from the Montebello AMP. The values and sensitivities of the AMP relevant to light emissions are breeding, foraging and resting habitat for seabirds, internesting, mating and nesting habitat for marine turtles, however lighting from the activity is not expected to extend far enough towards the AMP that these values would be impacted. Additionally, as described above, the impacts to marine fauna from lighting outside of the AMP are not expected to significantly impact the life cycle of threatened marine fauna such as marine turtles, such that the values of the AMP would be diminished. The consequence level is assessed as II – Minor.
Socio-economic receptors	Lighting is not expected to cause an impact to other marine users. However, lighting may attract commercially sensitivity fish stocks within the operational area. Given this is only expected to occur within approximately 90 m of the MODU, and there is a temporary exclusion zone of 500 m around the MODU, commercial fishers will not be impacted by any temporary change in fish stock behaviour. EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country.
Overall worst-case consequence	II- Minor

6.2.5 Demonstration of As Low As Reasonably Practicable

Artificial lighting is required 24 hours a day for operational and navigational safety during the activity. A minimum level of artificial lighting is required on a 24-hour basis to alert other marine users of the activity. There are also minimum light requirements that will be necessary to provide safe working conditions. To reduce lighting at night further would restrict the activity hours resulting in the activity taking approximately twice as long to complete. This would increase the period of time the operational area would need to be avoided by other marine users and the amount of waste, discharges and emissions produced.

The increased risks/impacts with potentially larger scale consequences associated with reduced light levels are considered to present a cost that is grossly disproportionate to any environmental benefit. Given that lighting on the MODU, ISV and support vessels will be consistent with industry standards and will result in negligible consequences, and that no reasonably practicable additional controls or alternatives were identified, it is considered that the environmental impacts of using 24-hour artificial lighting at an intensity to allow work to proceed safely are ALARP.

There is no safe and feasible alternative to flaring to complete the activity. Flaring can provide valuable information on the types of products the well can produce, the pressure and flow rates of fluids and other characteristics of the reservoir. Flaring procedures ensure that gases are disposed of in a controlled manner. It is not possible to divert the gas produced by well testing to production facilities, as the development well will be drilled prior to the required production infrastructure being installed. Flaring results in light emissions from the MODU for a short duration (two to three days per well test).

The operational area is located greater than 20 km away from the nearest turtle nesting beaches and, and seabird rookies at Barrow Island. Subsequently MODU, ISV and support vessels light emissions will not be visible from the beaches.

The operational area overlaps the wedge-tailed shearwater breeding BIA and individuals may forage in the waters surrounding the islands, with a greater likelihood of occurrence during nesting seasons. Impacts from operational lighting are expected to be restricted to localised attraction. Breeding behaviour is not expected to be interrupted, with individual seabird species expected to overfly the operational area. Light emissions from the MODU and/or vessels are unlikely to attract and/or affect the behaviour of large numbers of seabirds. Therefore, impacts are not expected on a population level or food sources or habitat.

The activity will not compromise the objectives as set out in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017), the Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2020b) or the National Light Pollution Guidelines for Wildlife (Commonwealth of Australia, 2023), as BIBs of nesting adults, foraging individuals and emerging/ dispersing hatchlings can continue given the short duration of the activity and the controls implemented. Additional control measures were considered but not adopted since the associated cost or effort was grossly disproportionate to any environmental benefit, as detailed in **Section 6.2.3**. The assessed residual consequence for this impact is considered minor.

With the described controls, the consequence of artificial light on marine fauna and seabirds is considered to be minor with insignificant impacts to ecological function. No population level impacts are expected, and the consequence is considered environmentally acceptable

6.2.6 Demonstration of Acceptability

Table 6-12: Acceptability evaluation – Light Emissions

Is the consequence ranked as I (Negligible) or II (Minor)	Yes – maximum consequence from light emissions is II – Minor.
Is further information required in 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' Environmental Hazard Identification and Assessment Procedure (EA-91-IG-00004), which considers principles of ESD. The residual consequence of the impact for this aspect is minor and therefore does not affect the outcomes of the principles of ecologically sustainable development as per **Table 5-5**.

Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – Controls implemented during the activity will minimise the potential impacts to species identified in recovery plans as having the potential to be impacted by light emissions. Relevant species recovery plans, conservation management plans and management actions, including but not limited to the: + Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017) + North-west Marine Parks Network Management Plan (2018) + Blue Whale Conservation Management Plan 2015 to 2025 (Department of Agriculture, Water and the Environment, 2021) + Approved Conservation Advice for *Megaptera novaeangliae* (humpback whale) (TSSC, 2015h) + National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (2020) + Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2020b)
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes. DBCA requested the EP give consideration to avoiding impacts to conservation significant marine species listed under the BC Act that are known to occur in the BIMMA and associated reserves in proximity to the proposed activity, such as considering using acoustic monitoring at nighttime, if start up after daylight hours as visual monitoring is likely to be ineffective. DBCA also recommended that vessel lighting is designed to align with the standard of the National Light Pollution Guidelines for Wildlife (Commonwealth of Australia, 2023) as far as practicable. DBCA also requested the EP assesses impacts to conservation significant species, accounting for the scale, location and biological significance of the proposed activities. In particular, large marine fauna such as cetaceans and whale sharks are common migratory species to the BIMMA, and the reserves unique ecosystems provide critical breeding and nesting habitat for significant marine turtle and shorebird species. DWER advised that the EP should consider the National Light Pollution Guidelines recommendations and relevant actions committed to. Previous feedback from DNP advised the EP should consider activity overlap with AMP (and their representativeness), BIAs, KEFs.

	Santos has addressed the impacts of lighting from vessels and 24-hour operations in **Section 6.2** (Light Emissions) and has committed to reduce impacts to marine fauna from lighting on all project vessels and the MODU through limiting lighting to that required by safety and navigational lighting requirements. Implementation of the National Light Pollution Guidelines has been assessed addressed in the aforementioned Section of the EP. Santos has considered and assessed light impacts from the activity and potential overlap with AMPs, BIAs and KEFs and these are addressed in **Section 3** and **6.2.2.** Santos considers these concerns to have been addressed within **Section3**and **Section 6.2** and in the environmental performance outcomes assessment and control measures assessment (**Section 6.2.3; Table 8-2**), including as per the Activity Notification and Reporting Requirements (**Table 8-5**).
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP.

Lighting of the MODU, ISV and support vessels is industry standard and required to meet relevant maritime and safety regulations. The potential consequences of the anthropogenic light sources in the operational area is considered to be insignificant in nature and restricted to short-term behavioural impacts on individual fauna present in the operational area during the activity.

The operational area intercepts an internesting buffer BIA for the flatback turtles, and breeding BIA for the wedge-tailed shearwater, both of which are vulnerable to artificial light. Due to the distance offshore, significant impacts are not expected on fauna, including nesting turtles or hatchlings, and nesting wedge-tailed shearwaters. No stakeholder concerns have been raised regarding lighting for the activity.

The Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017) specifies the following priority actions for the Pilbara genetic stock of flatback turtles and NWS genetic stock of green turtles in relation to light pollution: Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats. Although the operational area overlaps the internesting buffer BIA for flatback turtles, aggregating marine turtle adults are unlikely considering the deeper water depth of the operational area (ranging from approximately 95 m – 125 m). With management controls in place, lighting from the planned activity is not expected to impact aggregating adults.

The potential consequence of light emissions on receptors is assessed as II - Minor. With the control measures in place, including lighting management procedures and compliance with navigational safety legislation, no significant impacts are expected. Therefore, the impacts of light emissions to the receiving environment are ALARP and considered environmentally acceptable.

6.3 Atmospheric Emissions

6.3.1 Description of Event

Event	Potential impacts from atmospheric emissions may occur in the operational area from the following sources: + combustion through flaring during well testing (oil and gas). Other gasses (CO_2 and H_2S) may be produced from the reservoir + operation of MODU, ISV and support vessels engines, helicopters, generators, mobile and fixed plant and equipment. These emissions will include greenhouse gas (GHG) emissions, such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), and non-GHG emissions, such as sulphur oxides (SO_X) and nitrogen oxides (NO_X); + operation of incinerators on support vessels outside the 500 m temporary safety exclusion zone around the MODU, and the ISV; + when transferring dry bulk products used for drilling (e.g., barite, bentonite, cement), tank venting is necessary to prevent tank overpressure. The vent air will contain minor quantities of product particles, which will suspend in the air or settle on the sea surface. + Although the MODU, ISV and support vessels may use ozone-depleting substances (ODS), this will be in a closed rechargeable refrigeration system and there is no plan to release ODS to the atmosphere.
Extent	Localised: The quantities of gaseous and solid (powder) emissions are relatively small and will, under normal circumstances, quickly dissipate into the surrounding atmosphere.
Duration	Intermittent for the duration of the activity.

This EP includes the drilling and installation activities only. The condensate and gas from the Halyard-2 well will be processed on Varanus Island along with gas and condensate from other state facilities. Further information and impact assessment on the expected emissions associated with the operation of the Halyard 2 well and processing the condensate and gas are as described in Varanus Island Hub Operations Environment Plan for Commonwealth Waters (EA-60-RI-10003) (VI Hub Ops Cth EP).

6.3.2 Nature and Scale of Environmental Impacts

Potential receptors: Physical environment (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 and SO_X, can lead to a reduction in local air quality. GHG emissions are recognised to also contribute to the greenhouse gas emissions loading globally.

Direct GHG emissions associated with the activities are detailed in **Table 6-13**. Emissions have been calculated based on forecast fuel usage using the following standards and guidelines:

+ The GHG Protocol – provides specific guidance on GHG estimation;
+ ISO 14064 - provides clarity and consistency for quantifying, monitoring, reporting and validating or verifying GHG emissions;

- ISO 14040 - addresses quantitative assessment methods for the assessment of the environmental aspects of a product or service in its life cycle stages.
- The Australian Government's Climate Active Carbon Neutral Standard (Australian Government, 2020a); and
- GHG Corporate Reporting and Accounting Standard 2013 - It provides guidance on preparing a GHG emissions inventory and covers the accounting and reporting of the greenhouse gases covered by the Kyoto Protocol.

The total estimated direct GHG emissions for this activity is approximately 25,764t $C0_2$-e. The total annual Australian GHG emissions for the year from December 2022 to March 2023 are estimated by the Commonwealth Government to be 463.9 Mt CO_2-e (DISER, 2022). The estimated GHG emissions from the Halyard-2 drilling and pre-commissioning activities are estimated to be 0.005% of the total annual Australian GHG emissions.

Table 6-13: Estimated GHG emissions

Source	Greenhouse gases (t CO_2-e)			Total GHG emissions (t CO_2-e)
	CO_2	CH_4	N_20	
Drilling & Completion Activities				
Vessels	10,523	15	60	**10,598**
MODU fuel usage	3,656	5	21	**3,682**
Road Transport	-	-	-	**124**
Flaring - NG	3,568	1,189	33	**4,790**
Flaring – Condensate & SBM	2,400	7	45	**2,452**
Helicopters fuel usage	114	0	1	**115**
Flights	-		-	**320**
Embodied Carbon			-	**2,535**
Installation Activities				
Support vessels fuel usage			-	**1,035**
Helicopters fuel usage			-	**2**
Embodied Carbon			-	**111**
Total	**21,290**	**1,218**	**166**	**25,764**

GHG emissions refers to gases that trap heat within the atmosphere through the absorption of longwave radiation reflected from the Earth's surface. The emissions of carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4), as relevant to the activity, are recognised as GHG emissions. GHG emissions are linked to global warming and climate change. Santos recognises the science of climate change and supports the objective of limiting global temperature rise to less than 2°C and pursuing efforts to limit the temperature rise to 1.5°C. In recognition of the global need to reduce GHG emissions, Santos has had a Climate Change Policy since 2008, guiding the management of emissions and climate change risks. Santos also has gas emission reduction targets, including a new long-term target of achieving net zero Scope 1 and 2 absolute emissions by 2040. Santos' strategy focuses on natural gas as a reliable transition fuel source and the development of technologies such as carbon capture and storage and clean fuels, such as hydrogen, as foundations for our decarbonisation pathway.

Potential impacts as a result of climate change have been modelled by Commonwealth Scientific and Industrial Research Organisation (CSIRO). The modelling indicates that temperatures will increase across Australia; rainfall patterns will change significantly; and extreme events, such as droughts, floods and wildfires, will become more common. These changes are likely to impact on individual species, ecosystems and ecosystem services, such as food and water availability. Within decades, environments across Australia may be substantially different (CSIRO and Bureau of Meteorology, 2015).

To date, the currently observed global warming and the associated anthropogenic climate changes cannot be directly attributed to any one development or activity, as they are the result of net global GHG emissions and GHG sinks that have accumulated in the atmosphere since the industrial revolution began. Consideration for the purpose of this EP is framed by the contribution that the activity will make to national and global atmospheric emissions of GHG. This contribution is small, being less than 0.005% of the total current annual Australian GHG emissions.

Ozone-depleting substances are used in closed refrigeration systems on board vessels. Ozone-depleting substances have the potential to contribute to ozone-layer depletion if accidentally released to the atmosphere. Ozone-depleting substances are not used, generated or discharged by vessel activity other than what is incidentally located and used in closed systems on board vessels. ODS will not be deliberately released during the course the activity. ODS air emissions would only occur in the event of damaged or faulty refrigeration equipment.

Tank venting is a necessary safety control, and any dust emissions will be negligible and limited to the immediate vicinity of the MODU and support vessels.

Air emissions will be similar to other vessels operating in the region for both petroleum and non-petroluem activities. All vessels are required to comply with MARPOL air emissions regulations, by using low sulphur fuel (3.5% reducing to 0.5 % in 2020) and NO_X emissions controls as applicable to engine age and type. The quantities of gaseous emissions are relatively small and will quickly dissipate into the surrounding offshore atmosphere. Due to the volumes and highly dispersive nature of the emissions no adverse impacts to seabirds or humans are expected.

As the activity will occur in open-ocean offshore waters, the combustion of fuels in such remote locations will not impact on air quality in coastal towns, the nearest being Dampier (~180 km). The quantities of gaseous emissions are relatively small and will quickly dissipate into the surrounding atmosphere.

The estimated Halyard-2 drilling and pre-commissioning activities are estimated to be 0.005% of the total annual Australia GHG emissions and due to the remote location and the short duration of the Activity neither climate change impacts, additive or cumulative atmospheric emissions effects from the activities are predicted. Additionally, consultation with other operators have not identified any concurrent activities, therefore no potential additive or cumulative atmospheric emissions impacts from SIMOPS with other operators will occur.

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 emission impacts are not expected to have direct or cumulative impacts on sensitive environmental receptors or be above National Environmental Protection (Ambient Air Quality) measures.

6.3.3 Environmental Performance Outcomes and Control Measures

EPOs relating to this event include:

+ No unplanned objects, emissions or discharges to sea or air [H2-EPO-04]; and
+ Reduce impacts to air and water quality from planned discharges and emissions from the activities [H2-EPO-06].

The control measures considered for this activity are shown in **Table 6-14** with EPS and measurement criteria for the EPOs described in **Section 8.4.1**.

Table 6-14: Control measures evaluation for atmospheric emissions

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-DC-CM-003 H2-IC-CM-003	Waste incineration	Reduces the potential for emissions or particulates by ensuring only permissible waste is incinerated as per International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI and Marine Order 97. No incineration within the MODU 500 m temporary safety exclusion zone shall occur.	Personnel cost of maintaining waste records and training of staff.	**Adopted** – Negligible environmental impact outweighs the costs associated with transporting waste to shore for landfill.
H2-DC-CM-004 H2-IC-CM-004	Fuel oil quality	Reduces emissions through use of low sulphur fuel in accordance	No additional costs, as this is a regulatory requirement.	**Adopted** – no additional costs

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		with Marine Order 97.		
H2-IC-CM-005 H2-IC-CM-005	Air pollution prevention certification	Ensure all vessels are operating with acceptable emissions as per international standards. Ensure compliance with Australian Marine Orders as appropriate for vessel class.	No additional costs, as this is a regulatory requirement.	**Adopted** – Benefit of ensuring vessel is compliant outweighs the minimal costs and it is a legislated requirement.
H2-DC-CM-006 H2-IC-CM-006	Ozone-depleting substance handling procedures	Reduces probability of potential impacts to air quality due to ozone-depleting substance emissions.	Personnel cost of maintaining ozone-depleting substance record book or recording system.	**Adopted** – Benefit of ensuring no ozone-depleting substance release outweighs the minimal costs.
H2-DC-CM-007	Well test procedures	Includes control measures that reduce the risk of poor quality incineration of hydrocarbons entering the atmosphere	Cost associated with implementing procedures.	**Adopted** – Benefit of ensuring quality incineration outweighs the minimal cost
H2-DC-CM-008 H2-IC-CM-007	Marine Assurance Standard	Reduces emissions from vessels because equipment operating within its parameters.	Cost associated with implementing procedures.	**Adopted** – Benefit of implementing procedure outweighs the minimal costs.
H2-DC-CM-008 H2-IC-CM-008	Vessel PMS to maintain vessel DP. Engines and machinery	Reduces atmospheric emissions from the vessels because equipment is operating within its parameters.	Costs are standard for routine PMS.	**Adopted** – Benefits in reducing atmospheric emissions impacts outweigh the minimal costs.
Additional Control Measures				

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
N/A	No bulk product (powder) transfers at sea, with all products loaded prior to MODU mobilisation.	Reduces potential impacts to air quality from unintentional release.	Bulk product is required to perform the activity and transfers of bulk product are required. Given the size of the MODU, docking for quay-side loading of bulk products is not feasible.	**Rejected** – Not feasible
N/A	No incineration policy on support vessels	Reduction in fuel consumption and air emissions through zero incineration.	Increase in health risk from storage of wastes. Limited space available to store waste, additional trips to shore would be required to transport waste. Increase in risk due to transfers (increased fuel usage, potential increase in collision risk, disposal on land).	**Rejected** – Health and safety risks outweigh the benefit given the offshore location. Cost associated with transporting waste to shore for landfill or incineration outweighs onboard incineration. Incineration on the vessels (outside the 500 m temporary safety exclusion zone around the MODU) is a permitted maritime operation.
N/A	Removal of all ozone-depleting substance–containing equipment	Eliminates potential of ozone-depleting substance emissions occurring, impacting on air quality.	Lack of refrigeration systems on board the vessels would lead to unacceptable workplace conditions (i.e., air conditioning)	**Rejected** - Based on cost to replace all equipment and there is only a low potential for ozone-depleting substance releases.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			and poor food hygiene standards, limiting the vessel's ability to undertake the activity therefore there is no practical solution to the use of refrigeration. It is noted that ozone-depleting substances are rarely found on vessels.	
N/A	Use incinerators and engines with higher environmental efficiency	Improves air quality by more efficient burning or fuel combustion.	Significant cost in changing unknown vessel equipment.	**Rejected** – Cost grossly disproportionate to low environmental benefit (impact rated Negligible).
N/A	No flaring during well testing	Avoidance of flaring emissions and GHGs.	Introduces significant safety issues during well testing if the gas cannot be flared.	**Rejected** – Safety issues outweigh the environmental benefit for the short term well testing.
H2-DC-CM-010	Well flowback procedures	Requires: high-efficiency burner heads thereby improving air quality by more efficient burning or fuel combustion. Gas line pilots to reduce the risk of hydrocarbons being released to air.	Potential constraint to rig selection.	**Adopted** – high efficiency burners and gas line pilots result in more complete combustion of hydrocarbons, reducing harmful emissions due to products of incomplete combustion and prevent unburnt hydrocarbons from being released in all

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		Two burner booms to be provided on the MODU to allow for redundancy and operation in all weather conditions.		weather conditions.

6.3.4 Environmental Impact Assessment

Receptor	Consequence Level
Threatened, migratory or local fauna	Atmospheric emissions are relatively small and will, under normal circumstances, quickly dissipate into the surrounding atmosphere. Short-term behavioural impacts to seabirds could be expected if they overfly the location and they may avoid the area. This could include the wedge-tailed shearwater, which has a BIA that overlaps the operational aera. No decrease in local population size or area of occupancy of species, loss or disruption of critical habitat, disruption to the breeding cycle or introduction of disease. Any potential impacts are not expected to result in a decrease in local population sizes particularly to seabirds or disruption to breeding cycles. The consequence level is assessed I - Negligible.
Physical environment or habitat	The activity will occur in the open ocean and offshore waters, the combustion of fuels and venting and rare ODS releases in such a remote location 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 (i.e., strong and consistent) is expected to reduce potentially harmful or 'noticeable' gaseous concentrations within a short distance from the MODU, ISV or support vessels. Cumulative impacts are not expected. Greenhouse gas emissions will be released during the activity accounting for less than 0.006% of annual Australian GHG emissions. Given the relatively small quantity, detectable environmental impacts are not predicted. The consequence level is assessed as I - Negligible.
Threatened ecological communities	Not applicable – these receptors will not be impacted by air emissions.
Protected areas	Gaseous emissions are relatively small, will quickly dissipate into the surrounding atmosphere, and are unlikely to impact the values and sensitivities for protected areas, including the Montebello AMP, given the offshore environment and rapid dissipation. The consequence level is assessed as I – Negligible.
Socio-economic receptors	The activities occur in offshore waters. The combustion of fuels and ODS releases in these remote locations will not impact on air quality in coastal towns. 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. EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country. The consequence level is assessed as I - Negligible.
Worst-case consequence level	I – Negligible

6.3.5 Demonstration of As Low As Reasonably Practicable

Combustion of fossil fuels is essential to undertaking the activity to power the MODU, vessels, helicopters and equipment. Practical and reliable alternative fuel types and power sources for the MODU, vessels and helicopters have not been identified.

There is no safe and feasible alternative to flaring to complete well testing. Flaring is an essential element for safe well testing that results in atmospheric emissions. Bulk transfers are necessary to provide drilling materials and tank venting is a necessary safety control. There are no safe and feasible alternatives to venting to complete the activity.

Incineration on the support vessels will not occur within the 500 m temporary safety exclusion zone around the MODU. Implementation of a zero incineration policy on the vessels would result in significant costs associated with the transport of waste to shore for disposal. Further transportation of the waste to shore would increase the environmental impacts and risks associated with the drilling activity through increased vessel movements and generate greater volumes of emissions associated with the vessel movements. Additional space would also be required to store waste (including refrigerated storage) which would require larger vessels to allow for the storage, resulting in higher emissions from engine combustion and to power additional refrigeration units. Since incineration is a permitted maritime operation in accordance with Marine Order 97 (reflecting MARPOL Annex VI requirements) it is considered ALARP.

Lack of HVAC systems (i.e., air conditioning) on-board the MODU, ISV and support vessels conducting the activity would lead to unacceptable workplace conditions and poor food hygiene standards, limiting the vessels' ability to undertake the activities, therefore there is no practical alternative to the use of refrigeration.

The assessed residual consequence for this impact is Negligible (I) and cannot be reduced further. Additional control measures were considered but rejected, since the associated cost or effort was grossly disproportionate to any benefit and the offshore open environment where the atmospheric emissions dissipate rapidly in the surrounding air which is not in close proximity to sensitive receptors, as detailed in **Section 6.3.4**. Therefore, it is considered that the impact of the activities conducted is ALARP.

6.3.6 Demonstration of Acceptability

Table 6-15: Acceptability evaluation – Atmospheric Emissions

Is the consequence ranked as I (Negligible) or II (Minor)	Yes – maximum consequence from atmospheric emissions is I – Negligible.
Is further information required in 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' Environmental Hazard Identification and Assessment Procedure (EA-91-IG-00004), which considers principles of ESD. The residual consequence of the impact for this aspect is negligible and therefore does not affect the outcomes of the principles of ecologically sustainable development as per **Table 5-5**.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – pursuant to Marine Order 97 (Marine pollution prevention – air pollution), which gives effect under Australian law to Australian Marine Order 97. No plans identified atmospheric emissions like those described above as being a threat to marine fauna or habitats. The activity is compliant with requirements of the North-west Marine Parks Network Management Plan (2018).
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – no concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above.

Atmospheric emissions from support vessels are permissible under the *Protection of the Sea (Prevention of Pollution from Ships)* Act 1983, which is enacted in Australian waters by Marine Order 97 (Marine pollution prevention – air pollution) (which also reflects MARPOL Annex VI requirements). This is an internationally accepted standard that is utilised industry wide, and compliance with Australian Marine Order standards is considered to be an appropriate management measure in this case.

The residual consequence for this impact to the atmosphere and sensitive receptors are expected to be negligible if the emissions management is adhered to and impacts from emissions that are generated by the various decommissioning activities are considered to be ALARP and acceptable.

6.4 Seabed Disturbance

6.4.1 Description of Event

Event	Potential seabed disturbance may occur in the operational area from the following sources: + Positioning and anchoring of the semi-submersible MODU at the well location; + installation of infrastructure on the seabed; + construction of the well; + discharge of drill cuttings at seabed; + installation of support/stabilisation mattresses and grout bags; + placement of ROV baskets on the seabed; + placement of deployment frames on the seabed; + temporary wet storage of equipment/infrastructure. During the activity, the ISV will not require anchoring, and there will be no anchoring or mooring of support vessels within the operational area. Activities may disturb seabed and benthic habitat through direct physical disturbance of seabed and associated habitats and biota (from positioning infrastructure on the seabed), and indirect disturbance to benthic habitats and associated marine fauna (from increases turbidity and sedimentation as a result of sediment disturbance). Seabed disturbance associated with drilling discharges is described in **Section 6.7**. For solid objects that may be accidentally dropped overboard and are heavy enough to sink through the water column and subsequently land on the seabed, see **Section 7.1**.
Extent	Drilling Activities Seabed disturbance in the operational area from MODU anchoring is conservatively estimated to be 210 m^2 per anchor for a total disturbance area of approximately 2,600 m^2. Discharge of drill cuttings at seabed of will disturbance an area of approximately 100 m^2 around the well-head. Installation Activities Minimal seabed disturbance will occur in the operational area from installation activities associated with the following and this disturbance will be long-term (until the infrastructure is removed): + Installation of the USBL for ROV positioning during pre-installation surveys (approximately 2m^2) + Installation of the SCM skid (approximately 20m^2) + Installation of a EFLs and HFLs connecting the SCM to the PLEM and EFLs and HFLs connecting the SCM to the Halyard-2 tree (approximately 28m^2) + Installation of a rigid production spool between the Halyard-2 Xmas tree and the PLEM (Spool does not contact seabed) + Installation of grout bags and/or concrete mattresses as required (approximately 4$m^{2)}$ (+ Potential wet storage of equipment on the seabed – equipment may be temporarily wet stored in close proximity to its final deployment location or prior to recovery (approximately 7.5m^2) ROV Activities

	The ROV may be used close to or on the seabed for subsea installation activities. The typical footprint for an ROV is approximately 2.5 m x 1.7 m. ROV workbaskets may also be temporarily placed on the seabed.
Duration	Seabed disturbance from the MODU spud cans, installation activities, the ROV and ROV work baskets will be temporary for the duration of the activity and limited to within the operational area, with recovery within weeks to months following removal from the seabed within the area. Once installed, infrastructure will remain on the seabed for the life of the development.

6.4.2 Nature and Scale of Environmental Impacts

Potential receptors: Physical environment (benthic habitats and fauna), threatened, migratory or fauna (marine turtles and fish), commercial fisheries.

Operational activities have the potential to impact the seabed and benthic habitat through the following:

+ direct physical disturbance of an area of seabed habitat, including benthic fauna, of approximately 210 m^2 per anchor (approximately 2,520m^2 for sup to 12 anchors) during the drilling of the well,
+ indirect disturbance to benthic habitats and associated marine fauna by sedimentation; and
+ increased turbidity of the near-seabed water column.

The potential impacts to the seabed and benthic habitats from drilling discharges are discussed in **Section 6.7**.

6.4.2.1 Physical environment (benthic habitats and fauna)

The positioning of the MODU, subsea installation activities and ROV activities associated with the activity will directly contact the seafloor and will inevitably result in localised impact to benthic habitat (and associated fauna) in the operational area.

The majority of the operational area is likely to consist of soft sediment seabeds and sandy and muddy substrates, occasionally interspersed with hard substrates covered with sand veneers (Department of the Environment, Water, Heritage and the Arts, 2008) Non-coral benthic invertebrates are likely to be the dominant community, albeit in low densities. Non-coral benthic invertebrates that occur in the operational area are likely to include sea cucumbers, urchins, crabs and polychaetes on soft substrate. Hard substrates are likely to contain sessile (fixed in one place) invertebrates, such as sponges and gorgonians (Department of the Environment, Water, Heritage and the Arts, 2008). More diverse habitats are found on surrounding shoals, rather than on the soft sediment seabed.

The seafloor of this bioregion is strongly affected by cyclonic storms, and among the largest tidal energy observed anywhere in the world, which can resuspend sediments within the water column as well as move sediment across the seafloor.

The potential impacts of seabed disturbance caused by the planned activities are considered negligible due to the following:

+ Depressions on the seabed left by the MODU spud cans once the MODU has moved off site, and areas used for temporary wet-storage during installation activities are predicted to infill as a result of movement of sediments by water currents and by the deposition of detrital matter. Recovery and re-colonisation of soft sediment habitats happens in a short period of time and therefore any impacts would be short term and temporary in nature;

+ Deployment of the MODU anchors and installation of subsea infrastructure may cause localised and temporary impacts to water quality from increased turbidity in the lower water column near the seabed and direct physical impact to benthic habitat. This may cause relatively small scale, permanent impacts to the physical seabed habitat and benthic communities as described above and in **Section 3**;
+ No known sensitive seabed features (e.g., reefs, canyons, shipwrecks) or benthic primary producer habitat (e.g., significant areas of hard corals, seagrass, macroalgae or mangroves) are known to be present in the operational area; and
+ The nearest emergent reef or island that may support hard substrate communities including corals, is the Barrow Island, approximately 40 km from the operational area.

6.4.2.2 Marine Turtles

An internesting buffer BIA for the flatback turtle intersects the operational area, as does habitat critical to the survival for flatback turtles. The Recovery Plan for Marine Turtles in Australia: 2017-2027 (Commonwealth of Australia, 2017) highlights habitat modification as a threat to marine turtles. The Plan specifies the following priority actions for all stocks of marine turtles:

+ Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival; and
+ Manage anthropogenic activities in BIAs to ensure that biologically important behaviour can continue.

However, internesting activities typically occur within shallower waters than those in the operational area (Pendoley Environmental Pty Ltd, 2017; Whittock et al., 2016). If a marine turtle was displaced from the area of seabed and benthic habitat disturbance, widespread internesting habitat is available in the immediate vicinity that marine turtles could continue to use within the identified BIAs and the habitat critical to the survival of flatbacks. No loss or disruption of habitat critical to the survival of marine turtles or disruption to the breeding cycle of marine turtles is expected.

6.4.2.3 Socio-economic receptors

Commercial fisheries in the operational area are not predicted to be significantly affected due to the temporary nature of the seabed disturbance and the size of the operational area compared to the total available fishing area. Potential impacts to benthic habitats and subsequently to associated fish species of commercial importance are likely to be localised with the impact to, and displacement of, fish insignificant at a population level.

Any temporary turbidity and sedimentation associated with the drilling and installation activities (including cumulative impacts from concurrent activities) is not considered likely to cause a significant environmental impact given the high background levels of natural sediment movement in the area, the minor disturbance caused by the activity and the short duration of the activity.

Indirect impacts associated with a temporary (several hours) and localised (within tens of metres) decline in water quality due to increased suspended sediments or sedimentation of the seabed are not expected to affect any values and sensitivities of regional importance. It is not considered that localised impacts within the operational area will result in significant indirect impacts (in other words, turbidity) to nearby marine reserves, offshore reefs or islands, given their distance from the activity.

6.4.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event are:

+ Seabed disturbance is limited to planned activities and defined locations within the operational area [H2-EPO-07]; and
+ Do not displace marine turtles from habitat critical to the survival of the species or disrupt biologically important behaviours from occurring within biologically important areas [H2-EPO-09].

The control measures considered for this event are shown in **Table 6-16**, and the EPS measurement criteria for the EPOs are described in **Section 8.4.1**.

Table 6-16: Control measures evaluation – Seabed Disturbance

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-DC-CM-011 H2-IC-CM-009	Anchoring	No planned anchoring for support vessels within operational area reduces seabed disturbance area as no anchor or anchor chain drag/placement.	Costs associated with implementing procedures.	**Adopted** – Benefits considered to outweigh costs.
H2-DC-CM-012	MODU station keeping system	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.
H2-DC-CM-013 H2-IC-CM-010	Recovery of all deployed equipment	Prevents ongoing impact to the seabed due to drilling equipment being left in situ	Minimal additional cost to recover equipment	**Adopted** – Helps to minimise impacts and extent of seabed disturbance.
H2-IC-CM-011	All equipment installed on the seabed designed	Minimises ongoing impact to the	Costs associated with removing infrastructure.	**Adopted** – equipment will be designed so that it can be

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
	such that it can be fully removed.	seabed beyond operations.		removed from the seabed.
Additional Control Measures				
N/A	Use of MODU with DP systems only	Would reduce seabed disturbance as no contact of MODU with the seabed.	Not technically feasible to use a DP MODU as the water depth is too shallow.	**Rejected** – not technically feasible.
N/A	No installation of stabilisation materials associated with infrastructure installation.	Not using stabilisation, such as mattresses and grout bags, would reduce the area of seabed disturbance.	Structural integrity of the equipment would be compromised.	**Rejected** – structural integrity of the equipment would be compromised which outweighs the small reduction of seabed disturbance that would be achieved.

6.4.4 Environmental Impact Assessment

Receptor	Consequence Level
Threatened, migratory or local fauna	No sensitive seabed features are known to occur in the operational area. The areas of seabed that will be impacted by the activity do not contain any significant or unique areas of benthic habitat. The benthic habitats within the operational area are broadly homogenous and comprised of two main types: soft sediment seabed and sandy and muddy substrates and no evidence of rock outcropping or coral reef development. The benthic habitat that exists in the operational area is also widespread across the northwest shelf and is expected to recover quickly from any direct disturbance. Marine invertebrates may inhabit soft sediments and can contribute to the diet of some fauna. The area of soft sediment habitat that is potentially impacted is small compared to the amount of habitat available and therefore the disturbance is not expected to affect prey availability, or protected fauna species. Habitat modification is identified as a potential threat to a number of marine fauna species in relevant recovery plans and conservation advice. Whilst the operational area overlaps internesting habitat considered critical to the survival of flatback turtles, the nearest nesting beach is approximately 45 km from the operational area, and the operational area is located in waters greater than 40 m deep, which is beyond the 30 m contour the majority of internesting behaviour occurs in (Pendoley Environmental Pty Ltd, 2017; Whittock et al., 2016). While marine turtles may be present in offshore waters during the internesting period, they are typically freely moving through these

Receptor	Consequence Level
	areas before they return to shallow waters to rest in the days leading up to nesting activity. While it is possible that individual marine turtles will traverse through the operational area during the peak internesting period any impacts will be temporary and the area potentially impacted is small compared to the size of the areas used by these species for foraging and internesting activities, including habitat critical to the survival of flatback turtles. Therefore, no long-term impacts to these species are expected. No decrease in local population size, area of occupancy of species, loss or disruption of critical habitat or disruption to the breeding cycle of any of these protected matters is expected. The majority of the benthic habitat disturbance from the activity will be short term and temporary. The only exception is the permanent long-term impact at the footprint of the permanent infrastructure. However, as the permanent infrastructure has a small footprint and is located in an area of low-sensitivity the impact is considered to be II – Minor. The consequence level is assessed as II – Minor.
Physical environment or habitat	The area of physical environment and habitat that will be impacted during the proposed activities is small compared to the area of similar habitat in the wider environment and is expected to re-establish following disturbance. As such, long-term or significant impacts to habitat values or ecosystem function are not expected. The consequence level is assessed as II – Minor.
Threatened ecological communities	Not applicable – No threatened ecological communities are identified in the area where seabed disturbance could occur.
Protected areas	Not applicable – No protected areas within immediate vicinity of the operational area.
Socio-economic receptors	Disturbance of the seabed and benthic habitat within the operational area is highly unlikely to impact socio-economic receptors such as fishing and tourism. Any minor alteration or modification to habitats is not expected to impact commercial fisheries' target species based on the small size of disturbance relative to the available fishing grounds. No stakeholder concerns have been raised regarding socio-economic impacts. EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country
Worst-case consequence level	II- Minor

6.4.5 Demonstration of As Low As Reasonably Practicable

There are no reasonably practicable alternatives to the use of vessels and a semi-submersible MODU in order to undertake the activity. The use of a MODU with DP systems only, which would eliminate disturbance to the seabed from placement of spud cans, is not feasible for the activity as the water depth of the operational area is too shallow. Other MODUs (such as jack-up MODUs) also require anchoring, which results in a greater area of seabed disturbance than that of a semi-submersible MODU.

Planned seabed disturbance associated with the activity will be limited to the placement of the MODU anchors on the seabed and the installation of subsea infrastructure within defined installation footprints. The disturbance will involve an area of benthic habitats (i.e., primarily soft sediments) that are widely represented at a regional scale within the northwest shelf province. Given the extremely small area and temporary nature of disturbance from the MODU presence and subsea installation activities, the impacts are not considered to be significant, particularly given the open ocean environment and lack of sensitive features in the operational area, and will not displace flatback turtles from habitat critical to their survival. The MODU move procedure, installation procedures, use of position equipment, designated wet storage areas and pre and post-installation surveys are designed to limit the extent of direct seabed disturbance. The ISV will not anchor and the support vessels will not require moorings or anchoring in the operational area, further reducing potential impacts to the benthic environment. Impacts will be localised to within the operational area and benthic habitat would be expected to recolonise within weeks to months following completion of the activity.

Given the lack of sensitive receptors within the operational area and the expected rapid recovery time, minor environmental impacts are expected.

Given the limited area of disturbance and the expected recovery time, minor environmental impacts are expected. All practicable control measures have been reviewed (**Section 8.4.1**) and those adopted as described in **Table 6-16** are considered appropriate to manage the impacts such that the residual consequence is assessed to be minor and cannot be reduced further. The proposed management controls for seabed disturbance are in accordance with the Santos' risk management criteria and are considered appropriate to manage the risk to ALARP.

6.4.6 Demonstration of Acceptability

Table 6-17: Acceptability evaluation – Seabed Disturbance

Is the consequence ranked as I (Negligible) or II (Minor)	Yes – maximum consequence from seabed disturbance is II-Minor.
Is further information required in 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' Environmental Hazard Identification and Assessment Procedure (EA-91-IG-00004), which considers principles of ESD. The residual consequence of the impact for this aspect is minor and therefore does not affect the outcomes of the principles of ecologically sustainable development as per **Table 5-5**.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	No recovery plans or conservation advice identified seabed disturbance like those described above as being a threat to marine fauna or habitats. Yes – management consistent with relevant species recovery plans, conservation management plans, objectives and actions, including but not limited to the:

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	Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017). The activity is consistent with the North-west Marine Parks Network Management Plan (Director of National Parks, 2018).
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes. The WA Museum advised Santos not to undertake activities that will have, direct or indirect adverse impact on protected underwater cultural heritage (UCH) without a permit and suggested to consult with Traditional Owners where appropriate if the project involves seabed disturbance in water shallower than 130 m. The Department of Planning Lands and Heritage advised Santos it had undertaken a review of the proposed activity area against the Aboriginal Cultural Heritage Directory and confirmed the project area does not intersect with any known Aboriginal Cultural Heritage. There are no protected zones and no known sites of underwater heritage have been identified within the operational area (**Section 3.2.6**). WAFIC requested information on the seabed assessment undertaken to ensure all equipment can be fully removed in the future. Santos has addressed the impacts of seabed disturbance from the activity **Section 6.4** (Seabed Disturbance) and has committed to reduce impacts to the seabed from the proposed activities through: + No planned anchoring for support vessels within the operational area reduces seabed disturbance area as no anchor or anchor chain drag/placement; + MODU station keeping system; + Recovery of all deployed equipment; + All equipment installed on the seabed designed such that it can be fully removed. WA Museum requested Santos to Notify regulators of the discovery of any suspected UCH identified during the planning, development, operation, or decommissioning phases of a project within 21 days of the discovery. Santos considers these concerns to have been addressed within **Section 3** and **Section 6.4** and in the environmental performance outcomes

	assessment and control measures assessment (**Section 6.4.3; Table 8-2**), including as per the Activity Notification and Reporting Requirements (**Table 8-5**).
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above.

The potential consequence of seabed disturbance on receptors is assessed as Minor (II). With the control measures in place, including compliance with industry standards and legislation, no significant impacts are expected. Flatback turtles will not be displaced from habitat considered critical for their survival under the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017).

Therefore, the impacts of seabed disturbance to the receiving environment are ALARP and considered environmentally acceptable.

6.5 Interactions with Other Marine Users

6.5.1 Description of Event

Event	Interaction with other marine users may occur as a result of: + Vessel operations; + MODU operations; + Helicopter activities; and + Seabed equipment. The MODU, ISV and support vessels required for the activity will move within the operational area. A 500 m temporary safety exclusion zone will be established around the MODU and ISV during drilling and installation activities. Activities have the potential to cause temporary displacement, or cause disturbance to other marine users. Other marine users include commercial fisheries, recreational fishers, and other oil and gas activities. For commercial fisheries, the level of interaction could lead to temporary displacement to fishing grounds (see **Section 3.2.6.3** for relevant fisheries). Vessel and MODU presence could pose a navigational hazard and a collision risk (the risk of spills resulting from a collision if assessed in **Section 7.7**).
Extent	Operational area
Duration	For the duration of the activity. The expected duration of the activity will be up to 50 days for drilling, and up to 15 days for installation activities. The activity will be conducted over 24-hour operations, in a single campaign.

6.5.2 Nature and Scale of Environmental Impacts

Potential receptors: Socio-economic (commercial fishers, tourism, shipping traffic and other oil and gas activities).

The following marine users have been identified as potential marine users of the operational area:

+ commercial fisheries;
+ traditional fisheries;
+ recreational fishers;
+ petroleum industry; and
+ commercial shipping.

These users may be temporarily displaced by the physical presence of the MODU, ISV and support vessels during the activity.

6.5.2.1 Commercial Fisheries

A number of state and commonwealth fisheries overlap the operational area (refer to **Section 3.2.6.3**). There are three commonwealth fisheries that overlap the operational area; Western Tuna and Billfish Fishery; Southern Bluefin Tuna Fishery and Western Skipjack Tuna Fishery (**Section 3.2.6.3**). An analysis of the historical fishing effort data, current fishery closures, depth range of activity, fishing methods and consultation feedback (refer to **Section 4**) has revealed that there is a low potential for interaction with Commonwealth commercial fisheries. None of the Commonwealth fisheries identified in **Section 3.2.6.3** are likely to be active in the operational area. There are three state managed fisheries that overlap the operational area and which have been active (according to FishCube data collected from 2015 until 2020; DPIRD, 2022) over the operational area. These fisheries include Pilbara Demersal Scalefish Fisheries (trap fishery), Pilbara Line Fishery and Mackerel Managed Fishery (**Table 3-12**). Therefore, there is potential for interaction with these State commercial fisheries.

Potential impacts to commercial fisheries will likely be operational inconveniences such as short-term displacement from fishing grounds during the activity. Displacement of fisheries from fishing grounds due to the presence of the operational area is expected to be minimal and temporary due to the short duration of the activity. The operational area intersects the Pilbara Demersal Scalefish Fisheries (trap and trawl fisheries), overlapping the closed zone of the Pilbara Fish Trawl Interim Managed Fishery, however, this area is open to trap fishing. There is potential for longer term impacts to the trap fishery, Pilbara Line Fishery and Mackerel Managed Fishery which have a low level of activity in the operational area since 2015 (**Section 3.2.6.3**). Permanent infrastructure that will be in place until the facility is decommissioned presents a snag risk to trawl fisheries and therefore excludes these activities from occurring in the area, should the closed area of the Pilbara Fish Trawl Interim Managed Fishery become open to trawling in the future.

However, as the activity is being conducted next to existing infrastructure trap and trawl fishers are unlikely to be historically targeting this area due to the increased risk of gear entanglement, damage and loss. Line fishers may be displaced for a very short time, and once the activity is completed in approximately 65 days, fishing activities can resume.

There may be cumulative impacts to commercial fisheries from concurrent drilling and installation activities. However, given the low level of commercial fishing expected, any potential impacts to commercial fishing vessels in the operational area would be localised over the short duration of the activity with no lasting impact.

6.5.2.2 Traditional Fisheries

Indigenous subsistence fishing may occur in shallow waters, close to the coastline outside of the operational area, and therefore interactions with vessels will not occur. Consultation with First Nations Peoples has raised no concerns about the activity.

6.5.2.3 Recreational Fisheries

Fishing may occur in waters surrounding the Montebello Islands, Varanus Island and Barrow Island. Due to the distance offshore it is unlikely recreational fishing and tourism activities will take place within the operational area. Recreational fishing and tourism is likely to occur within shallower waters closer to the mainland coast inshore and south of the Montebello Islands. Activities are likely to be concentrated closer to and around significant features such as shallow water reefs, which are absent from the operational area. Consultation with recreational fishers has raised no concerns about the activity. Recreational fishers welcomed leaving suitable assets in-situ for artificial reefs if they deliver equal or better environmental outcomes compared to complete removal.

6.5.2.4 Tourism and recreation

Sites of interest to tourists include places to fish, areas for sightseeing and secluded locations for general relaxation. Most of the tourism and recreation activities are confined to coastal areas and islands, plus luxury cruises that take tourists along the coastline and increasingly out to isolated coral atolls for fishing and diving (Gaughan and Santoro, 2018). Charter vessels usually visit the northern parts of the marine conservation reserves between April and November and most of these visits centre around the Montebello Islands, tourism activities around Barrow Island are rare. Interaction with these activities and the operational area are unlikely to occur especially considering the in-force PSZ surrounding the offshore petroleum assets. As such, impacts to tourism are not expected. Consultation with tour operators raised no concerns regarding the activity.

6.5.2.5 Petroleum Industry

Petroleum-related activities are located within the Carnarvon Basin, which is a highly developed petroleum province. Activities are undertaken as a regular occurrence in the surrounding waters. All petroleum-related activities within WA-13-L are Santos-operated. As such, no impacts to other oil and gas operators are expected. Chevron, operator of the Barrow Island Gas Field, requested for any work planned is executed during the cyclone season, a cyclone anchor configuration, as well as mooring design, site specific geophysical and geotechnical data, anchor analysis, risk mitigations to inform Chevron Australia of the potential risks to Chevron assets within the affected leases. Consultation with the majority of other operators has raised no concerns about the activity.

6.5.2.6 Commercial Shipping

In the Pilbara region there is significant commercial shipping activity, the majority of which is associated with the mining and oil and gas industry. The Australian Maritime Safety Authority (AMSA) has introduced a network of commercial shipping fairways to reduce the risk of vessel collisions with offshore infrastructure and the operational area does not overlap any of these designated shipping fairways. However, there is still potential for interaction with and displacement of commercial fishing for the duration of drilling and installation activities.

6.5.3 Environmental Performance Outcomes and Control Measures

Environmental Performance Outcomes (EPOs) relating to this event include:

+ Reduce impacts on other marine users through the provisions of information to relevant stakeholders such that they can plan for their activities and avoid unexpected interference [H2-EPO-01]

The Control Measures considered for this activity are shown in **Table 6-18** with Environmental Performance Standards (EPS) and Measurement Criteria for the EPOs described in **Section 8**.

Table 6-18: Control measures evaluation for Interaction with Other Marine Users

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-DC-CM-002 H2-IC-CM-002	Lighting will be used as required for safe work conditions and navigational purposes	Ensures the vessels are seen by other marine users. Reduces the risk of collisions with other marine users.	No additional costs to Santos. Standard requirement for vessel navigation lighting and equipment to be compliant with COLREGS /	**Adopted** – The safety benefits of having navigation and lighting equipment and procedures outweighs any cost. This is a

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			Marine Orders 30: Prevention of Collisions, and with Marine Orders 21: Safety of Navigation and Emergency Procedures.	maritime requirement.
H2-DC-CM-014 H2-IC-CM-012	Seafarer certification	Requires appropriately trained and competent personnel to navigate vessels to reduce interaction with other marine users.	Costs associated with personnel time in obtaining qualifications.	**Adopted** – Benefits considered to outweigh costs and is a legislated requirement.
H2-DC-CM-008 H2-IC-CM-007	Marine Assurance Standard	Ensures contracted vessels are operated, maintained and manned in accordance with industry standards and regulatory requirements (this EP) and the relevant Santos procedures mentioned in this EP.	No additional cost.	**Adopted** – Benefits considered to outweigh costs.
H2-DC-CM-015 H2-IC-CM-013	Support vessel	Minimises risk of collision through visual identification and avoidance of other vessels	Negligible costs	**Adopted** – Benefits considered to outweigh costs.
H2-DC-CM-016 H2-IC-CM-014	Santos stakeholder consultation strategy	Ensures other marine users, such as commercial fisheries, are aware of upcoming operations so they can plan their business	Limited additional costs to Santos. Stakeholders time required to review consultation material and	**Adopted** – Benefits considered to outweigh negligible costs. Important control to ensure other

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		accordingly and impacts can be minimised.	communicate with Santos.	marine users are aware of upcoming operations and potential business disruptions. Provides an opportunity for Santos and stakeholders to discuss additional ways of minimising on-water interference and business disruptions.
H2-DC-CM-017 H2-IC-CM-015	Maritime Notices	Ensures other marine users are aware of the presence of vessels.	Costs associated with the personnel time in issuing notifications and closing out queries and responses.	**Adopted** – Benefits considered to outweigh negligible costs. Maritime requirement to issue maritime notices.
H2-DC-CM-018	MODU identification system	MODU has Automatic Identification System to aid in their detection at sea.	Negligible costs of operating navigational equipment. Standard equipment on MODU.	**Adopted** – Benefits considered to outweigh negligible costs to Santos.
H2-DC-CM-019	Exclusion zone established around the MODU and ISV	Reduces potential for collision or interference with other marine user activities	Negligible costs, standard industry practice	**Adopted** – Benefits considered to outweigh negligible costs to Santos
H2-DC-CM-020	Pre-lay anchors are marked with surface buoys when MODU is not connected	Increases visibility over infrastructure so that other marine users can avoid the area	Cost associated with installation of buoys	**Adopted** – cost of installation is less than the benefits to

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
				other marine users.
H2-IC-CM-016	Navigational charting of infrastructure.	Offshore facilities and subsea infrastructure, including permanently and temporarily abandoned wells, is charted on Australian Hydrographic Service nautical charts.	No additional costs to Santos. Other marine users may be temporarily excluded from areas, disrupting their interests	**Adopted** – The positive benefits of identifying subsea infrastructure to other marine users outweigh the process of arranging their charting with Australian Hydrographic
H2-DC-CM-0 H2-IC-CM-017	No fishing from MODU, ISV or support vessels	Reduce potential impacts to fisheries in the vicinity of the activity. Personnel are prohibited from recreational fishing activities on MODU, ISV or support vessels.	Negligible costs.	**Adopted** – Benefits considered to outweigh negligible costs to Santos.
Additional Control Measures				
N/A	Eliminate the use of vessels and MODU	Would eliminate potential impacts to other marine users.	Not considered feasible as vessels and MODU are the only form of transport that can undertake the activities.	**Rejected** – Not feasible as vessels and MODU are required to complete the activities.
N/A	Manage the timing of the activity to avoid peak marine user periods (e.g., tourism, fishing)	Would eliminate potential impacts to other marine users.	Not considered feasible as marine users could potentially be in the area all year round. The area that stakeholders are excluded from is small when compared to the area available to	**Rejected** – Stakeholders and shipping in the area all year round. Cost grossly disproportionate to low socio-economic benefit, given the location of the activity has

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			other marine users, and there is low fishing activity in the area as evidenced through consultation.	low usage by commercial fisheries or areas of tourism.
N/A	Avoidance of other active marine users, where safe to do so	The key marine vessels don't have the ability to avoid other vessels under own propulsion when on station for project activities, in the unlikely event that interaction with marine user requires a primary vessel to avoid other user. Note primary controls around stakeholder engagement and navigational lighting will suffice this control to not be implemented.	Additional costs as the ISV will need to be stationary and not able to move from position. If move from position is required, this may delay the activity.	**Rejected** – Not feasible as ISV will need to be stationary. However, primary controls to avoid other marine users is thorough stakeholder engagement.
N/A	Support vessel in place/on standby during installation (ISV) activities	Identifies and communicates with approaching third-party vessels to ensure exclusion (safety) zone is observed, preventing potential interaction or interference.	Significant additional costs of contracting a dedicated support vessel.	**Rejected –** Significant cost of a dedicated support vessel on standby for the duration of installation activities outweighs the negligible environmental benefit.

6.5.4 Environmental Impact Assessment

Receptor	Consequence Level
Threatened, migratory or local fauna	Not applicable – related to socio-economic receptors only
Physical environment or habitat	
Threatened ecological communities	
Protected areas	Not applicable – No protected areas within immediate vicinity of the operational area.
Socio-economic receptors	The impact of the MODU, ISV and support vessel operations on socio-economic receptors are considered to be Negligible (I) due to the fact that: + the MODU, ISV and subsea infrastructure will not be positioned within an AMSA defined shipping fairway; + Operational area is not located within AMSA defined shipping fairway; + vessels could be expected to divert around the operational area but this would be a temporary exclusion given the duration of the activity; + tourism activities are not expected to occur in the operational area given the water depth, lack of seafloor features and distance from shore; + the operational area is not extensively fished – commercially, traditionally or recreationally. The presence of subsea infrastructure (well head, flexible flowline and associated equipment) is not expected to present a hazard to commercial fisherman, considering that no trawl fishing occurs within the operational area. The Mackerel Managed Fishery and Pilbara Line Fishery are line fisheries and are unlikely to target pelagic species near the seabed; + other operators may have vessels traversing the region that will need to avoid the operational area to access exploration and development sites, but the scale of exclusion area is small (500 m temporary safety exclusion zone around the MODU and ISV) and duration of the activities; + any cumulative impacts from concurrent activities would be localized with no lasting impacts; + additional controls to ensure communication of activity details and PSZ (MODU)or Safety Exclusion Zone (ISV) and communication with active fishermen are in place; + stakeholder consultation and a review of recent shipping data did not raise any concerns regarding disruptions to commercial shipping or other oil and gas operators; + all installed subsea equipment will be marked on nautical charts; + interaction with trawl operators is unlikely as the operational area intersects with Zone 1 of the fishery which has been closed since 1998, and is unlikely to reopen during the activity; and + EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country.

Receptor	Consequence Level
	The consequence level is assessed as I – Negligible
Overall worst-case consequence	I – Negligible

6.5.5 Demonstration of As Low As Reasonably Practicable

There are no alternatives to the use of a MODU, ISV and support vessels to undertake the activity and a 500 m temporary safety exclusion zone around the MODU is required in accordance with the OPGGS Act. In addition, a 500 m temporary safety exclusion zone will established around the ISV. Other navigational controls, as specified in the Navigation Act, will also be implemented (lighting, communication aids and charting) during the activity and for permanent infrastructure. If the management controls are adhered to, then the risk of interacting with other users of the sea will have been reduced to ALARP.

Santos' stakeholder consultation process is described in **Section 4**. Throughout the duration of EP preparation, details of the activity have been communicated to relevant stakeholders as appropriate. In consultation, stakeholders are made aware of the proposed area from which other marine users may be excluded for the duration of the activity, and the potential schedule. Notice to Mariners will be issued detailing the location and nature of activities and the vessels will maintain navigation aids.

WAFIC raised concerns regarding displacement of fishers, however the proposed activities are being conducted next to existing infrastructure and trap and trawl fishers are historically unlikely to be targeting this area due to the increased risk of gear entanglement, damage and loss. Nevertheless, due to the short duration and temporary nature of the drilling and installation activities the activity will be completed within 65 days and line fishing activities can resume. Additionally, maritime notices will be issued regards the activity reducing the likelihood of interactions. Santos' HSE induction for the activity will reinforce no fishing from the MODU and all project vessels. Santos considers any potential concerns have therefore been addressed.

With the controls adopted, the assessed residual consequence for this impact is negligible and cannot be reduced further. Additional control measures were considered but rejected since the associated cost/effort was grossly disproportionate to any benefit as detailed above. Therefore, it is considered that the impact is ALARP.

6.5.6 Demonstration of Acceptability

Table 6-19: Acceptability evaluation – Interaction with Other Marine Users

Is the consequence ranked as I (Negligible) or II (Minor)	Yes – maximum consequence from interaction with other marine users is I -Negligible.
Is further information required in 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' Environmental Hazard Identification and Assessment Procedure (EA-91-IG-00004), which considers principles of ESD. The residual consequence of the impact for this aspect is negligible and therefore does not affect

	the outcomes of the principles of ecologically sustainable development as per **Table 5-5**.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – management consistent with Safety of Life at Sea (SOLAS) 1974 and *Navigation Act 2012*.
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes. Previous feedback from AMSA advised project vessels: + Exhibit appropriate lights and shapes to reflect the nature of operations. + Set navigation status correctly in the ship's Automatic Identification System (AIS) unit. WAFIC raised concerns that there are no management measures in place to address fishing displacement and further information on the controls in place to ensure all equipment can be fully removed in the future. Santos has addressed the impacts of interactions with marine users and fishing displacement from the activity in **Section 6.5** (Interactions with Other Marine Users) and has committed to no fishing from MODU, ISV or support vessels. Fishers may be displaced for a very short time, and once the activity is completed in approximately 65 days, line fishing activities can resume. Santos has adopted an additional control whereby all equipment installed on the seabed is designed such that it can be fully removed during decommissioning. Santos considers these concerns to have been addressed within **Section 3** and **Section 6.5** and in the environmental performance outcomes assessment and control measures assessment (**Section 6.5.3**; **Table 8-2**), including as per the Activity Notification and Reporting Requirements (**Table 8-5**).
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above.

The presence of the MODU, ISV, support vessels and permanent infrastructure is not expected to significantly affect other marine users, including commercial fishing operations, recreational vessels or shipping traffic, given:

- the existing (gazetted) PSZ (500 m) surrounding the MODU and ISV is a small exclusion zone in the context of the wider areas for commercial fishing, shipping transit and navigation. The PSZ's will be relinquished on completion of operations activities;
- short duration and temporary nature of the drilling and installation activities;
  - the activity will be completed within 65 days and line fishing activities can resume. The activity is being conducted next to existing infrastructure trap and trawl fishers are unlikely to be historically targeting this area due to the increased risk of gear entanglement, damage and loss.
- all installed infrastructure will be marked on navigational charts; and
- Feedback from Recfishwest identified some structures may be suitable for artificial reefs compared to the complete removal.

Therefore, the impacts on marine users is considered ALARP and acceptable.

6.6 Operational Discharges

6.6.1 Description of Event

Event	Potential impacts may occur in the operational area from the following operational discharges from the MODU, ISV and support vessels: + sewage and grey water; + putrescible wastes; + deck drainage; + cooling water; + bilge water; + brine; + ballast water; and + fire-fighting foam during routine testing. **Sewage and Grey Water** The volume of sewage and grey water is proportional to the number of persons onboard the MODU, ISV and support vessels. Up to 30 to 40 L of sewage/grey water will be generated per person per day. Approximately 140 persons will be onboard the MODU, 100 persons will be onboard the ISV and 18 persons will be onboard the other vessels (up to four vessels, total of 72 persons). Therefore it is estimated 12,480 L/day will be produced for 312 persons. Sewage may be disposed of in accordance with Marine Order 96 (Marine pollution prevention – sewage), which gives effect to Annex IV of MARPOL, Chapter 4 of the *Navigation Act 2012* and Division 2 of Part IIIB (prevention of pollution by sewage) of the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*. **Food Waste** Approximately 1 L of putrescible waste (e.g., food scraps) per person per day may be discharged to the sea. Putrescible wastes will be discharged in accordance with Annex V of MARPOL and Part IIIC (prevention of pollution by garbage) of the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*. **Deck Drainage** Deck drainage from the MODU, ISV and support vessels consists of rainwater, sea spray and deck wash. Deck drainage will be discharged directly to the sea. Deck drainage may contain traces of contaminants, such as oil, grease and detergents, that are routinely used on deck. Controls will be in place for high risk areas (e.g., chemical storage areas) to prevent harmful discharges of deck wash. **Cooling Water** Seawater may be used as a heat exchange medium for cooling of machinery, such as combustion engines. Seawater used for cooling will be drawn from the sea and pumped through heat exchanges, transferring heat to the seawater which is then discharged to the sea. Cooling water may be dosed with biocide. Biocides discharged to sea will be subject to the chemical selection process described in **Section 2.8**. **Bilge Water** The MODU, ISV and support vessels may discharge water that has collected in bilge water. Bilge water, such as water collected from machinery spaces, may contain traces of oil and grease. Bilge water discharges to sea will be treated with a MARPOL-certified oily water separation system to less than 15 parts per million oil, in accordance with

	Part II (prevention of pollution by oil) of the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, which gives effect to Annex I of MARPOL. **Brine** Brine generated from the water supply systems on board the MODU, ISV and support vessels will be discharged to the ocean at a salinity of approximately 10% higher than seawater. The volume of the discharge depends on the requirement for fresh (or potable) water and will vary depending on the freshwater consumption requirements. The effluent may contain residual scale inhibitors that control inorganic scale formation in water-making plants. Other water purification chemicals such as chlorine may also be added to potable water. Other water-making plant cleaning chemicals such as Ameroyal or Saf Acid may be used and discharged to sea after completion of the cleaning process. **Ballast Water** Ballast water could potentially be discharged to the marine environment from the MODU, ISV or support vessels ballast tanks. Ballast water is a potential vector for the translocation of invasive marine species. Refer to **Section 7.2** for details on the risk of introduction of IMS. **Fire Fighting Foam** During routine testing that could occur during the activity aqueous firefighting foam (AFFF) could be discharged from the foam tanks over each area covered by an AFFF firefighting system. It is unavoidable that some of this foam will be discharged to sea unless it is discharged within a closed bunding system.
Extent	Operational discharges may cause sort-term, localised decreases in water quality, such as nutrient enrichment, organic and particulate loading, toxic effects in marine fauna, thermal impacts and increased salinity in waters around discharge point. The environment that may be affected by operational discharges will be contained within the operational area and typically restricted to within approximately 100 m of the discharge point in the upper 5 m of the water column.
Duration	Operational discharges will occur throughout the drilling and installation activities. The receiving environment will return to natural conditions within minutes to hours of cessation of discharges due to dilution.

6.6.2 Nature and Scale of Environmental Impacts

Potential receptors: water quality, marine fauna, plankton

6.6.2.1 Water quality

Small volumes of operational discharges will be released to the marine environment and result in a localised reduction in water quality. The discharge of small volumes of non-hazardous wastes to the marine environment will result in a localised reduction in water quality. Discharges will be temporary and when required, localised and limited to surface waters (less than 5 m depth). The discharges are expected to be dispersed and diluted rapidly, with concentrations of wastes significantly dropping with distance from the discharge point. Changes to ambient water quality outside of the operational area are considered unlikely to occur.

6.6.2.1.1 Nutrients

The discharge of food wastes treated sewage and grey water can result in localised increases in nutrient concentrations (e.g., nitrogen, phosphorus and carbon). Increased nutrients may promote the growth of phytoplankton, and organic matter may increase the biological oxygen demand in the receiving waters.

In a study of sewage discharge from a range of vessels, Loehr et al. (2006) reported that discharges from vessels with crew sizes similar to the ISV and support vessels diluted rapidly and posed little environmental risk. Studies of sewage plume dilution by Parnell (2003) found similar results when examining sewage discharges from outfalls, with discharges mixing rapidly in the environment with no apparent significant increase in nutrients of chlorophyll.

Given the well-mixed, highly oxygenated surface waters receiving putrescible waste and sewage discharges and the controls that will be implemented (e.g., vessels only discharge sewage when underway), changes in nutrients will be short-term and highly localised, resulting in negligible consequence.

6.6.2.1.2 Salinity

Brine discharged from reverse osmosis systems will be approximately 10% more saline than the receiving waters. This brine is denser than seawater and hence will sink upon discharge to the sea, which will promote mixing and dilution of the brine. Discharges that include volumes of freshwater (e.g., grey water) will tend to be buoyant relative to the receiving environment, where they will be amenable to mixing processes in surface water (e.g., wind-driven and tidal currents).

Salinity of surface waters in the North West Shelf varies naturally due to evaporation (which increases salinity) and precipitation (which decreases salinity). Organisms in the environment are naturally adapted to variations in salinity.

Brine and freshwater discharges will dilute and mix rapidly in the environment, and the biota within the receiving environment are adapted to natural variations in salinity. Consequently, the impacts of changes in salinity will be localised and short-term, with return to natural conditions expected to occur with minutes to hours of the discharge ceasing. These impacts have negligible environmental consequence.

6.6.2.1.3 Temperature

Cooling water will be discharged at a temperature above ambient seawater temperature. Upon discharge the thermal plume with mix with the receiving waters, dissipating the heat in the environment. Wind shear on the surface water in the area can persist for extended periods and result in long trajectories, such surface winds also contribute to dissipating heat from the water (**Section 3.2.1**).

Water temperatures, particularly in surface waters, vary naturally seasonally and diurnally. Marine biota are adapted to changes in temperature within the range naturally experienced. Thermal stress of approximately 5 °C above the maximum natural temperature has been demonstrated to induce mortality in copepods in a laboratory setting, however the effect could not be detected in response to cooling water discharge in the natural environment (Choi et al., 2012). Choi et al. (2012) suggested this was due to rapid mixing of the cooling water upon release to the receiving waters.

Woodside Energy Limited (2011) commissioned cooling water discharge modelling for a development concept for the Browse field. The modelled discharge was substantially greater in volume than would be discharged during the activities, and approximately 20 °C above the receiving water temperature. The modelling indicated that the range at which temperature would be reduced to ≤ 3 °C was within

21 m of the discharge point under median ambient flow conditions. This indicates thermal pollution from cooling water discharges during the activities will be limited to within tens of metres from the discharge point. These impacts will be limited to when the MODU, ISV and support vessels are in the operational area. Given the localised and temporary nature, environmental impacts to water temperature will be negligible.

6.6.2.1.4 Toxicants

Operational discharges may contain traces of potential toxicants, such as biocides in cooling water, AFFF and residual hydrocarbons in bilge water. The concentration of potential toxicants in operational discharges will be low due to the nature of such discharges (e.g., deck wash is largely water, bilge water is treated prior to discharge etc.). As described above, utility discharges will dilute rapidly upon release to the environment and the potential for toxic effects to biota will be limited to the immediate vicinity of the discharge location, resulting in negligible impact.

6.6.2.2 Biological Environment

6.6.2.2.1 Fauna

Marine fauna which could be exposed to operational discharges include fish, marine mammals, marine reptiles, diving seabirds and zooplankton (considered below in **Section 6.6.2.2.2**). Given wastewater discharges will primarily occur near the sea surface and will mix rapidly following discharge, pelagic fauna that are at or near the sea surface are most likely to be exposed to wastewater streams. The spatial extent of impacts to water quality are limited to within tens to hundreds of metres of the operational discharge location. The temporal extent of these impacts is limited to during the discharge and shortly after the discharge ceases.

Fishes and seabirds may be attracted to discharged food scraps and sewage, which are a food source for these taxa. This attraction is a short-term behavioural impact that will be limited to around the discharge point during the activities and will have no lasting effect.

Changes in salinity due to operational discharges may induce behavioural responses in fauna, such as avoidance of plumes. Given such plumes will mix rapidly, potential behavioural impacts will be localised to within the discharge plume and temporary in nature.

Elevated water temperatures have the potential to induce minor physical stress in marine fauna. These alterations may cause a variety of effects, ranging from behavioural responses (including attraction and avoidance behaviour), minor stress and potential mortality for prolonged exposure (Walkuska and Wilczek, 2010). Given the nature of thermal pollution from cooling water and the unconstrained open water receiving environment, impacts to fauna from changes in water temperature will be limited to short-term behavioural changes within the plume.

Air-breathing marine fauna, such as turtles, cetaceans and seabirds, are generally resistant to potential contaminants in operational discharges as their skin forms an impermeable barrier, and thus no toxic effects are expected to air-breathing fauna. Fish may be more vulnerable as their gills may form a large area through which potential contaminants may be exchanged. 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. Mobile organisms such as fish and marine mammals and reptiles may detect and avoid areas with harmful levels of potential contaminants such as chlorine and hydrocarbons (Abarnou and Miossec, 1992; International Tanker Owners Pollution Federation, 2011).

Impacts to fauna from operational discharges will be limited to behavioural responses, such as avoidance or attraction. These responses will be limited to within the vicinity of the discharge location while the discharge is occurring. As a result, only a very small portion of marine fauna populations could credibly be affected. As such, impacts to fauna from operational discharges are negligible.

6.6.2.2.2 Plankton

Planktonic organisms have limited ability to avoid plumes from operational discharges compared to nektonic species. As a result, planktonic fauna will not exhibit behavioural responses that reduce their exposure to operational discharge plumes.

Many marine species have planktonic larval phases, typically the result of the production of very high numbers of offspring (i.e., an r-selection life history). Planktonic larval phases may be more susceptible to impacts of increased salinity than adults (Neuparth et al., 2002). Early life stages of fish (embryos and larvae) and other plankton may also be susceptible to toxic exposure from residual toxicants in operational discharges. However, planktonic organisms are expected to rapidly recover once background water quality is re-established (International Tanker Owners Pollution Federation, 2011), as they are known to be widely distributed, have high levels of natural mortality and a rapid replacement rate (Joint Group of Experts on the Scientific Aspects of Marine Pollution, 1984). The potential impacts of operational discharges on plankton are expected to be short-term and localised, and hence are negligible.

6.6.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to operational discharges are:

+ Reduce impacts to air and water quality from planned discharges and emissions from the activities [H2-EPO-06]

Control measures considered for operational discharges are shown in **Table 6-20**, with associated EPS and measurement criteria shown in **Table 8-2**.

Table 6-20: Control measures evaluation – Operational Discharges

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-DC-CM-022 H2-IC-CM-018	Waste (garbage) management procedure	Reduces probability of garbage being discharged to sea, reducing potential impacts to marine fauna. Stipulates putrescible waste disposal conditions and limitations. Provides compliance with Marine Order 95 (Marine pollution prevention – garbage).	Personnel cost of pre-mobilisation audits and inspections, and in reporting discharge levels	**Adopted** – Benefits of ensuring vessels are compliant outweigh the minimal costs of personnel time and it is a legislated requirement.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
H2-DC-CM-023 H2-IC-CM-019	Deck cleaning and product selection	Improves water quality of discharge (reduced toxicity) to the marine environment. Deck cleaning products planned to be released to sea meet the criteria for not being harmful to the marine environment according to MARPOL Annex V.	Personnel costs of implementing, potential additional cost and delays of chemical substitution.	**Adopted** – Benefits of ensuring vessels are compliant and deck cleaning products planned to be released to sea meet MARPOL criteria.
H2-DC-CM-024 H2-IC-CM-020	Chemical selection procedure	Improves water quality discharge (reduced toxicity) to the marine environment.	Personnel costs of implementing potential additional cost and delays of chemical substitution.	**Adopted –** Benefits of ensuring vessel is compliance outweigh the minimal costs.
H2-DC-CM-025 H2-IC-CM-021	General chemical management procedures	Reduces potential for inappropriate discharge of chemicals at sea through appropriate handling.	Personnel costs associated with vessel inspection and implementation of management procedures.	**Adopted** – Benefits of ensuring vessel is compliant outweigh the minimal costs of personnel time and it is a legislated requirement.
H2-DC-CM-026 H2-IC-CM-022	Sewage treatment system	Reduces potential impacts of inappropriate discharge of sewage. Provides compliance with Marine Order 96 (Marine pollution prevention – sewage).	Personnel cost in ensuring vessel certificates are in place during vessel contracting and in pre-mobilisation audits and inspections, and in reporting discharge levels.	**Adopted** – Benefits of ensuring vessel is compliant outweigh the minimal costs of personnel time and it is a legislated requirement.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
H2-DC-CM-027 H2-IC-CM-023	Oily water treatment system	Reduces potential impacts of planned discharge of oily water to the environment. Provides compliance with Marine Order 91 (Marine pollution prevention – oil).	Time and personnel costs in maintaining oil record book.	**Adopted** – Benefits of ensuring vessel is compliant outweigh the minimal costs of personnel time and it is a legislated requirement.
Additional Control Measures				
N/A	Do not test AFFF containing firefighting equipment on MODU, ISV and support vessels	Would eliminate the discharge of the small quantities of AFFF.	Increased safety risk due to potentially untested AFFF system. Inability to fight fire effectively.	**Rejected** – Safety consideration s outweigh the environment al benefit given
N/A	Restrict use of desalination plant	Would eliminate potential impacts from brine discharges by importing potable water	Cost associated with transporting potable water. Health risks associated with limited supply of potable water.	**Rejected** – Cost outweighs the benefit, given the low impact expected from planned discharges and high potential impacts from risk transfer.
N/A	Re-design desalination plant effluent discharge system	Limited benefit to be gained given desalination brine will be diluted.	High costs associated with modifications to vessels. May not be feasible with some vessels. Salinity difference would be minimal compared to significant cost of altering the desalination	**Rejected** – Cost grossly disproportion ate to environment al benefit. Limited benefit to be gained, given low impact. Minimal detectable change in water quality

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			plant effluent discharge system.	expected. Water making and brine discharge permitted maritime practice.

6.6.4 Environmental Impact Assessment

Receptor	Consequence Level
Threatened, migratory or local fauna	Sensitive receptors that may be impacted include fish at surface, marine turtles and mammals, and seabirds. As the activity is located in an open oceanic environment where tides and currents would quickly dilute and disperse the planned discharges. Any effects on water quality are expected to be within the surface waters only and have no effect on seabed receptors. Impacts will be limited to short-term water quality impacts and temporary behavioural effects observed in fish, sharks and seabirds. Impacts to water quality will be experienced in the discharge mixing zone which will be localised and will occur only as long as the discharges occur (i.e., no sustained impacts), therefore recovery will be measured in hours to days. Consequently, only short-term behavioural impacts are expected with no decrease in local population size/area of occupancy of species/loss or disruption of habitat critical/ disruption to the breeding cycle/introduction of disease. No planned operational discharges will occur within areas known to be used by third-party operators or for tourism and recreation. EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country. Given the nature of the planned operational discharges, the small volumes that could be released to the marine environment, the high levels of dilution and the nature of the marine environment in the vicinity of the operational area, the consequence level is assessed as I – Negligible.
Physical environment or habitat	
Socio-economic receptors	
Threatened ecological communities	Not applicable – No threatened ecological communities identified in the area over which operational discharges are expected.
Protected areas	Not applicable – No protected areas within immediate vicinity of the operational area.
Overall worst-case consequence	I – Negligible

6.6.5 Demonstration of As Low As Reasonably Practicable

A MODU, ISV and support vessels are required to undertake the activity. The alternative to discharging these small amounts of liquid wastes to the marine environment is to store and transport the wastes to land, where they would be disposed of in line with industry best practice. However, 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 (for example, incineration, treatment, etc) of the additional wastes. This method would also result in an increased risk of vessel-to-vessel collision, which could lead to a marine diesel spill. Therefore, this option would be of no net environmental benefit and would increase the risk associated with the activity, so it has not been adopted. In some cases, the containment of discharges is difficult without significant modifications to vessels and the MODU (e.g. additional bunding or containment systems) presenting an increase in safety risk to personnel through the reduction in deck space, increased lifts and health hazards of storing wastes or other discharges.

The use of AFFF for emergency purposes requires routine testing of that foam fire-fighting system is critical for emergency response. Given the product will be assessed through the Drilling Fluid and Chemical Selection in Drilling Activities Procedure (EA-91-II-00007), potential impacts will be reduced.

To reduce the impacts and risks associated with discharging liquid wastes, these wastes will be treated in line with industry best practice. Discharge of sewage and other liquid wastes from vessels in Australian waters is permissible under the Protection of the Sea (Prevention of Pollution from Ships) Act 1983, which reflects requirements of MARPOL 73/78 Annexes IV, V and I and AMSA Marine Orders 95 and 96.

On-board treatment of most wastes and their subsequent discharge to the marine environment is considered to be the most environmentally sound method of disposal, considering that the waste streams will either be treated to a level unlikely to cause significant environmental harm or will be of a nature not considered to pose significant risk to the receiving environment. The proposed management controls for planned operational discharges are considered appropriate to manage the risk to ALARP. Additional control measures were considered but rejected since the associated cost or effort was grossly disproportionate to any benefit. Therefore, it is considered that the impact of operational discharges is ALARP.

6.6.6 Demonstration of Acceptability

Table 6-21: Acceptability evaluation – Operational Discharges

Is the consequence ranked as I (Negligible) or II (Minor)	Yes – maximum planned operational discharge consequence is rated I – Negligible.
Is further information required in 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' Environmental Hazard Identification and Assessment Procedure (EA-91-IG-00004), which considers principles of ESD. The residual consequence of the impact for this aspect is negligible and therefore does not affect the outcomes of the principles of ecologically sustainable development as per **Table 5-5**.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans,	Yes – management consistent with the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, which in Australian waters is enacted by the Marine Orders.

conservation advice and Australian Marine Park zoning objectives)?	Yes —IUCN principles of nearby reserves are met.
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – no concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above.

Release of non-hazardous discharges into the sea from vessels in Australian waters is permissible under the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, which in Australian waters reflects Australian Marine Orders requirements respectively, and is enacted by:

+ Marine Order 91 (Marine pollution prevention – oil);
+ Marine Order 96 (Marine pollution prevention – sewage); and
+ Marine Order 95 (Marine pollution prevention – garbage).

The operational discharges are not expected to significantly impact the receiving environment given the management controls proposed, including compliance with all relevant Marine Orders requirements. The Marine Orders are considered to be the most appropriate standard given that the nature and scale of the events is expected to reduce the potential for environmental impacts to a level that is considered ALARP and environmentally acceptable.

6.7 Drilling Discharges

6.7.1 Description of Event

Event	Potential impacts from drilling and cement discharges may occur in the operational area from: + drilled solids or cuttings; + drilling fluids; + lost circulation materials; + brines; + cement (set or unset); + hydraulic fluid from the BOP; + other miscellaneous chemicals and additives such as tracer dyes and cement spacer; and + formation water during well testing [up to 160m^3]. During the activity, the following estimated and approximate discharge volumes could be expected for the single well activity: + 350 m^3 of drill cuttings discharged to seabed (riserless surface hole section); + 175 m^3 of WBM based drill cuttings discharged at sea surface (remaining well sections); + 175 m^3 of NAF based drill cuttings discharged at sea surface (if contingency NAF used; there will be no bulk discharges of NAF); + 1,800 m^3 of water-based drilling fluids discharged at sea surface; + 3,500 m^3 of seawater/gel sweeps/mud discharged at seabed (riserless surface hole section); + 300 m^3 of brine; + approximately 40 m^3 of cement (wet) discharged to seabed; + less than 15 m^3 of cement (wet or set) discharged at sea surface (i.e., cement spacer, flushing tanks and lines); + 100 m^3 of cement (wet) discharged at sea surface or 250 m^3 at the seabed in the event of a cement job not meeting technical and safety standards; + 70 m^3 of each stock cement/bentonite/brine at the end of the well in the event the stocks cannot be re-used/sold; + aqueous-based lost circulation material (LCM) may also be pumped downhole at times; and + tracer dyes may also be used during cementing operations and for equipment leak detection. Cuttings discharge volumes are calculated based on the expected section sizes and lengths and include some contingency. The total volume of drilling fluid and cement is an estimate based on previous drilling and completion programs. There are many variables during drilling campaigns that could cause the above mentioned volumes to change, for example re-spud or side-tracking could be required and/or the interval length could change. Some of these variations could cause the estimated discharge volumes to increase or decrease, in particular the need for re-spud or side-track double the estimated volumes.

	Santos intends to keep unmixed bulk cement, barite, bentonite, and brine on-board the MODU at the end of the drilling program. In the event that this activity is the final well in the rig schedule, these substances will be disposed of according to the decision list in **Table 6-22**.
Extent	Drill cuttings and fluids during riserless drilling of the surface hole section will be discharged to the seabed around the wellhead. Drill cuttings and fluids from sections below the surface hole will be discharged from the MODU. Drilling discharges with larger particle sizes such as large drill cuttings are expected to settle below the discharge point, whereas discharges with finer particles such as drilling muds could be carried with prevailing currents before settling. The seabed area affected by drill cuttings is expected to extend up to 1 km from the source, with higher concentrations expected to be restricted to within 50 m of the well. The finer particles associated with bulk discharges of unused products if they can't be re-used or sold at the end of the campaign, may settle several kilometres from the well. Turbidity from drilling-related discharges is expected to affect water quality down current the well location, albeit during a relatively short period of time. Any formation water produced during well testing would be discharged to the marine environment following water treatment. The volume of formation water is unknown at this stage. The discharge will be limited to the duration of the well test.
Duration	Intermittent during drilling activities.

6.7.1.1 Drilling Activities

The activity is planned to use WBM for all hole sections, although NAF may be used as a contingency for sections of the well if WBM cannot meet technical requirements for effective drilling.

WBM and cuttings will be discharged at the seabed for the riser-less top-hole sections of the well. Once the surface casing, high pressure riser and BOP are installed, thereby establishing a closed circulating system, the remainder of the well will be drilled with a weighted brine/shale inhibited drilling fluid.

Cuttings produced during drilling with the riser in place will be discharged from the MODU following treatment by the solids control equipment. While much of the drilling fluid will be recovered by the solids control equipment, residual drilling fluids will be discharged with the cuttings. The WBM will be discharged from the MODU at sea surface from surface storage tanks/mud pits when no longer required. NAF will be retained onboard the MODU (except for residual NAF on cuttings) for onshore disposal.

The WBM will be comprised of water or brine (greater than 90% aqueous) as the major liquid phase. The remainder of the WBM will be made up of low toxicity drilling fluid solid additives (e.g., barite) and chemicals that are either completely inert or additives in such low concentrations they pose little or no risk to the environment.

As detailed in **Section 2.5.4**, the fluids and components of the drilling and completion fluids will be selected in accordance with the Santos Drilling Chemical Selection and Approval Process (EA-91-II-00007) to ensure that environmentally acceptable products are used or the risks can be demonstrated to be ALARP from the use of other chemicals.

6.7.1.2 Cement Activities

Cement will be used to form permanent barriers and fix casings in place prior to drilling ahead with subsequent sections in the well. Cement in the annular space between casing and formation will form a seal to ensure the circulation system remains closed. Cement may also be used to seal a lost circulation zone and plug the wells from which a sidetrack may be drilled.

The majority of cement pumped remains downhole, but minor volumes may be discharged at the seabed (when cementing the conductor or surface casing) or at surface (when flushing lines or tanks). Some cement may be mixed and dumped as part of cement unit commissioning prior to the start of a campaign if the cement unit/pump has not been used before or in a considerable period of time.

During cementing operations, surface cementing equipment and lines will need to be flushed, washed and cleaned with water to prevent hard setting. The residual cement and wash water will be discharged to sea after each cement job.

Tracer dyes may be used during cementing operations for detection purposes. While transferring dry bulk cement, minor solids will be vented to air to prevent tank over-pressuring.

6.7.1.3 Drilling Fluids and Chemical Selection

All drilling fluids and chemicals (e.g., additives) will be selected in accordance with the Santos Drilling Fluid and Chemical Selection in Drilling Activities Procedure (EA-91-II-00007). The procedure is intended to select products that pose acceptable impacts to the environment while meeting technical requirements for safe and effective drilling. The procedure considers rankings under the OCSN and the PLONOR list maintained by the OSPAR Commission, which consider the potential toxicity, biodegradability and bioaccumulation of drilling fluids and chemicals. Refer to **Section 2.8** for a description of the chemical selection process.

6.7.1.4 Solids Control Equipment

The well will be drilled in sections or intervals (e.g., top hole, surface, intermediate and production). The top hole and surface sections will be drilled riserless, with all cuttings and fluids discharged directly to sea at the wellhead.

The remaining well sections will be drilled with a closed loop circulating system with all drilled solids and well returns managed via the MODU solids control equipment. Drill cuttings will typically be removed via shale shakers and centrifuges (as required) and discharged to sea surface. WBM fluids will be re-circulated downhole, stored for future if practicable, or discharged to sea surface if no longer required. Shale shakers are comprised of a series of vibrating shaker screens.

If contingency NAF are required, the NAF separated by solids control equipment will be retained onboard for onshore disposal. The shale shaker screens are sized so that valuable drilling fluid (i.e., liquid and fine solids) passes through ('underflow') and drilled cuttings/solids do not ('overflow'). The shaker screens will meet American Petroleum Institute (API) standard, providing a level of confidence that the screens will perform to a specific separation limit (e.g., particle size cut point, etc). The selected shaker screen cut points (API screen sizes) will be as small as possible, so the maximum drilled solids removal efficiency is achieved. A cuttings dryer package will also be used to further reduce NAF on cuttings prior to discharge of cuttings.

Centrifuges may be used to remove ultra-fine solids in the recovered drilling fluid (i.e., once surface hole section casing installed). The ultra-fine solids are detrimental to the drilling fluid properties due to increased surface area and reactivity. Centrifuges do not process all the well returns. Given the large volume, it is not practicable to centrifuge the entire drilling fluids system. Hence, a portion of the drilling fluid recovered from the shakers may be sent to the centrifuges where the higher G forces facilitate removal of finer particles.

6.7.1.5 Lost Circulation Material

Lost circulation can occur in any hole interval and varies in severity. Lost circulation occurs when the drilling fluid flows into natural geological fissures, fractures or caverns. In the surface interval, when drilling riserless, it is often not necessary to take any action to cure the losses as they often self-cure once sufficient cuttings have entered the loss zone.

For losses that have to be cured, there is a choice of options available. Conventional LCM additives such as granular and fibrous material are usually pumped into the loss zone in the first instance. When conventional LCM additives fail to plug the loss zones it may be necessary to pump speciality lost circulation additives, such as cement or cross-linked polymers to heal the loss zones. By design the LCM enters the loss zone thereby plugging it and allowing drilling operations to re-commence. Typically, the LCM additives remain in the subsurface loss zone and do not return to surface. On some occasions the lost circulation is cured before all the material pumped enters the loss zone. When this occurs, the lost circulation material remains in the wellbore until it is usually circulated back to the surface where it is discharged along with the cuttings.

6.7.1.6 Residual Drilling Fluid Discharges

The conductor and surface hole sections will be drilled with seawater and pre-hydrated gel sweeps. These fluids will be mixed and blended on the MODU and stored in the surface mud storage tanks, or mud pits, until they are pumped downhole and discharged directly to the sea (top hole to seabed and surface hole from the conductor at sea level). Excess sweeps and mud will be retained in the surface mud pit system, in the event that it is required to be pumped while running surface casing. Once the surface casing is run and cemented, surface residual volumes will be discharged, due to incompatibility with the subsequent fluid system, to marine environment. The fluid would be discharged at the sea surface from the mud pit.

Once the surface casing string is installed, a drilling fluid system will be maintained until well TD. This mud system will be mixed and blended on the MODU and stored in the mud pits until pumped downhole and recycled via the conductor to the MODU continuously, assuming there are no sub-surface loss zones.

Consumed drilling fluid volume will be replenished as required to reach TD. Once TD is reached, the well will be displaced to a brine and/or pre-hydrated water-based mud to aid wellbore stability. Once TD is reached, and the well has been completed, residual WBM drilling fluids will be discharged to sea from the mud pit unless they can be used on a subsequent well. NAF will be retained onboard for onshore disposal.

6.7.1.7 Tank Cleaning

At stages during the activity, tanks may need to be cleaned, including mud pits (i.e., tanks used to mix and hold brine, sweeps, WBM or NAF), cement mixing/holding tanks and bulk storage tanks. Cleaning may be required to remove or flush ‘dead’ or residual volumes of WBM, or settled inert solid material and also if switching between WBM and NAF. The cement system will need to be flushed to prevent curing inside the cement unit and pipework after each cement job is completed. In most instances, tanks and pipework would be flushed with seawater or drill water and the diluted fluid discharged to sea surface. If NAF is used as a contingency and the tanks are cleaned, waste could contain up to 1% synthetic oil content.

6.7.1.8 Blowout Preventor and Xmas Tree Control Fluid Discharges

A BOP will be installed before drilling the production hole sections, and Xmas trees will be installed on the well once drilling is complete. The BOP and Xmas trees will be routinely checked by completing pressure and function testing. Each function test will release control fluid (approximately 60 to 600 L) to the marine environment. The control fluids are subject to the Santos Offshore Division Drilling Chemical Selection and Approval Process (EA-91-II-00007) described in **Section 2.8**.

6.7.1.9 Formation Water

Formation water which may be produced from the reservoir during well flowback and discharged to sea. This will notionally take 24 to 36 hrs pending well and surface process conditions. The non-flammable completion fluids and produced water will be treated via a water treatment package to reduce the oil-in-water content to < 30 mg/L before discharge to sea. Other chemicals such as methanol and MEG may also be injected into the flow stream and either flared or discharged to sea.

Water that has been condensed from the steam used to heat the fluids via a steam exchanger in the well flowback package will also be discharged to sea. It is estimated that approximately 100 m^3 of heated water at a notional temperature of 60 °C could be discharged to sea per well flowback. The discharge rate would be notionally 2 to 3 m^3 per hour.

6.7.1.10 Bulk Products

Once the well has been completed, or during an emergency (e.g. cyclone avoidance), unmixed bulk drilling fluid solid additives (barite and bentonite), dry cement and brine will be managed in accordance with the decision list in **Table 6-22**. For all scenarios in **Table 6-22** and specific to this activity, bulk powder cement, barite and bentonite will not be discharged to the sea.

Table 6-22: Decision list for managing bulk powders[3] and brines remaining on the MODU at the end of the well

Trigger	Fate of Stock	Reasoning
Well is not the last well in the MODU schedule and ongoing use of the product is anticipated.	**Retain stock** Stock will be retained on-board for use in the next well, or may be sent for temporary storage on a supply vessel. This option eliminates overboard disposal.	These products are expensive. Santos' preferred option is to use all stock in subsequent wells in the MODU schedule to minimise activity costs and reduce discharges.
Well is the last well in the MODU schedule and the next Operator is willing to buy the stock.	**Sell stock** Stock will be retained on-board or may be sent for temporary storage on a supply vessel for used by the next Operator.	It may be possible for Santos and the next Operator using the MODU to transfer ownership of the unmixed stock. The implementation of this option is dependent on demand and commercial agreements.

[3] Bulk powders include any of the following: barite, bentonite and cement

Trigger	Fate of Stock	Reasoning
	This option eliminates overboard disposal	
Well is the last well in the MODU schedule and selling the stock to the next Operator is not an option.	**Minimise stock** Santos will have measures in place to reduce the stock requiring disposal at the end of the activity.	Stock minimisation measures will be put in place without compromising the minimum bulk stock required for well control or dealing with lost circulation.
Well is the last well in the MODU schedule, selling the stock to the next Operator is not an option but another Santos operated MODU is in proximity and can take on stock.	**Transfer stock to alternative MODU** This option eliminates overboard disposal.	Stock can be transported to an alternate MODU dependent on: + whether Santos has another MODU operating in the region; + alternative MODU can use the product; + travel distance and cost associated with transporting the stock to the alternative MODU are not prohibitive; and + alternate MODU has the capacity to take on additional stock.

6.7.2 Nature and Scale of Environmental Impacts

Potential receptors: water quality, sediment quality, benthic habitat, and fauna.

Drilling and cement-related discharges will be intermittent during the activity. Their discharge to the marine environment, particularly discharges from the MODU, will result in a localised reduction in water and sediment quality, and smothering of benthic habitats.

6.7.2.1 Water Quality

Drilling solids (i.e., cuttings), cement and solid additives (e.g., barite, bentonite) will be discharged during the activity. Drill cuttings and retained drilling fluid discharges are expected to increase turbidity and TSS levels above ambient concentrations above the seabed (top-hole well sections) or in the upper surface layers (bottom-hole well sections with discharge below the water line from the MODU).

Conductor and surface well sections will be drilled riserless, hence drill cuttings and drilling fluids (WBM) will be discharged at the seabed. The relatively coarse material (drill cuttings) will deposit on the seabed and the finer sediment material (the WBM) will cause localised elevated TSS in the water column above the seabed surrounding the well. This reduction in water quality will be temporary (limited to the operational discharges during drilling) and subject to rapid dispersion and dilution by prevailing seabed currents.

During bottom-hole well sections, when drill cuttings with retained drilling fluids are discharged below the water line (from the MODU), the larger particles, representing about 90% of the mass of the solids, form a plume that drops out of suspension in the water column rapidly and, deposits on the seabed.

About 10% of the mass of the solids (the fines predominately composed of drilling fluid) form a plume in the upper surface layer (depending on the depth of discharge from the MODU) that will be transported by prevailing currents away from the MODU and is diluted rapidly in the receiving waters (Neff, 2010, 2005), as shown in **Figure 6-2**. Jones et al. (2021) found more than 95% of drill cuttings from wells comparable to Halyard-2 were greater than 1 mm in size, with the modelled and observed deposition zone for most cuttings being roughly circular. These findings are consistent with other results, such as Bakke et al. (2013) and Rye et al. (2006).

Cuttings with adhered fluids discharged from the MODU will dilute rapidly, with dilution of the drilling cuttings and fluid plume by a factor of at least 10,000 within 100 m of the discharge point (Neff, 2005). Further to that, Neff (2005) states that in well-mixed oceans waters, the plume is diluted by more than 100-fold within 10 m of the discharge site.

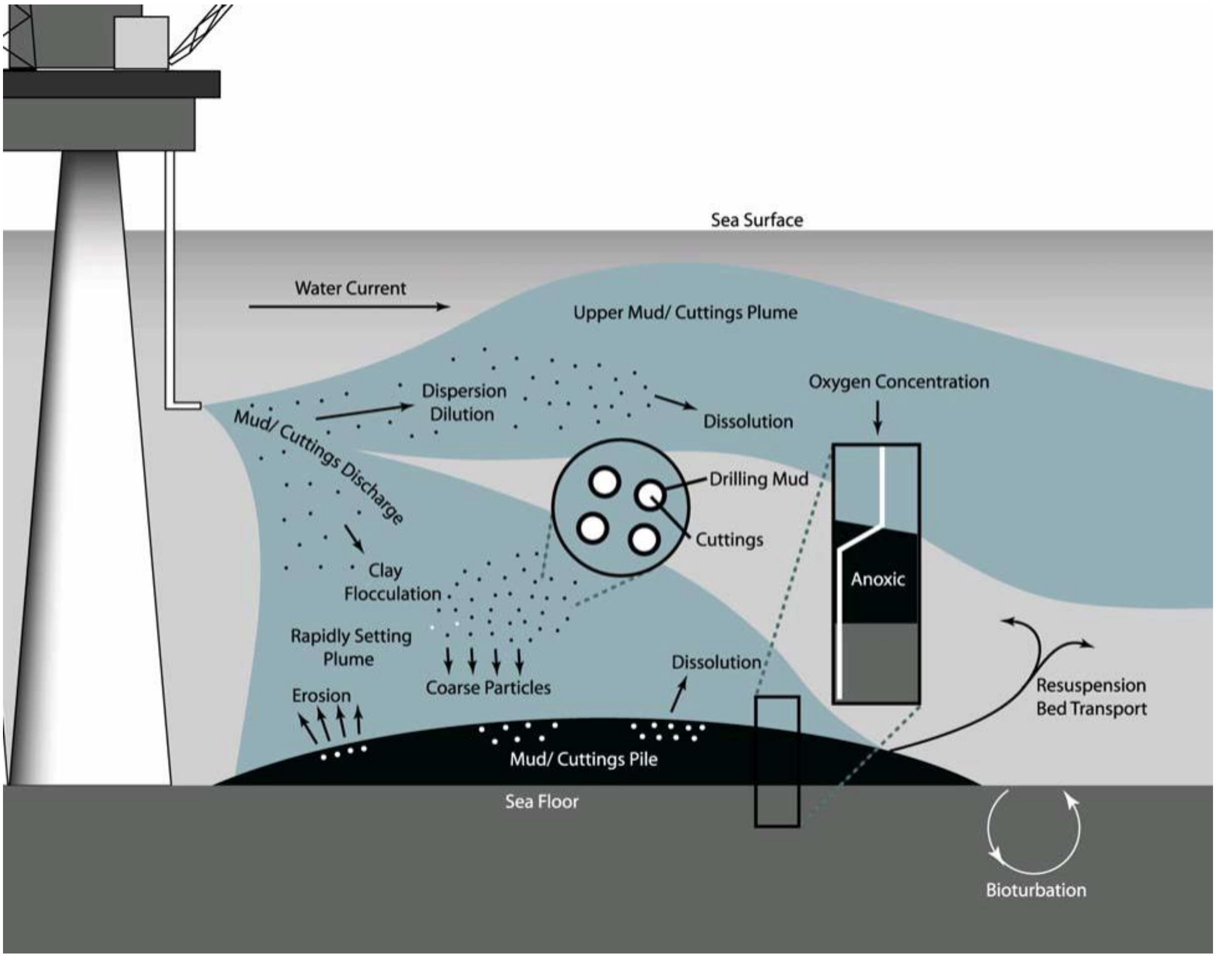

Figure 6.2: Conceptual model for the dispersion of WBM following discharge in the sea (from Neff, 2005)

Bulk discharge of WBM from the mud pits on the MODU, such as at the completion of drilling a section of the well, will result in a turbid plume extending from the discharge location. Unlike the discharge of drill cuttings, bulk discharge of WBM consists of liquids such as seawater or brine and fine solids such as clay-sized particles. The duration of bulk WBM discharges is typically much shorter than the discharge of drill cuttings. Bulk mud discharges will be denser than the receiving seawater and the resulting plume will be negatively buoyant. The plume is expected to turbulently mix as it billows and sinks towards the seabed. Jones et al. (2021) modelled and measured bulk discharges of WBM from drilling activities on the NWS and found intermittent pulsed total suspended solids concentrations of 10 mg/L could occur up to 1,000 m from the discharge location. For context, transient peak total suspended solids from the passage of cyclones and storms in tropical shallow water can exceed hundreds of milligrams per litre for a few hours (Abdul Wahab et al., 2017; Fisher et al., 2015). Hence, the turbidity caused by the bulk discharge of WBM will be comparable to natural turbidity pulses within hundreds of metres of the discharge location and will be limited to discrete pules of turbidity during bulk discharges.

Discharges of formation water may be required during well clean-up. Formation water will be treated by the water treatment equipment onboard the MODU to reduce oil in water concentrations to < 30 ppm. The volume of formation water discharged wis unknown, but will be limited to that required to complete the well clean-up.

The increase in total suspended solids in the water column due to the discharge of drill cuttings and fluids will reduce the penetration of light through the water column. Insufficient photosynthetically active radiation (PAR) reaches the seabed in the operational area to support benthic primary producer habitats (macroalgae, seagrasses, zooxanthellate coral etc.). Photosynthetic plankton may receive less PAR due to the increase in turbidity, resulting in a localised, short-term decrease in planktonic primary production.

Increased total suspended solids may also impact upon filter feeding organisms due to clogging of feeding apparatus. Pulses of increased turbidity occur naturally in the region and biological communities are adapted to, and constrained by, turbidity gradients in the region (Moustaka et al., 2018). Filter feeders in the water column include many planktonic fauna, such as copepods, which may experience a decrease in abundance due to impacts from increased total suspended solids. Planktonic communities are widely represented and have been shown to recover rapidly from disturbance, with large-scale oceanographic features driving much of their population dynamics (McKinnon et al., 2003).

Plumes of discharges drilling fluids may induce toxic effects due to chemicals in residual drilling fluids and contaminants from the cuttings. The potential for toxic effects is low given the rapid dilution of drilling fluids and cuttings and the chemical selection process which preferences low toxicity drilling additives. Residual NAF generally has inherently greater potential for toxicity than contemporary WBM; residual NAF tends to remain closely associated with cuttings and hence doesn't tend to be dispersed in the water column (International Association of Oil and Gas Producers, 2016). Modern

Nektonic fauna, such as fishes, turtles and cetaceans, are expected to avoid the plume in the water column, which will limit impacts to short-term behavioural disturbance.

The increase in turbidity near the seabed from discharge of drill cuttings and fluids will be relatively localised compared to the plume in the water column. Benthic filter feeders impacted by increased total suspended solids will be limited due to adaptation to naturally high pulses of turbidity but will be impacted by smothering from deposited cuttings and fluids (discussed below).

Residual fluids on drill cuttings may increase the biological oxygen demand due to microbial degradation of organic compounds. This effect will be negligible in the water column due to the well-mixed and highly oxygenated water column in the operational area.

Discharged formation water will have potential toxicants from the reservoir, such as residual hydrocarbons, dissolved solids (including metals) and nutrients. Formation water is typically warmer than the receiving waters and discharged near the sea surface and will mix with the receiving seawater. Toxicants in formation water may induce acute toxic effects in planktonic organisms within the plume, with the potential for toxic effects diminishing at the plume dilutes. Nektonic fauna, such as fishes, are expected to avoid the plume and hence are unlikely to experience toxic effects. Modelling and monitoring of produced formation water discharges from production facilities show that continuous discharges of relatively large volumes of produced water mix rapidly (Barnes et al., 2019). Harmful effects in the water column from such discharges are typically restricted to within several hundred metres of the discharge point (Barnes et al., 2019).

The impacts to water quality described above are short-term, restricted in spatial extent (i.e. within plumes), and recovery to natural conditions will occur within hours to days after discharges cease. These impacts are negligible when assessed using Santos' environmental consequence descriptions (**Table 5-2**).

6.7.2.2 Sediment Quality

The accumulation of cuttings will physically modify the sediments by modifying the particle size distribution. These cuttings will be largely comprised of cuttings that are relatively coarse compared to natural sediments. Coarse deposited sediments are unlikely to be resuspended by currents but may be distributed as bedload by high energy weather events such as cyclones. Finer sediments deposited further will likely be reworked by currents and transported as bedload or suspended sediments by tidal currents.

The residual WBM includes drilling fluid components such as metals – predominantly barium, a component of the commonly used weighting agent, barium sulphate – as well as residual organic matter. Drilling fluid components for WBM are selected to have a low toxicity and hence pose little impact to sediment quality. Residual organic material, such as guar gum, may support microbial degradation, which can result in temporary depletion of oxygen within the drill cuttings pile, although this is unlikely to impact upon biota as most biota under the cuttings pile will be lost from smothering.

If NAF is used, cuttings with residual NAF will clump together in large particles that settle rapidly to the seabed (International Association of Oil and Gas Producers, 2016; Neff et al., 2000) and will be concentrated around the release location. NAF may contain a range of synthetic hydrocarbons such as paraffins and olefins, which have low potential for toxicity and bioaccumulation but may persist in the environment. Modern NAF are formulated to have very low levels of polycyclic aromatic hydrocarbons (PAH), which substantially reduces the toxicity compared to historical NAF. Cuttings with residual NAF are expected to have a higher concentration of residual organic matter compared to WBM. The seabed affected by cuttings with residual NAF has greater potential for oxygen reduction via microbial degradation and associated changes to sediment chemistry.

Cement has negligible potential for toxic effects, and cement additives are subject to Santos' chemical selection requirements, which preference additives with low toxicity. Once hardened, discharges of excess cement slurry will effectively bind such additives within the cement As such, bulk discharge of cement will have negligible impact on sediment quality. Discharge of cement at the sea surface has not demonstrated significant harm to water column flora and fauna (Neff, 2005).

The processes of bioaccumulation, bioconcentration and biomagnification may result in increased concentrations of potential toxicants in organisms. These processes occur when substances accumulate in an organism faster than they can be eliminated (e.g., through prey species or from the abiotic environment). An extensive review by Gray (2002) found that biomagnification was less common in marine systems than terrestrial system, with many studies failing to show biomagnification (although may showed bioaccumulation – increased concentrations within an organisms during its life). Of the metals, Gray (2002) concluded that only organic mercury biomagnifies in food webs (particularly in lipids), with other metals being regulated and excreted. Mercury may be present in barite (barium sulphate) in the form of inorganic and insoluble mercuric sulphide, with concentrations varying substantially depending on the geological origin of the barite. The forms of mercury in barite have very low bioavailability, much lower than methylmercury, and pose little risk of biomagnification (Neff, 2008). The Santos Offshore Division Drilling Chemical Selection and Approval Process (EA-91-II-00007) preferences chemicals with low potential for toxicity and bioaccumulation. As such, biomagnification of toxicants to harmful levels is not considered credible.

6.7.2.3 Benthic Habitat

The discharge of drill cuttings and residual fluids has the potential to impact benthic communities, largely due to physical and chemical changes to sediments and water quality described above. Particularly, burial and smothering of benthic habitats from the discharge of drill cuttings will impact upon the existing benthic habitats at the drilling location. A review by Smit et al. (Smit et al., 2008) determined the hazardous concentration for 5% for burial effects on epifauna was 6.5 mm. Hence, burial depths less than this are unlikely to result in substantial changes to epifauna communities. The cuttings pile may reach a thickness of up to 1 m around the wellhead and below the MODU cuttings discharge point, however this thickness rapidly reduces away from these discharges. Recent modelling commissioning by Santos for the Spartan development (similar cuttings volumes and metocean conditions) indicated the thickness of deposition would be approximately 3 mm within 175 m of the discharge location, with cuttings distributed along the predominant current vector (RPS, 2021a). Given the localised area within which benthic communities would be impacted by smothering and the widespread nature of the benthic habitats and communities that would be lost, the loss of benthic habitats due to smothering is negligible.

Sessile benthic fauna and infauna within this deposition footprint may experience smothering that may result in mortality. The recovery of the area subject to deposition ≥ 10 mm thickness will potentially take many years, depending on natural sedimentary processes. Recovery may be linked to the deposition of relatively fine natural sediments on the coarse sediments in the cuttings pile to create suitable habitat. Studies of the recovery of benthic communities on visible cuttings piles – consistent with the area subject to drill cuttings and fluids deposition ≥ 10 mm – indicated considerable recovery within three years, particularly where deposition was thinner; however, the benthic communities had not yet recovered to be similar to pre discharge conditions or the surrounding unaffected seabed (Gates and Jones, 2012).

Benthic communities subject to deposition between 1 mm and 10 mm thickness are less likely to experience mortality but may experience sublethal impacts, such as impaired feeding due to clogging of filter feeding organs and increased energy expenditure from removing sediment from burrows (International Association of Oil and Gas Producers, 2016). Recognising sediment deposition from drill cuttings and fluids is in addition to natural processes, benthic communities subject to deposition of drill cuttings and fluids of < 1 mm thickness are unlikely to experience impacts from physical deposition of cuttings, as this thickness is consistent with natural sedimentary deposition rates.

Increased turbidity near the seabed due to the discharge of drilling fluids and cuttings is not expected to result in substantial impacts to benthic fauna beyond those caused by smothering. Near-bottom waters in the region naturally vary in turbidity. High energy metocean events, such as cyclones, can result in elevated levels of turbidity, to which the benthic communities are naturally adapted. Studies by Smit et al. (2008) found benthic biota were relatively insensitive to increased turbidity from drilling fluids and cuttings, particularly compared to planktonic biota.

Changes in sediment chemistry may impact upon benthic communities, particularly changes in oxygen demand from biodegradation of organic compounds in residual drilling fluids. Trannum et al. (2010) examined the effects of cuttings with residual WBM and found a significant reduction in abundance and diversity of benthic infauna as cuttings thickness increased, compared to natural sediment, and suggested changes in sediment chemistry were a significant factor. Increased oxygen demand resulting from aerobic degradation of organic compounds in the WBM were suggested as a cause, along with fluxes in silicon and phosphorous (Trannum et al., 2010). The effects at low sediment thickness (< 10 mm) were much less apparent than relatively high rates of burial. These results are consistent with findings from other investigations of potential impacts of WBM (Smit et al., 2006). The increased oxygen demand will diminish over time as organic material is consumed and will approach natural conditions.

6.7.2.4 Fauna

There are a range of marine fauna in the region, including cetaceans, marine reptiles, pelagic and demersal fishes, and seabirds (**Section 3.2.5**). These may be exposed to discharges of drilling fluids and cuttings, potentially resulting in physical and toxic effects. Impacts to sessile benthic fauna and infauna are considered above.

There are no known benthic habitats or features in the operational area that would result in the aggregation or occurrence of site attached marine fauna. Several BIAs overlap the operational area (**Section 3.2.5.1**), however they represent transitory use of the area (e.g., migration) and extent considerable distances away from the operational area. Marine fauna found in the water column, such as fish, marine mammals and marine reptiles, are expected to actively avoid discharge plumes and associated turbidity and toxicity within the water column.

Drilling fluids and cuttings discharges within the field development area are localised and rapidly dilute. Given fish, marine mammals and marine reptile species are highly mobile and transitory in nature, the impacts of these discharges are expected to be negligible. As impacts to fish are not expected from drilling cuttings and fluid discharges, indirect impacts to commercial fisheries are not expected.

6.7.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to drilling discharges are:

+ No unplanned objects, emissions or discharges to sea or air [H2-EPO-04];
+ Reduce impacts to air and water quality from planned discharges and emissions from the activities [H2-EPO-06]; and
+ Seabed disturbance limited to planned activities and defined locations within the operational area [H2-EPO-07].

Control measures considered for drilling discharges are shown in **Table 6-23**, with associated EPS and measurement criteria shown in **Table 8-2**.

Table 6-23: Control measures evaluation – Drilling Discharges

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-DC-CM-024	Chemical selection procedure	Aids in the process of chemical management that reduces the impact of drilling discharges to sea. Only environmentally acceptable products are used.	Cost associated with implementation of procedure. Range of chemicals reduced with potentially higher costs for alternative products.	**Adopted** – Environmental benefit of using lower toxicity chemicals outweigh procedural implementation costs.
H2-DC-CM-028	Cuttings management system	Reduces the concentration of drilling mud on cuttings prior to discharge while drilling with a closed circulating system, thereby reducing the total volume of mud lost to sea.	High cost associated with implementing procedure.	**Adopted** – Benefits of implementing procedure and measures implemented outweigh costs.
H2-DC-CM-029	Inventory control procedure	Restricts the type and volume of drilling discharges, and includes a decision-making framework for managing left-over bulk products (refer to **Table 6-22**).	High cost associated with implementing procedure.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh costs.
H2-DC-CM-007	Well test procedures	Ensures well testing fluids are appropriately managed and that oil-water content in formation water, if produced, is below 30 ppm.	Cost associated with implementation of procedure.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh costs
H2-DC-CM-030	Quality controls for Barite	Puts a limit on the contaminants within the barite, therefore reducing sediment contamination as a result of cuttings	Low cost associated with ensuring the barite selected by	**Adopted** – Environmental benefit of using a barite with lower

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		discharge or any future cuttings disturbance.	the drilling contractor meets the contaminant limits.	contaminant concentrations outweigh the implementation costs.
Additional Control Measures				
N/A	Eliminate the use of NAF	Reduces the potential environmental impacts of drill cuttings and fluids discharges.	NAF may be required to ensure safe and effective drilling, including wellbore stability.	**Rejected –** The drill cuttings and fluids are inherently low risk due to the chemical selection process and the solids control equipment onboard the MODU. Elimination of NAF may lead to intolerable risks to well integrity. NAF will only be used where technically justified.
N/A	Early establishment of closed circulating system	Establishes a closed circulating mud system, hence provides an opportunity to re-use drilling fluids, thereby reducing environmental discharges. Does not reduce the volume of drilled cuttings discharged to sea.	Cost associated with change to well design.	**Rejected** – A conductor reduces risk to well design by protecting the inner casings from the ocean.
N/A	Transportation of cuttings to shore for onshore treatment and disposal	Transfers the impact to the marine environment to the onshore environment. Onshore treatment of cuttings may introduce additional treatment measures	Cost associated with transportatio n and onshore management of cuttings. Transfer of risk from	**Rejected –** The drill cuttings and fluids are inherently low risk due to the chemical selection process and the solids control equipment

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			marine environment to terrestrial environment.	onboard the MODU. Transfer to shore for disposal results in little environmental benefit, while transferring the environmental risk to another location. The cost is grossly disproportionate to the environmental benefit.
H2-DC-CM-44	Decision list for managing bulk powders and brines remaining on the MODU at the end of the drilling campaign	Optimise resource recovery and reuse where possible	Administrative cost in identifying and assessing options.	**Adopted** – environmental benefits of ensuring procedures are followed outweigh administrative costs.
H2-DC-CM-45	No disposal of bulk cement, barite or bentonite at the end of the drilling campaign	The Minamata convention requires best available techniques be adopted when considering discharge of wastes that contain any mercury content. Stock barite is known to contain low levels of naturally occurring mercury and barite stocks are tested to ensure they meet the limits prescribed by API standards (Mercury (Hg): max 1 mg/kg (<1ppm) dry weight in stock barite). This limit supports the use of barite as a necessary drilling operations material and the associated operational discharges. Barite is an essential product for use in both drilling operations and as contingency for well control activities.	Cost associated with either the transportation and onshore management of barite or administrative cost in identifying and assessing for carry over/pass on to next operator.	**Adopted -** Given that there are credible alternatives to the discharge of these bulk materials at the end of the drilling campaign, the action of discharge is not seen as a best available technique under the Minamata convention. For this reason, bulk cement, barite and bentonite will not be discharged at the end of the activity. Environmental benefits of ensuring procedures are followed outweigh administrative costs.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		By eliminating the disposal of bulk barite at the end of drilling campaign, potential impacts associated with the trace amounts of heavy metals of concern (cadmium and mercury) within stock barite will not be discharged to the environment. This eliminates the potential impacts on the benthic environment and water quality. The elimination of discharge of cement, barite and bentonite is linked to end of activity, left over bulk materials only and does not restrict operational discharges. The operational discharge of cement, barite, bentonite is assessed in Section 6.6, with appropriate controls assessed below.		

6.7.4 Environmental Impact Assessment

Receptor	Consequence Level
Threatened, migratory or local fauna	No sensitive seabed features are known to occur within either operational area or in the area predicted to be contacted (directly or indirectly) by drilling discharges. The areas of seabed that will be impacted by the activity do not contain any significant or unique areas of benthic habitat. The benthic habitats within the operational area and the area predicted to be contacted by drilling discharges are broadly homogenous and widely represented in the region. Marine invertebrates may inhabit soft sediments and can contribute to the diet of some fauna. Non-coral benthic invertebrates may be present in the operational area and surrounds, including filter feeders such as sponges, soft corals, gorgonians, anemones and crinoids. However, there is not expected to be any significant areas of these. Furthermore, the area of soft sediment habitat that is potentially impacted is small compared to the amount of habitat available and therefore the disturbance is not expected to affect prey availability, or protected fauna species.

Receptor	Consequence Level
	Recovery of benthic communities from burial and organic enrichment occurs by recruitment of new colonists from planktonic larvae and immigration from adjacent undisturbed sediments. Ecological recovery usually begins shortly after the end of drilling and often is well advanced within a year. Full recovery may be delayed until concentrations of biodegradable organic matter decrease through microbial biodegradation to the point where surface layers of sediment are oxygenated. Habitat modification is identified as a potential threat to a number of marine fauna species in relevant recovery plans and conservation advice (**Table 3-11**). Impacts to threatened or migratory species will be temporary and the area potentially impacted is small compared to the size of the areas used by these species. Therefore, no long-term impacts to these species are expected. No decrease in local population size, area of occupancy of species, loss or disruption of critical habitat or disruption to the breeding cycle of any of these protected matters is expected. Mobile marine species are expected either to avoid turbid stretches of water or pass through with no significant impacts. The toxicity of WBM, formation water and cement is considered low and the potential for bioaccumulation of any toxic compounds is negligible. As with all chemicals selected for use in drilling operations by Santos, the chemicals chosen for the activity will be either CHARM rated Gold or Silver (or E or D OCNS) or risk assessed through the Chemical Risk Assessment process as being environmentally acceptable, reducing the likelihood of any impacts. The increased particle load in the water column could adversely affect respiratory efficiency of fish, although most visual orientated fish species would likely avoid the affected area. The operational area and surrounds are in a high-energy, well mixed open water environment and significant discharge plumes are not expected to occur outside of the areas directly adjacent to the operational area. Cumulative impacts from concurrent project activities will not occur. The consequence level is assessed as II – Minor, given the low toxicity of the drilling and cement discharges and there are no significant impacts expected to threatened and migratory fauna.
Physical environment or habitat	Local changes to soft sediment habitat will result from cuttings and associated drilling mud deposition near the MODU. Effects to benthic infauna communities from sedimentation and reduction in sediment quality resulting from drilling discharges have been determined to most likely be a result of smothering and a change in sediment texture as opposed to any toxicological effects, with increased clays and larger particles altering the habitat suitability for some species. Given the low toxicity of the materials to be discharged and the relatively small area predicted to be significantly smothered or have a reduction in sediment quality, overall impacts are considered to be minor to this habitat type and due to the loss of epifauna and infauna expected through smothering and release of drilling and cement discharges. The impacts are considered recoverable within months to years. For cement discharges, geomorphology of the habitat would be altered, with cement hardening over time and blanketing the existing habitat. Although

Receptor	Consequence Level
	impacts on the form of the seabed and sediment quality in the immediate vicinity of the MODU will be longer term, the impacts are low in magnitude owing to the small area that would be affected. Impact is anticipated to be detectable but insignificant to local population. The consequence level is assessed as II – Minor.
Threatened ecological communities	Not applicable – No threatened ecological communities are identified in the area where discharge effects could occur.
Protected areas	Not applicable – No protected areas within immediate vicinity of the operational area.
Socio-economic receptors	Impacts to commercial fishing are likely to be negligible, with important commercial species unlikely to be affected by drilling discharges due to the temporary nature of the discharges, rapid dilution of the plume and lack of significant seabed features in the area. Impacts to tourism and recreation are unlikely, given these activities occur in shallower water, closer to shore and distant from the potential area of impact from drilling discharges. The Department of Planning Lands and Heritage advised Santos their review of the proposed activity area against the Aboriginal Cultural Heritage Directory confirmed the project area does not intersect with any known Aboriginal Cultural Heritage. EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country. No stakeholder concerns have been raised regarding this event. Overall, the consequence to socio-economic receptors from drilling and cement discharges is assessed as I (Negligible).
Overall worst-case consequence level	II- Minor

6.7.5 Demonstration of As Low As Reasonably Practicable

Drilling and cementing is a requirement of the activity and the resultant discharges to the environment cannot reasonably be eliminated. With the control measures adopted to minimise the environmental impact of drilling discharges, the consequence was assessed as Minor (II). In particular, the application of Santos' Drilling Fluid and Chemical Selection in Drilling Activities Procedure (EA-91-II-00007), so that only environmentally acceptable products are used, ensures the impacts to the environment will not be significant.

Santos uses a risk-based approach to selecting chemical products ranked under the OCNS as described in **Section 2.8**. Santos' Drilling Fluid and Chemical Selection in Drilling Activities Procedure (EA-91-II-00007) requires that chemicals for use and discharge are CHARM rated Gold or Silver, or non-CHARM rated E or D. Any chemicals which are not OCNS CHARM or non-CHARM-able rated are risk assessed through the procedure (EA 91 II 00007) to provide for a product that is environmentally acceptable for discharge to the marine environment.

If the activity is the last on the MODU schedule, residual bulk powders will be managed in accordance with **Table 6-22.** The commitment to not discharge any residual drilling fluids at all during the drilling program was rejected because of the high alternative disposal costs and the low potential for environmental impact in the operational area and surrounding environment. The discharge of drilling fluids and other chemicals to the marine environment is seen as the most viable management method for this waste stream. In addition, control measures have been adopted to reduce the impact of the waste stream to the marine environment (including the Montebello AMP) to a minor consequence, including processing the return fluids and on board the MODU prior to disposal, mixing chemicals to further dilute them (e.g., as a slurry) prior to discharge and selecting chemicals using the chemical selection procedure.

Where possible, produced water will be burned with the flared hydrocarbon produced during well testing, eliminating the discharge of produced water to the marine environment. If any formation water is unable to be flared, it will be discharged to the marine environment following processing. MARPOL Annex I (Regulation 15 and 39) is not appropriate to use for maximum oil in water concentrations for formation water, as it applies to the discharge of oil from machinery spaces on ships (defines the discharge requirement of the oil in water content to not exceed 15 ppm). MARPOL Annex I (Regulation 56) states for fixed/floating platforms (which includes MODUs) that only the discharge of machinery space drainage and contaminated ballast should be subject to MARPOL 73/78, and that discharges including production water discharge, are not subject to these regulations.

The well test equipment including the treatment system to remove oil is a separate system to the MODU's MARPOL-compliant oily water treatment system. The additional volume of oil introduced to the marine environment comparing an oil in water (OIW) concentration of 30 ppm rather than 15 ppm would be small. The estimated total oil volume at 30 ppm concentration and 15 ppm concentration for 55 m^3 of discharge would be less than two litres and less than one litre respectively.

To meet an OIW discharge of 15 ppm, a specialised water treatment tank (to enable re-treatment and storage of the water to reach 15 ppm) would need to be mobilised to the MODU before the well test. The tank would consume valuable open deck space desirable for safe working conditions, including crew egress. The additional cost to hire the tank, as well as additional filtration cartridges, is estimated at greater than $50,000 AUD.

Monitoring of PFW discharge at the Stag platform (previously operated by Santos) shows that the discharge of produced formation water does not significantly affect water quality. At a distance of more than 50 m from the Stag discharge point, the PFW could not be differentiated from background conditions in the marine environment. The hydrocarbon and metal concentrations were also below all 95% species protection guidelines provided by the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Commonwealth of Australia and New Zealand Government, 2018). These results indicate that there is no significant impact from the release of produced formation water at the Stag facility. Given produced formation water discharges from production facilities are substantially greater than the volumes of formation water discharges during Halyard-2 drilling, the associated impacts from Halyard-2 will be negligible.

Given the lack of sensitive receptors in the operational area and surrounding environment, Santos considers that there is negligible environmental benefit to reduce the OIW content of the PFW further (i.e., to less than 15 ppm, less than one litre of oil for the well test) prior to PFW discharge from well testing. Given the potential reduction of oil discharge to the marine environment, for an additional cost greater than $50,000 AUD Santos considers this cost to be disproportionate given the negligible environment consequence, therefore the OIW concentration of 30 ppm is ALARP for potential discharge volumes associated with the activity.

With the control and management measures adopted, the assessed residual consequence for this impact is Minor (II). Additional control measures were considered but rejected since the associated cost or effort was grossly disproportionate to any benefit. Therefore, it is considered that the impact from drilling and cement discharges is ALARP.

6.7.6 Demonstration of Acceptability

The consequences of drilling discharges on receptors is assessment as II – Minor. Based on an assessment of Santos' acceptability criteria and with the control measures in place (**Table 6-24**), potential impacts are considered acceptable.

Table 6-24: Acceptability evaluation – Drilling Discharges

Is the consequence ranked as I (Negligible) or II (Minor)	Yes – maximum consequence from drilling discharges is II – Minor.
Is further information required in the consequence assessment?	No – potential impacts are well understood through the information available.
Are risks and impacts consistent with the principles of ESD?	Yes – activity evaluated in accordance with Santos' *Environmental Hazard Identification and Assessment Procedure* which considers principles of ESD.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – no contact with sensitive habitats or protected areas predicted. Consistent with relevant species recovery plans, conservation management plans and management actions set out in **Table 3-11**.
Are risks and Impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy
Are risks and impacts consistent with stakeholder expectations?	Yes. The WA Museum advised Santos not to undertake activities that will have, direct or indirect adverse impact on protected underwater cultural heritage (UCH) without a permit and suggested to consult with Traditional Owners where appropriate if the project involves seabed disturbance in water shallower than 130m. The Department of Planning Lands and Heritage advised Santos it had undertaken a review of the proposed activity area against the Aboriginal Cultural Heritage Directory and confirmed the project area does not intersect with any known Aboriginal Cultural Heritage. There are no protected zones and no known sites of underwater heritage have been identified within the operational area **Section 3.2.6.2**). Santos has addressed the impacts of drilling discharges on seabed disturbance and impacts to benthic habitats from the activity **Section 6.7**

	(Drilling Discharges) and has committed to reduce impacts to the seabed from the proposed activities through: + Cuttings management system; and + Inventory control procedure. WA Museum requested Santos to Notify regulators of the discovery of any suspected UCH identified during the planning, development, operation, or decommissioning phases of a project within 21 days of the discovery. Santos considers these concerns to have been addressed within **Section 3** and **Section 4** and in the environmental performance outcomes assessment and control measures assessment (**Section 6.7.3; Table 8-2**), including as per the Activity Notification and Reporting Requirements (**Table 8-5**).
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above

The use of drilling fluids and solid additives, and the generation of drilling discharges, is an unavoidable part of the drilling program. It is accepted industry practice to discharge cuttings to sea, along with any associated water-based drilling fluids. Water quality and benthic impacts will be highly localised and largely concentrated immediately around the surface hole location and MODU. The operational areas are not located close to any sensitive nearshore habitats.

The drilling activity will use WBM drilling fluids which are either completely inert or have additives in such low concentrations they pose little or no risk to the environment. NAF drilling fluids may also be used as a contingency. However, the drill cuttings and fluids are inherently low risk due to the chemical selection process and the solids control equipment onboard the MODU. The application of the chemical selection procedure for drilling and cementing chemicals is an important control measure for reducing the toxicity of drilling discharges to the marine environment. In accordance with the procedure, CHARM-rated Gold/Silver and non-CHARM grouped E/D chemicals managed under the OCNS, or PLONOR substances listed by OSPAR, or chemicals risk assessed by Santos and deemed environmentally acceptable, will be selected for the drilling program.

Drilling discharges are not expected to result in significant impacts to the values and sensitivities of the Montebello AMP and are not considered inconsistent with the North-west Marine Park Network Management Plan. Drilling discharges will not prevent biologically important activities for marine turtles, nor displace flatback turtles from areas considered critical to their survival, and are therefore, are not considered inconsistent with the Recovery Plan for Marine Turtles.

With control measures in place to minimise the environmental impact of drilling discharges, the consequence was assessed as Minor (II) and ALARP. The managed discharges will not reduce the habitat values of the area potentially affected as described in relevant Recovery Plans, Approved Conservation Advice or North-west Marine Park Network Management Plan, or be inconsistent with the strategies of these documents. No concerns have been raised regarding this event by stakeholders. Therefore, the minor impacts expected from proposed drilling discharges are considered to be environmentally acceptable.

6.8 Subsea Infrastructure Discharges

6.8.1 Description of Event

Event	**<u>BOP Operation</u>** Operation of the BOP (e.g., during function testing required by the WOMP) will release of approximately 2-5 L of hydraulic fluid. **<u>Leak Testing</u>** Leak testing may release small (<10 L) quantities of treated seawater. **<u>Electronic Hydraulic Flying Lead Tie-in</u>** The HFL cores will contain MEG-water mixture and hydraulic fluid prior to loadout and installation. HFL multi quick connectors have poppet valves, which limit the amount of fluid that may be lost during connection (< 10 L). **<u>Valve Operation</u>** Once the subsea system is fully installed and leak tested, the valves on the Xmas tree will be functioned to demonstrate operability. During the valve operations (closing) hydraulic fluid will be released due to the open loop system design. Approximately 2-5 L of hydraulic fluid is released per valve, resulting in a total of approximately 25 L released during cold commissioning. **<u>Spool Installation</u>** The production spool will free flood during installation Nitrogen may be inserted into the spool to reduce corrosion risks prior to start up. Chemical sticks may be installed into the XT and PLEM hubs prior to spool connection, during which a small quantity of treated seawater will be released at the seabed near the Halyard-2 Xmas tree and the production manifold. When the Xmas tree pressure cap is removed to install the spool, there will be small release of approximately 10 L preservation fluid. **<u>ROV Operations</u>** ROV operations may result in small releases of hydraulic fluid of approximately 1 L during hot stab operations.
Extent	Chemicals and hydraulic fluids may be discharged to the marine environment from the surface or close to the seabed. Discharges will be small in volume and dissipate quickly in the open ocean marine environment. Temporary localised decline in water quality in the immediate vicinity of the discharge and toxicity to marine fauna.
Duration	Various chemical and hydraulic discharges will occur intermittently for the duration of the activity, and will last for minutes to several hours over the course of the activity.

6.8.1.1 Hydraulic fluids

Hydraulic fluids are used extensively in the petroleum industry in subsea production systems. Hydraulic fluids are either petroleum- or water-based blends with additives. The main properties required of a hydraulic control fluid are low viscosity, low compressibility, corrosion protection, resistance to microbiological attack, and compatibility with seawater. Hydraulic fluids are subject to the Santos Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) and Santos Drilling Fluid and Chemical Selection in Drilling Activities Procedure (EA-91-II-00007) described in **Section 2.8**.

6.8.1.2 Treated Seawater

Treated seawater will contain a biocide, likely to be Hydrosure O-3670R a common biocide used in the offshore oil and gas industry–- or similar. Although biocides typically contain a substance (quaternary ammonium chloride) which is known to be very toxic to aquatic organisms, the concentration is typically very low less than 30%) within the biocide itself as a whole. While toxic, quaternary ammonium is consumed rapidly biodegraded in the environment and does not bioaccumulate. Oxygen scavengers, such as sodium sulphite, chemically combine with available oxygen. While not inherently toxic, they consume oxygen.

6.8.1.3 Monoethylene Glycol (MEG)

MEG has low toxicity, is readily biodegradable and is rated as posing little or no risk to the environment (PLONOR) and E (non-CHARM) in the OCNS rankings. Therefore, it is likely that any impacts to benthic fauna and water quality will be highly localised, if occurring at all.

6.8.2 Nature and Scale of Environmental Impacts

Potential Receptors: Water quality and marine fauna.

6.8.2.1 Water Quality

Discharges of hydraulic fluids, preservation fluids and MEG will result in a localised decrease in water quality. On discharge to the marine environment, the low volumes of hydraulic fluids, treated seawater and MEG will rapidly disperse in the offshore marine environment. There may be a localised and temporary (hours) reduction in water quality in the immediate vicinity of the release. Toxicity impacts to marine fauna from the release of chemicals are unlikely to eventuate because:

+ the chemicals will have been risk assessed for their suitability for discharge using Operations Chemical Selection Evaluation and Approval Procedure (EA-91-II-10001);
+ quaternary ammonium and MEG are readily biodegradable;
+ the water column is well-oxygenated, hence residual oxygen scavenger will be rapidly consumed;
+ the receiving environment that may be affected is widely represented in the region and is of low sensitivity;
+ the discharge volumes are relatively small (typically < 10 L) and are separated in time; and
+ water movement will facilitate dilution of releases.

Consequently, environmental receptors that may be impacted by a decrease in water quality are within 10's of metres of the release location at the seabed. The sandy unconsolidated sediment habitat and associated biota are well represented in the region.

6.8.2.2 Marine Fauna

Subsea infrastructure discharges occur at or near the seabed and the area within which water quality is decreased is relatively small. This, along with the water depth (ranging from approximately 95 m – 125 m), precludes many species of threatened or migratory fauna coming into contact with subsea discharges as such fauna are typically at or near the sea surface (e.g., seabirds and cetaceans). Fishes exposed to the discharges are reasonably expected to move away from harmful concentrations of chemicals, which would limit impacts to short-term displacement.

6.8.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event include:

+ Reduce impacts to air and water quality from planned discharges and emissions from the activities [H2-EPO-06]

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 EPS and measurement criteria which are presented in **Table 8-2**. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Table 6-25: Control measures evaluation –- Subsea Infrastructure Discharges

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-IC-CM-020	Chemical selection procedure	Ensures that planned discharges to sea meet the criteria for not being harmful to the marine environment according to MARPOL Annex V; or Gold/Silver/D or E rated through OCNS; or have a completed Santos ecotoxicological risk assessment so that only environmentally acceptable products are used.	Personnel time associated with chemical selection, approval and procurement as per chemical selection procedure.	**Adopted** – the environmental benefits outweigh minor costs.
H2-IC-CM-024	Displace hydrocarbons in the Halyard-1 spool with MEG prior to breaking containment for removal	Reduces hydrocarbon concentration of discharge.	Cost of flushing activity	**Adopted** – the cost of displacing hydrocarbons from the infrastructure is less than the environmental benefit to be gained.
Additional Control Measures				
N/A	Flushing the Halyard-1 spool with treated water	Flushing with treated water may be effective in	Significant additional cost. Flushing of the	**Rejected** – Santos experience indicates flushing

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
	prior to breaking containment for removal	reducing residual oil concentration prior to breaking containment	Halyard-1 spool would require a dedicated vessel and flushing spread. Connecting a flushing spread directly to the Halyard XT introduces safety risks to the vessel personnel (connection of a downline to the production system of the XT will be a MAE in the safety case).	up to three volumes of the spool would displace most of the residual hydrocarbons. Residual hydrocarbons in the small volume of the spool (total spool volume < 1 m^3) would have negligible environmental impact. Cost and additional safety risk of control is grossly disproportionate to environmental benefit.

6.8.4 Environmental Impact Assessment

Receptor	Consequence Level
Threatened, migratory or local fauna Physical environment or habitat	Planned subsea infrastructure discharges have the potential to cause a localised decrease in water quality. Any effects on water quality are expected to be localised to within 10's of metres of the discharge point due to the small volumes involved and the open, well-mixed receiving water. Impacts to fauna will be a potential short-term displacement of fauna within the plume. Recovery to natural conditions will occur within hours. The consequence level is assessed as II – Minor.
Socio-economic receptors	Planned chemical and hydrocarbon discharges are not expected to impact fishery resources (demersal fish species) and are unlikely to result in changes in distribution and abundance of fish species outside the operational area. EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country. The consequence level is assessed as I – Negligible.
Threatened ecological communities	Not applicable – no threatened ecological communities credibly impacted by discharge plume.
Protected areas	Not applicable – no protected areas credibly impacted by discharge plume.
Overall worst-case consequence	II–- Minor

6.8.5 Demonstration of As Low As Reasonably Practicable

Subsea discharges routinely occur during the operation of equipment and are critical in preventing high consequence environmental impacts from occurring (e.g., preventing loss of containment due to corrosion or loss of well control). The controls in place to manage the nature and scale of subsea discharges manage the volumes released to the ocean to ALARP. The assessed residual consequence for this impact is minor and cannot be reasonably be reduced further.

Additional control measures were considered but rejected since the associated cost / effort was grossly disproportionate to any benefit. It is considered therefore that the impact is ALARP.

6.8.6 Demonstration of Acceptability

The consequences of drilling discharges on receptors has been assessed as II – Minor. Based on an assessment of Santos' acceptability criteria and with the control measures in place (**Table 6-26**), potential impacts are considered acceptable.

Table 6-26: Acceptability evaluation – Subsea Infrastructure Discharges

Is the consequence ranked as I (Negligible) or II (Minor)	Yes – maximum consequence from planned chemical and hydrocarbon discharges is II (Minor).
Is further information required in 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' Environmental Hazard Identification and Assessment Procedure, which considers principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – no contact with sensitive habitats or protected areas predicted. Consistent with relevant species recovery plans, conservation management plans and management actions set out in **Table 3-11**.
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environmental, Health and Safety Policy
Are risks and impacts consistent with stakeholder expectations?	Yes – no concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above.

The subsea discharges during the activity are unavoidable as they are required to safely complete the activities and ensure integrity of the equipment. However, impacts to water quality will be localised to within 10's of metres of the discharge. The operational area is not located nearby to any sensitive habitat.

The application of the chemical selection procedure is an important control for reducing the impacts of subsea discharges. In accordance with the procedure, CHARM-rated Gold/Silver and non-CHARM grouped E/D chemicals managed under the OCNS, or PLONOR substances listed by OSPAR, or chemicals risk assessed by Santos and deemed environmentally acceptable, will be selected.

With control measures in place to minimise the environmental impact of subsea discharges, the consequence was assessed as Minor (II) and ALARP. The managed discharges will not reduce the habitat values of the area potentially affected as described in relevant recovery plans and approved conservation advice, or be inconsistent with these documents. No concerns have been raised regarding this event by stakeholders. Therefore, the minor impacts expected from the proposed discharges are considered to be environmentally acceptable.

6.9 Spill Response Operations

6.9.1 Description of Event

Event	In the event of a hydrocarbon spill, response strategies will be implemented where possible to reduce environmental impacts to ALARP. The selection of strategies will be undertaken through the Net Environmental Benefit Analysis (NEBA) process, outlined in this EP and the OPEP. Spill response will be under the direction of the relevant Controlling Agency, as defined within the OPEP, which may be Santos and/or another agency. In all instances, Santos will undertake a 'first-strike' spill response and will act as the Controlling Agency until the designated Controlling Agency assumes control. The response strategies deemed appropriate for the worst case oil spill scenarios identified for the activity are detailed in **Section 7** of the OPEP and comprise: + Source control; + Monitor and evaluate (operational monitoring); + Mechanical Dispersion; + offshore containment and recovery; + Shoreline Protection and Deflection; + Shoreline Clean-up; + Oiled Wildlife Response; + Scientific Monitoring; and + Waste Management. 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 during the implementation of spill response strategies can also result in environmental harm over and above that already caused by the spill. The greatest potential for impacts additional to those described for routine operations is from chemical dispersant on subsea receptors, shoreline clean-up and oiled wildlife response operations, where coastal and shoreline habitat damage and fauna disturbance may occur.
Extent	Extent of spill. Spill response could occur anywhere within the MEVA for the worst-case spill scenarios. Some strategies will be concentrated in the vicinity of sensitive receptors in coastal waters and along shorelines.
Duration	The spill response effort as a whole will exceed the duration of the worst-case spill, due to persistence of the oil in the environment and the requirement to remove this oil and/or monitor impacts and recovery to sensitive receptors. The OPEP provides further detail the duration of specific response strategies.

6.9.2 Nature and Scale of Environmental Impacts

Light emissions
Spill response activities will involve the use of vessels which are required at a minimum, to display navigational lighting. Vessels may operate in close proximity to 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	+ Fauna (including Threatened/ Migratory/ Local Fauna); + Protected Areas; and + Socio-Economic Receptors
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 includes threatened and migratory fauna, have been identified as key fauna susceptible to lighting impacts. Spill response activities that require lighting may take place in protected areas important to turtles and birds, such as shoreline locations of the Montebello Islands, Barrow Island, the Muiron Islands, and Ningaloo area, which are seasonally important for turtles and include BIAs and critical habitats. 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.	
Noise Emissions	
Spill response activities will involve the use of aircraft and vessels which will generate noise both offshore and in proximity to sensitive receptors in coastal areas. Spill response activities will also involve the use of equipment on coastal areas during clean-up of shorelines (e.g. pumps and vehicles), for accessing shoreline areas (e.g. vehicles) and for supporting temporary camps (e.g. diesel generators).	
Potential receptors	+ Fauna (including Threatened/ Migratory/ Local Fauna); + Protected Areas; and + Socio-Economic Receptors.
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; e.g., temporary avoidance of the area, which may impact key lifecycle processes (e.g., spawning, breeding, calving). Underwater noise can also mask communication or echolocation used by cetaceans. **Section 6.1** provides further detail on these impacts from vessels and helicopters. Cetaceans and sirenians have been identified as the key concern for vessel noise within the MEVA. The humpback migration BIA, humpback resting BIA pygmy blue whale distribution BIA and dugong foraging (high density) BIA are all within the MEVA. Spill response activities using vessels have the potential to impact fauna in protected areas, which may impact on the conservation values of the protected areas. This includes the Montebello AMP and Ningaloo. 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 take place 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 and sharks), noise has the potential to impact supported industries such as tourism and commercial fishing and recreational values of marine parks.

Atmospheric emissions

The use of fuels to power vessel engines, generators and mobile equipment used during spill response activities will result in emissions of greenhouse gases (GHG) such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), along with non-GHG such as sulphur oxides (SOx) and nitrous oxides (NOx). Emissions will result in localised decrease in air quality.

Potential receptors	+ Physical Environment/habitat; + Fauna (including Threatened/ Migratory/ Local Fauna); and + Socio-economic receptors.

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/or areas where tourism is important; however, the scale of the impact relative to potential oil spill impacts is not considered great.

Operational discharges and waste

Operational discharges include those routine discharges from vessels used during spill response which may include:

- Bilge water;
- Deck drainage;
- Putrescible waste and sewage;
- Cooling water from operation of engines;
- Desalination plant effluent (brine) and backwash water discharge; and
- In addition, there are specific spill response discharges and waste creation that may occur, including:
  - Cleaning of oily equipment/vessels and vehicles
  - Flushing water for the cleaning of shoreline habitats
  - Sewage/putrescible and municipal waste at camp areas
  - Creation, storage and transport of oily waste and contaminated organics.

Potential receptors	+ Fauna (including Threatened/ Migratory/ Local Fauna); + Physical Environment/habitat; + Protected Areas; and + Socio-Economic Receptors.

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 6.6**. Vessel discharges may occur in shallower coastal waters during spill response activities than that described in **Section 6.6**. Discharge could potentially occur adjacent to marine habitats, such as corals, seagrass and macroalgae, and in protected areas (i.e., receptors anywhere within the MEVA), which support a more diverse faunal community; however, discharges are still expected to be localised and temporary.

Cleaning of oil-contaminated equipment, vehicles and vessels has the potential to spread oil from contaminated areas to areas not impacted by a spill, potentially spreading the impact area and moving oil into a more sensitive environment.

Flushing of oil from shoreline habitats is a clean-up technique designed to remove oil from the receptor that has been oiled and remobilise it back into the marine environment. It results in further dispersion of the oil. 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 onshore activities at temporary camps, which may include toilet and washing facilities. These wastes have the potential to 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 oil 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.

Physical presence and disturbance

The movement and operation of vessels, vehicles, personnel and equipment, undertaking of clean-up activities and the set-up of temporary camp areas during spill response activities has the potential to disturb the physical environment and marine/coastal habitats and fauna, which may include those habitats and fauna within protected areas. Disturbance may also impact cultural values of an area. The movement of vessels could potentially introduce invasive marine species attached as biofouling to nearshore areas, while vehicle and equipment movement could spread non-indigenous flora and fauna.

Oiled wildlife response activities may involve deliberate disturbance (hazing), capture, handling, cleaning, rehabilitation and release of wildlife which could lead to additional impacts to wildlife.

Potential receptors	+ Fauna (including Threatened/ Migratory/ Local Fauna); + Physical Environment/habitat; + Protected Areas; and + Socio-Economic Receptors

The use of vessels may disturb benthic habitats in coastal waters, including corals, seagrass, macroalgae and mangroves. Impacts to habitats from vessels include damage through the deployment of anchors, chains and nearshore booms 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, whales and dugongs, particularly in areas where BIAs for these species are located (humpback migration BIA, humpback resting BIA, pygmy blue whale distribution BIA and dugong foraging (high density) BIA). 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 (e.g., 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 and may have flow on impacts to socio-economic values and industry (e.g., tourism, fisheries).
Disruption to other users of marine and coastal areas and townships
Spill response activities may involve the use of vessels, equipment and vehicles and the establishment of temporary camps in areas used by the general public or industry. The mobilisation of spill response personnel into an affected area may also place increased demands on local accommodation and other businesses.
Potential receptors: + Socio-Economic Receptors
The use of vessels in the nearshore and offshore environment and the undertaking of spill response activities at shoreline locations may exclude the general public and industry use of the affected environment. As well as impacting leisure activities of the general public, this may impact on revenue with respect to industries such as tourism and commercial fishing. The mobilisation of personnel to small 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.

6.9.3 Environmental Performance Outcomes and Control Measures

The control measures considered for this activity are shown in **Table 6-27**. However, EPOs, EPS and measurement criteria for these spill response control measures are provided within the relevant strategy sections of the OPEP.

Table 6-27: Control measures evaluation – Spill Response Operations

Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Competent Incident Management Team (IMT) and oil spill responder personnel.	Ensures that spill response strategy selection and decommissioning activities consider the potential for additional environmental impacts.	Personnel and operational costs associated with maintaining competent IMT team and responder personnel.	**Adopted** – Considered a standard spill response control.
Use of competent vessel crew and personnel.	Reduces potential for environmental impacts from vessel usage.	Personnel and operational costs associated with maintaining contracts with	**Adopted** – Considered a standard spill response control.

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Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		competent vessel crew and personnel.	
Noise Emissions			
Vessels and aircraft compliant with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-II-00003).	Reduces potential for behavioural disturbance to cetaceans.	No cost/issue associated with this control measure	**Adopted** –Ensures compliance with Part 8 of the EPBC Regulations 2000, which is considered a standard spill response control (regulatory requirement).
Atmospheric Emissions			
If required under Australian Marine Orders, vessels will maintain a current International Air Pollution Prevention (IAPP) Certificate	Reduces level of air quality impacts.	Personnel and operational costs associated with maintaining Air Pollution Certificate.	**Adopted** – Considered a standard spill response control (regulatory requirement).
Operational discharges and waste			
Vessels meet applicable sewage disposal requirements	Reduces potential for water quality impacts.	No cost/issue associated with this control measure	**Adopted** – Considered a standard spill response control (regulatory requirement).
Vessel meet applicable requirements for oily water (bilge) discharges	Reduces potential for water quality impacts.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard spill response control (regulatory requirement).
Ballast water management plan	Improve quality of water discharged to marine environment to ALARP. Reduce risk of introduced marine species.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard spill response control (regulatory requirement).
Compliance with controlled waste, unauthorised discharge and landfill regulations.	Ensures correct handling and disposal of oily wastes.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard spill response control (regulatory requirement).

Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Physical presence and disturbance			
Vessels and aircraft compliant with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-II-00003).	Reduces potential for behavioural disturbance to cetaceans.	No cost/issue associated with this control measure	**Adopted** – Ensures compliance with Part 8 of the EPBC Regulations 2000, which is considered a standard spill response control (regulatory requirement).
Use of shallow draft vessels for shoreline and nearshore operations.	Reduce seabed and shoreline disturbance.	Operational costs associated with operating shallow draft vessels for shoreline and nearshore operations.	**Adopted** – Considered a standard control.
OSR Team Leader assesses and selects vehicles appropriate to shoreline conditions.	Reduce coastal habitat and fauna disturbance.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control.
Conduct shoreline, nearshore habitat, bathymetry assessment.	Reduce shoreline habitat disturbance.	Operational costs associated with conducting shoreline nearshore habitat assessment.	**Adopted** – Considered a standard control.
Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting and roosting areas and turtle nesting habitat.	Reduce coastal habitat and fauna disturbance.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control.
Operational restriction of vehicle and personnel movement to	Reduce coastal habitat erosion and compaction.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control.

Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
limit erosion and compaction.			
Prioritise use of existing roads and tracks.	Reduce coastal habitat and fauna disturbance.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control.
Select temporary base camps in consultation with DoT and DBCA	Reduce coastal habitat and fauna disturbance.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control to be adopted by the relevant Control Agency
Soil profile assessment prior to earthworks.	Reduce habitat disruption and erosion.	Operational costs associated with soil profile assessment.	**Adopted** – Considered a standard control.
Pre-cleaning and inspection of equipment (quarantine)	Reduces potential for invasive species to offshore islands	Cost/effort in inspecting equipment	**Adopted** – Considered a standard control.
Use of Heritage Advisor if spill response activities overlap with potential areas of cultural significance.	Reduce disturbance to culturally significant sites.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control to be adopted by the relevant Control Agency.
Adhere to WA Oiled Wildlife Response Plan and Pilbara Regional Oiled Wildlife Response Plan	Oiled wildlife hazing, capture, handling and rehabilitation meet minimum standards as outlined within the WA Oiled Wildlife Response Plan.	Operational costs associated with response plan.	**Adopted** – Considered a standard control to be adopted by the relevant Control Agency.
Chemical dispersant application			
Chemical Dispersant Plan	Additional impacts from dispersant application are reduced to ALARP.	No cost/issue associated with this control measure.	**Adopted** – A standard control adopted by industry.
Disruption to other users of marine and coast areas and townships			
Stakeholder consultation	Promotes awareness and reduces potential impacts from response to socio-economic activities.	Minimal cost in relation to overall effort/costs in managing incident.	**Adopted** – Considered a standard control for incident management.
Utility resource assessment and support to be conducted if	Reduces potential impact due to higher utility demands causing	No cost/issue associated with this control measure.	**Adopted** –Considered a standard control.

Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
activity is of significant size in comparison to the size of the coastal community	disruptions to local community.		
Accommodation assessment	Reduces strain on accommodation	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control.
Transport Management Plan	Reduces potential for traffic disruptions.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control for large scale deployment in highly populated areas.

6.9.4 Environmental Impact Assessment

Receptor	Consequence Level
Spill Response Operations–- Light Emissions	
+ Threatened, migratory or local fauna + Physical environment or habitat + Threatened ecological communities + Protected Areas + Socio-economic receptors	The receptors considered most sensitive to lighting from vessel and shoreline operations are seabirds/shorebirds and marine turtles, particularly over summer months with respect to marine turtles where emerging hatchlings are sensitive to light spill onto beaches. Following restrictions on night-time operations by spill response vessels, which will demobilise to mooring areas offshore with safety lighting only, the consequence level is assessed as I– Negligible. The positioning of temporary camps will be done at direction of DoT/ DBCA and following control measures on lighting colour and direction the consequence level of shoreline lighting is assessed as I–Negligible. These species are likely to be values of the protected area they occur in (e.g., Montebello Islands, Barrow Island, Ningaloo, etc), and the consequence level of light to protected areas is also assessed as I–Negligible. As a consequence of impacts to fauna, lighting has the potential to impact supported industries, such as tourism; however, as impacts to fauna are considered negligible, any the consequence level of indirect impacts on tourism is assessed as I- Negligible.
Overall worst case consequence level	I – Negligible
Spill response operations – Acoustic Disturbance	
+ Threatened, migratory or local fauna	The receptors considered most sensitive to vessel noise disturbance is the humpback whale during migration season, when these whales come close to the Montebello Islands and Barrow Island during their peak migration (July to October), as well as populations of marine turtles, whale sharks, dugongs

Receptor	Consequence Level
+ Physical environment or habitat + Threatened ecological communities + Protected Areas + Socio-economic receptors	and pygmy blue whales. However, following the adoption of control measures to limit close interaction with protected fauna (i.e., Protected Marine Fauna Interaction and Sighting Procedure (EA-91-II-00003), a temporary behavioural disturbance is expected only with a consequence level assessed as I- Negligible. With respect to noise from onshore operations (mobile equipment and vehicles), nesting, roosting or feeding birds are considered to be the most sensitive to noise, in particular shorebirds that may be aggregating at Montebello Islands, Barrow Island, the Muiron Islands, Lowendal Islands, and the Ningaloo coast. The equipment used is not considered to have excessive sound levels and, following direction by DoT and DBCA on the location of temporary camp areas, the consequence to birds from noise is expected to be Negligible (I). Shorebirds may be official values of the protected area they occur in, and the consequence level of noise to the protected area is assessed as I – Negligible.
Overall worst case consequence level	I – Negligible
Spill Response Operations – *Atmospheric Emissions*	
+ Threatened, migratory or local fauna + Physical environment or habitat + Threatened ecological communities + Protected Areas + Socio-economic receptors	Atmospheric emissions from spill response equipment will be localised and impacts to even the most sensitive fauna, such as birds, are expected to be Negligible. Because of the localised and low level of emissions, the consequence level is assessed as I–Negligible.
Overall worst case consequence level	I – Negligible
Spill Response Operations – Discharges and Waste	
+ Threatened, migratory or local fauna + Physical environment or habitat + Threatened ecological communities + Protected Areas	The use of vessels and nearshore booms has the potential to disturb benthic habitats, including sensitive habitats in coastal waters, such as corals, seagrass, macroalgae and mangroves. A review of shoreline and shallow water habitats and of bathymetry and the establishment of demarcated areas for access and anchoring will reduce the consequence level to I–Negligible.

Receptor	Consequence Level
+ Socio-economic receptors	
Overall worst case consequence level	II – Minor
Spill Response Operations – Physical Presence and Disturbance	
+ Threatened, migratory or local fauna + Physical environment or habitat + Threatened ecological communities + Protected Areas + Socio-economic receptors	The use of vessels in the nearshore and offshore environment and spill response activities at shoreline locations, and within townships, may exclude general public and industry use. It should be noted that this is distinct from the socio-economic impact of a spill itself which would have a far greater detrimental impact to industry and recreation. Following the application of control measures it is considered that the additional impact of spill response activities on affected industries would be II– Minor. The consequence level is assessed as II – Minor. The use and movement of vehicles, equipment and personnel during shoreline response activities has the potential to disturb coastal habitats, such as dune vegetation, samphire and mangroves, and important habitats of threatened and migratory fauna, including nests of turtles and birds and bird roosting areas. Furthermore, clean-up can involve physical removal of substrates that could impact habitats and fauna and alter coastal hydrodynamics. As with vessel use, an assessment of appropriate vehicles and equipment to reduce habitat damage, along with the establishment of access routes, demarcation zones, and operational restrictions on equipment and vehicle use, will limit sensitive habitat damage and damage to important fauna areas. The establishment of temporary camp areas will be done under direction of DoT and DBCA with suitable advice sought if access is needed to culturally significant areas. Following these and other control measures, the resultant consequence to the physical environment and habitat is assessed as Minor (II), indicating that there may be a detectable reduction in habitat area from response activities (as separate from spill impacts), but recovery will be relatively rapid once spill response activities cease. As with all spill response activities, this disturbance will only occur if there is a net benefit to accessing and cleaning shoreline areas. 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 Minor (II) consequence following compliance with the WA Oiled Wildlife Response Plan and the Pilbara Region Oiled Wildlife Response Plan. These habitats or environments are likely to be values of the protected area they occur in, and the consequence level is assessed as II – Minor The disturbance to marine and coastal natural habitat, as well as the potential for disruption to culturally sensitive areas, which may occur in specially protected areas, may have flow-on impacts to socio-economic values and industry (e.g., tourism, fisheries). The consequence level is assessed as II – Minor.

Receptor	Consequence Level
Overall worst case consequence level	II – Minor
Spill Response Operations – Disruption to Other Users of Marine and Coastal Areas and Townships	
+ Socio-economic receptors	The use of vessels in the nearshore and offshore environment and spill response activities at shoreline locations and within townships may exclude general public and industry use. Note that this is distinct from the socio-economic impact of a spill itself, which would have a far greater detrimental impact to industry and recreation. Following the application of control measures, the consequence level is assessed as II – Minor.
Overall worst case consequence level	II – Minor

6.9.5 Demonstration of As Low As Reasonably Practicable

A NEBA is the primary tool used during spill response to evaluate response strategies with the goal of selecting strategies that result in the least net impact to key environmental sensitivities. The NEBA process conducted as a spill occurs, will identify and compare net environmental benefits of alternative spill response options. The NEBA will effectively determine whether an environmental benefit will be achieved through implementing a response strategy compared to undertaking no response. NEBA will be undertaken by the relevant Control Agency for the activity. For those activities under the control of Santos, the IMT Environmental Team Leader will be responsible for reviewing the priority receptors and selected response strategies identified within this EP and coordinating the NEBA for each operational period. This will ensure that at the strategy level, the response operations reduce additional environmental impacts to ALARP.

Spill response activities will be conducted in offshore and coastal waters using vessels and aircraft. The greatest potential for additional impacts from implementing spill response is considered to be to wildlife in offshore waters from oiled wildlife response activities, and to shoreline habitats and fauna receptors within shallow waters or on shorelines from shoreline clean-up activities.

Given the types of activities considered appropriate to responding to a worse-case spill and the scale of operations, standard control measures adopted by Santos for spill response to reduce the level of additional impacts are considered to reduce these impacts to ALARP. This includes working with the relevant Control Agency for spill response and applying the process and standards e.g. for oiled wildlife response as included within the WA Oiled Wildlife Response Plan.

Santos has considered the actions prescribed in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017) and approved conservation advice for other relevant threatened fauna relevant to spill responses for the activities to minimise noise and light impacts on marine cetaceans, fish, sharks and marine turtles, especially flatback turtles. The proposed activity will not result in significant impacts on these species and implementation of identified control measures is in line with the relevant conservation advice and recovery plans. Pollution events (such as hydrocarbon spills) could impact on fauna, and the use of vessels and equipment during the spill response could result in potential impacts as described within this EP. Control measures in place for vessel and helicopter use will reduce potential impacts to marine fauna and these are consistent with current conservation advice. The assessed residual consequence for this impact is minor and cannot be reduced further without grossly disproportionate costs. It is considered therefore that the impact of the activities conducted is ALARP.

6.9.6 Demonstration of Acceptability

Table 6-28: Acceptability evaluation – Spill Response Operations

Is the consequence ranked as I (Negligible) or II (Minor)	Yes – Maximum consequence is II– Minor from planned events.
Is further information required in 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' Environmental Hazard Identification and Assessment Procedure which considers principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – IUCN principles of nearby reserves met. Control measures implemented will minimise the potential impacts from spill response activities protected areas and their values, and to species identified in recovery plans and conservation advice as having the potential to be impacted. Consistent with relevant species recovery plans, conservation management plans and management actions, and the North-west Marine Parks Network Management Plan 2018 (Australian Maritime Safety Authority, n.d.).
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – During any spill response, a close working relationship with relevant regulatory bodies (e.g., DoT, DBCA, AMSA) will occur, therefore there will be post EP acceptance consultation implementation with relevant stakeholders on the acceptability of response operations. Wildlife response will be conducted in accordance with the WA Oiled Wildlife Response Manual and Plan and Pilbara Regional Oiled Wildlife Response Plan (DBCA, 2023).
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above.

The implementation of spill response activities to reduce the potential impacts from a spill are required by legislation. The spill response options selected have been 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 (AMSA, 2019). No concerns from stakeholders have been raised regarding response activities, and the controls proposed reduce the consequences of the potential impacts to Minor (II) and ALARP. The controls used during spill response activities are therefore considered to reduce additional impacts to an acceptable level.

7 Unplanned Events Risk Assessment

OPGGS(E)R 2023 Requirements
Regulation 21. Environmental assessment.
Evaluation of environmental impacts and risks 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 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: a) all operations of the activity; and b) potential emergency conditions, whether resulting from accident or any other reason. 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 ENVID workshop was held in January 2023 to identify and manage the environmental impacts and risks that may credibly arise from the activities associated with the activities. This ENVID workshop identified eight unplanned environmental impacts associated with the activity. The results of the environmental assessment are summarised in **Table 7-1**. A comprehensive risk and impact assessment for each of the unplanned events and subsequent control measures proposed by Santos to reduce the risk and impacts to ALARP are detailed in the following subsections.

Table 7-1: Summary of the risk assessment ranking for unplanned activities

EP Section Reference	Event	Consequence	Likelihood	Residual Risk Level
7.1	Release of Solid Objects	II – Minor	B – Unlikely	Very Low
7.2	Introduction of Invasive Marine – species	III - Moderate	B – Unlikely	Low
7.3	Marine Fauna Interactions	III – Moderate	B – Unlikely	Low
7.4	Non-hydrocarbon Unplanned Release	I – Negligible	D - Occasional	Low
7.6	Loss of Well Control	III- Moderate	B – Unlikely	Low

7.7	Subsea release of Condensate from Subsea Pipeline	III – Moderate	A - Remote	Very Low
7.8	Subsea Release of Condensate from Wellheads	III - Moderate	A - Remote	Very Low
7.9	Hydrocarbon Spill - Marine Diesel Oil	II – Minor	B – Unlikely	Very Low
7.10	Minor Hydrocarbon Releases (Surface and Subsea)	I – Negligible	D - Occasional	Low

7.1 Release of Solid Objects

7.1.1 Description of Event

Event	Solid objects, such as those listed below, can be accidentally released to the marine environment, and potentially impact on sensitive receptors: + Non-hazardous solid wastes, such as paper and packaging; + Hazardous solid wastes, such as oily and contaminated materials (such as sorbents, laboratory waste, oily rags), batteries, medical waste, fluorescent tubes, and aerosol cans; + Equipment and materials, such as hard hats, tools, or infrastructure parts; and + Dropped equipment to the seabed during installation activities. Release of these waste streams may occur as a result of overfull and/ or uncovered bins, incorrectly disposed items or spills during transfers of waste, or dropped objects/ lost equipment. The release of solid objects could credibly result in damage to subsea infrastructure, resulting in a loss of containment and subsequent hydrocarbon release. The environmental impacts and risks of a loss of containment from subsea infrastructure are considered in the Varanus Island Hub Operations Environment Plan for Commonwealth Waters (EA-60-RI-10003)
Extent	Localised as all non-buoyant waste material or dropped objects are expected to remain within the operational area. Buoyant waste material or dropped objects could potentially move beyond the operational area under wave action.
Duration	All dropped objects are planned to be recovered and therefore impacts are expected to be temporary.

7.1.2 Nature and Scale of Environmental Impacts

<u>Potential Receptors:</u> Water quality, Benthic Fauna, Fish & Sharks, Marine Mammals, Marine Reptiles and Seabirds

Release of hazardous solid waste such as batteries, fluorescent tubes, medical wastes and aerosol cans may result in the pollution of the immediate receiving environment, leading to detrimental health impacts to marine flora and fauna. Chemical effects such as physiological damage through ingestion or absorption may occur to individual fish, cetaceans, marine reptiles or seabirds.

7.1.2.1 Physical environment

Objects accidentally dropped to the seabed could occur during the activity, such as the transfer and lifting of objects and equipment. Equipment and other items lost at sea could be caused by crane failure, adverse weather, human error, rigging failure and vessel motions and potentially could lead to loss of or changes to benthic habitats. The area of potential disturbance from a non-buoyant dropped object would be restricted to the operational area in which it was dropped.

The seabed within the operational area are primarily soft sediments with sparse epifauna, this habitat type is widely distributed and well represented in the Northwest Shelf Province. While soft sediment benthic habits will not be destroyed, disturbance of the communities on and within them (i.e., the epifauna) will occur in the event of a dropped object and depressions may remain on the seabed for some time after removal of the dropped object as they gradually infill over time.

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Impacts to benthic communities from dropped object disturbance are expected to be short term in duration due to the ability for such communities to recover.

Buoyant dropped objects have the potential to be transported by marine currents and may impact on reefs, islands, shoals and banks within the region. Accidentally dropped objects, such as plastics, have the potential to smother benthic environments, and the release of hazardous solids (e.g., wastes such as batteries) could also impact water quality through pollution of the immediate receiving environment. Impacts from accidentally released liquids are discussed in **Section 7.4.**

7.1.2.2 Threatened, migratory or local fauna (marine mammals, marine reptiles, sharks and rays, fish and birds)

Solids such as plastics have the potential to harm marine fauna through entanglement or ingestion. A number of BIAs for turtles (internesting), whales (migration and distribution), whale sharks (foraging) and marine birds (breeding) overlap the operational area and therefore, these receptors may be present.

Marine turtles and seabirds are particularly at risk from entanglement. Turtles are known to be indiscriminate feeders and may mistake plastic for jellyfish (Mrosovsky et al., 2009). The Recovery Plan for Marine Turtles in Australia 2017 to 2027 (Commonwealth of Australia, 2017a) identifies ingestion of marine debris as a threat to all species of marine turtles. Seabirds at the sea surface foraging on plankton may eat floating plastic. Once ingested, plastics can damage internal tissues and inhibit physiological processes, which can both potentially result in fatality (Derraik, 2002). Marine debris has been highlighted as a threat to marine turtles, humpback whales and whale sharks). These recovery plan and approved conservation advices, as well as the Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (Commonwealth of Australia, 2018a), have specified a number of recovery actions to help combat this threat. Of relevance to this activity is the legislation for the prevention of garbage disposal from vessels.

Release of hazardous solid objects (e.g., wastes such as batteries) may result in the pollution of the immediate receiving environment, leading to very localised detrimental health impacts to marine flora and fauna. Physiological damage through ingestion or absorption may occur to individual fish, cetaceans, marine reptiles or seabirds.

The recovery plans and approved conservation advice have specified a number of recovery actions to help combat this threat. Of relevance to this activity is the legislation for the prevention of garbage disposal from vessels, which Santos implements through adherence to MARPOL. While soft sediment benthic habits will not be destroyed, disturbance of the communities on and within them (the epifauna and infauna) will occur in the event of a dropped object, and depressions may remain on the seabed for some time after removal of the dropped object as they gradually infill over time. 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 (**Section 3.2.1**). In this context, any potential sediment movement caused by the event is likely to have minimal impacts.

The area of potential disturbance due to a non-buoyant dropped object would be restricted to the operational area in which it was dropped. The seabed within the operational area vary, but is generally made up of silts, sands and some low relief hard substrates and limited benthic faunal communities.

7.1.2.3 Socio Economic Receptors – other marine users

Impacts to socioeconomic receptors may occur if hazardous/ non-hazardous solids cause a safety hazard to other marine users.

Tourism activities, such as snorkelling, diving, surfing and recreational fishing are not expected to occur in the operational area, given the water depth (ranging from approximately 95 m – 125 m), lack of seafloor features and distance from shore. Although dropped solid objects have potential to float to nearby areas used for tourism or recreational purposes solid non-hydrocarbon releases are not expected to occur frequently or to a scale that may cause significant pollution that would impact the socio-economic values of these areas. Impacts to socioeconomic receptors could occur should debris interfere with other marine users or their equipment (for example, commercial fishing activities).

7.1.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event include:

+ No unplanned objects, emissions or discharges to sea or air [H2-EPO-04]
+ No injury or mortality to EPBC Act 1999 and WA Biodiversity Conservation Act 2016 listed marine fauna during activities [H2-EPO-05]

The control measures for this event are shown in **Table 7-2**, and the EPS and measurement criteria for the EPOs are described in **Section 8.4.1**.

Table 7-2: Control measures evaluation – Release of Solid Objects

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-DC-CM-031 H2-IC-CM-025	Dropped object prevention procedure	Impacts to environment are reduced by preventing dropped objects and by retrieving dropped objects unless the environmental consequences are negligible or there are risks to safety. Minimises drop risk during MODU, ISV and support vessels lifting operations. Ensures lifting equipment certified and inspected.	Personnel costs involved in implementing procedures and in incident reporting.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh cost to Santos.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
H2-DC-CM-022 H2-IC-CM-018	Waste (Garbage) management procedure	Reduces probability of garbage being discharged to sea, reducing potential impacts to marine fauna. Stipulates putrescible waste disposal conditions and limitations. Marine Order 95 (Marine pollution prevention – garbage).	Personnel cost of pre-mobilisation audits and inspections and in reporting discharge levels.	**Adopted** - Benefits of ensuring MODU/vessels are compliant outweighs the minimal costs of personnel time and it is a legislated requirement.
H2-DC-CM-032 H2-IC-CM-026	Hazardous chemical management procedures	Reduces the risk of spills and leaks (discharges) to sea by controlling the storage, handling and clean-up.	Personnel cost associated with implementation of procedures and permanent or temporary storage areas.	**Adopted –** Benefits of ensuring procedures are followed and measures implemented outweigh costs.
H2-DC-CM-025 H2-IC-CM-021	General chemical management procedures	Reduces the risk of spills and leaks (discharges) to sea by controlling the storage, handling and clean-up.	Personnel cost associated with implementation of procedures and permanent or temporary storage areas.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh costs.
H2-DC-CM-033 H2-IC-CM-027	Maritime Dangerous Goods Code	Dangerous goods managed in accordance with International Maritime Dangerous Goods Code (IMDG Code) to reduce the risk of an environmental incident, such as an accidental release to sea or unintended	Cost associated with implementation of code/ procedure.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh costs.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		chemical reaction.		
H2-DC-CM-024 H2-IC-CM-020	Chemical selection procedure	Aids in the process of chemical management that reduces the risk of accidental discharge to sea by controlling the storage, handling and clean-up of chemicals.	Personnel cost associated with implementation of procedure.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh costs.
H2-DC-CM-034 H2-IC-CM-028	Bulk solid transfer procedure	Reduces potential impacts to the marine environment during bulk transfer through correct equipment maintenance and integrity to prevent accidental loss of solids.	Cost associated with implementation of procedure.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh costs.
Additional Control Measures				
N/A	Eliminating lifting in the field	Reduces the risk release of non-hydrocarbon solid to the marine environment due to dropped object.	Eliminating lifting would require MODU/vessels storing more equipment and supplies on-board, and/or additional trips to shore. MODU/vessels will not have enough deck space to store all required equipment, materials, supplies needed	**Rejected** - Not feasible to eliminate lifting in the field

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			for the duration of the activity.	

7.1.4 Environmental Impact Assessment

Description	
Receptor	+ Physical environment/ habitat – benthic habitats + Threatened, migratory or local fauna (marine mammals, marine reptiles, sharks and rays, fish and birds) + Socio-economic receptors – other marine users
Consequence	II - Minor
Physical environment – benthic habitats Non-buoyant dropped objects are expected to impact the seabed, however, due to the small footprint of the infrastructure any impact is expected to be very small and limited to within the operational area in which it was dropped. Any area of the seabed impacted through dropped objects would be expected to recover. Buoyant dropped objects have the potential to wash up on island beaches. It is considered that the application of management measures will effectively prevent this impact occurring on a significant scale. Therefore, impacts will result in a Minor (II) reduction in habitat area or function. *Threatened or migratory fauna (marine mammals, marine reptiles, sharks and rays, fish and birds)* The release of solid objects to the marine environment has the potential to cause minor impact to marine fauna. Ingestion of solid wastes by marine fauna could occur in small quantities. Only small volumes of non-hydrocarbon solids would be generated during the activity, as a result, any accidental loss to the environment would be small in size. Any impacts would be restricted to a small number of individuals, if any. Relevant recovery plans and conservation advice have identified marine debris as a potential threat. There is a Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (Commonwealth of Australia, 2018a). As such there is the potential for impacts only to a small proportion of a local population with no consequences for conservation status or reproductive success of cetaceans, marine turtles or fish species that may occur in the area. The limited quantities associated with this unplanned event indicate that even in a worst-case release of solid waste, the number of fauna fatalities would be limited to individuals and is not expected to result in a decrease of the local population size. Therefore, the consequence is assessed as II - Minor. *Socio-economic receptors – other marine users* Impacts to tourism and recreation have the potential to occur through buoyant objects floating into areas used for these activities, adversely impacting tourism and recreation values and creating poor aesthetics. Given the limited quantities associated with this unplanned event, even a worst-case release of solid waste is unlikely to have flow-on effects significant enough to impact the tourism and recreation industries. Furthermore, EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country. Therefore, the consequence is assessed as I – Negligible.	
Likelihood	B - Unlikely
Control measures proposed ensure that the risk of dropped objects, lost equipment or release of non-hydrocarbon solid waste to the environment has been minimised. Given the controls in place, the	

Description	
likelihood of releasing non-hydrocarbon solids to the environment resulting in a minor consequence is considered Unlikely (B).	
Residual Risk	The residual risk associated with this event is **Very Low.**

7.1.5 Demonstration of As Low As Reasonably Practicable

Solid waste will be generated during the activity and lifting operations and MODU/vessel operations are required as part of the activity. Equipment loss and dropped objects, which might occur during MODU/vessel transfers in the field will be managed through lifting and transfer procedures and equipment management. The control measures proposed reduce the risk of non-hydrocarbon solid releases to a residual risk level that is Very Low and cannot be reduced further. There are no reasonably practicable additional control measures identified that would reduce the chance of a loss of non-hydrocarbon solid release.

Therefore, it is considered that the impact of the activities conducted is ALARP.

7.1.6 Demonstration of Acceptability

Is the consequence ranked as Very Low to Medium?	Yes – residual risk is ranked Very Low.
Is further information required in 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' Environmental Hazard Identification and Assessment Procedure, which considers principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – management consistent with Marine Order 95. Controls implemented will minimise the potential impacts from the activity to species identified in recovery plans and approved conservation advices as having the potential to be impacted by solid objects. Specific actions that contribute to the long-term prevention of marine debris (Objective 1 of the Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (Commonwealth of Australia, 2018a)) have been adopted, including compliance with applicable legislation in relation to the improvement of waste management practices. Consistent with relevant species recovery plans, conservation management plans and management actions. Consistent with the Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (Commonwealth of Australia, 2018a). Consistent with the North-west Marine Park Network Management Plan (Director of National Parks, 2018).

Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – no concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above.

The handling and use of non-hydrocarbon solid materials is standard industry practice and the potential impacts well understood. This aspect will be managed consistent with relevant legislation, regulations and guidelines and the residual risks are low and ALARP.

The control measures proposed are consistent with applicable actions described in the relevant recovery plans and approved conservation advice and no stakeholder concerns have been raised regarding this event.

With the control measures in place to prevent accidental releases and the low risk predicted from these types of solids, the low risk of a non-hydrocarbon solid release to the environment is considered environmentally acceptable.

7.2 Introduction of Invasive Marine Species

7.2.1 Description of Event

Event	Introduction of invasive marine species (IMS) may occur due to: + Biofouling on project vessels and external/internal (e.g., sea chests, seawater systems) niches + Biofouling on equipment that is routinely submerged in water (e.g., ROVs, submersible equipment) + Discharge of high-risk ballast water + Cross contamination between vessels.
Extent	For IMS it is localised (seabed within the operational area) to widespread if successfully translocated to new areas via ocean currents or project equipment transit.
Duration	Temporary to long-term (in the event of successful translocation and establishment).

7.2.2 Nature and Scale of Environmental Impacts

Potential receptors: Physical environment (benthic habitats), threatened/migratory fauna (marine mammals, marine reptiles, sharks, fish and rays) and socio-economic receptors (fisheries, tourism and recreation).

IMS are marine plants and animals that have been introduced into a region that is beyond their natural range but that have the ability to survive and possibly thrive (Wells et al., 2009). The majority of climatically compatible IMS to the Northwest Province are found in southeast Asian countries. Some IMS pose a significant risk to environmental values, biodiversity, ecosystem health, human health, fisheries, aquaculture, shipping, ports and tourism (Wells et al., 2009). IMS can cause a variety of adverse effects in a receiving environment, including:

+ over predation of native flora and fauna;

+ displacement of native marine species;
+ outcompeting of native flora and fauna for food and space;
+ depletion of viable fishing areas and aquaculture stock; and
+ reduction of coastal aesthetics.

The above impacts can result in flow-on detrimental effects to fisheries, tourism and recreation. IMS 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. Species of concern vary from one region to another depending on various environmental factors, such as water temperature, salinity, nutrient levels and habitat type. These factors dictate their survival and invasive capabilities.

It is recognised that artificial, disturbed and/or polluted habitats in tropical regions are susceptible to invasive marine species introductions, which is why ports are often areas of higher IMS risk (Bax et al., 2003) Neil et al., 2005). However, in Australia there are limited records of detrimental impact from IMS compared to other tropical regions (such as the Caribbean). Following their establishment, eradication of IMS populations is difficult, limiting management options to ongoing control or impact minimisation. Case studies in Australia indicate that, from detection to eradication, this can take approximately four weeks (Bax et al., 2003). However, this depends on the environmental conditions and species. For this reason, increased management requirements have been implemented in recent years by Commonwealth and State regulatory agencies. Ballast water is responsible for 20 to 30% of all marine pest incursions into Australian waters. However, research indicates that biofouling (the accumulation of aquatic micro-organisms, algae, plants and animals on vessel hulls and submerged surfaces) has been responsible for more foreign marine introductions than ballast water (Bax et al., 2003; DAFF, 2011). The potential biofouling risk presented by vessels will relate to:

+ the length of time that these vessels have already been operating in Australian waters or, if they have been operating outside Australian waters;
+ the locations of the operations they have been undertaking;
+ the length of time spent at these locations; and
+ whether the vessels have undergone hull inspections, cleaning and application of new anti-foulant coating prior to returning to operate in Australia.

The risk of introducing IMS is limited by the operational area occurring in relatively deep, offshore waters that are not directly adjacent to any shoals or banks. Although there will be infrastructure installed within the operational area, that can act as hard substrate for IMS to establish, the depth of the water (ranging from approximately 95 m – 125 m), and lack of light make this an unlikely occurrence. IMS are generally unable to establish in deep-water ecosystems (Geiling, 2014), most likely due to a lack of light or suitable habitat to sustain their growth and survival. 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). Further, it is known that highly disturbed environments (such as marinas and jetties) are more susceptible to colonisation than open-water environments where the number of dilutions and the degree of dispersal are high (Paulay et al., 2002).

7.2.3 Environmental Performance Outcomes and Control Measures

The EPO relating to this event is:

+ No introduction of marine pest species [H2-EPO-02]

The control measures for this event are shown in **Table 7-3**, and the EPS and measurement criteria for this EPO are described in **Table 8-2**.

Table 7-3: Control measures evaluation – Introduction of Invasive Marine Species

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-DC-CM-035 H2-IC-CM-029	Compliance with the *Biosecurity Act 2015* and *Biosecurity Amendment (Biofouling Management) Regulations 2021*	The risk of introducing IMS is reduced due to assessment procedure and management of ballast water.	Personnel costs involved in risk assessing vessels in accordance with the Invasive Marine Species Management Plan. Costs associating with reducing the vessel risk to 'low' (for example, dry docking, hull cleaning or additional costs due to inspections). Could lead to potential delays and therefore costs in vessel contracting process due to unavailability of vessels.	**Adopted** – Minimal personnel costs and potential delays or costs to project are considered outweighed by the benefits of reducing the risk of IMS.
Additional Control Measures				
N/A	Heat or chemical treatment of ballast water to eliminate IMS	Would reduce potential for IMS to establish by eliminating individuals present in ballast water.	High cost compared to existing risk; introduction of chemicals or water at much higher temperature than surrounding marine environment	**Rejected** –Based on increased risk to marine environment and high cost considered disproportionate compared to base case risk (after application of standard

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			would likely be toxic or result in death of native marine species.	controls (see above))
N/A	Contract MODU/vessels only operating in local, State or Commonwealth Waters to reduce potential for IMS	Reduce potential for IMS to be transported into area since vessels would not have originated elsewhere.	MODU/vessels and equipment suitable for the activity may not be available in State/Common wealth Waters. Potential significant costs and delay in activity schedule by only contracting MODU/vessels working in State/National waters.	**Rejected** – Not feasible due to uncertainty over local vessel availability.
N/A	Mandatory dry docking of vessels prior to entering field to clean vessel and/or equipment and remove biofouling	Ensure that no IMS are present on vessel or associated equipment.	Significant cost (grossly disproportionat e to the risk) would lead to scheduling delays.	**Rejected** – Costs disproportionate ly high compared to environmental benefit given other controls in place already reduce the risk.
N/A	Utilise an alternative ballast system to avoid uptake and discharge of water in vessels	Eliminate need for ballast water exchange, therefore decreasing risk of introducing IMS through ballast water.	MODU/vessels suitable for the activity may not have options for alternative ballast, therefore would require modification at significant cost.	**Rejected** – Cost disproportionate ly high compared to environment benefit.
N/A	Zero discharge of ballast water	Would reduce the potential for IMS by implementation of no ballast water exchange policy	Ballast water exchange required on the MODU, ISV and support vessels for stability.	**Rejected** – On the basis that ballast water exchange is a safety-critical activity for

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		on MODU, ISV and support vessels.		marine operation
N/A	Mandatory independent IMS survey of MODU, ISV and survey vessels	Eliminate invasive marine species	Cost is high compared to existing risk.	**Rejected** - High additional cost is disproportionate compared to the environmental benefit. The ISV will be subject to assessment under Santos IMS assessment process.

7.2.4 Environmental Impact Assessment

Description	
Receptors	Physical environment (benthic habitats) Threatened, migratory and local fauna (marine mammals, marine reptiles, sharks, fish and rays) Socio-economic receptors (fisheries, tourism and recreation)
Consequence	III – Moderate
Ballast water is responsible for 20 to 30% of all marine pest incursions into Australian waters. However, research indicates biofouling (the accumulation of aquatic micro-organisms, algae, plants and animals on vessel hulls and submerged surfaces) has been responsible for more foreign marine introductions than ballast water (DAFF, 2003). 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. If an IMS is introduced, the species has been known to colonise areas outside of the areas to which it is introduced. In the event an invasive marine species is introduced into the operational area, 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. No threatened ecological communities are present in the area that could be affected. The overall consequence level was assessed as Moderate, this also takes into consideration the distance of the activity to protected areas and the requirements of the North-West MPNMP which applies adjacent to the operational area which requires that vessel ballast water exchange is completed in accordance with the Australian Ballast Water Management Requirements.	
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 a number of environmental conditions. It has been found that highly disturbed environments (such as marinas) are more susceptible to colonisation than open water environments where the number of dilutions and the degree of dispersal are high (Paulay et al., 2002). Given the depth of the operational area (ranging from approximately 95 m – 125 m), creating an unfavourable habitat for colonisation (i.e., light limiting and low habitat biodiversity with sparse epibiota) and distance from shallow coastal habitats, there is a very low likelihood IMS would	

Description	
be able to survive translocation and subsequently establish and colonise. Although infrastructure will be installed within the operational area, the depth of this infrastructure will make it unlikely for IMS to establish on it. Given the dispersive open-ocean environment of the operational area, the successful translocation to surrounding shallower habitats of an IMS introduced to the operational area is unlikely. Furthermore, stakeholder consultation for the activity did not raise any concerns regarding potential impacts to cultural features including sea country. With controls in place to reduce the risk of IMS introduction, the likelihood is considered Remote (B).	
Residual Risk	The residual risk associated with this event is **Low**.

7.2.5 Demonstration of As Low As Reasonably Practicable

There are no alternatives to the use of a MODU, ISV and support vessels 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. The proposed management controls are considered appropriate to manage the risk of introduction of IMS to ALARP.

Ballast water exchange will be managed through Ballast Water Management actions consistent with the Australian Ballast Water Management Requirements, and a vessel biosecurity risk assessment in accordance with the Invasive Marine Species Management Plan (EA-00-RI-10172) will be undertaken to demonstrate that the MODU/vessels are low risk so that IMS are not introduced.

Santos has adopted a risk-based approach to managing biofouling given it is not practicable or reasonable to inspect and/or clean every vessel before each voyage. Such an approach is consistent with other petroleum operators on the NWS and is beyond that enforced on the majority of commercial and recreation vessels that regularly transit the same bioregion. International vessels are given the highest priority to prevent the introduction of IMS into Australian waters. However, domestic vessels (interstate and locally sourced) are also risk-assessed to reduce the likelihood of spreading marine pest species already established in Australian waters. The biofouling risk assessment approach adopted by Santos will ensure that the *Aquatic Resources Management Act 2016* and associated regulations prohibiting the introduction of non-endemic fish species will be met.

With adherence to the proposed management controls, the risk to the environment from IMS has been reduced to low and ALARP.

7.2.6 Demonstration of Acceptability

Table 7-4: Acceptability evaluation – Introduction of Invasive Marine Species

Is the consequence ranked as Very Low to Medium?	Yes – introduction of IMS residual risk ranking is Very Low.
Is further information required in the consequence assessment?	No – potential impacts and risks well understood through the information available
Are risks and impacts consistent with the principles of ESD?	Yes – activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure (EA-91-IG-00004), which considers principles of ESD. The residual consequence of the impact for this aspect is Low and therefore does not affect the

	outcomes of the principles of ecologically sustainable development as per **Table 5-5**.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – management consistent with Biosecurity Act 2015, and associated regulations, Australian Biofouling Management Requirements guideline, (DAWE, 2022), National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2018) and the *Aquatic Resources Management Act 2016.* Controls implemented will minimise the potential impacts to species identified in recovery plans and conservation advice.
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – no concerns raised. Santos will follow advice of DAFF to ensure all project vessels (inc. MODU) present low level biosecurity risk.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above

The mobilisation of MODU/vessels and equipment to undertake offshore activities is industry standard practice, and the IMS risks are well understood and subject to regulation. The vessels and equipment that are internationally mobilised will meet Australian biosecurity requirements, and proposed management is consistent with National Biofouling Management Guidance for the petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2018) and Australian Biofouling Management Requirements (DAWE, 2022).

Application of the proposed control measures and adherence to legislation and regulations reduce the likelihood of introducing invasive species into the operational area and surrounding islands, and the dispersive offshore location in the operational area reduces the probability of successful establishment in the unlikely event of introduction.

No stakeholder concerns have been raised regarding this aspect, and the proposed controls will reduce the residual level of risk to low and ALARP. Therefore, the residual risk associated with IMS is considered by Santos to be environmentally acceptable.

7.3 Marine Fauna Interactions

7.3.1 Description of Event

Event	There is the potential for vessels or equipment from the vessels involved in operational activities to interact with marine fauna, including potential strike or collision, potentially resulting in severe injury or mortality. Bird strike may also occur from helicopters during take-off and landing.
Extent	Within the operational area, in the immediate vicinity of the MODU, and vessels, or helicopters, while moving.
Duration	For the duration of the activity.

7.3.2 Nature and Scale of Environmental Impacts

Potential receptors: Threatened or migratory fauna (marine mammals, marine turtles, sharks and rays, fish and birds).

Movement of the vessels in the operational area introduces the potential for interaction with marine fauna present at the same location during the activity. Marine fauna in surface waters that would be most at risk from vessel collision include marine mammals and marine turtles. The operational area overlaps several BIAs/ habitats critical for the flatback turtles (internesting buffer; habitat critical to the survival of the species), humpback whale (migration) and pygmy blue whale (distribution), as well as the whale shark (foraging) and wedge-tailed shearwater (breeding).

Vessel strike and vessel disturbance are identified as potential threats to a number of marine fauna species in relevant recovery plans and conservation advice.

7.3.2.1 Marine Mammals and Fish and Sharks

The withdrawn Conservation Advice for *Megaptera novaeangliae* (humpback whale) (TSSC, 2015h) indicates that humpback whales are one of the most frequently reported whale species involved in vessel strikes worldwide (Laist et al., 2001; Jensen & Silber, 2003). This observation is supported by Australian studies referenced in The National Strategy for Reducing Vessel Strike on Cetaceans and Other Marine Megafauna (DoEE, 2017a). The increase in vessel numbers (Silber & Bettridge, 2012) is not only a threat to humpback whales in relation to vessel strikes but also in relation to disturbance and displacement from key habitats. Similarly, vessel strike is also recognised by the Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) as one of the threats to the recovery of whale sharks.

The most commonly sighted whale in continental shelf waters of the region is the humpback whale. As described in Existing Environment (**Section 3**), the, the humpback whale migrates between calving grounds in the Kimberley region of Western Australia to feeding grounds in Antarctica, with the northbound migration from early June to early August (BHPB, 2005) and the peak of the northbound migration between Exmouth Gulf and the Dampier Archipelago occurring around July, concentrated inshore of the 200-m depth contour (Jenner et al., 2001). The southern migration peaks around early September, with pods travelling in shallower waters, typically at 30 m to 100 m and passing west of Barrow Island and north of the Montebello Islands. Higher numbers may be encountered in the operational area during the humpback whale southern migration, given the water depths of the operational area.

Pygmy blue, sei, Bryde's, orca and/or fin whales may also transit through the operational area, although it is outside the blue whale migration corridor in the region (DoEE, 2017a). Given the water depths in the operational area (ranging from approximately 95 m – 125 m), it is unlikely there will be significant numbers of these species encountered during the activity.

The worst potential impact from vessel collision would be mortality or serious injury of an individual. Collisions between vessels and cetaceans are most frequent on continental shelf areas where high vessel traffic and cetacean habitat occur simultaneously (WDCS, 2006). Instances of cetacean deaths as a result of vessel collisions in Australian waters have been recorded (e.g., a Bryde's whale in Bass Strait in 1992) (WDCS, 2006), although the data indicates this is likely to be associated with container ships and fast ferries. The Whale and Dolphin Conservation Society also indicates that some cetacean species, such as humpback whales, can detect and change course to avoid a vessel (WDCS, 2006). The reaction of whales to the approach of a ship is quite variable. Some species remain motionless when in the vicinity of 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).

Whale sharks are at risk from vessel strikes when feeding at the surface or in shallow waters (where options to dive are limited). The operational area overlaps the whale shark foraging BIA, therefore individuals may be encountered during operational activities. However, the whale shark presence within the operational area is not expected to comprise significant numbers given that no main aggregation area exists within the operational area, therefore, their presence would be transitory and of a short duration. No constraints within the operational area (e.g., shallow water or shorelines) would prevent whale sharks from moving away from vessels. Vessel speed has been demonstrated to be a key factor in relation to collision with marine fauna, particularly cetaceans, with faster-moving vessels posing a greater collision risk than slower vessels (Laist et.al., 2001; Jensen & Silber, 2003; Hazel, 2009). Laist et al. (2001) suggest the most severe and lethal injuries to cetaceans are caused by vessels travelling at 14 knots or faster.

7.3.2.2 Marine Turtles

Turtles may be encountered in the operational area given the depth of water, and the presence of internesting BIAs (including habitat critical for the survival of the species). However, as the operational area is approximately 45 km from the nearest nesting beach it is unlikely that internesting individuals will be present in the operational area, despite overlapping the BIA. Marine turtle and vessel interactions arising from increased vessel traffic is recognised as one of a number of key threats to marine turtles in the Recovery Plan for Marine Turtles (Commonwealth of Australia, 2017).

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 (Commonwealth of Australia, 2017). However, turtles appear to be more vulnerable to vessel strike in areas of high urban population where incidents of pleasure crafts are higher. WA turtle populations have not been highlighted as those most affected by vessel strike, possibly due to the relatively low human population density of the NWS coastline.

Turtles will typically avoid vessels by rapidly diving; however, their ability to respond varies greatly depending on the speed of the vessel. Hazel (2009) reported that the number of turtles that fled vessels decreased significantly as vessel speed increased. Turtles are also adapted to detect sound in water (Popper et al., 2014) and will generally move from anthropogenic noise-generating sources, including vessels, within their detection range.

7.3.2.3 Seabirds

A number of protected species of marine birds have potential habitats or migratory routes in and around the operational area (**Section 3.2.5**). Furthermore, the breeding and BIA for the wedge-tailed shearwater overlaps the operational area. This species is considered pelagic, not known to ground on platforms or vessels, making them of low risk to helicopter strike during helicopter landing and take-off.

The number of helicopter flights required to support activities is relatively low and flights occur in the daylight, thereby reducing potential interactions with birds. The risk of helicopter strike is not high because helicopter noise is expected to elicit a behavioural response in birds to avoid collision and because of the relatively low speeds at which helicopters would be flying during take-off or landing.

7.3.3 Environmental Performance Outcomes and Control Measures

The EPO relating to this event is:

+ No injury or mortality to EPBC Act 1999 and WA Biodiversity Conservation Act 2016 listed fauna during activities [H2-EPO-05].

The control measures for this event are shown in **Table 7-5**, and the EPS and measurement criteria for this EPO are described in **Table 8-2**.

Table 7-5: Control measures evaluation – Marine Fauna Interactions

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-DC-CM-001 H2-IC-CM-001	Procedure for interacting with marine fauna	Reduces risk of physical and behavioural impacts to marine fauna from vessel, because if they are sighted, then the vessel can slow down or move away, and helicopters can increase distances from sighted fauna if required.	Operational costs to adhere to marine fauna interaction restrictions, such as vessel and helicopter speed and direction, are based on legislated requirements and must be adopted.	**Adopted** - Benefits in reducing impacts to marine fauna outweigh the costs incurred by Santos. Control drives compliance with EPBC Regulations (Part 8).
Additional Control Measures				
N/A	Restrict the timing of activities to operate outside of sensitive periods only	Reduce risk of collisions (causing harm) during environmentally sensitive periods for listed marine fauna.	High cost in moving or delaying schedule while the risk to all listed marine fauna cannot be reduced due to variability in	**Rejected** - Grossly disproportionate to low incremental environmental benefit given existing low level of risk

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			timing of migration periods and unpredictable presence of some species.	
N/A	Dedicated MMO on vessels (EPBC Policy Statement 2.1 Part B)	Improved ability to spot and identify marine fauna at risk of collision (that may cause harm).	Additional cost of contracting MMO.	**Rejected** - Cost disproportionate to increase in environmental benefit and would severely limit operations, which are required to occur 24 hours a day, 7 days a week.
N/A	Activities will only occur during daylight hours	Reduced potential for a vessel-fauna collision occurring as activities only undertaken during daylight hours when visibility highest.	Lengthens duration of the activity as operations only continue for approximately ten hours per day. Increased cost due to increased activity time (more than double the cost). Lengthened schedule results in increased impacts and risks (e.g., planned emissions and discharges, interference with other marine users.	**Rejected** - Substantial additional cost due to doubling of activity duration. No overall environmental benefit as results in increased impacts and risks
N/A	Adopt further measures to those outlined in EPBC Regulations 2000 — Part 8 Division	Potentially provide an additional level of protection of marine fauna.	Administrative costs to update existing procedure. Operational	**Rejected** - The existing control ‘procedure for interacting with marine fauna’

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
	8.1 during peak periods of ecological sensitivity, for example, additional management considerations for vessels outlined in the Australian National Guidelines for Whale and Dolphin Watching (DoEE, 2017b)		costs through interruption to activities through implementation of controls developed for an industry trying to get close to marine fauna, when Santos activities aim to avoid fauna.	has been written in accordance with the EPBC Act and other relevant guidelines. A review of this procedure against the Australian National Guidelines for Whale and Dolphin watching (DoEE, 2017b) found that there are no additional relevant controls in the Australian National Guidelines for Whale and Dolphin watching and therefore adopting this control is not ALARP.

7.3.4 Environmental Impact Assessment

Description	
Receptors	Threatened, migratory and local fauna (marine mammals, marine reptiles, sharks, fish, rays and seabirds)
Consequence	III – Moderate

In the event of a collision with marine fauna, there is the potential for injury or death to an individual. Of the receptors that could be present in the operational area, the following species are more likely to be present due to the operational area overlapping their BIAs:

+ flatback turtles (internesting buffer; habitat critical to the survival of the species),
+ humpback whale (migration)
+ pygmy blue whale (distribution)
+ whale shark (foraging)
+ wedge-tailed shearwater (breeding).

Description	
Boat strike and vessel disturbance are identified as potential threats to a number of marine fauna species in relevant recovery plan and conservation advice. The above information demonstrates that with control measures in place the activity will be conducted in a manner that reduces potential impacts to ALARP and of acceptable level. There is the potential for death or injury of EPBC Act listed individual species. As they would represent a small proportion of the local population it is not expected that it would result in a decreased population size over what would usually occur due to natural variation, at a local or regional scale. However, the threat assessment applied to marine fauna species that are protected under the EPBC Act (matters of national environmental significance protected turtle, whale shark, whale or bird would be a moderate (III) consequence.	
Likelihood	b – Unlikely
Given the presence of a number of BIAs for turtles, marine mammals and birds, receptors are expected to be present in the operational area at various times of the year. The operational area overlaps the humpback whale northern and southern migration pathway, and as such migrating individuals may traverse this operational area. No known aggregation areas (breeding, resting or calving) occur within the operational area and therefore concentrations of milling individuals are unlikely. Vessels will be moving very slowly whilst inside the operational area, posing a low risk of collision with marine fauna. In addition, the noise generated from vessel operations will deter marine fauna from coming in close proximity to vessels. Furthermore, EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country. With controls in place ensuring the vessels are compliant with EPBC Regulations, the likelihood of a collision with marine fauna resulting in a very low/negligible consequence is considered to be Unlikely (b).	
Residual Risk	The residual risk associated with this event is **Low.**

7.3.5 Demonstration of As Low As Reasonably Practicable

There are no alternatives to the use of the MODU, ISV and support vessels to undertake the activity. The inherent likelihood of encountering fauna in the operational area is limited by the separation from areas of high surface fauna density. With relatively low vessel speeds and compliance with fauna interaction procedures, including Regulation 8 of the EPBC Regulations 2000, a fauna collision is considered unlikely.

In the event that vessels come in close proximity to EPBC Act listed marine fauna, such as whales, dolphins, turtles, birds and whale sharks, EPS have been implemented for limiting vessel operations, as well as for ensuring that the crew are aware through inductions of the risk posed by conducting the activity, in order to reduce the likelihood of a marine fauna collision to ALARP. Inductions for the crew of support vessels will include information about how to interact with marine fauna in accordance with the EPBC Regulations.

With the control measures adopted, the assessed residual risk for this impact is Low and cannot be reduced further. Additional control measures were considered but rejected since the associated cost or effort was grossly disproportionate to any benefit. Therefore, it is considered that the impact of the activities conducted is ALARP.

7.3.6 Demonstration of Acceptability

Table 7-6: Acceptability evaluation – Marine Fauna Interaction

Is the consequence ranked as Very Low to Medium?	Yes – marine fauna interaction residual risk ranking is Low.
Is further information required in 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' Environmental Hazard Identification and Assessment Procedure, which considers principles of ecologically sustainable development. The residual risk for this aspect is Low and therefore does not affect the outcomes of the principles of ecologically sustainable development as per **Table 5-5.**
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – Management consistent with Part 8 of the EPBC Regulations. Controls implemented will minimise the potential impacts to species identified in recovery plans and conservation advice. Relevant species recovery plans, conservation management plans and management actions, including but not limited to the: + *Recovery Plan for Marine Turtles in Australia* (Commonwealth of Australia, 2017) + Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (Threatened Species Scientific Committee, 2015c) + Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (Threatened Species Scientific Committee, 2015b) + Conservation Management Plan for the Blue Whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2015-2025 (Commonwealth of Australia, 2015b) + Approved Conservation Advice for *Megaptera novaeangliae* (humpback whale) (TSSC, 2025h) + *North-west Commonwealth Marine Reserves Network Management Plan 2014-24* (Director of National Parks, 2018) + Conservation Management Plan for the Blue Whale: A Recovery Plan under the *Environment Protection and Biodiversity*

	Conservation Act 1999 2015-2025 (Commonwealth of Australia, 2015b) + Approved Conservation Advice for *Rhincodon typus* (whale shark) (Threatened Species Scientific Committee, 2015a) + Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (Commonwealth of Australia, 2018a) Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2011-2021 (Department of Sustainability, Environment, Water, Population and Communities, 2012)
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes. DBCA requested the EP give consideration to avoiding impacts to conservation significant marine species listed under the *BC Act* that are known to occur in the BIMMA and associated reserves in proximity to the proposed activity. DMP also requested the EP assesses impacts to conservation significant species, accounting for the scale, location and biological significance of the proposed activities. In particular, large marine fauna such as cetaceans and whale sharks are common migratory species to the BIMMA, and the reserves unique ecosystems provide critical breeding and nesting habitat for significant marine turtle and shorebird species. Santos has assessed the impacts of marine fauna interactions from the activity in **Section 6.1** (Noise Emissions) and has committed to reduce physical and behavioural impacts to marine fauna from support vessels, helicopters and UAVs from noise on all project vessels and the MODU through implementing Procedures for interacting with marine fauna. This control measure also ensures compliance with Part 8 of the EPBC Regulations. Santos considers these concerns to have been addressed within **Section 3** and **Section 6.1** and in the environmental performance outcomes assessment and control measures assessment (**Section 6.2.3; Table 8-2**), including as per the Activity Notification and Reporting Requirements (**Table 8-5**).

Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above.

Movement of MODU, ISV and support vessel(s) are unavoidable to undertake the activity. The possibility of vessel strike is a well understood risk for maritime operations, including for commercial shipping and fishing.

Vessel movements will comply with all relevant maritime standards and regulations, including EPBC regulations to minimise risks to marine fauna. Application of the proposed management controls and adherence to Commonwealth regulations reduces the likelihood of vessel interactions with marine fauna. As part of Santos' reporting requirements for the activity, in the event that an impact did occur in the operational area, it will be reported in the National Ship Strike Database (CM & EPS H2-DC-CM-001-EPS-002 within Table 8-2).

Therefore, the impact is considered to be ALARP and environmentally acceptable.

With application of the proposed control measures, the potential impacts and risks to threatened fauna will be managed consistent with relevant recovery plans and approved conservation advice. Therefore, the risk is considered to be ALARP and environmentally acceptable.

7.4 Non-hydrocarbon Unplanned Releases

7.4.1 Description of Event

Event	Non-hydrocarbon liquids including miscellaneous chemicals and waste streams (brine, mixed cement, cleaning and cooling agents, stored or spent chemicals and leftover paint materials) are used or stored on-board the MODU/vessels during the activity. The presence of non-hydrocarbons liquids and chemicals represents a potential spill risk during chemical storage and handling e.g., due to tank damage, or human error. Another credible spill is due to a hose that parts when loading/offloading brine. Rupture of the pumping hose used to transfer these chemicals may occur due to dropped object, vessel motion, or hose failure. An accidental release of chemicals and other non-hydrocarbon liquids into the marine environment has the potential to occur from: + MODU (including drilling fluids), ISV and support vessel operations; + Transferring, storing or using bulk products (e.g. mixed cement); + Mechanical failure of equipment; + Handling and storage spills and leaks; + Hose or hose connection failure or leak; and + Lifting – dropped objects damaging liquid vessels (containers) Accidental loss of non-hydrocarbon liquids or chemicals to the marine environment could occur via tank pipework failure or rupture, inadequate bunding and /or storage, insufficient fastening or inadequate handling may result in impacts to water quality and hence sensitive environmental receptors.
Extent	The maximum volume of non-hydrocarbon liquids or chemicals that could be released during routine operations is likely to be small and realistically limited to the volume of individual containers (e.g., drums) stored on deck of vessels or the MODU. The worst-case credible scenario, however, would be the accidental release of a MODU mud pit (approximately 100 m^3 in any one pit for a nominal MODU). Dilution from most discharges in open waters is rapid, with 1 in 1,000 dilution usually occurring within 30 minutes. These findings indicate that it is unlikely for acute toxicity to develop at ecologically significant locations nor is it likely that detectable levels would be achieved at discharge locations (Costello and Read, 1994). In the event that the spill is not contained on deck, a release to the marine environment would likely disperse rapidly within the operational area. The environment that may be affected for non-hydrocarbon liquids or chemical release resulting in a decrease in water quality is likely to be restricted to around the MODU, ISV and support vessels but predominantly contained within the operational area in which it was released.
Duration	Instantaneous release during the activity.

7.4.2 Nature and Scale of Environmental Impacts

<u>Potential receptors:</u> Physical environment (water and sediment quality, benthic habitats), threatened, migratory or local fauna (marine mammals, marine reptiles, sharks and rays, fish and birds) and socio-economic receptors (tourism and recreation).

7.4.2.1 Physical environment

Non-hydrocarbon liquids or chemicals released to the marine environment may lead to contamination of the water column in the vicinity of the MODU, ISV and support vessels. The potential impacts would most likely be highly localised and restricted to the immediate area surrounding the release, with rapid dispersal to concentrations below impact thresholds likely to occur in the open ocean.

Due to the small volumes and expected rapid dispersal to concentrations below impact thresholds, impacts to water quality are not expected to cause flow-on effects to sediment quality or benthic habitats, including reefs, and offshore islands. There is no emergent or intertidal habitat that could be impacted by a surface release. Owing to the water depth, any spilled material is unlikely to reach land or affect any of benthic habitats.

7.4.2.2 Threatened or migratory species

Changes to water quality could potentially lead to short-term impacts on marine fauna (e.g., pelagic fish and sharks, marine mammals, marine reptiles and seabirds). As the operational area overlap several BIAs, including BIAs for flatback turtles (internesting), humpback whale (migration), whale shark (foraging), pygmy blue whale (distribution) and wedge-tailed shearwater (breeding) and habitat critical for the survival of the species for flatback turtles.

Recovery plans and conservation advice for numerous bird species identify marine pollution and contamination impacts as a threat to the species. In addition, the Recovery Plan for Marine Turtles in Australia 2017 to 2027 (Commonwealth of Australia, 2017) identifies deteriorating water quality as a threat to all species of marine turtles in Australia. These species have been identified as potentially being within the operational area from time to time.

Chemical 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, in particular those present at the sea surface (e.g., seabirds), by entrained or surface hazardous liquids and sublethal or lethal effects from toxic chemicals are considered unlikely given the expected low concentrations and short exposure times.

7.4.2.3 Socio-economic receptors

Given the localised and temporary impacts of an unplanned hazardous liquid spill, any impact to other marine users and their activities is considered unlikely.

7.4.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event include:

+ No unplanned objects, emissions or discharges to sea or air [H2-EPO-04].

The control measures for this event are shown in **Table 7-7**, and the EPS and measurement criteria for the EPOs are described in **Table 8-2.**

Table 7-7: Control measures evaluation – Non-hydrocarbon Unplanned Releases

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
H2-DC-CM-031 H2-IC-CM-025	Dropped object prevention procedure	Impacts to environment are reduced by preventing dropped objects and by retrieving dropped objects unless the environmental consequences are negligible or there are risks to safety. Minimises drop risk during MODU, ISV and support vessels lifting operations. Ensures lifting equipment certified and inspected.	Personnel costs involved in implementing procedures and in incident reporting.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh cost to Santos.
H2-DC-CM-032 H2-IC-CM-026	Hazardous chemical management procedures	Reduces the risk of spills and leaks (discharges) to sea by controlling the storage, handling and clean-up.	Personnel cost associated with implementation of procedures and permanent or temporary storage areas.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh costs.
H2-DC-CM-025 H2-IC-CM-021	General chemical management procedures	Potential impacts to the environment are reduced through following correct procedures for the safe handling and storage of chemicals.	Personnel costs associated with ensuring procedures are in place and implemented during inspections.	**Adopted – Benefits of** ensuring procedures are followed and measures implemented outweigh the costs of personnel time.
H2-DC-CM-023 H2-IC-CM-019	Deck cleaning and product selection	Improves water quality of discharge (reduced toxicity) to the	Personnel costs of implementing, potential additional cost	**Adopted –** Benefits of ensuring vessels are compliant and deck cleaning products planned to be released

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		marine environment.	and delays of chemical substitution.	to sea meet MARPOL criteria.
H2-DC-CM-024 H2-IC-CM-020	Chemical selection procedure	Aids in the process of chemical management that reduces the impact of drilling discharges to sea. Only environmentally acceptable products are used.	Cost associated with implementation of procedure. Range of chemicals reduced with potentially higher costs for alternative products.	**Adopted** – Environmental benefit of using lower toxicity chemicals outweigh procedural implementation costs.
H2-DC-CM-033 H2-IC-CM-027	Maritime Dangerous Goods Code	Dangerous goods managed in accordance with IMDG Code to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction.	Cost associated with implementation of code/procedure.	**Adopted – Benefits of** ensuring procedures are followed and measures implemented outweigh costs.
H2-DC-CM-036 H2-IC-CM-030	Bulk liquid transfer procedure	Bulk liquid transferred in accordance with bulk transfer procedures to reduce the risk of an unintentional release to the sea.	Cost to implement ongoing procedure. Cost of purchasing and maintaining equipment (e.g., bulk hoses and connections).	**Adopted –** Benefits of ensuring procedures are followed and measures implemented outweighs costs.
H2-DC-CM-037 H2-IC-CM-031	MODU and support vessel spill response plans including predrilling source control plan	Implements response plan to deal with an unplanned hydrocarbon spills quickly and efficiently in order to reduce impacts to the	Personnel cost and administrative costs associated with preparing documents, ongoing management (spill response	**Adopted** - Environmental benefits of ensuring response plans in place, are followed and measures implemented, and that the MODU/support vessels are compliant outweighs the costs of

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		marine environment.	exercises) and implementation of plans.	personnel time associated with preparation and implementation of spill response plans
H2-DC-CM-038	MODU Planned Maintenance System (PMS).	MODU equipment is operating within its parameters, reducing the risk of unplanned discharges to the marine environment	Costs are standard for routine PMS.	**Adopted** – benefits in reducing atmospheric emissions impacts outweigh the minimal costs.

7.4.4 Environmental Impact Assessment

<table>
<tr><th colspan="2">Description</th></tr>
<tr><td>Receptors</td><td>Physical environment (water and sediment quality, benthic habitats)
Threatened, migratory or local fauna (marine mammals, marine reptiles, sharks, fish, rays and birds)</td></tr>
<tr><td>Consequence</td><td>II – Minor</td></tr>
<tr><td colspan="2">In the event of a non-hydrocarbon liquid or chemical spill, the quantity of a worst-case liquid release is unlikely to be greater than 1 m^3(the size of the largest storage container) for all chemicals other than drilling fluid, and up to 100 m^3 of drilling fluids. The small volumes, dilution and dispersion from natural weathering processes such as ocean currents indicate that the extent of exposure will be limited in area and duration. Furthermore, most of the drilling fluids that are planned to be used will be water based muds therefore having low impact on the marine environment.

The susceptibility of marine fauna to non-hydrocarbon liquids and chemicals is dependent on the type and exposure duration; however, given that exposures would be limited in extent and duration, exposure to marine fauna from this hazard is not expected to result in a fauna fatality. Impacts from discharges to the marine environment to water quality would be short-term and localised, due to the nature and behaviour of the chemicals identified as being at risk of spilling, only pelagic fauna present in the immediate vicinity of the spill would likely be at risk of impact.

Habitat degradation, deteriorating water quality and marine pollution are identified as potential threats to a number of marine fauna species (that may be present in the operational area) in relevant recovery plans and conservation advice and to matters of national environmental significance (MNES) (DoE, 2013). However, the potential non-hydrocarbon releases of liquids or chemicals are not expected to significantly impact the receiving environment with control measures proposed to prevent releases.

Furthermore, EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country.

Given that a non-hydrocarbon or chemical spill would not result in a decreased population size at a local or regional scale it is expected that a spill of this nature would result in a Minor (II) consequence.</td></tr>
<tr><td>Likelihood</td><td>b – Unlikely</td></tr>
</table>

Description	
A small non-hydrocarbon liquid release is unlikely to have widespread ecological effects, given the nature of the chemicals on board, the small volume that could be released, the depth and transient nature of marine fauna in this area, and the prevention and management procedures in place to clean up a spill. Santos reviewed non-hydrocarbon liquid spills and leaks from equipment and machinery in recent history (due to split hoses, small leaks, or handling errors). Most of the spills and leaks reported occurred within bunded areas, were less than 100 L, did not reach the marine environment and were cleaned up immediately. The likelihood of a small hazardous liquids release occurring is limited given the set of mitigation and management controls in place for this program. Consequently, the likelihood of releasing hazardous liquids to the environment, which results in a minor consequence, is considered to be Unlikely (B).	
Residual Risk	The residual risk associated with this event is **Very Low.**

7.4.5 Demonstration of As Low As Reasonably Practicable

Non-hydrocarbon liquids and chemicals will be required to undertake the activity, so their removal from the operation is not viable. Dangerous chemicals used during the drilling activity will be managed where applicable, in compliance with the Maritime Dangerous Goods Code. Procedures are in place for the transfer of bulk liquids, reducing the risk of unplanned releases to sea due to equipment failure, operational error, or overflows and leaks. Objects will need to be moved around the decks of the MODU, ISV and support vessels and transferred between the MODU/ISV and the support vessels. Control measures in place will ensure correct lifting, storage and handling procedures are followed as well as ensuring the maintenance of equipment is undertaken according to preventative management systems. No beneficial additional control measures were identified to further reduce the risk of this hazard.

Other management controls that have been implemented include vessel maintenance systems, chemical management procedures, spill clean-up equipment and Shipboard Marine Pollution Emergency Plan (SMPEP)/OPEPs not only to minimise the risk of an accidental release, but also to reduce the impact in the event that a release does occur.

Containment of small spills from bunding, inherent in the design of vessels and from spill containment kits onboard these vessels (detailed in the SMPEP) provides a barrier to any spills reaching the marine environment. The inspection and maintenance of bunding and drainage systems and of spill response kits provides assurance that these are available to contain spills in the event of a small leak. It is considered that barriers in place to contain spills would prevent spills from reaching the marine environment and thus it is considered that there are no further controls that would offer a further benefit to the environment.

A thorough set of controls has been proposed to ensure the risks of minor hazardous liquid spills and leaks occurring and subsequent impacts are minimised. The resulting impacts to marine fauna that could potentially result from a spill of this size would be minor, with impacts restricted to a small number of individuals within a localised area.

The controls proposed are in line with applicable actions described in relevant recovery plans and conservation advice to reduce the risk of habitat degradation and deteriorating water quality (for example, from pollution) to a level considered to be ALARP by Santos. The assessed residual risk for this impact is low and cannot be reduced further. It is considered therefore that the impact of the activities conducted is ALARP.

7.4.6 Demonstration of Acceptability

Table 7-8: Acceptability evaluation – Non-hydrocarbon Unplanned Releases

Is the consequence ranked as Very Low to Medium?	Yes – maximum hazardous liquid release (surface) residual risk is ranked Very Low.
Is further information required in 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' Environmental Hazard Identification and Assessment Procedure, which considers principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – management consistent with Marine Order 94 (Marine pollution prevention – packaged harmful substances) and with relevant recovery plans and conservation advice for species that may occur in the operational area. Relevant species recovery plans, conservation management plans, North-west Marine Park Network Management Plan, and management actions.
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – no concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above.

With the controls in place to prevent an accidental release of small volumes of non-hydrocarbon liquids and chemicals and the minor impacts predicted from an unplanned release of such material, the risk to the marine environment is considered low. Potential risks are unlikely to be greater than those caused by other commercial marine vessels or offshore activities in deep water.

The materials will be managed in accordance with relevant legislation and standards and Santos' procedures. The small volumes negate the need for any further contingencies to be in place that are included for some of the larger spill scenarios associated with the activity.

With the controls in place to prevent accidental spills and the low impacts predicted from a spill of this size, the environmental risk of using and handling the required chemicals is considered ALARP and environmentally acceptable.

7.5 Overview of Unplanned Releases of Hydrocarbons

There is the potential for:

+ loss of well control (subsea and surface);
+ loss of containment (wellhead and pipeline) through damage to existing infrastructure (via dropped object or anchor drag);

- loss of containment of marine diesel oil (MDO) due to a vessel collision event or refuelling activities within the operational area

Liquid condensate and diesel spill trajectory modelling were used to predict the potential extent of a worst-case spill event for both the MDO spills and LOWC scenarios at one location within the operational area (RPS, 2023).

Table 7-9 Summary of Largest Credible Hydrocarbon Spill Scenarios

Maximum Credible Scenario	Hydrocarbon Type	Maximum Credible Volume	EP Section
Loss of well control or damage to infrastructure causing condensate with gas release from Halyard-2 wellhead at subsea and surface	Halyard Condensate	173,755 m^3	**Section 7.6**
Loss of integrity or damage causing condensate with gas release from the East Spar pipeline in Commonwealth waters.	Halyard condensate	Halyard-1: 161 m^3	**Section 7.7**
Loss of integrity or damage to infrastructure causing condensate with gas release from Halyard-1 subsea wellhead or Halyard-1 well.	Halyard condensate	1,269 m^3 (based on 13 m^3 per day)	**Section 7.8**
Surface spill – Release of diesel from support fuel tank (due to vessel collision or dropped object) in Commonwealth waters.	Diesel	186 m^3	**Section 7.9**
Minor Hydrocarbon Release	Diesel, Oil and Hydraulic Oil	1 m^3	**Section 7.10**

7.5.1 Spill scenario selection

7.5.1.1 Loss of well control

Santos has identified a loss of well control (LOWC) as the worst-case type of credible oil release scenario that could potentially occur during the activity. A LOWC incident may discharge directly to the sea surface or at the seabed, depending on the type of failure that occurs. The following worst-case credible LOWC oil spill scenarios were assessed:

- a LOWC at the Halyard-2 well location with the release of 173,755 m^3 of Halyard condensate at the seabed; and

+ a LOWC at the Halyard-2 well location with the release of 170,576 m^3 of Halyard condensate at the sea surface.

7.5.1.2 Vessel collision

It is considered credible that a release of MDO to the marine environment could occur from a collision between the activity vessels and an errant third party vessel. Such events could have sufficient impact to result in the rupture of a diesel tank leading to a loss of integrity. This is considered credible given the diesel tanks may not be protected or double-hulled and fuel tank ruptures resulting in a hydrocarbon release have occurred before within the maritime industry.

The *Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities* (AMSA, 2015) recommend that the spill scenario for modelling and impact assessment should be based on the largest single fuel tank volume. A review of the contracted ISV fuel oil tank layout confirmed; that the largest single fuel tank is 186 m^3 in capacity. A conservative modelled spill volume of 329 m^3 has been used for this EP.

7.5.1.3 Refuelling

A minor spill (approximately 37.5 m^3) of MDO could occur during vessel to MODU, or vessel to ISV refuelling resulting in a discharge of hydrocarbons to the marine environment at the sea surface. Spills during refuelling can occur through several pathways, including fuel hose breaks, coupling failure or tank overfilling.

Spills resulting from overfilling will be contained within the vessel or MODU drains and slops tank system. In the event that the refuelling hose is ruptured, the fuel bunkering activity will cease by turning off the pump, the fuel remaining in the transfer line will escape to the environment as well as fuel released prior to the transfer operation being stopped. The *Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities* (AMSA, 2015) provides guidance for calculating a maximum credible spill volume for a refuelling spill. The guidance provided by AMSA (2015) for a refuelling spill under continuous supervision is considered appropriate given refuelling will be constantly supervised. The maximum credible spill volume during refuelling is calculated as: transfer rate (150 m^3/hr) x 15 minutes of flow. The detection time of 15 minutes is seen as conservative but applicable following failure of multiple barriers, followed by manual detection and isolation of the fuel supply.

7.5.1.4 Damage to subsea infrastructure

Should live subsea infrastructure within close proximity to the proposed Halyard-2 well be damaged during any stage of the Halyard-2 activity, a loss of containment/hydrocarbon release scenario. Potential damage may be caused from a dropped object, anchor drag or similar event.

Live subsea infrastructure and distance to the Halyard-2 well is listed below:

Subsea Infrastructure	Distance from the Halyard-2 drill centre (m)
Halyard-1 Well	+/-10
GES PLEM	+/-25

Given the LOWC scenario described in Section 7.5.1.1 is the worst case release of condensate, the same event and proposed response would apply to a loss of containment from the subsea East Spar

Pipeline or the suspended Halyard-1 wellhead/ well. Loss of containment (LOC) from damage to the subsea East Spar pipeline caused by dropped object or anchor drag has been previously assessed within the accepted VI Hub Ops Cth EP. Detailed within this EP is the potential for a dropped object or anchor drag to damage the section of the East Spar pipeline which is situated within the defined operational area for the Halyard-2 activities (Section 7.7). Under Regulations 56 (1(b)) of the OPGGS Act, Santos refers to Section 7.7 of the accepted VI Hub Ops Cth EP for assessment of this event.

LOC from damage to the Halyard-1 wellhead via either dropped object or anchor drag has been deemed a credible scenario. The LOC from a suspended wellhead has previously been assessed within the VI Hub Ops Cth EP (Section 7.8). Section 7.8 of this EP details the LOC event from the Halyard-1 well as a result of Halyard-2 activities (dropped object or anchor drag). The release volume from a LOC is a much smaller volume than that of the LOWC scenario presented in Section 7.6 (Wellhead LOC: 1,269 m^3, LOWC 173,755 m^3) of this EP, as a result assessment of LOC refers back to the LOWC assessment within Section 7.6.

Santos have defined a ‘handling zone’ to the North-North-West for deployment and handling of large infrastructure including XT and BOP (**Figure 7.1**). All anchor operations will be performed with the active fairlead away from infrastructure.

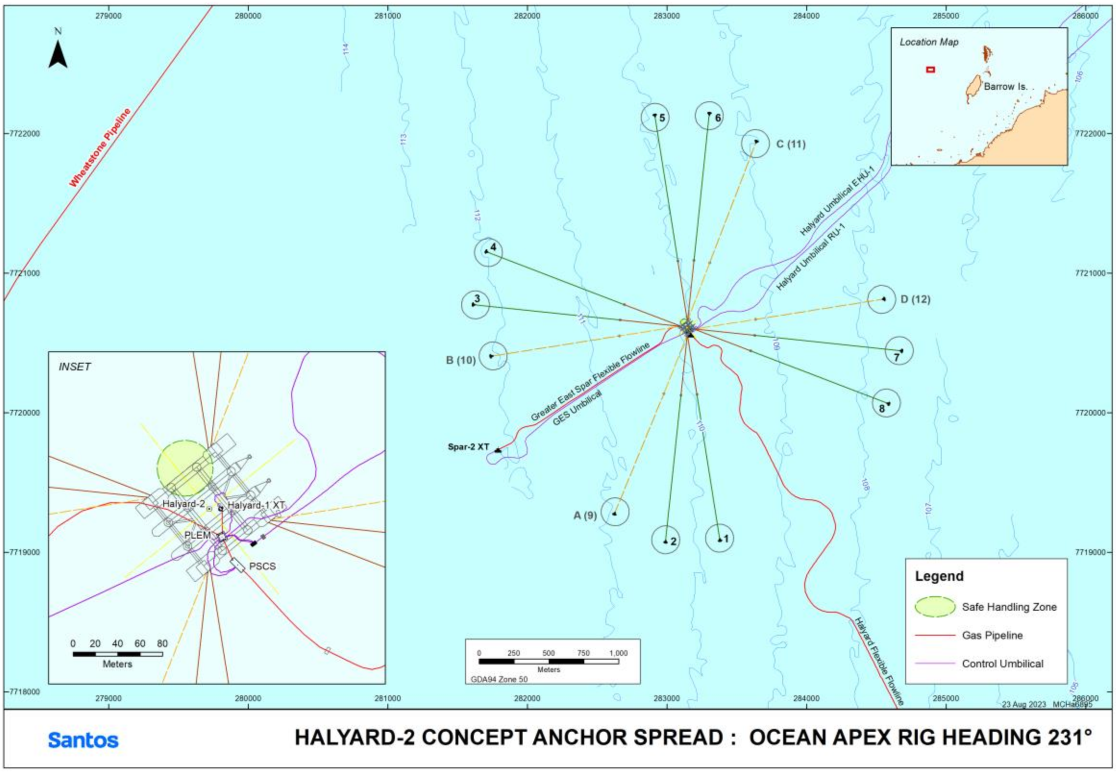

Figure 7.1 Halyard-2 Anchor Spread with identified Safe Handling Zone

7.5.2 Spill modelling overview

To determine the spatial extent of impacts from potential hydrocarbon spills, modelling was completed for the LOWC scenarios (RPS, 2023) and vessel collision scenario (RPS, 2021b). A surface spill of MDO during refuelling is considered relatively small in comparison to a surface spill of MDO during a vessel collision. It is therefore assumed that the extent of a hydrocarbon spill during refuelling would remain within the extent of the worst-case spill trajectory of diesel from a vessel collision, subsequently, modelling of a smaller spill was not conducted.

In the studies, oil spill modelling was undertaken using a three-dimensional oil spill trajectory and weathering model, SIMAP (Spill Impact Mapping and Analysis Program), which is designed to simulate the transport, spreading and weathering of specific oil types under the influence of changing meteorological and oceanographic forces. For the subsea release near-field subsurface discharge modelling was undertaken using OILMAP, which predicts the centreline velocity, buoyancy, width and trapping depth (if any) of the rising gas and oil plumes. A total of 300 individual 'realisations' made up the full stochastic simulation set for loss of well control spill scenarios, while 150 realisations made up the stochastic simulation for the vessel collision spill scenario.

For each set of stochastic realisations, SIMAP spatially tracked the surface oil, entrained oil in the water column, dissolved oil and oil on shorelines.

The outputs of this modelling showed a number of different possible outcomes of a spill, which were then analysed to determine the concentrations of hydrocarbon at each grid cell of the model, providing information about the probability of contact and concentration at contact of hydrocarbons across the EMBA.

Deterministic modelling was also performed to understand the potential area of influence that could be expected from a single spill event.

The LOWC scenarios were modelled at the Halyard-2 well location (RPS, 2023). The vessel collision scenario was modelled at the Spartan well location in WA-63-L (RPS, 2021b); this location is closer to sensitive receptors and the same hydrocarbon type and volume as the vessel collision scenario considered in this EP. Hence, the vessel collision modelling is considered a conservative representation of the vessel collision scenario considered in this EP.

7.5.2.1 Loss of well control spill modelling

Hydrocarbons that could be released to the environment are natural gas and hydrocarbon liquid (condensate) from a surface or subsea blowout. Quantitative hydrocarbon spill modelling was undertaken for the worst-case subsea and surface spill discharge rates and volumes from the Halyard-2 well location to inform the environmental impact assessment and to assist with emergency planning. Key parameters for each scenario modelled are given in **Table 7-9** on the basis of Santos' Halyard-2 Drilling & Completion Well Worst-Case Discharge Technical Fine Note (7910-375-REP-0001) and include:

+ a worst-case seabed discharge cumulative volumes of up to 1.093 MMSTB (173,755 m^3) of condensate and 52.058 Bscf of gas.
+ a worst-case sea surface discharge cumulative volumes of up to 1.073 MMSTB (170,576 m^3) of condensate and 51.102 Bscf of gas.

Table 7-10: Summary of spill scenarios modelled for surface and subsea loss of well control scenarios

Scenario Attribute	Surface Blowout	Subsea Blowout
Depth of release	Surface	139.7 m

Location of release	Halyard-2 well location	
Total volume of condensate	1.073 MMSTB (170,576 m^3)	1.093 MMSTB (173,755 m^3)
Total volume of associated gas	51.102 Bscf	52.058 Bscf
Time of year	Year-round	
Spill duration	11 weeks (77 days)	
Modelling duration	14 weeks (98 days)	

7.5.2.2 Vessel collision spill modelling

Quantitative spill modelling was undertaken for the worst-case credible spill from a vessel collision. Key attributes of this scenario are summarised in **Table 7-10**. The scenario was based on the loss of the entire contents of the single largest tank of a vessel, as recommended by AMSA (2015). Based on a review of representative vessels that may be used during the activity, this volume was determined to be 329 m^3 of MDO. This modelling was based on the worst-case credible vessel collision spill for the Spartan development project, which lies approximately 35 km east of the Halyard-2 well location. This modelling is considered representative as:

+ the hydrocarbon type is the same (MDO)
+ the release volume and duration are the same (329 m^3)
+ the metocean conditions are similar
+ the release location is closer to shore and sensitive receptors, hence the modelling may slightly over-estimate the extent of impacts from the spill.

Table 7-11: Summary of modelled vessel collision spill scenario

Scenario Attribute	Vessel Collision
Depth of release	Surface
Location of release	Spartan well location (approx. 35 km east of Halyard-2)
Total volume of MDO	329 m^3
Time of year	Year-round
Spill duration	Instantaneous
Modelling duration	21 days

7.5.3 Hydrocarbon characteristics

7.5.3.1 Condensate

Condensate is the term given to the mixture of low density liquid hydrocarbons that are present in natural gas produced from the Halyard field. Condensate may be in a gas phase in the reservoir, and condense into the liquid phase once temperature or pressure are reduced. The characteristics of the Halyard condensate are provided in **Table 7-11** and **Table 7-12**.

Table 7-12: Characteristics of Halyard condensate

Parameter	Description

API Gravity	52.1
Density (kg/m3)	770.5
Pour Point (oC)	<-36
Asphaltene (%)	<0.5
Viscosity (cP at 20 °C)	1.5
Hydrocarbon property category	Group I
Hydrocarbon property classification	Non persistent

Table 7-13: Boiling point ranges for Halyard condensate

Oil Type	Component	Non-persistent			Persistent
		Volatile[1]	Semi-volatile[2]	Low volatility[3]	Residual[4]
Halyard condensate	% of total	64.3	20.7	15	0.05
Boiling point ranges for: [1] <180 °C [2] 180-265 °C [3] 265-380 °C [4] >380 °C					

Condensate weathering

Evaporation is the primary weathering mechanism for volatile condensates such as Halyard condensate. Under constant calm wind speeds of 2.6 m/s, approximately 85% of the surface slick is predicted to evaporate in the first 24 hours, with approximately 10% remaining on the sea surface after seven days (**Figure 7-1**). Under variable wind speeds, the evaporation rate was similar, while wind-driven entrainment meant approximately less than 1% remained on the sea surface after 7 day (**Figure 7-2**). Halyard condensate has a wax content of <2% and has low asphaltene content (<0.5%), which indicates a very low propensity to take up water to form water-in-oil emulsion.

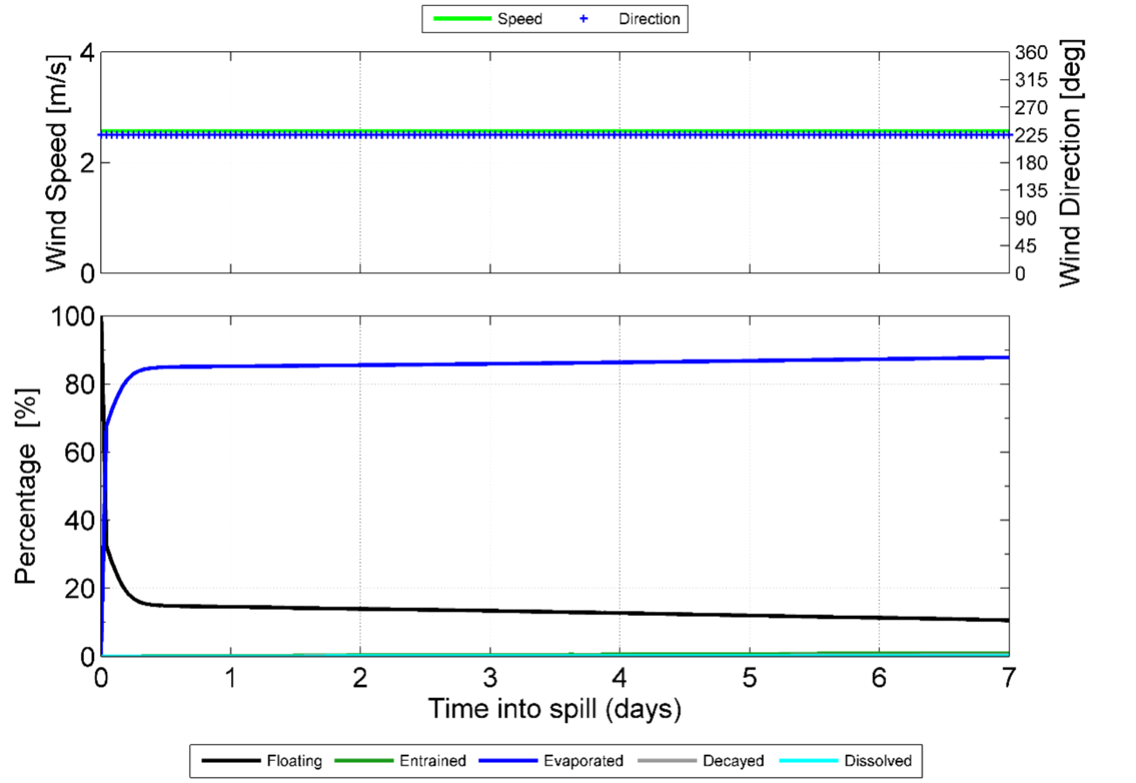

Figure 7.2: Simulated weathering of Halyard condensate for constant windspeeds of 5 knots (2.6 m/s) wind speed at 27°C water temperature (RPS, 2023).

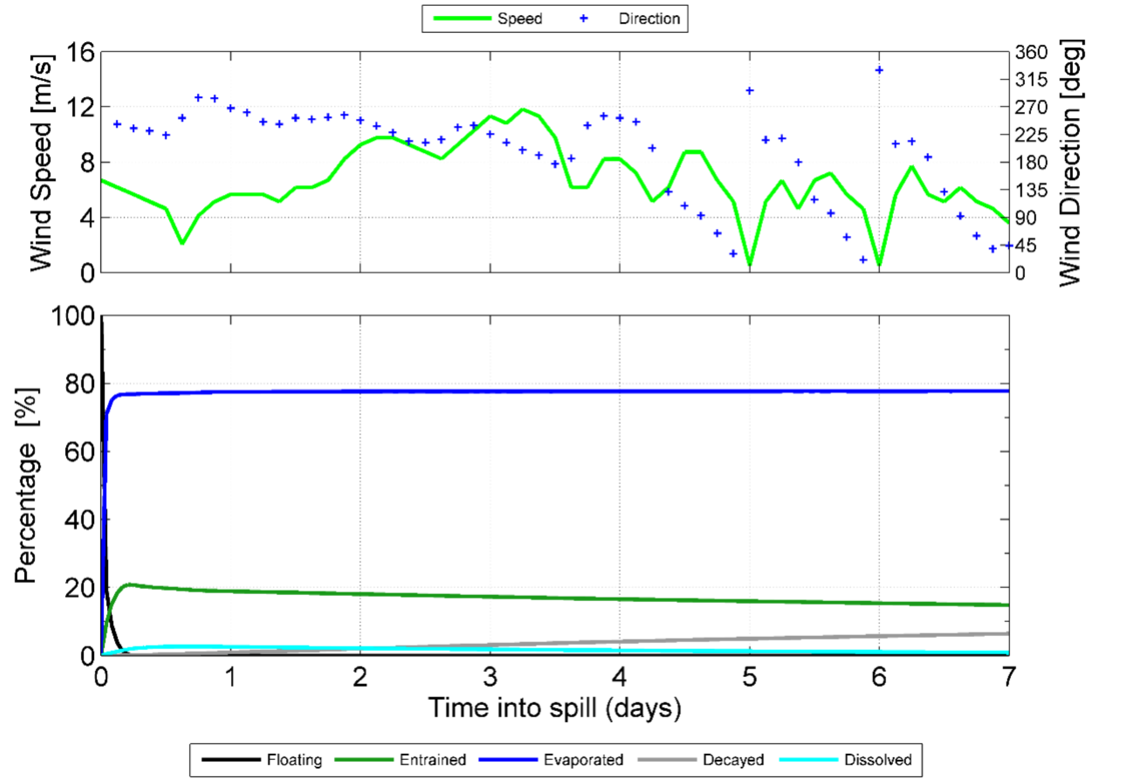

Figure 7.3: Simulated weather of Halyard condensate subject to variable wind speeds (6-8 m/s) at 27°C water temperature (RPS, 2023)

7.5.3.2 Marine diesel

International Tanker Owners Pollution Federation (2011b) and the Australian Marine Oil Spill Centre (AMOSC, 2011) categorise MDO as a light 'group II' hydrocarbon. In the marine environment, a 5% residual of the total quantity of MDO spilt will remain after the volatilisation and solubilisation processes associated with weathering. In the marine environment, MDO is expected to behave as follows:

+ MDO will spread rapidly in the direction of the prevailing wind and waves
+ evaporation will be the dominant process contributing to the fate of spilled MDO from the sea surface and will account for 60 to 80% reduction of the net hydrocarbon balance
+ the evaporation rate of MDO will increase in warmer air and sea temperatures
+ MDO residues usually consist of heavy compounds that may persist longer and will tend to disperse as oil droplets into the upper layers of the water column.

A surface release of 329 m^3 of MDO was modelled to represent the vessel collision scenario. This modelling was done to support the Spartan project and has been used as a proxy for the activity (refer to **Section 7.5.1.2**). This modelling is an appropriate proxy given it is in close proximity to the operational area and similar distances to the nearest sensitive receptors.

Upon release, the MDO is forecast to spread rapidly out to a thin film on the sea surface, and evaporation is forecast to remove approximately 50% of the released volume within several days of release. The MDO will also become increasingly subject to entrainment into the water column as the density increases after losing the lighter components through evaporation (RPS, 2021b).

A summary of the representative characteristics of MDO is provided in **Table 7-13** and **Table 7-14**.

Table 7-14: Characteristics of MDO

Parameter	Description
API Gravity	36.4
Density (kg/m^3)	843
Pour Point (°C)	<-36
Asphaltene (%)	<0.5
Viscosity (cP at 20 °C)	3.9
Hydrocarbon property category	Group II
Hydrocarbon property classification	Moderately persistent

Table 7-15: Boiling point ranges for MDO

Oil Type	Component	Non-persistent			Persistent
		Volatile1	Semi-volatile[2]	Low volatility[3]	Residual[4]
MDO	% of total	6.0	34.6	54.4	5.0
Boiling point ranges for:					

Oil Type	Component	Non-persistent			Persistent
		Volatile1	Semi-volatile[2]	Low volatility[3]	Residual[4]

[1] <180 °C

[2] 180-265 °C

[3] 265-380 °C

[4] >380 °C

MDO weathering

MDO is a moderate weight and moderately persistent oil in the marine environment. Under constant low winds (2.6 m/s), 44% of the surface slick is predicted to evaporate in the first 24 hours, and approximately 23% would remain on the sea surface after five days (**Figure 7-3**). Under variable wind conditions, where the winds are of greater strength, entrainment into the upper water column is indicated to be significant. Approximately 45% is expected to entrain after 24 hours and further 35% is forecast to evaporate, leaving approximately than 1-2% floating on the sea surface (**Figure 7-4**). MDO has a very low tendency for emulsion formation.

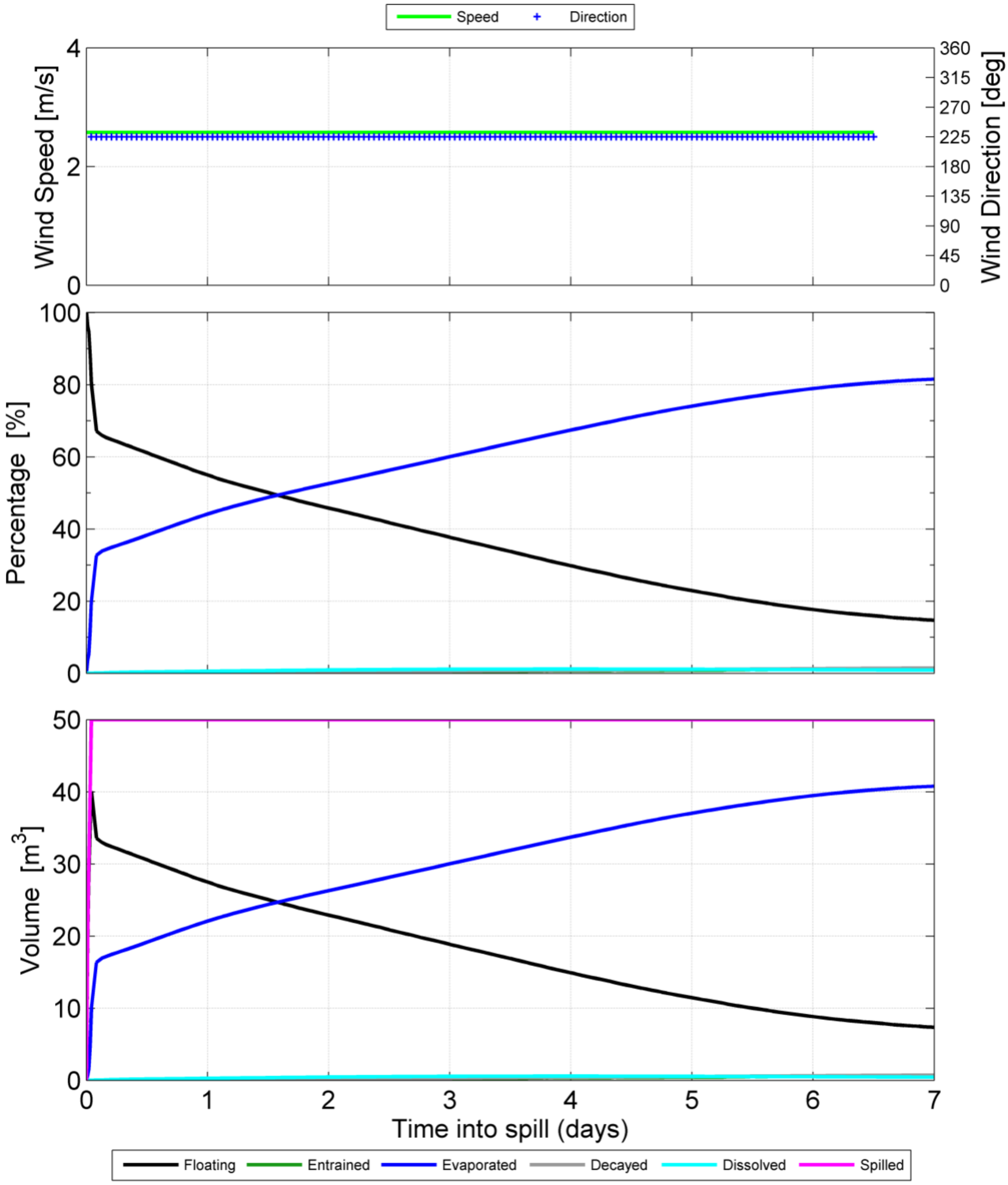

Figure 7.4: Simulated weathering of MDO for constant wind speeds of 2.6 m/s (RPS, 2021b)

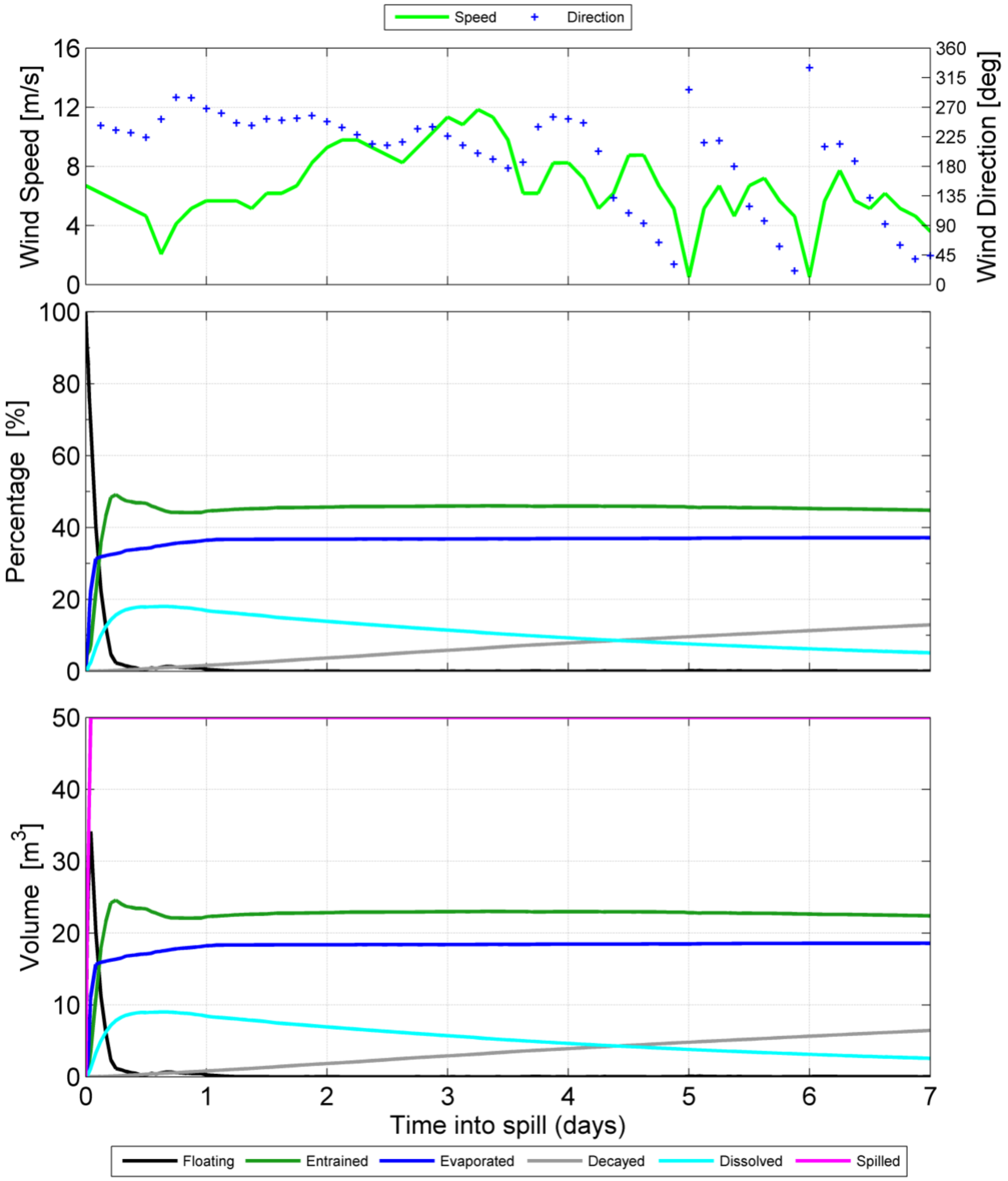

Figure 7.5: Simulated weathering of MDO for variable wind speeds (RPS, 2021b)

7.5.4 Hydrocarbon exposure values

To inform the impact 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 described below.

The EMBA shown in **Figure 3-1** was identified using low exposure values. 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/or subsurface hydrocarbons (NOPSEMA, 2019) and a visible sheen.

To inform impact assessment, exposure values that may be representative of biological impact have also been identified. These are called 'moderate exposure values' (defined by the MEVA) and 'high exposure values' (defined by the HEVA) and are shown in **Figure 3-1**. Moderate and high exposure values are modelled for each fate of hydrocarbon to identify what contact is predicted for surface (floating oil), subsurface (entrained oil and dissolved aromatic hydrocarbons), and shoreline accumulation of hydrocarbon at sensitivities.

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 identify appropriate exposure values Santos has considered the advice provided by NOPSEMA Bulletin #1 Oil Spill Modelling (NOPSEMA, 2019) and scientific literature. The selected hydrocarbon exposure values applied to the Halyard-2 Drilling & Completion oil spill modelling are discussed in **Table 7-15**, **Table 7-16** and **Table 7-17**. 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 OPEP).

Table 7-16: Floating hydrocarbons exposure values

Surface oil concentration (g/m2)	Exposure value	Description
1	Low	**Risk Evaluation** It is recognised that a lower floating oil concentration of 1 g/m² (equivalent to a thickness of 0.001 mm or 1 ml of oil 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 environment that might be contacted (EMBA) from floating oil. **Response Planning** Contact at 1 g/m² (as predicted by oil spill trajectory modelling) is used as a conservative trigger for activating scientific monitoring plans as detailed in the OPEP.
10	Moderate	**Risk Evaluation** There is a paucity of data on floating oil 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, 1996). The impact of floating oil on birds is better understood than on other receptors. A conservative exposure value of 10 g/m² has been applied to impacts from surface hydrocarbons (floating oil) in this EP. Although based on birds, this hydrocarbon exposure value is also considered

Surface oil concentration (g/m2)	Exposure value	Description
		appropriate for turtles, sea snakes and marine mammals (NRDAMCME, 1996). 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 surface oil to wildlife increases. All other things being equal, contact to wildlife by surface oil at 50 g/m² is expected to result in a greater impact. **Response Planning** Containment and recovery effectiveness drops significantly with reduced oil thickness (McKinney et al., 2017; NOAA, 2014). McKinney et al. (2017) tested the effectiveness of various oil skimmers at various oil thicknesses. Their results showed that the oil recovery rate of skimmers dropped significantly when oil 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, surface oil greater than 50 g/m² (Bonn Agreement Code 4/5 and equivalent to oil 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 7-17: Shoreline hydrocarbons accumulation exposure values

Shoreline oil concentration (g/m²)	Exposure value	Description
10	**Low**	**Risk evaluation** An accumulated concentration of oil 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). **Response planning** Not specifically used for response planning because 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

Shoreline oil concentration (g/m²)	Exposure value	Description
		risk of exposure to shoreline accumulations of oil, 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 that an oil 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 man-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 that the oil can be effectively cleaned according (AMSA, 2015; NOPSEMA, 2019) and is therefore used as a guide for shoreline clean-up planning. This exposure value equates to approximately ½ a cup of oil per square metre of shoreline contacted.
1,000	High	**Risk evaluation** At greater thicknesses, the potential for impact of accumulated oil to shoreline receptors increases. All other things being equal, accumulation of oil above 1,000 g/m² is expected to result in a greater impact. **Response planning** As oil increases in thickness the effectiveness of oil recovery techniques increases. This value can therefore be used to prioritise oil recovery efforts, assuming oil recovery is deemed to have an environmental benefit.

Table 7-18: Dissolved aromatic hydrocarbon exposure values

Shoreline oil concentration (g/m²)	Exposure value	Description
1	Low	**Risk evaluation** Dissolved Aromatic Hydrocarbons (DAH) include the monoaromatic hydrocarbons (compounds with a single benzene ring such as benzene, toluene, ethyl benzene, and xylenes) and polycyclic aromatic hydrocarbons [PAHs] (compounds with multiple benzene rings such as naphthalenes and phenanthrenes). These compounds have a greater bioavailability that other components of oil and are considered to be main contributors to oil toxicity. The toxicity of DAHs is a function of the concentration and the duration of exposure by sensitive receptors with greater concentration and exposure time causing more severe impacts. Typically tests of

Shoreline oil concentration (g/m^2)	Exposure value	Description
		toxicity done under laboratory conditions measure toxicity as proportion of test organisms affected (for example, 50% mortality or LC50) at the end of a set time period, often 48 or 96 hours. French-McCay (2002) in a review of literature, reported LC50 for dissolved PAHs with 96 hour exposure, range between 30 ppb for sensitive species (2.5th-percentile species) and 2,260 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 oil droplets) was 6 ppb to 410 ppb with an average of 50 ppb (French-McCay, 2002). More recently, French-McKay et al. (2018) described in-water thresholds as 10 – 100 µg / L (equivalent to ppb). Regarding the effect of UV on PAH toxicity, French-McKay et al. (2018) used the findings of Deepwater Horizon Natural Resource Damage Assessment Trustees (2016) to adjust for this affect by reducing the water column exposure thresholds by 10 x in the top 20 m of the water column. The dissolved hydrocarbon 10 ppb exposure value has been used to inform the EMBA within **Section 3**. An exposure value of 10 ppb is appropriate as it is concentration that could have some potential negative effect. **Response planning** Contact at 10 ppb (as predicted by oil spill trajectory modelling) is used as a trigger for activating scientific monitoring plans as detailed in the OPEP. Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers (NOPSEMA, 2019).
50	Moderate	**Risk evaluation** Approximates potential toxic effects, particularly sublethal effects to sensitive species (refer to above text). Consistent with NOPSEMA (2019). This value has been used to define the MEVA. **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). **Response planning** Encompassed by response to 10 ppb. There is nothing different for higher exposure values.

7.5.5 Spill risk assessment approach

The spill risk assessment approach adopted is based on Santos' Oil Spill Risk Assessment and Response Planning Procedure (SO-91-II-20003).

A consistent risk assessment approach is applied to unplanned hydrocarbon release scenarios. The spill risk assessment approach is based on Santos' Oil Spill Risk Assessment and Response Planning Procedure (SO-91-II-20003). The procedure describes the spill risk assessment process as follows:

+ identify the spatial extent of the EMBA. This has been completed as part of the assessment of the existing environment and receptors that are known to occur or may occur within the EMBA are described in **Section 3.2** and **Appendix C**.
+ identify areas of high environmental value (HEV) within the EMBA (HEVs are described in **Section 7.5.5.2**;
+ Identify and then risk assess hot spots. Hot spots are effectively a subset of HEVs, and their determination is described in **Section 7.5.5.3**; and
+ identify priorities for protection (for consideration of spill response strategies in the OPEP)

7.5.5.1 Spill environment that may be affected

Defining the EMBA by an oil spill is the first step in oil spill risk and impact assessment. For activities where there is the potential for multiple spill scenarios, the spill scenario, or combination of spill scenarios, resulting in the greatest spatial extent is used to define the overall EMBA for the activity. The EMBA is further described in **Section 3.1**. To determine the potential impact to receptors within the EMBA, the MEVA is used to determine them as described in **Section 3.1**.

7.5.5.2 Areas of high environmental value

Santos has predetermined areas of HEV along the Western Australian coastline by ranking these areas based on:

+ Protected area status – This is used as an indicator of the biodiversity values contained within that area, where a World Heritage Area, RAMSAR Wetland and Marine Protected Area will score higher than areas with no protection assigned.
+ BIAs of listed threatened species – These are spatially defined areas where aggregations of individuals of a species are known to display BIBs, such as breeding, feeding, resting or migration. Each one of these within the predefined areas contributes to the score.

Further input to determine areas of HEV included:

+ sensitivity of habitats to impact from hydrocarbons in accordance with the guidance document Sensitivity Mapping for Oil Spill Response produced by IPIECA, the International Maritime Organisation and International Association of Oil and Gas Producers
+ sensitivities of receptors with respect to hydrocarbon-impact pathways
+ status of zones within protected areas (IUCN (1A) and sanctuary zones compared to IUCN (VI) and multiple use zones)
+ listed species status and predominant habitat (surface versus subsurface)
+ social values, socio-economic and heritage features (such as commercial fishing, recreational fishing, amenities, aquaculture).

Tallied scores for each predefined area along the Western Australian coastline were then ranked from 1 to 5, with an assignment of 1 representing areas of the highest environmental value and those with

5 representing the areas of the lowest environmental value. HEVs for the worst-case oil spill EMBA, MEVA and HEVA associated with the Halyard-2 Drilling & Completion activities are shown in **Figure 7-5**.

7.5.5.3 Hot spots

While the entire MEVA 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 environmental value – considered by Santos to be HEV areas ranked 1 to 3
+ highest probability of contact by oil (either floating, entrained or dissolved aromatic)
+ greatest potential concentration or volume of oil arriving at the area.

These areas are termed 'hot spots'. Defining hots pots 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
+ receive the greatest concentration or volume of oil, either floating or stranded oil, entrained oil or DAH above contact exposure values described in **Section 7.5.4**.

A workshop was held to review the hotspots for the Halyard-2 Drilling & Completion activities worst case oil spill scenarios. During the workshop, additional hotspots may be included through discretion of workshop attendees where they do not strictly meet all of the above criteria. For example, an HEV ranked 1-3 with <5% probability, or an HEV ranked 4 or 5 with >5% probability, depending on the concentrations and volumes presented in the modelling report.

During the hotspot workshop, an environment consequence assessment is conducted against each of the hotspots identified using the Santos risk assessment process identified in **Section 5**, the outcome of this is provided in **Appendix G**.

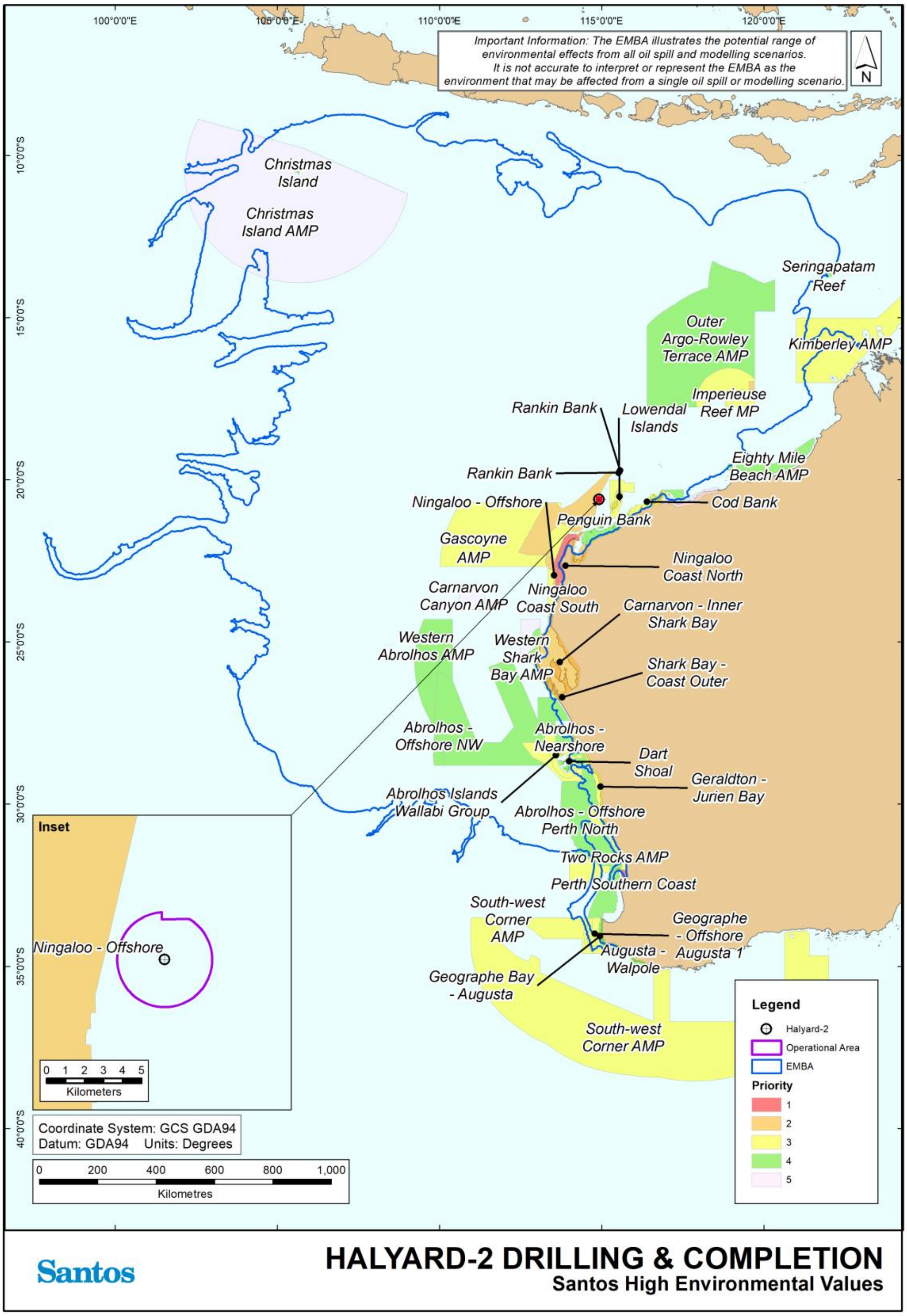

Figure 7.6: High environmental values within the EMBA, MEVA and HEVA

7.5.5.4 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. Hot spots with features that are not wholly submerged (emergent features) should have specific spill response planning conducted. This final determination of 'Priority for Protection' sites, for the oil spill response strategy, is based on the worst-case estimate of floating oil concentration, shoreline loading and minimum contact time at exposure value concentrations.

Further detail on selection of Protection Priority Areas process is detailed in the Oil Spill Risk Assessment and Response Planning Procedure (SO-91-II-20003).

The following Hot Spot locations have been identified as Priorities for Protection areas for oil spill response planning for the Halyard-2 Drilling & Completion activities within the Varanus Island Hub Operations OPEP and are based on the worst-case estimate of surface oil concentration, shoreline loading and minimum contact time at exposure value concentrations for the Halyard-2 Drilling & Completion activities:

+ Muiron Islands
+ Ningaloo Coast North
+ Montebello Islands
+ Barrow Island

The oil spill response strategies for Priority for Protection areas are undertaken within the Varanus Island Hub Operations OPEP (EA-60-RI-00186.02).

An assessment of each protection priority will be undertaken to determine the most appropriate spill response strategies based on the type of oil and the values of the protection priority area. This can be done through a strategic NEBA approach.

7.5.5.5 Potential hydrocarbon impact pathways

To help inform the hydrocarbon spill risk assessment receptors within the EMBA and potential impact pathways have been defined (**Table 7-18**). The potential impact pathways consider physical and chemical pathways. Physical pathways include contact from floating oil, accumulated shoreline oil, or entrained oil droplets. Chemical pathways include ingestion, inhalation or contact from any hydrocarbon phase. These are summarised in **Table 7-18** and the information is drawn upon within the hydrocarbon risk assessment for the spill scenario. **Table 7-19** 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 7-19: 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 oil coating is dependent upon the energy of the shoreline area, the type of the rock formation and continual biodegradation of the oil.	Impacts to flora (mangroves) and fauna further described below.	Chemical pathway to fauna and flora via adsorption through cellular membranes and soft tissue, ingestion, irritation/ 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 oil.	Indirect impacts to nesting and foraging habitats for birds and turtles. Direct impacts to infauna.	Chemical pathway to fauna and flora via adsorption through cellular membranes and soft tissue, ingestion, irritation/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 (e.g. 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 oil.	Indirect impacts to foraging habitats for birds and turtles. Direct impacts to infauna.	Chemical pathway to fauna and flora via adsorption through cellular membranes and soft tissue, ingestion, irritation/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 down into sediments. Degree of loading is dependent upon the energy and tidal reach of the shoreline, the type of	Indirect impacts to foraging habitats for turtles and fish. Direct impacts to infauna.	Adsorption via cellular membranes and soft tissue, ingestion, irritation/burning on contact and inhalation.	Indirect impacts to foraging habitats for turtles and fish. Direct impacts (mortality) to

Receptor	Physical Pathway	Potential Impacts	Chemical Pathway	Potential Impacts
	the substrate and continual weathering of the oil.			infauna through toxic effects and smothering.
Mangroves	Coating of root system 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 oil.	Yellowing of leaves. Defoliation. Increased sensitivity to stressors. Tree death. Reduced growth. Reduced reproductive output. Reduced seed viability.	External contact by oil 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	Coating of leaves/thalli reducing light availability and gas exchange. Degree of coating depends upon the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the oil.	Bleaching or blackening of leaves. Defoliation. Reduced growth.	External contact by oil and adsorption across cellular membranes.	Mortality. Bleaching or blackening of leaves. Defoliation. Disease. Reduced growth. Reduced reproductive output. Reduced seed/propagule viability.
Hard 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 oil.	Bleaching. Increased mucous production. Reduced growth.	External contact by oil and adsorption across cellular membranes.	Mortality. Cell damage. Reduced metabolic capacity. Reduced immune response. Disease.

Receptor	Physical Pathway	Potential Impacts	Chemical Pathway	Potential Impacts
				Reduced growth. Reduced reproductive output. Reduced egg/larval success. Growth abnormalities.
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 oil.	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. Cell damage. Reduced metabolic capacity. Reduced immune response. Disease. Reduced growth. Reduced reproductive output. Reduced egg/larval success. Growth abnormalities. Behavioural disruption.
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).	Mortality. Cell damage. Flesh taint. Reduced metabolic capacity. Reduced immune response. Disease. Reduced growth. Reduced reproductive output. Reduced egg/larval success.

Receptor	Physical Pathway	Potential Impacts	Chemical Pathway	Potential Impacts
				Growth abnormalities. Behavioural disruption.
Birds (seabirds and shorebirds)	Degree of coating is dependent upon the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the oil.	Feather and skin irritation and damage, with the potential to cause secondary impacts such as: + Physical restriction of flight and swimming movement. + Mortality. + Hypothermia / impairing the waterproofing of feathers. + Disruption to feeding / starvation. + Disruption to breeding. + Disruption to migration.	Ingestion (during feeding or preening). 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.
Marine reptiles	Degree of coating is dependent upon the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the oil.	Irritation of eyes/mouth and potential illness, which may cause secondary impacts such as: + Mortality. + Disruption to feeding / starvation. + Physical restriction. + Behavioural disruption.	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 hatchling success. Reduced reproductive output.

Receptor	Physical Pathway	Potential Impacts	Chemical Pathway	Potential Impacts
				Growth abnormalities. Behavioural disruption.
Marine mammals	Fur damage and matting, reduced mobility and buoyancy (for applicable species). Coating of feeding apparatus in some species (baleen whales).	Irritation of eyes/mouth, damage to fur and potential illness, which may cause secondary impacts such as: + Mortality. + Disruption to feeding / starvation. + Physical restriction. + Behavioural disruption.	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.
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.
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/burning on contact and inhalation. Impacts to flora and fauna, as discussed in rows above.	Impacts to flora and fauna, as discussed in rows above.

Receptor	Physical Pathway	Potential Impacts	Chemical Pathway	Potential Impacts
Protected areas	Coating of benthic habitats, shoreline habitats and marine fauna/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 (fisheries, tourism, shipping, defence, shipwrecks, Indigenous users, oil and gas)	Presence of hydrocarbon residue in the water, which may filter down to sediments or continue to biodegrade on the surface. Coating of benthic habitats, shoreline habitats and marine fauna/flora within protected areas as discussed in rows above.	Degradation of cultural or maritime heritage sites. Disruption to tourism, recreation or shipping activities. Reduction in resource available for commercial and recreational fisheries. EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country. However, Indigenous users and cultural features may be impacted in the event of an	Impacts to flora, fauna and the physical environment as discussed in rows above. Commercial/recreational fish species – refer to 'fish' as discussed above.	Degradation of cultural or maritime heritage sites. Disruption to tourism, recreation or shipping activities. Reduction in resource available for commercial and recreational fisheries.

Receptor	Physical Pathway	Potential Impacts	Chemical Pathway	Potential Impacts
		unplanned hydrocarbon release.		

Table 7-20: Nature and scale of hydrocarbon spills on environment and socio-economic receptors within the EMBA and MEVA

Receptor	Impacts of Hydrocarbon Spill	
	Entrained and Dissolved Aromatic Hydrocarbons	Surface Hydrocarbons
Fauna (including Threatened / Migratory Fauna)		
Plankton (including zooplankton, fish and coral larvae)	There is potential for localised mortality of plankton due to reduced water quality and toxicity. Also, through physical contact of small oil droplets, plankton mobility, feeding and/or respiration may be impaired. Plankton could include the eggs and larvae of marine invertebrates and fish and therefore entrained oil could impact on recruitment of invertebrate/fish species. Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest.	Plankton utilising the sea surface layer could be impacted by floating oil.
	Plankton could include the eggs and larvae of marine invertebrates and fish and therefore impact on recruitment of invertebrate/fish species. The operational area has the potential to overlap with spawning of some fish species given the year-round spawning of some species. In the unlikely event of a spill occurring, fish larvae may be impacted by hydrocarbons entrained in the water column. Following a hydrocarbon release a portion of the slick will rapidly evaporate and disperse in the offshore environment, reducing the concentration and toxicity of the spill. Maximum entrained oil concentrations were predicted at Glomar Shoals. Plankton utilising the sea surface layer, as well as pelagic invertebrates, could be impacted from floating oil. Exposure to entrained oils and DAHs may result in lethal or sub-lethal impacts to plankton or pelagic invertebrates through a direct contact pathway. Such contact could impair the mobility, feeding and respiration of these fauna and exchange of chemicals could occur.	
Marine Mammals	Lethal or sub-lethal physical and toxic effects such as irritation of eyes/mouth and potential illness.	At risk of direct contact with surface hydrocarbons due to chance of surfacing within slick. Effects include irritation of eyes/mouth and potential illness. Surface respiration could lead to accidental ingestion of hydrocarbons or result in the coating of sensitive epidermal surfaces.

Receptor	Impacts of Hydrocarbon Spill	
	Entrained and Dissolved Aromatic Hydrocarbons	**Surface Hydrocarbons**
		Potential impact to feeding apparatus of some species (baleen whales).
	Fourteen migratory marine mammal species were identified by the PMST as occurring within the EMBA. Of these, three are listed as endangered (blue whale, southern right whale and Australian sea-lion) and two as vulnerable (fin whale and sei whale). The operational area and EMBA overlap with blue whale, humpback whale and dugong BIAs (**Section 3.2.5.1**). For further information about environmental impacts to marine mammals from hydrocarbon exposure and increased toxicity, refer to **Table 7-18**. Other migratory marine mammals may encounter either surface or water column hydrocarbons in the EMBA. Dugongs may be particularly susceptible to surface slicks, a reduction of seagrass habitat for foraging and/or ingestion of seagrass coated with oil. Dugongs occur throughout the shallow waters between the Pilbara offshore islands and the mainland and have been observed in the shallow waters along the east coast of Barrow Island and over the Lowendal Shelf. The EMBA overlaps a BIA for dugongs (**Figure 3-10**). Aerial surveys of dugong distribution have found that the animals occur around Barrow Island, Airlie Island, Lowendal Islands and the Montebello Islands further offshore (Prince, 2001).	
Marine reptiles	Lethal or sub-lethal physical and toxic effects such as irritation of eyes/mouth and potential illness. The *Recovery Plan for Marine Turtles in Australia: 2017–2027* (Commonwealth of Australia, 2017) highlights acute chemical discharge as one of several threats to marine turtles.	At risk of direct contact with surface hydrocarbons due to chance of surfacing within slick. Effects include irritation of eyes/mouth and potential illness. Surface respiration could lead to accidental ingestion of hydrocarbons or result in the coating of sensitive epidermal surfaces. Contact with hydrocarbons that have accumulated on shorelines particularly at nesting beaches. Oiling of eggs/hatchlings may occur. Shoreline hydrocarbons are expected to be less toxic than fresh oils due to weathering processes such as photo oxidation and biodegradation reducing the levels of lighter chain hydrocarbons which are generally more toxic.
	Eight species of threatened marine reptile were identified as possibly being impacted by a spill. Loggerhead, green, leatherback, hawksbill and flatback are widely dispersed across the NWS and in the unlikely event of a hydrocarbon spill occurring, individuals traversing open water may come into contact with water column or surface hydrocarbons. The EMBA overlaps with BIAs and critical habitat for four turtle species (flatback, green, hawksbill and loggerhead) as shown in **Figure 3.12**, **Figure 3.13**, **Figure 3.14** and **Figure 3.15**. Sea snakes are associated with the offshore reefs and banks within the EMBA, particularly those at Rankin Bank and Glomar Shoals.	

Receptor	Impacts of Hydrocarbon Spill	
	Entrained and Dissolved Aromatic Hydrocarbons	Surface Hydrocarbons
	Critical habitat including internesting habitat offshore form important nesting beaches for turtle species are present within the EMBA. The highest shoreline accumulations above the 100 g/m^2 exposure value were predicted for Ningaloo Coast North, Barrow Island, Montebello Islands and Muiron Islands. In the event of a spill, the presence of hydrocarbons on beaches would disrupt behaviour and potentially threaten turtle populations. For further detailed environmental impacts to marine reptiles from hydrocarbon exposure and increased toxicity, refer to **Table 7-18**.	
Birds (seabirds and shorebirds)	Lethal or sub-lethal physical and toxic effects such as irritation of eyes/mouth and potential illness. May encounter entrained hydrocarbons while diving and foraging.	Particularly vulnerable to surface slicks. 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 water proofing 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. Shorebirds may be impacted by the presence of hydrocarbons accumulated on shorelines which may result in exposure to eggs and ingestion by foraging individuals. Shoreline hydrocarbons are expected to be less toxic than fresh oils due to weathering processes such as photo oxidation and biodegradation reducing the levels of lighter chain hydrocarbons which are generally more toxic.
	84 threatened or migratory species of seabirds and shorebirds were identified within the EMBA by the PMST (**Table 3-10**). Of these, thirteen were identified within the operational area. A BIA for wedge-tailed shearwater breeding overlaps the operational area. Migratory seabird BIAs for breeding and resting overlap with the EMBA (**Table 3-10**) therefore, species may be impacted by surface and entrained hydrocarbons while foraging (dive and skim feeding) with higher numbers expected during the breeding periods. Birds (seabirds and shorebirds) are highly susceptible to hydrocarbon spills, with impacts primarily attributed to oiling of birds at the sea surface from slicks and oil on shorelines. Given the EMBA contacts multiple areas where seabirds are known for breeding including Montebello Islands, Barrow Island, Muiron Islands, Ningaloo Coast and Pilbara Islands, impacts to birds may include coating by oil when	

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Receptor	Impacts of Hydrocarbon Spill	
	Entrained and Dissolved Aromatic Hydrocarbons	**Surface Hydrocarbons**
	floating in open water, diving into open and coastal waters to feed on fish, wading and foraging on shallow intertidal mud/sand flats and wetlands or roosting on oil affected sandy beaches. Other impacts could include behavioural impacts whereby birds avoid important nesting and migratory stop-over areas including RAMSAR wetlands or reduced food availability if important foraging areas are impacted. For further information about environmental impacts to seabirds/shorebirds through hydrocarbon exposure and toxicity effects, refer to **Table 7-18**.	
Sharks, Rays and Fish	Hydrocarbon droplets can physically affect fish, sharks and rays exposed for an extended duration (weeks to months). Smothering through coating of gills can lead to the lethal and sub-lethal effects of reduced oxygen exchange, and coating of body surfaces may lead to increased 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. Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest and therefore demersal fish communities (including those associated with the Ancient Coastline at 125 m depth contour KEF, Continental Slope Demersal Fish Communities KEF) and Glomar Shoals may be exposed. For further information about environmental impacts to fish/sharks/rays from hydrocarbon exposure and toxicity effects, refer to **Table 7-18**.	While fish, sharks and rays do not generally break the sea surface, individuals may feed at the surface. For condensate/MDO spills where a slick is expected to quickly disperse and evaporate, prolonged exposure to surface hydrocarbons by fish, shark and ray species is unlikely. Due to the filter-feeding nature of whale sharks they may be susceptible to ingesting surface hydrocarbons, both fresh and weathered (tar balls) if feeding at the sea surface particularly from MDO spills.
	The NWS supports a diverse assemblage of fish, including 456 species of finfish, particularly in shallower water near the mainland and islands. Threatened species identified by the PMST include the white shark, whale shark, grey nurse shark, sawfishes (freshwater, dwarf, green, narrow and large-tooth), giant manta ray and reef manta ray, mako sharks, blind gudgeons and cave eel, porbeagle, and oceanic white tip sharks which may be present in the EMBA. However, given the absence of critical habitat for most of these species, significant numbers are not expected to be exposed to hydrocarbons in the event of a spill. These threatened and migratory fish and sharks could be present at low densities all year round within the operational area and EMBA; however, the absence of any known feeding, resting or breeding areas means significant numbers are unlikely to be impacted if an unplanned release were to occur. The whale shark foraging BIA is presented in **Figure 3-8** and the main whale shark aggregation location (Ningaloo Marine Park) is more than 160 km southwest of the operational area. The EPBC Act-listed whale shark may occur in the EMBA, particularly off the Ningaloo coastline between March and June and is known to feed in surface waters. There is, therefore, the potential for this species to ingest oil from surface	

Receptor	Impacts of Hydrocarbon Spill	
	Entrained and Dissolved Aromatic Hydrocarbons	**Surface Hydrocarbons**
	slicks with resultant damage to gills, other tissues and organs. For further information about environmental impacts to fish/sharks/rays from hydrocarbon exposure and toxicity effects, refer to **Table 7-18**.	
Socio-economic		
Commercial, Recreational and Traditional Fisheries	Hydrocarbons in the water column can have toxic effects on fish (as outlined above) potentially reducing catch rates and rendering fish unsafe for human consumption.	In addition to the effects of entrained and DAHs, exclusion zones surrounding a spill can directly impact fisheries by restricting access for fishermen. Weathered MDO (WMDO) slicks may form tar balls which may result in oiling of nets and fishing infrastructure.
	A number of commercial fisheries operate within the EMBA (**Section 3.2.6.3**). Impacts to these fisheries from a spill may range from disruption of fishing activities caused by the physical presence of the slick, loss of (or loss of function of) coastal intertidal habitat (for example, seagrass meadows, mangrove communities, intertidal mudflats) which may provide nursery habitat for fishery species (for example, fish and crustaceans) and contact of surface and entrained hydrocarbons with the eggs and larvae of commercially important species. Exposure to entrained and DAHs could result in the accumulation of oil in fish tissues to the extent that could result in hydrocarbon taint of fish flesh. Connell and Miller (1981) compiled a summary of studies listing the exposure value concentrations at which tainting occurred for hydrocarbons. The results contained in their review indicate that tainting of fish occurs when fish are exposed to ambient concentrations of 4 to 300 ppm (4,000 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 that entrained hydrocarbons are predicted to exceed the moderate threshold 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 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. This would most likely be the case for fisheries species that utilise shallow waters around the Barrow and Montebello Islands and could occur through direct impacts to fish or to fish habitats (for example, seagrass, coral reef, mangrove habitats). The same negative impacts could also occur to important recreational fish species and the recreational fisheries they support although impacts to commercial fisheries could result in the additional impact of loss of income for commercial fishers.	
Recreation and Tourism	A number of tourism destinations occur within the EMBA, including Ningaloo Reef (which is within a World Heritage Area, National Heritage Place and a Commonwealth Heritage Place) and offshore islands such as the Montebello Islands. A number of areas with high diversity or which have unique ecological values are protected within AMPs. As well as reducing the visual amenity of these areas, a LOWC spill could impact the habitats and marine fauna of these areas thereby impacting the environmental values of these tourism areas. Depending upon the extent of impact, loss of revenue to coastal towns and communities could also occur.	

Receptor	Impacts of Hydrocarbon Spill	
	Entrained and Dissolved Aromatic Hydrocarbons	Surface Hydrocarbons
Shipping	Multiple shipping fairways intersect the EMBA (**Figure 3.25**). 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), vessel may have to take large detours leading to potential delays and increased costs.
Defence	The level of defence activities performed in the vicinity of operational area is low, though the EMBA does overlap some of the North West Exercise Area. Interference of defence activities due to a hydrocarbon spill is expected to be minimal.	
Shipwrecks	There are a number of historic (more than 75 years old) shipwrecks within the EMBA. Shipwrecks may be of important heritage value and/or act as dive sites. Surface hydrocarbons will have no impact on shipwrecks. Hydrocarbons in the water column either as entrained oil or DAHs may extend thousands of kilometres from the release location. The potential for in-water hydrocarbons to impact on shipwrecks is poorly documented. However, it has been proposed that exposure to oil may alter bacterial community composition (biofilms) inhabiting shipwrecks possibly altering corrosion potential (Salerno et al., 2018).	
Indigenous users	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. The level of activities undertaken by indigenous users is expected to be low.	
Existing oil and gas activity	A number of oil and gas operators operate within the EMBA which encompasses the entire NWS with existing projects and infrastructure in place as well as continuing drilling and exploration programs. A surface slick has the potential to disrupt activity potentially halting production or exploration with associated economic impact. Exclusion zones surrounding spills will reduce access potentially resulting in delays to work schedules with possible subsequent financial implications.	
Protected Areas		
Marine Parks and Commonwealth Heritage Areas	Protected areas are described in **Section 3.2.4**. These areas provide key habitats that support an array of marine flora and fauna along with unique natural phenomena. These protected areas support all the habitats and faunal groups described above and support unique/protected habitats/marine fauna or ecological features. Impacts to the habitat/fauna receptors described above therefore have an impact on the values of these reserves which could have flow-on effects to tourism revenue for coastal communities that provide access to these marine reserves. The protected areas may also support nursery/feeding/aggregation areas for fisheries species and therefore may assist in maintaining healthy fish stocks and commercial/recreational fisheries.	

Receptor	Impacts of Hydrocarbon Spill	
	Entrained and Dissolved Aromatic Hydrocarbons	Surface Hydrocarbons
RAMSAR wetlands	No RAMSAR wetlands ae located within the EMBA.	
KEFs	KEFs overlapping the EMBA are described in **Section 3.2.4.2** . 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 floating oil. Impacts to these marine fauna are described above.	
Threatened Ecological Communities	No Threatened Ecological Communities are located within the EMBA.	

7.5.6 Spill response strategies

Numerous oil spill response strategies are available to be implemented in the event of a spill. These are generally strategies that have been implemented in the past or are considered good industry practice. **Section 7** of the OPEP provides a detailed description of the applicable response strategies for this activity, which include, depending on the type and size of the spill:

- source control
- monitor and evaluate
- mechanical dispersion
- shoreline protection and deflection
- shoreline clean-up
- oiled wildlife
- scientific monitoring.

7.6 Hydrocarbon Spill – Loss of Well Control

7.6.1 Description of Event

Event	A loss of well control (LOWC) during drilling may occur due to a number of reasons, including: + Shallow gas + Well kick + Tripping/swabbing + Loss of primary / secondary well control + Failure to keep the correct mud density + Failure to keep the hole full In the event of a LOWC, condensate and associated gas may be released to the marine environment with the most likely release points at either the MODU or seabed. The worst-case credible spill scenarios were predicted by selecting the most likely hydrocarbon flow parameters from the well to yield the credible maximum blowout volumes and rates (i.e., environmentally credible worst-case volume and rate) from both subsurface (seabed) and surface (MODU floor) unplanned releases. Key parameters for input to this ‘worst-case’ blowout were taken from key Santos well design documents and Well Design Automation System, suitable analogues, latest reservoir models, or Santos best estimates where information was unavailable. Quantitative hydrocarbon spill modelling was undertaken for the worst-case subsea and surface LOWC scenarios. The LOWC worst-case discharge volumes that were used for the hydrocarbon spill modelling were based on Santos’ Spar Halyard Infill Worst Case Discharge Technical File Note. Rev 0, Sept 2022 (Santos Doc No. 7910-375-REP-0001). Outputs from the modelling were used to inform the environmental assessment and to assist with emergency planning. The environmental consequences of a LOWC are highly variable, dependent on the characteristics of the hydrocarbon released, the dynamics of the receiving environment and the proximity of the release point to sensitive environmental receptors.

Extent	The MEVA and EMBA for modelled LOWC scenarios are defined in **Section 3.1** and **Figure 3-1**. For information on the extent of potential impact associated with a LOWC, refer to **Section 7.5.5.5**
Duration	The worst-case duration of a LOWC is predicted as 77 days (refer to the OPEP). This is the estimated time required to drill a relief well and gain control of the primary well. Hydrocarbons would persist within the environment for a longer period of time, although the condensate released is expected to weather quickly through evaporation and dispersion.

7.6.1.1 Stochastic spill modelling – summary of results for moderate exposure thresholds

The spill modelling results above the moderate threshold at moderate to very high probabilities are summarised below for subsea and surface LOWC at the Halyard-2 well location. More detailed results are provided in **Appendix H**.

Further parameters required to inform spill response strategies are described in the OPEP.

<u>Subsea LOWC</u>

The subsea dynamics of the subsea LOWC are highly energetic due to the significant gas volume that accompanies the release of liquid condensate for this scenario. Whereas a surface release scenario will result in the gas being immediately lost to the atmosphere, the gas in a subsea discharge scenario contributes to the velocity and momentum of the subsea plume as it exits the release orifice.

Accumulated shoreline oil above 100 g/m²

No shoreline accumulation above the 100 g/m² threshold was predicted to occur by modelling studies.

Surface oil greater than 10 g/m²

Surface oil above the moderate threshold extends up to approximately 74 km from the release location. No Commonwealth or state protected areas were predicted to be contacted by floating oil above 10 g/m². BIAs for cetaceans, birds, marine turtles and whale sharks were predicted to be at risk of contact with floating oil above 10 g/m².

Entrained oil greater than 100 ppb

Entrained oil at the moderate threshold was predicted to occur up to 1,098 km from the release location.

Entrained oil impacts at the moderate threshold with the highest probabilities and concentrations include:

+ Ningaloo:
  - Offshore, with 99% likelihood of contact, a maximum concentration of 13,416 ppb and shortest time to contact of 2 hrs.
  - Outer coast north, with 59% likelihood of contact, a maximum concentration of 2,166 ppb and shortest time to contact of 96 hrs.
  - Outer NW, with 84% likelihood of contact, a maximum concentration of 2,770 ppb and shortest time to contact of 78 hrs.
  - Coast North, with 45% likelihood of contact, a maximum concentration of 1,930 ppb and shortest time to contact of 106 hrs.

- Gascoyne AMP, with 76% likelihood of contact, a maximum concentration of 1,587 ppb and shortest time to contact of 154 hrs.
- Montebello AMP, with 52% likelihood of contact, a maximum concentration of 3,053 ppb and shortest time to contact of 62 hrs
- Barrow-Montebello surrounds, with 16% likelihood of contact, a maximum concentration of 785 ppb and shortest time to contact of 208 hrs.

Dissolved oil greater than 50 ppb

Dissolved hydrocarbons at the moderate threshold were predicted to be within approximately 444 km of the release site.

Dissolved oil impacts at the moderate threshold with the highest probabilities and concentrations include:

- Ningaloo:
  - Offshore, with 99% likelihood of contact, a maximum concentration of 632 ppb and shortest time to contact of 5 hrs.

<u>Surface LOWC</u>

Accumulated shoreline oil above 100 g/m²

No shoreline accumulation above the 100 g/m^2 threshold was predicted to occur by modelling studies.

Surface oil greater than 10 g/m²

Surface oil above the moderate threshold extends up to approximately 70 km from the release location. No Commonwealth or state protected areas were predicted to be contacted by floating oil above 10 g/m^2. BIAs for cetaceans, birds, marine turtles and whale sharks were predicted to be at risk of contact with floating oil above 10 g/m^2.

Entrained oil greater than 100 ppb

Entrained oil at the moderate threshold was predicted to occur up to 1,100 km from the release location.

Entrained oil impacts at the moderate threshold with the highest probabilities and concentrations include:

- Ningaloo:
  - Offshore, with 99% likelihood of contact, a maximum concentration of 16,193 ppb and shortest time to contact of 2 hrs.
  - Outer coast north, with 60% likelihood of contact, a maximum concentration of 2,283 ppb and shortest time to contact of 84 hrs.
  - Outer NW, with 87% likelihood of contact, a maximum concentration of 3,013 ppb and shortest time to contact of 70 hrs.
  - Coast North, with 50% likelihood of contact, a maximum concentration of 2,061 ppb and shortest time to contact of 120 hrs.

- Southern Islands Coast, with 49% likelihood of contact, a maximum concentration of 1,322 ppb and shortest time to contact of 111 hrs.
- Gascoyne AMP, with 82% likelihood of contact, a maximum concentration of 1,655 ppb and shortest time to contact of 148 hrs.
- Montebello AMP, with 46% likelihood of contact, a maximum concentration of 3,115 ppb and shortest time to contact of 41 hrs
- Muiron Islands, with 52% likelihood of contact, a maximum concentration of 1,307 ppb and shortest time to contact of 105 hrs

Dissolved oil greater than 50 ppb

Dissolved hydrocarbons at the moderate threshold were predicted to be within approximately 562 km of the release site.

Dissolved oil impacts at the moderate threshold with the highest probabilities and concentrations include:

- Ningaloo:
  - Offshore, with 99% likelihood of contact, a maximum concentration of 1,796 ppb and shortest time to contact of 3 hrs.

7.6.1.2 Deterministic modelling

The stochastic simulation output provides a probabilistic temporal and spatial representation of potential impacts from an oil spill incident. To further inform the OPEP, individual stochastic realisations were selected to characterise shoreline loading (i.e., loads). The deterministic simulations were selected based on the following criteria:

- Greatest area of floating oil ≥ 50 g/m^2
- Maximum volume ashore

Subsea LOWC

Stochastic realisation 51 of the subsea LOWC scenario resulted in the greatest area of floating oil ≤ 50 g/m^2. This realisation resulted in:

- Floating oil exposure extending up to approximately 45 km, 25 km and 10 km for low, moderate and high thresholds, respectively.
- No shoreline accumulation was predicted for this realisation.
- The maximum concentration of entrained hydrocarbons during this realisation was 9,374 ppb at Ningaloo Offshore. The same receptor recorded the highest dissolved hydrocarbon concentration as 252 ppb.

Stochastic realisation 48 of the subsea LOWC scenario resulted in the maximum volume of oil ashore. This realisation resulted in:

- Floating oil exposure extending up to approximately 80 km, 25 km and 5km for low, moderate and high thresholds, respectively.
- The greatest volume of accumulation (at or above 10 g/m^2) was 5 m^3 for the Ningaloo Coast North with a predicted shoreline length of 12 km.

+ No shoreline accumulation with concentrations exceeding 100 g/m^2 was predicted.
+ The maximum concentration of entrained hydrocarbons during this realisation was 9,578 ppb at Ningaloo Offshore. The same receptor recorded the highest dissolved hydrocarbon concentration as 261 ppb.

Surface LOWC

Stochastic realisation 37 of the surface LOWC scenario resulted in the greatest area of floating oil ≤ 50 g/m^2. This realisation resulted in:

+ Floating oil exposure extending up to approximately 50 km, 35 km and 10 km for low, moderate and high thresholds, respectively.
+ No shoreline accumulation was predicted for this realisation.
+ The maximum concentration of entrained hydrocarbons during this realisation was 9,764 ppb at Ningaloo Offshore. The same receptor recorded the highest dissolved hydrocarbon concentration as 950 ppb.

Stochastic realisation 87 of the surface LOWC scenario resulted in the maximum volume of oil ashore. This realisation resulted in:

+ Floating oil exposure extending up to approximately 80 km, 25 km and 5km for low, moderate and high thresholds, respectively.
+ The greatest volume of accumulation (at or above 10 g/m^2) was 3 m^3 for the Ningaloo Coast North with a predicted shoreline length of 4 km.
+ No shoreline accumulation with concentrations exceeding 100 g/m^2 was predicted.
+ The maximum concentration of entrained hydrocarbons during this realisation was 11,791 ppb at Ningaloo Offshore. The same receptor recorded the highest dissolved hydrocarbon concentration as 866 ppb.

7.6.2 Nature and Scale of Environmental Impacts

Hydrocarbon spills will cause a decline in water quality and may cause chemical (e.g., toxic) and physical (e.g., 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 (i.e., extent, duration) and sensitivity of the receptor.

The magnitude of potential environmental impact from a condensate release depends on multiple factors including hydrocarbon type, release volume and rate, and ocean and weather conditions.

An assessment of the sensitive environmental receptors at risk from a condensate release has been determined based on a literature review and trajectory and fate modelling described above. **Section 3** includes a description of biological environment present in the operational and/or spill (MEVA) trajectory area.

Potential receptors: physical environment (water and sediment quality, shoals and banks, benthic habitats), threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds), protected and significant areas (marine parks, KEFs), socio-economic receptors (fisheries, tourism, recreation and other third-party operators), cultural features and sea country.

A LOWC release to the marine environment would result in reductions in water quality for at least one model time step (approximately an hour) at a probability greater than 10% across the 150 individual realisations per scenario over the following worst case spatial extent from any modelled location are:

+ For a seabed release scenario at the moderate (impact) thresholds:
  - No shoreline accumulation above 100 g/m^2
  - Surface oil (10 g/m^2) within approximately 74 km
  - Entrained oil (100 ppb) within approximately 1,098 km
  - Dissolved oil (50 ppb) within approximately 444 km.
+ For a surface release scenario at the moderate (impact) thresholds:
  - No shoreline accumulation above 100 g/m^2
  - Surface oil (10 g/m^2) within approximately 70 km
  - Entrained oil (100 ppb) within approximately 1,100 km
  - Dissolved oil (50 ppb) within approximately 562 km.

The potential impact pathways (physical and chemical) of hydrocarbon exposure to relevant habitat and marine fauna receptors are summarised in **Table 7-18** and an impact assessment completed for receptors within the EMBA in **Table 7-19**.

7.6.3 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 oil, are feasible to use safely in particular conditions, and will reduce the impact of an oil spill on the environment.

The NEBA process is used during pre-spill planning (strategic NEBA) and during a response (operational NEBA). A strategic NEBA is an integral part of the contingency planning process and is used to ensure that response strategies for scenarios are well informed. An operational NEBA is used to ensure that evolving conditions are understood, so that response strategies can be adjusted as necessary to manage individual response actions and end points.

Balancing trade-offs may involve differing and conflicting priorities, values and perceptions of the importance of sensitive receptors. 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 OPEP related to an unplanned release of condensate, with the potential environmental benefit or potential impact to each protection priority area. This will provide information that will help to select response strategies tailored to the key environmental values within the areas of highest priority. A summary of spill response strategies is available for each of the priorities for protection 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 takes place during a spill response (i.e., an operational NEBA). An operational NEBA will also consider real-time monitoring of the effectiveness and potential impacts of a response and will also consider accessibility, feasibility and safety of responders (refer to **Section 5.8** of the OPEP).

7.6.4 Environmental Impact Assessment

The below environmental impact assessment follows the risk assessment approach detailed in **Section 7.5.5**.

7.6.4.1 Identification of Hot Spots for Consequence Assessment

As described in **Section 7.5.5**, all HEVs within the MEVA and EMBA for LOWC are listed in **Table 7-20**. The values and sensitivities associated with these HEVs have been described in **Appendix C**. Further to this, **Table 7-20** filters the HEV to identify the Hot Spots where they meet the criteria (as described in **Section 7.5.5**) from either the subsea or surface loss of well control scenario of any hydrocarbon phase. As noted in **Section 7.5.5**, discretion was applied during the workshop to include hotspots that didn't meet the criteria, these are marked with an asterisk and the rationale for their inclusion as a hotspot is included in **Table 7-20** below.

Note that the worst-case values were taken from both surface and subsea modelling scenarios to identify the hot spots; e.g., very low shoreline loading in a subsea scenario, but high in the surface scenario, then that would be allocated as a hot spot.

Table 7-21: Identified high environmental value and hot spot receptors for surface and subsea

Receptor	HEV Ranking	Exposure Threshold		Hot Spot[1]	Hot Spot Selection Rationale
		Low (EMBA)	Moderate (MEVA)		
Abrolhos - Nearshore	4	✓	×	N	Not in MEVA
Abrolhos - Offshore NW	4	✓	✓	N	Low probability of contact
Abrolhos - Offshore Perth North	4	✓	×	N	Not in MEVA
Abrolhos - Outer Island Shoals	3	✓	×	N	Not in MEVA
Abrolhos Islands Easter Group	4	✓	×	N	Not in MEVA
Abrolhos Islands Pelsaert Group	4	✓	×	N	Not in MEVA
Abrolhos Islands Wallabi Group	3	✓	×	N	Not in MEVA
Abrolhos West	3	✓	×	N	Not in MEVA
Augusta - Walpole	4	✓	×	N	Not in MEVA
Barrow Island	3	✓	✓	Y	HEV = 3 & in MEVA
Barrow-Montebello Surrounds	3	✓	✓	Y	HEV = 3 & in MEVA

Receptor	HEV Ranking	Exposure Threshold		Hot Spot[1]	Hot Spot Selection Rationale
		Low (EMBA)	Moderate (MEVA)		
Beagle Knoll	5	✓	×	N	Not in MEVA
Bennett Shoal	5	✓	×	N	Not in MEVA
Brewis Reef	5	✓	✓	N	Low probability of contact
Camplin Shoal	5	✓	×	N	Not in MEVA
Carnarvon - Inner Shark Bay	2	✓	×	N	Not in MEVA
Carnarvon Canyon AMP	5	✓	✓	N	Low HEV ranking
Christmas Island	4	✓	×	N	Not in MEVA
Christmas Island AMP	5	✓	×	N	Not in MEVA
Clerke Reef MP	3	✓	×	N	Not in MEVA
Cod Bank	5	✓	×	N	Not in MEVA
Cooper Shoal	5	✓	×	N	Not in MEVA
Dampier AMP	4	✓	×	N	Not in MEVA
Dampier Archipelago	3	✓	×	N	Not in MEVA
Dart Shoal	5	✓	×	N	Not in MEVA
Eighty Mile Beach AMP	4	✓	×	N	Not in MEVA
Exmouth Gulf Coast	2	✓	✓	Y	HEV = 2 & in MEVA
Exmouth Reef	5	✓	✓	N	Low HEV ranking
Gascoyne AMP	3	✓	✓	Y	HEV = 3 & in MEVA
Geographe - Offshore Augusta 1	3	✓	×	N	Not in MEVA
Geographe - Offshore Augusta 2	3	✓	×	N	Not in MEVA
Geographe Bay - Augusta	4	✓	×	N	Not in MEVA
Geraldton - Jurien Bay	3	✓	×	N	Not in MEVA
Glomar Shoals	5	✓	✓	N	Low HEV ranking
Imperieuse Reef MP	3	✓	✓	N	Low probability of contact

Receptor	HEV Ranking	Exposure Threshold		Hot Spot[1]	Hot Spot Selection Rationale
		Low (EMBA)	Moderate (MEVA)		
Jurien AMP	3	✓	×	N	Not in MEVA
Jurien Bay - Yanchep	3	✓	×	N	Not in MEVA
Kalbarri - Geraldton	3	✓	×	N	Not in MEVA
Karratha-Port Hedland	5	✓	×	N	Not in MEVA
Kimberley AMP	3	✓	×	N	Not in MEVA
Larkin Shoal	5	✓	×	N	Not in MEVA
Lowendal Islands	3	✓	✓	Y	HEV = 3 & in MEVA
Madeleine Shoals	4	✓	×	N	Not in MEVA
Mermaid Reef AMP	2	✓	×	N	Not in MEVA
Middle Islands Coast	4	✓	✓	N	Low probability of contact
Montebello AMP	3	✓	✓	Y	HEV = 3 & in MEVA
Montebello Islands	3	✓	✓	Y	HEV = 3 & in MEVA
Muiron Islands	2	✓	✓	Y	HEV = 2 & in MEVA
Ningaloo - Offshore	2	✓	✓	Y	HEV = 2 & in MEVA
Ningaloo - Outer Coast North	1	✓	✓	Y	HEV = 1 & in MEVA
Ningaloo - Outer NW	3	✓	✓	Y	HEV = 3 & in MEVA
Ningaloo Coast North	1	✓	✓	Y	HEV = 1 & in MEVA
Ningaloo Coast South	2	✓	✓	N	Low probability of contact
Northern Islands Coast	3	✓	✓	N	Low probability of contact
Outer Argo-Rowley Terrace AMP	4	✓	✓	N	Low HEV ranking
Penguin Bank	5	✓	✓	N	Low HEV ranking
Perth Canyon AMP	3	✓	×	N	Not in MEVA
Perth Northern Coast	3	✓	×	N	Not in MEVA
Perth South - Geographe - Offshore	4	✓	×	N	Not in MEVA

Receptor	HEV Ranking	Exposure Threshold		Hot Spot[1]	Hot Spot Selection Rationale
		Low (EMBA)	Moderate (MEVA)		
Perth Southern Coast	1	✓	×	N	Not in MEVA
Poivre Reef	5	✓	✓	N	Low HEV ranking
Rankin Bank	5	✓	✓	N	Low HEV ranking
Ripple Shoals	5	✓	✓	N	Low HEV ranking
Rosily Shoals	5	✓	✓	N	Low HEV ranking
Rottnest Island	4	✓	×	N	Not in MEVA
Rowley Shoals surrounds	3	✓	✓	N	Low probability of contact
Seringapatam Reef	4	✓	×	N	Not in MEVA
Shark Bay - Coast Outer	3	✓	×	N	Not in MEVA
Shark Bay AMP	4	✓	✓	N	Low probability of contact
Snapper Shoal	5	✓	×	N	Not in MEVA
Southern Islands Coast	4	✓	✓	N	Low HEV ranking
South-west Corner AMP	3	✓	×	N	Not in MEVA
Sultan Reef	5	✓	✓	N	Low HEV ranking
Thevenard Islands	4	✓	✓	N	Low HEV ranking
Trap Reef	5	✓	✓	N	Low HEV ranking
Two Rocks AMP	3	✓	×	N	Not in MEVA
Western Abrolhos AMP	4	✓	✓	N	Low HEV ranking
Western Shark Bay AMP	5	✓	✓	N	Low HEV ranking

[1]Greater than 5% probability of contact at the medium or high exposure value for consideration for further Hot Spot assessment

This process identified the following hot spots:

- Barrow Island
- Barrow-Montebello Surrounds
- Exmouth Gulf Coast
- Gascoyne AMP

+ Lowendal Islands
+ Montebello AMP
+ Montebello Islands
+ Muiron Islands
+ Ningaloo - Offshore
+ Ningaloo - Outer Coast North
+ Ningaloo - Outer NW
+ Ningaloo Coast North
+ Outer Argo-Rowley Terrace AMP
+ Southern Islands Coast
+ Thevenard Islands
+ Western Abrolhos AMP

Appendix G provides a simplified summary of the consequence assessment results for each of the Hot Spot areas. The consequence assessment was based on predicted contact and concentration of floating oil, accumulated oil, total submerged oil and dissolved oil. For each Hot Spot area, the consequence to the key values were assessed using the methodology described in **Section 7.5.5**.

Table 7-22: Impact, likelihoods and consequence ranking – loss of well control

Description	
Receptors	Physical environment (water and sediment quality, benthic habitats, offshore reefs and islands) Threatened or migratory fauna (marine mammals, marine reptiles, sharks, rays, fish, and birds) Protected and significant areas (marine parks and KEFs) Socio-economic receptors (fisheries, tourism and recreation) Cultural features and sea country
Consequence	IV – Major
The detailed consequence assessment for each hot spot is provided in **Appendix G**. A summary of the consequence assessment for each receptor category is presented below. *Physical environment or habitat* In the highly unlikely event of a LOWC subsea or surface, hydrocarbons will likely reach a range of marine habitats above ecological impact thresholds. Hydrocarbons that reach nearshore environments have the potential to impact benthic coral reefs and mangrove areas, which may result in a long-term decrease in ecological values given toxicity impacts associated with hydrocarbon exposure. The worst-case consequence assessment for physical environment at any identified hotspot was IV – Major at Ningaloo Coast-North, Montebello Islands, Barrow Island, Lowendal Islands and Muiron Islands. *Threatened or migratory fauna* In the highly unlikely event of a LOWC, the volume of condensate released would result in a reduction in water quality with the potential to impact marine fauna. Marine fauna present in the area may be potentially impacted by a spill through exposure to floating oil, entrained oil, or dissolved aromatic	

Description
hydrocarbons. A description of impacts to marine fauna from exposure to condensate is provided in **Table 7-19**. Impacts from a LOWC release would be greatest within several kilometres from the spill when the toxic aromatic components of the hydrocarbon will be at their highest concentration and when the hydrocarbon is at its thickest on the surface of the receiving waters. Upon release to the marine environment, the condensate will rapidly lose toxicity with time and will spread thinner at the surface as evaporation continues or will become entrained within the water column. The potential sensitive receptors in the surrounding areas of the spill will include fish, marine mammals, marine reptiles and seabirds at the sea surface, as discussed in **Table 7-19**. Habitat modification, degradation, disruption or loss, deteriorating water quality and marine pollution are identified as potential threats to a number of marine fauna species in relevant recovery plans and conservation advice (**Table 3-11**). With controls in place that align with relevant actions described in various recovery plans, the activity will be conducted in a manner that reduces potential impacts to ALARP and an acceptable level. The worst-case consequence assessment for threatened or migratory fauna at any identified hotspot was IV – Major at Ningaloo Coast-North, Montebello Islands, Barrow Island, Lowendal Islands and Muiron Islands. *Protected areas* The MEVA intersects several protected areas including AMPs and marine management areas (**Section 3.2.4**). Combined, these areas support all the habitats and faunal groups described above. Impacts to the habitat or fauna receptors described above therefore have an impact on the values of these reserves, which could have flow-on effects to tourism revenue of coastal communities that provide access to these marine reserves. Many of these receptors are values of protected areas, and there could be moderate-term effects to them. The worst case consequence assessment for protected areas at any identified hotspot was IV – Major at Montebello Islands, Barrow Island, Muiron Islands and Ningaloo Coast – North. *Socio-economic receptors* There is the potential for entrained oil to temporarily disrupt fishing activities if the surface or entrained oil moves through fishing areas. Entrained oil at more than 100 ppb could reach pearl farming activities at the Montebello Islands. Pearl oysters are filter feeders therefore, entrained oil droplets could create negative impacts through ingestion and accumulation of hydrocarbon compounds in oyster tissues or interference with respiratory structures. Ecotox (2009) reported that no observable effect concentration levels from weathered condensates for a comparable oyster species ranged from approximately 9,000 to 28,000 ppm. Significant impacts on aquaculture would therefore be unlikely, as predictive modelling reported that the maximum entrained and dissolved oil concentrations for the worst realisation at the Montebello Islands were 24 ppb and 587 ppb respectively. Some loss of value to the local industry could occur in the event of a LOWC that results in a condensate spill. In addition, recreational fishing hot spots including the Montebello Islands, Barrow Island, Lowendal Islands, Muiron Islands and Ningaloo are of high value to recreational fishers. Tourism could be affected by spilled condensate, either from reduced water quality or shoreline oiling preventing recreational activities, reducing aesthetic appeal or from impacts to habitats and marine fauna as described in **Table 7-19**. *Cultural Features* While there was no surface shoreline hydrocarbons accumulation predicted in the event of a significant spill, the EMBA may overlap cultural features in the marine environment including a disruption/displacement of cultural activities caused by the physical presence of the hydrocarbon, decline

Description	
in traditional food sources and / or mortality of fauna with cultural significance, may result in the event of a significant spill of hydrocarbons. Potential impacts to cultural features from a hydrocarbon spill may include decline in traditional food sources and/or mortality of fauna with cultural significance. Indigenous users may also be impacted in the event that a land-based response is required. A number of oil and gas operators operate within the MEVA with existing projects and infrastructure in place, as well as continuing drilling and exploration programs. A LOWC in the operational area has the potential to disrupt these activities, with associated economic impact, albeit on a temporary basis. The worst case consequence assessment for socio-economic receptors at any identified hotspot was III Moderate - Montebello Islands, Lowendal Islands and Muiron Islands. On the basis of the above assessment, a LOWC has the potential to impact an array of receptors. Given the extent and the presence of protected areas within the MEVA, the worst-case consequence is considered to be Major (IV).	
Likelihood	B – Unlikely
In accordance with the Santos Risk Matrix, a worst-case surface release of crude as a result of LOWC has been defined as an 'Unlikely' event as it 'has occurred elsewhere OR could occur within decades'. The likelihood of a LOWC event occurring is based on industry statistics, Santos statistics and the standard preventive control measures in place. Wells are designed with essential engineering and safety control measures to prevent a loss of containment occurring. Blowout events during development well drilling has been reported at a frequency of 3.9 x 10^{-5} per drilled well (IOGP, 2019; development drilling, normal operations on deep, normal wells of North Sea standard). This frequency is based on two blowout incidents occurring in the UK between 1980 and 2014 during development well drilling (IOGP, 2019) and supports the likelihood of 'has occurred elsewhere OR could occur within decades'. Management controls in place to control the flow of hydrocarbons include well construction design, safety shutdown systems, regular inspection, testing and maintenance, and competent personnel. Additional industry-standard and activity-specific control measures to reduce the chance of a loss of containment event have also been implemented including (but not limited to) procedures such as a NOPSEMA accepted WOMP, safety case, crew training and awareness, and a spill response plan (OPEP). These control measures are considered to reduce the risk of a loss of containment (and minimise impacts) occurring to a level that is acceptable. In accordance with the Santos Risk Matrix, given the control measures in place, the likelihood of worst-case seabed release of crude as a result of LOWC resulting in a Major (IV) consequence is considered to be Unlikely.	
Residual Risk	The residual risk associated with this event is **Low**.

7.6.5 Environmental Performance Outcomes and Control Measures

The EPOs relating to this hazard include:

+ No loss of containment of hydrocarbon to the marine environment [H2-EPO-03].
+ No unplanned objects, emissions or discharges to sea or air [H2-EPO-04].
+ No injury or mortality to EPBC Act 1999 and WA Biodiversity Conservation Act 2016 listed marine fauna during activities [H2-EPO-05]

The extensive planning, risk assessment of the activity and the engineering and operational control measures in place are considered to result in a low risk of a hydrocarbon release due to LOWC occurring. The control measures considered for this activity are shown below in **Table 7-22** with EPS and measurement criteria for the EPOs described in **Table 8-1**. Operational controls that would be implemented to guide an effective response after a spill has occurred are provided within relevant sections of the OPEP, together with corresponding EPS and measurement criteria.

Table 7-23: Control measures evaluation – Hydrocarbon Spill – Loss of Well Control

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-DC-CM-039	Drilling and Completions Management Process	Includes control measures for well integrity and well control in an accepted WOMP, MODU Safety Case. Defines critical acceptance criteria for well operations that reduce the risk of a LOWC. Accounts for emergency situations such as cyclone response plan	Costs associated with preparing and implementing the WOMP, Safety Case and D&C programs.	**Adopted –** regulatory requirement, must be adopted.
H2-DC-CM-037	MODU and support vessel spill response plans including predrilling source control plan	Implements response plan to deal with an unplanned hydrocarbon spills quickly and efficiently in order to reduce impacts to the marine environment.	Personnel cost and administrative costs associated with preparing documents, ongoing management (spill response exercises) and implementation of plans.	**Adopted** - Environmental benefits of ensuring response plans in place, are followed and measures implemented, and that the MODU/support vessels are compliant outweighs the costs of personnel time associated with preparation and implementation of spill response plans
H2-DC-CM-040	Accepted OPEP	Implements response plans to deal with an	Administrative costs of preparing	**Adopted** - Regulatory

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment.	documents and large costs of preparing for and implementing response strategies.	requirement must be adopted.
H2-DC-CM-008	Marine assurance standard	Reduces emissions from vessels because equipment operating within its parameters.	Cost associated with implementing procedures.	**Adopted** – Benefit of implementing procedure outweighs the minimal costs.
H2-DC-CM-038	MODU Planned Maintenance System (PMS).	MODU equipment is operating within its parameters, reducing the risk of unplanned discharges to the marine environment	Costs are standard for routine PMS.	**Adopted** – benefits in reducing atmospheric emissions impacts outweigh the minimal costs.
Additional Control Measures				
H2-DC-CM-041	Pre-campaign commencement assurance check	Ensures consideration of worst case hydrocarbon spill scenario for the proposed activity based on actual MODU, vessel and activity details.	Administrative costs to undertake assurance check and risk assessments for each campaign.	**Adopted** – Benefit of implementing procedure outweighs the costs.
N/A	Manage the timing of the activity to avoid sensitive periods (e.g., spawning, whale and whale shark migration, bird and turtle nesting)	Reduce risk of impacts from highly unlikely LOWC during environmentally sensitive periods for listed marine fauna (e.g., spawning, whale and whale shark migration, bird and turtles nesting)	High cost in moving or delaying activity schedule. Would double duration of activity; increase impacts or potential impacts in other areas including increase in waste, air	**Rejected** - Given the minimal risk of impacts to listed marine species (e.g., turtles) occurring, the financial and environmental costs of extending activity duration deemed grossly disproportionate to low environmental benefits.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			emissions, risk of vessel collisions etc. 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.	
N/A	Dedicated resources (e.g., dedicated spill response facilities on location) in the event of loss of hydrocarbons to allow rapid response	May allow for quicker response to a spill as resources will be within close proximity.	Large costs associated with a dedicated resources on location. Modelling shows shoreline contact albeit with moderate maximum volumes. Condensate has low to no persistence in the environment and therefore prolonged loading on shorelines is not expected.	**Rejected** - Large cost associated with dedicated resources on location deemed grossly disproportionate to very low risk of LOWC and very high natural dispersion and low persistence of condensate.
N/A	A dedicated second MODU on standby for the purpose of relief well drilling	Could reduce the length of time taken to drill a relief well and may reduce the timeframe for stopping a blowout by up to two weeks, although planning/approval /set-up	The cost of having a MODU and personnel/equipment on standby (at a rate of ca. $600,000/day) would double the cost of the activity.	**Rejected** - Considered grossly disproportionate to the environmental benefit (reduction of two weeks of release), considering the rare likelihood of a LOWC, the

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		requirements mean the reduction would likely be less.		existing preventative control measures in place to prevent a well blowout and the additional safety and environmental risks of having another MODU and support equipment/personnel on standby
N/A	Mange the timing to avoid drilling during cyclone season	Reduce the consequence of impact in the event of a loss of well control due to cyclonic conditions potentially spreading an oil spill further or hindering oil spill response activities	During cyclone season the weather can provide some of the best weather windows for drilling with calm sea state. Drilling within cyclone season does not increase the likelihood of a loss of well control as procedures are in place (as per the NOPSEMA accepted WOMP and Safety Case) to ensure that cyclone response plans are in place (including monitoring of cyclones) and barriers for cyclone suspension that are	**Rejected** – The cost of mobilising a MODU either side of cyclone season adds a grossly disproportionate cost to the activity. In addition, during cyclone season the weather can provide some of the best weather windows for drilling with calm sea state. Given that drilling year-round on the NWS is well managed and understood, and there are cyclone management procedures in place, the control is considered grossly disproportionate to the cost and risk of a LOWC event.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			implemented as required. Cyclones are a known risk on the NWS and drilling within cyclone season is well managed under current industry standards. Adjusting the timing to avoid cyclone season would preclude drilling for 6 months of the year, significantly reducing MODU availability and increasing the length of the drilling campaign as the MODU would need to be demobilised part way through the campaign and re-mobilised after cyclone season therefore increasing costs estimated at ~5MM USD per mobilisation.	
N/A	Time the drilling campaign to align with the other Santos drilling activities so that nearby MODU could be used for	Could reduce the length of time taken to drill a relief well and may reduce the timeframe for stopping a blowout by 20-30	Delays in drilling campaign schedule to align with other activities in the area	**Rejected** – Santos have no foreseeable plans to contract 2 MODUs to operate in the same region.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
	the relief well drilling.	days, although planning/approval /set-up requirements mean the reduction would likely be less. Reduction in spill duration by 20-30 days, results in less hydrocarbon exposure and reduced shoreline loading volumes		
N/A	Pre-drill riserless intervals for a potential relief well, prior to drilling the main well	Reduce the time taken for the relief well to be drilled by approximately 10 days, therefore stopping the LOWC event sooner and resulting in less hydrocarbon exposure and reduced shoreline loading volumes	The activity itself would require approximately 10 days and a complete rig move to perform at a cost of approximately $6-7MM USD. Once the main well was completed, the partially completed relief well would need to be abandoned. At a further cost of approximately $6-7MM USD. A different wellhead/conductor system would need to be procured to facilitate this at estimate cost of $0.75MM USD. Additional environmental impacts from	**Rejected** – Detailed relief well designs will be re-evaluated and revised for an actual LOWC event. There will be several locations for the relief well identified before an incident, with the optimal location selected after a LOWC incident, based on real-time information (i.e. prevailing weather). A pre-drilled relief well top-section might result in having to use a sub-optimal design and location. It is not industry practice, and such a pre-drilled riseless interval may adversely affect functionality and reliability of this

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			drilling wells from drill cuttings and discharges.	response strategy. The additional cost associated with drilling the riserless intervals would be ~$15MM USD per well which is considered grossly disproportionate to the reduction in the duration that could potentially be achieved of a LOWC event.

7.6.6 Demonstration of As Low As Reasonably Practicable

The use of industry standard safe drilling methodologies, including the inherently safe well design and its operations with primary well control features (i.e., maintaining the appropriate hydrostatic pressure via a monitored fluid column) and secondary well control features (i.e., blowout preventers), reduces the probability of a loss of containment occurring to a very low level. All safety options have been considered in well design and equipment choice for the activity, with no additional safety options possible, it is considered that the risk of a loss of containment occurring has been reduced to ALARP.

The combination of the standard prevention control measures (**Section 7.6.5**) (which reduce the likelihood of the event happening), and the spill response strategies (which may reduce the consequence) together reduce the hydrocarbon spill risk.

Based on the stochastic spill modelling, Santos has determined applicable source control response measures to limit the spill volume from a LOWC event to ALARP. Further detail is provided below.

<u>Source control</u>

A number of source control options have been evaluated for the activity (refer to OPEP). Of these source control options, the drilling of a relief well is considered the primary means of controlling the source in the event of an unplanned well release. Spill response and impact assessment for this activity has been based on the relief well taking 77 days (11 weeks) to execute. A breakdown of the key tasks and their timeframe to drill a relief well in 11 weeks have been included in **Section 8.3.2** of the OPEP.

Supporting controls to allow the relief well schedule to be met include:

+ Assurance Review 4: Readiness to Spud" is conducted under the Drilling & Completions Management Process (DCMP).
+ Rig capability register is maintained.

- A well-specific Source Control Plan (SCP) is prepared in accordance with the Santos Source Control Planning and Response Guidelines. The SCP contains information and considerations for relief well operations including but not limited to:
  - Relief well surface locations (primary and secondary)
  - Relief well trajectory and interception target point
  - Dynamic well kill modelling calculations for controlling a worst-case discharge (e.g. kill mud weight, kill pump rate/pressure and kill mud volume required)
  - Status of relief well tangible equipment.
  - Australian Energy Producers (AEP) Memorandum of Understanding (MoU) provides for access to other Operator rigs.
  - Contracts and MoUs for 3rd party independent well control specialist personnel are in place.

The implementation timeframe of this control is key to its effectiveness. A second MODU positioned on standby in the vicinity of the activity during the drilling activity was considered as an additional control that could reduce the length of time taken to drill a relief well. This would involve hiring an additional rig for the duration of the activity. If adopted, this may reduce the timeframe for stopping a blowout by up to two weeks, although planning/approval/set-up requirements mean the reduction would likely be less. The cost of having a MODU and personnel/equipment on standby (at a rate of ca. $250,000/day) would double the cost of the activity and introduce additional safety and environmental risks due to presence of an additional MODU and support vessels/equipment being on standby. This is considered grossly disproportionate to the environmental benefit (a potential reduction of two weeks to stop the LOWC, particularly considering the likelihood of a LOWC and the existing preventative control measures in place to prevent a well blowout. Having a dedicated second MODU on standby for the purpose of relief well drilling was therefore rejected as a control measure.

In order to minimise lead times a rig with a NOPSEMA approved Safety Case will be preferred. These rigs are tracked on the Rig Capability Register and access is covered under the AEP MoU. For the water depths at this location, it is possible that a semi-submersible MODU may be feasible to drill the relief well instead of a jack-up, but this would also depend on the exact circumstances of the LOWC scenario and therefore feasibility is not guaranteed. The well specific Source Control Plan will assess the feasibility and availability of suitable MODUs prior to each drilling activity occurring.

Direct intervention (i.e., deployment onto the MODU) using specialised well control personnel is a strategy that could be adopted and supported through contractual arrangements with well control vendors. This strategy is contingent on technical aspects of the LOWC event and safety considerations which could only be assessed at the time of a spill event. For this reason, the current preparedness measures for well intervention experts is considered ALARP.

Santos has access to a subsea first response toolkit (SFRT) and deployment personnel through contract to AMOSC and Oceaneering respectively. This includes access to a capping stack and subsea dispersant application. The high gas release may preclude deployment of the capping stack; such limitations would be considered during response implementation taking into account the specific conditions of the LOWC.

In the event SFRT was required, SFRT equipment can be mobilised to Dampier from the Jandakot storage yard in two days, under existing arrangements. Locating this equipment in Dampier could potentially reduce deployment time by two days providing a suitable vessel was on standby for immediate mobilisation. However, the equipment is a shared resource across AMOSC SFRT subscription members so relocating for a drilling campaign is not considered viable. Providing a vessel on standby for SFRT deployment could reduce deployment time, but given SFRT deployment may not be suitable or feasible a potential reduction in deployment time due to a vessel being on standby is not seen to offer sufficient environmental benefit given crewed vessel standby costs would be tens of thousands of dollars each day over the drilling period.

Spill mitigation controls

Santos considers that through the selection of appropriate spill response strategies, development of spill response controls and maintenance of preparedness arrangements and resources to implement these controls, spill risk is mitigated to ALARP. Preparedness spill response controls are outlined in **Section 6.9** while those that would be implemented in the event of a spill are outlined within the OPEP.

7.6.7 Demonstration of Acceptability

Table 7-24: Acceptability evaluation – Hydrocarbon Spill – Loss of Well Control

Is the risk ranked between Very Low to Medium?	Yes – maximum credible hydrocarbon spill volume (condensate from a LOWC) residual risk is ranked as Low.
Is further information required in the consequence assessment?	Yes – hydrocarbon spill modelling results were used to determine consequence and risk
Are risks and impacts consistent with the principles of ESD?	Yes – activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – management consistent with OPGGS(E)R 2023 Regulations, including safety case and WOMP. Santos has considered the values and sensitivities of the receiving environment Relevant species recovery plans, conservation management plans and management actions, including but not limited to the: + *Recovery Plan for Marine Turtles in Australia* (Commonwealth of Australia, 2017) + Approved Conservation Advice for *Megaptera novaeangliae* (humpback whale) (TSSC, 2025h) + Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (Threatened Species Scientific Committee, 2015b) + Approved Conservation Advice for *Rhincodon typus* (whale shark) (Threatened Species Scientific Committee, 2015a) Management is also consistent with the zoning of the Australian marine parks, and their

	management plans in that risks have been reduced to ALARP, e.g., implementation of spill response activities will limit impacts, thereby conserving the marine park values which and other habitats critical to the diversity and value of the protected areas.
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – no concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes (see ALARP above)

The likelihood of a LOWC event during the activity is unlikely when considering industry statistics, Santos statistics and the preventative controls in place. Wells are designed with essential engineering and safety control measures to prevent a LOWC incident occurring. Additional industry-standard and activity-specific control measures to reduce the chance of the event occurring (and minimise impacts) have also been implemented, including (but not limited to) procedures such as the safety case, WOMP, personnel training and awareness, and a spill response plan (OPEP). In accordance with Santos' risk assessment process, the residual risk is considered to be ALARP. The proposed control measures will reduce the risk of impacts from a LOWC to a level that is considered acceptable.

7.7 Subsea release of Condensate from Subsea Pipeline

7.7.1 Description of Event

The LOC from damage to the East Spar pipeline caused by dropped object or anchor drag has been previously assessed within the VI Hub Ops Cth EP. Under Regulations 56 (1(b)) of the OPGGS Act, Santos refers to **Section 7.7** of the VI Hub Ops Cth EP for assessment of this event. It is noted that this activity will occur concurrently with ongoing operations for the Varanus Island Hub commonwealth facilities, managed through an Interface Management Plan.

This section assesses the potential for a dropped object or anchor drag to damage the section of the East Spar pipeline which is situated within the defined operational area for the Halyard-2 activities (**Section 7.7**)

Event	Dropped objects or anchor drag, as a result of the Halyard-2 activities, may cause a loss of containment. This is considered a credible scenario under the assumption of multiple and simultaneous failures of the controls in place. A loss of containment would escalate to a loss that would be detected and result in an almost instantaneous emergency shutdown. The maximum credible spill is therefore calculated based on the entire condensate volume within the pipeline between isolation points. Based on the respective pipeline inventory, the East Spar pipeline would result in a release volume of 161 m^3.
Extent	The loss of containment is along the section of the East Spar pipeline which runs within the defined operational area for the Halyard-2 activities. The extent of a subsea release of the East Spar pipeline was assessed within **Section 7.7** of the VI Hub Ops Cth EP, where, due to the larger pipeline inventory of the John Brookes pipeline, predictive oil spill modelling for a subsea release of 210 m^3 of John Brookes condensate at the State waters boundary has been modelled. This modelling is considered appropriate for both pipeline release scenarios in terms of the similarities in hydrocarbon type, water depth and environmental conditions. Under Regulations 56 (1(b)) of the OPGGS Act, Santos refers to **Section 7.7.1** of the VI Hub Ops Cth EP for details on the extent of this event.
Duration	Release over 5.4 hours.

7.7.2 Nature and Scale of Environmental Impacts

Hydrocarbon spills will cause a decline in water quality and may cause chemical (e.g., toxic) and physical (e.g., 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 (i.e., extent, duration) and sensitivity of the receptor.

Potential receptors: Physical environment (water and sediment quality, shoals and banks, benthic habitats, offshore reefs and islands), threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds), protected and significant areas (marine parks, heritage areas, key ecological features (KEFs)), socio-economic receptors (fisheries, tourism, recreation and other third-party operators).

A surface release of East Spar condensate to the marine environment would result in a localised reduction in water quality in the upper surface waters of the water column. Under Regulations 56 (1(b)) of the OPGGS Act, Santos would like to refer the reader to Section 7.7.2 of the VI Hub Ops Cth EP for a full description on the Nature and Scale of Environmental Impacts.

7.7.3 Environmental Performance Outcomes and Control Measures

The EPO relating to this event includes:

- No loss of containment of hydrocarbon to the marine environment [H2-EPO-03];
- No unplanned objects, emissions or discharges to sea or air [H2-EPO-04]; and
- No injury or mortality to EPBC Act 1999 and WA Biodiversity Conservation Act 2016 listed marine fauna during activities [H2-EPO-05].

Control measures applied to prevent an oil spill are shown in **Table 7-25**, and corresponding EPSs and measurement criteria for the EPO described in **Table 8-1**.

Selection of oil spill response strategies and associated EPOs, control measures and EPSs, including those required to maintain preparedness and for response, are detailed within the OPEP. The OPEP contains an evaluation of oil spill preparedness arrangements to demonstrate that oil spills will be mitigated to ALARP.

Table 7-25 Control Measure Evaluation for the Subsea Release of Condensate from Subsea Pipeline

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Controls				
H2-DC-CM-039	Drilling and Completions Management Process	Regulator accepted MODU Safety Case includes control measures for well control that reduce the risk of an unplanned release of hydrocarbons.	Costs associated with personnel time in writing, reviewing and implementing the safety case.	**Adopted** – Benefits considered to outweigh costs. Regulatory requirement must be adopted.
H2-DC-CM-046	Testing and maintenance of emergency shutdown systems and shutdown/safety valves	Maintenance and testing of emergency systems and shutdown valves enable potential spill volumes to be minimised.	Costs associated with personnel time in performing the testing and maintenance.	**Adopted** – Benefits considered to outweigh costs.
H2-DC-CM-047 H2-IC-CM-035	Incident Response Plan detailing the requirements for preparedness and response to emergencies and crises to protect people and the environment	Provides detail to ensure the ESD system is activated quickly and efficiently if it has not automatically activated, to reduce the extent of impacts to the marine environment.	Administrative costs of preparing documents.	**Adopted** – Benefits considered to outweigh costs.
H2-IC-CM-016	Navigational charting of infrastructure	Provides a means for marine users to be aware of the presence of the WHP and subsea infrastructure.	Costs associated with personnel time in issuing notifications.	**Adopted** – Benefits considered to outweigh costs.
H2-IC-CM-025	Dropped object prevention procedure	Impacts to the environment are reduced by preventing dropped objects.	Costs associated with personnel time in implementing	**Adopted** – Benefits considered to outweigh costs.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		Requires lifting equipment is certified and inspected.	procedures and in incident reporting.	
H2-IC-CM-032	Accepted OPEP	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 -** Benefits of ensuring procedures are followed and measures implemented and that the vessels are compliant outweigh the costs. Regulatory requirement must be adopted.
Additional Controls				
H2-DC-CM-011 H2-IC-CM-09	Anchoring and equipment deployment management.	Anchoring and placement of equipment is controlled through ensuring that any anchoring occurs at pre-approved locations, thereby reducing potential environmental impacts.	Costs associated with implementing procedures.	**Adopted** – Benefits considered to outweigh costs.
HC-DM-CM-049	Interface Management Plan (IMP)	Interface Management Plan, detailing permitted activities to reduce the safety and environmental risks and impacts. Specifically: + Halyard-1 and Spar-2 will be shut-in at the XTs (During drilling activities); and + The subsea production system (SPS) depressurised (prior to the MODU entering the field).	Costs associated with personnel time in writing, reviewing and implementing the IMP.	**Adopted** – Benefits considered to outweigh costs.

7.7.4 Environmental Impact Assessment

Description	
Receptors	Physical environment (water and sediment quality, shoals and banks, benthic habitats, offshore reefs and islands) Threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds) Protected and significant areas (marine parks and KEFs) Socio-economic receptors (fisheries, tourism and recreation)
Consequence	III - Moderate
The consequence for a much larger release of Halyard Condensate has been previously detailed within Halyard-2 LOWC Environmental Impact Assessment (**Section 7.6.4**). As this is based upon a far greater release volume (Pipeline LOC: 161 m^3, LOWC 173,755 m^3) and exceeds the consequence from a LOC at the East Spar pipeline, the consequence can be referred to for this event. A condensate release from a pipeline rupture has the potential to impact receptors in the water column. Given the moderate extent, the worst-case consequence is considered to be Moderate (III).	
Likelihood	a - Remote
A hydrocarbon release resulting from a pipeline rupture caused by a dropped object or anchor drag is unlikely to have widespread ecological effects, given the nature of the condensate, the controls in place, the safety design of the production system, the limited volumes that could be released, the water depth, and the transient nature of marine fauna in this area. Deteriorating water quality is identified as a potential threat to turtles in the marine turtle recovery plan (DoEE, 2017), and some bird and shark species (**Table 3-11)**. Habitat modification, degradation, disruption, pollution and/or loss are also identified as threats to sharks, birds, cetaceans and turtles in conservation management and recovery plans. However, the potential hydrocarbon releases as a result of pipeline rupture caused by dropped object are not expected to significantly impact the receiving environment with the management controls proposed. Additionally, long-term impacts resulting in complete habitat loss or degradation are not considered likely given the controls proposed to prevent releases; therefore, the activity will be conducted in a manner that is considered acceptable. The likelihood of a hydrocarbon release occurring due to pipeline rupture caused by a dropped object is limited given the set of mitigation and management controls in place. Consequently, the likelihood of a pipeline rupture releasing hydrocarbons to the environment that results in a moderate consequence is considered to be remote (a).	
Residual Risk	The residual risk associated with this event is **Very Low**.

7.7.5 Demonstration of As Low As Reasonably Practicable

The demonstration of ALARP argument, presented within **Section 7.7.5** of the VI Hub Ops Cth EP, contains multiple controls which will remain in place for the Halyard-2 activities, given concurrent opertions. Various procedural controls are in place that reduce the likelihood of these events. 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.

Santos

The primary mechanism to immediately respond to a release of hydrocarbon from the subsea production system is via the emergency shutdown system managed through the Varanus Island Incident Response Plan (QE-00-ZF-00044). In terms of spill response activities, Santos will implement oil spill response as specified in the OPEP. A detailed ALARP assessment on the adequacy of arrangements available to support spill response strategies and control measures is presented in the OPEP.

Specific to this EP and the Halyard-2 activities, Santos are also committed to introducing additional practicable risk reduction measures further to those described in the VI Hub Ops Cth EP.

Santos have defined a 'handling zone' to the North-North-West of the Halyard-2 well, away from live subsea infrastructure, for deployment and handling of large infrastructure including XT and BOP. In addition, all anchor operations will be performed with the active fairlead away from infrastructure.

During drilling activities, the subsea production system (SPS) will be depressurised prior to the MODU entering the field (a permitted activity as described in the Interface Management Plan). Should pre-laying of anchors be selected the anchor pattern will also be pre-set to minimise dropped object risk, with provision for additional anchors for cyclone preparedness to minimise risk of anchor drag. The Halyard/East Spar field Safety Case Addendum for MODU SIMOPS [7915-012-PHA-0005-06] and the Campaign Specific HSE Case Revision for the Ocean Apex [APEX-HSEC-001-08-12 (approved 22 April 2024) further details these controls.

For the ISV well tie in works, the ISV operates on Dynamic Positioning and will not use anchors in field. All lifts will be performed in safe deployment zones to minimise risks to subsea infrastructure. During the works the pressure in the entire GES subsea production system will be reduced to 13 bar to prevent flammable plume at sea level and minimise LOC risks (based on gas plume and dispersion modelling [7915-787-REP-0030]. All critical lifts will also be subject to independent Validation and Verification.

Santos conducted a DROPs study, inclusive of gas dispersion analysis modelling [7915-787-REP-0030] which confirmed that an MAE is not credible (50% LEL/LFL at lower most manned deck on the Ocean Apex) in the event of a flowline/subsea infrastructure rupture. Santos will reduce the pressure to 13 bar for both operations so that the dispersion modelling works for both the MODU and ISV. Subsea ambient pressure at GES is approximately 11 barg, and Santos policy is not to reduce the pressure below subsea ambient for flexible pipes.

Within the operational phase of the Halyard-2 well, its 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 SCM and connecting spool, as per existing asset design/philosophy, is inherently robust minimising risk of damage should a dropped object occur. Pressure monitoring of the pipeline during operation will be capable of detecting significant LoC events and tripping the well.

Accounting for the above risk reduction measures in combination to those already provided for within the V Hub Ops EP, it is considered that spill volume has been reduced to ALARP for a major leak/rupture scenario.

7.7.6 Acceptability Evaluation

Is the risk ranked between Low to Medium?	Yes – maximum credible spill volume from East Spar pipeline (161 m^3) residual risk is ranked as very low.

Is further information required in the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecological sustainable development?	Yes – activity evaluated in accordance with Santos's Environmental Hazard Identification and Assessment Procedure. which considers principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – management consistent with OPGGS(E)R 2023 Regulations, including safety case and WOMP. Santos has considered the values and sensitivities of the receiving environment. Relevant species recovery plans, conservation management plans and management actions, including but not limited to the: + Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017) + Approved Conservation Advice for Megaptera novaeangliae (humpback whale) (TSSC, 2025h) + Approved Conservation Advice for Balaenoptera physalus (fin whale) (Threatened Species Scientific Committee, 2015b) + Approved Conservation Advice for Rhincodon typus (whale shark) (Threatened Species Scientific Committee, 2015a) Management is also consistent with the zoning of the Australian marine parks, and their management plans in that risks have been reduced to ALARP, e.g., implementation of spill response activities will limit impacts, thereby conserving the marine park values which and other habitats critical to the diversity and value of the protected areas.
Are risks and impacts consistent with Santos's Environmental Management Policy?	Yes – aligns with Santos's Environmental Management Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes (see ALARP above).

The likelihood of a subsea condensate release from a pipeline is extremely low (remote) when considering industry statistics, Santos statistics and the preventive controls in place. This activity will be undertaken concurrently with operations from other Varanus Island Hub commonwealth facilities, as such the mitigations and controls described in the accepted VI Hub Cth Ops EP, will also be implemented. Additional industry-standard and activity-specific control measures to reduce the chance of the event occurring (and minimise impacts) have also been implemented, including (but not limited to) procedures such as the safety case, WOMP, personnel training and awareness, and a spill response plan (the OPEP). In accordance with Santos's risk assessment process, the residual risk is considered to be ALARP. The proposed control measures will reduce the risk of impacts from a subsea pipeline condensate release to a level that is considered acceptable.

7.8 Subsea Release of Condensate from Wellheads

7.8.1 Description of Event

As previously detailed, LOC from damage to the Halyard-1 wellhead via either dropped object or anchor drag has been deemed a credible scenario and was previously assessed within the VI Hub Ops Cth EP (**Section 7.8**).

The release volume from LOC at Halyard-1 is a far smaller volume than that of the LOWC scenario presented in **Section 7.6** of this EP (Wellhead LOC: 1,269 m^3, LOWC 173,755 m^3). As a result, assessment of LOC refers back to the LOWC assessment within **Section 7.6** of this EP. The assessment below details the LOC event from the Halyard-1 well as a result of Halyard-2 activities (dropped object or anchor drag).

Event	It is considered credible for an unplanned release of condensate and gas to occur from damage to a subsea wellhead (Halyard-1) (**Section 7.5.1**). Dropped objects or anchor drag as a result of the Halyard-2 activities in scope of this EP, may cause a loss of containment. This is considered a credible scenario under the assumption of multiple and simultaneous failures of the controls in place. A loss of containment would escalate to a loss that would be detected and result in an almost instantaneous emergency shutdown.
Extent	The extent of a subsea release was assessed within **Section 7.8** of the VI Hub Ops Cth EP.. This assessment determined that the worst case credible subsea wellhead release would occur from a subsea well (Halyard 1 or Spar-2). A 100% full-bore blowout was not considered credible. A worst-case leak of 1,269 m3 was determined from Halyard-1. However, as the LOWC event within **Section 7.6.1** details a far greater release volume and extent then an LOC at Halyard-1, that extent is to be utilised for this event.
Duration	Utilising the duration of LOWC presented in **Section 7.6.1** of this EP, the worst-case duration is predicted as 77 days (refer to the OPEP). This is the estimated time required to drill a relief well and gain control of the primary well. Hydrocarbons would persist within the environment for a longer period of time, although the condensate released is expected to weather quickly through evaporation and dispersion.

7.8.2 Nature and Scale of Environmental Impact

Potential receptors: Physical environment (water and sediment quality, shoals and banks, benthic habitats, offshore reefs and islands), threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds), protected and significant areas (marine parks, KEFs), socio-economic receptors (fisheries, tourism and recreation).

Hydrocarbon spills will cause a decline in water quality and may cause chemical (e.g., toxic) and physical (e.g., 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 (i.e., extent, duration) and sensitivity of the receptor. A subsea release of condensate from wellheads (Halyard-1) to the marine environment would result in a localised reduction in water quality in the upper surface waters of the water column near the location of the spill. Modelling has been produced for a larger volume LOWC at Halyard-2 and the nature and scale of the environmental impact based on this larger volume is presented in **Section 7.6.2**.

7.8.3 Environmental Performance Outcomes

The EPOs relating to this event includes:

- No loss of containment of hydrocarbon to the marine environment [H2-EPO-03];
- No unplanned objects, emissions or discharges to sea or air [H2-EPO-04]; and
- No injury or mortality to EPBC Act 1999 and WA Biodiversity Conservation Act 2016 listed marine fauna during activities [H2-EPO-05].

Control measures applied to prevent an oil spill are shown in **Table 7-26** and corresponding EPSs and measurement criteria for the EPOs described in **Table 8-1**.

Selection of oil spill response strategies and associated EPOs, control measures and EPSs, including those required to maintain preparedness and for response, are detailed within the OPEP. The OPEP contains an evaluation of oil spill preparedness arrangements to demonstrate that oil spills will be mitigated to ALARP.

Table 7-26: Control Measure Evaluation for the Subsea Release of Condensate from Wellheads

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Controls				
H2-DC-CM-039	Drilling and Completions Management Process	Includes control measures for well integrity and well control in an accepted WOMP, MODU Safety Case. Defines critical acceptance criteria for well operations that reduce the risk of a LOWC. Accounts for emergency situations such as cyclone response plan	Costs associated with preparing and implementing the WOMP, Safety Case and D&C programs.	**Adopted** – Benefits considered to outweigh costs. Regulatory requirement must be adopted.
H2-DC-CM-037	MODU and support vessel spill response plans including predrilling source control plan	Implements response plan to deal with an unplanned hydrocarbon spills quickly and efficiently in order to reduce impacts to the marine environment.	Personnel cost and administrative costs associated with preparing documents, ongoing management (spill response exercises) and implementation of plans.	**Adopted** - Environmental benefits of ensuring response plans in place, are followed and measures implemented, and that the MODU/support vessels are compliant outweighs the costs of

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
				personnel time associated with preparation and implementation of spill response plans
H2-DC-CM-048	Well services procedures and criteria.	Includes control measures for well integrity, well operations and well control.	Costs associated with personnel time in writing, reviewing and implementing the procedures.	**Adopted–** Benefits considered to outweigh costs.
H2-DC-CM-046	Testing and maintenance of emergency shutdown systems and shutdown/safety valves.	Maintenance and testing of emergency systems and shutdown valves enables potential spill volumes to be minimised.	Costs associated with personnel time in performing the testing and maintenance.	**Adopted** – Benefits considered to outweigh costs.
H2-DC-CM-047	Incident Response Plan detailing the requirements for preparedness and response to emergencies and crises to protect people and the environment.	Provides detail to ensure the ESD system is activated quickly and efficiently if it has not automatically activated, to reduce the extent of impacts to the marine environment.	Administrative costs of preparing documents.	**Adopted** – Benefits considered to outweigh costs.
H2-DC-CM-031 H2-IC-CM-025	Dropped object prevention procedure	Impacts to the environment are reduced by preventing dropped objects. Ensures lifting equipment is certified and inspected.	Costs associated with personnel time in implementing procedures and in incident reporting.	**Adopted** – Benefits considered to outweigh costs.
H2-DC-CM-040 H2-IC-CM-032	Accepted OPEP	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** – Benefits of ensuring procedures are followed and measures implemented and that the vessels are compliant outweighs the costs. Regulatory requirement must be adopted.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
H2-IC-CM-016	Navigational charting of infrastructure.	Provides a means for marine users to be aware of the presence of the WHP and subsea infrastructure.	Costs associated with personnel time in issuing notifications.	**Adopted** – Benefits considered to outweigh costs.
Additional Controls				
H2-DC-CM-041	Pre-campaign commencement assurance check	Ensures consideration of worst case hydrocarbon spill scenario for the proposed activity based on actual MODU, vessel and activity details.	Administrative costs to undertake assurance check and risk assessments for each campaign.	**Adopted** – Benefit of implementing procedure outweighs the costs.
H2-DC-CM-011 H2-IC-CM-09	Anchoring and equipment deployment management.	Anchoring and placement of equipment is controlled through ensuring that any anchoring occurs at pre-approved locations, thereby reducing potential environmental impacts.	Costs associated with implementing procedures.	**Adopted** – Benefits considered to outweigh costs.
HC-DM-CM-049	Interface Management Plan (IMP)	Interface Management Plan, detailing permitted activities to reduce the safety and environmental risks and impacts. Specifically: + Halyard-1 and Spar-2 will be shut-in at the XTs (During drilling activities); and + The subsea production system (SPS) depressurised	Costs associated with personnel time in writing, reviewing and implementing the IMP.	**Adopted** – Benefits considered to outweigh costs.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		(prior to the MODU entering the field).		

7.8.4 Environmental Impact Assessment

The environmental impact assessment follows the risk assessment approach detailed in **Section 7.5.5.**

The impact, likelihoods and consequence ranking for a subsea release of condensate from wellheads are outlined in **Table 7-27**.

Table 7-27 Impact, Likelihoods and Consequence Ranking – Subsea Release of Condensate from Wellheads

Description	
Receptors	Physical environment (water and sediment quality, shoals and banks, benthic habitats, offshore reefs and islands) Threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds) Protected and significant areas (marine parks and KEFs) Socio-economic receptors (fisheries, tourism and recreation)
Consequence	III - Moderate
The consequence for a much larger release of Halyard Condensate has been previously detailed within Halyard-2 LOWC Environmental Impact Assessment (**Section 7.6.4**). As this is a far greater volume than an LOC event, the consequence details can be referred to for this event. A condensate release from subsea wells has the potential to impact receptors predominantly in the water column only. As such, the worst-case consequence is considered to be Moderate (III).	
Likelihood	A – remote
The likelihood of a loss of well control event occurring either due to dropped object, anchor or chain drag is extremely low when considering industry statistics, Santos statistics and the preventive control measures in place. Wells are designed with essential engineering and safety control measures to prevent a loss of containment occurring. Management controls in place to control the flow of hydrocarbons include construction design, safety shutdown systems, regular inspection and maintenance, and competent personnel. Additional industry-standard and activity-specific control measures to reduce the chance of a loss of containment event have also been implemented including (but not limited to) procedures such as the WOMP, safety case, crew training and awareness, and a spill response plan (OPEP). In conjunction with controls to prevent vessel collision and anchoring incidents, the control measures are considered to reduce the risk of a loss of containment (and minimise impacts) occurring to a level that is acceptable. It should be noted that prior to the drilling of Halyard-2 and any subsea installation activity being undertaken, the Halyard-1 well will be shut in, in accordance with **Section 2.6.2**. The likelihood of a worst-case subsea release at the Halyard-1 resulting in a Moderate (III) consequence is considered to be remote (a).	

Residual Risk	The residual risk associated with this event is **Very Low**.

7.8.5 Demonstration of As Low As Reasonably Practicable

The combination of the standard prevention control measures (which reduce the likelihood of the event happening), and the spill response strategies (which may reduce the consequence) together reduce the hydrocarbon spill risk.

In addition to the measures presented within **Section 7.6.6** for a LOWC event, Santos are also committed to introducing additional practicable risk reduction measures specific for a wellhead LOC event.

Santos have defined a 'handling zone' to the North-North-West for deployment and handling of large infrastructure including XT and BOP. All anchor operations will be performed with the active fairlead away from infrastructure.

In order to mitigate both the risk and impact further, key management controls will be implemented at each stage of the proposed activities. During drilling activities, Halyard-1 and Spar-2 will be shut-in at the XTs prior to the MODU entering the field (a permitted activity as described in the Interface Management Plan). Should pre-laying of anchors be selected the anchor pattern will also be pre-set to minimise dropped object risk, with provision for additional anchors for cyclone preparedness to minimise risk of anchor drag. The Halyard/East Spar field Safety Case Addendum for MODU SIMOPS [7915-012-PHA-0005-06] and the Campaign Specific HSE Case Revision for the Ocean Apex [APEX-HSEC-001-08-12 (approved 22 April 2024) further details these controls.

For the ISV well tie in works, the ISV operates on Dynamic Positioning and will not use anchors in field. All lifts will be performed in safe deployment zones to minimise risks to subsea infrastructure. All XTs will be isolated (Halyard-1, Halyard-2 and Spar-2) during the works. All critical lifts will also be subject to independent Validation and Verification.

Santos conducted a DROPs study, inclusive of gas dispersion analysis modelling [7915-787-REP-0030] which confirmed that an MAE is not credible (50% LEL/LFL at lower most manned deck on the Ocean Apex) in the event of a flowline/subsea infrastructure rupture.

Within the operational phase of the Halyard-2 well, its 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 pipeline during operation will be capable of detecting significant LoC events and tripping the well and any loss of communication and/or control of Halyard-2 well would result in the XT valves failing closed.

7.8.6 Acceptability Evaluation

Is the risk ranked between Low to Medium?	Yes –maximum credible spill volumes from Halyard-1 wellhead (1,269 m^3) residual risk is ranked as Very Low.
Is further information required in the consequence assessment?	No – potential impacts and risks are well understood through the information available

Are risks and impacts consistent with the principles of ecological sustainable development?	Yes – activity evaluated in accordance with Santos's Environmental Hazard Identification and Assessment Procedure, which considers principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – management consistent with OPGGS(E)R 2023 Regulations, including safety case and WOMP. Santos has considered the values and sensitivities of the receiving environment. Relevant species recovery plans, conservation management plans and management actions, including but not limited to the: + *Recovery Plan for Marine Turtles in Australia* (Commonwealth of Australia, 2017) + Approved Conservation Advice for *Megaptera novaeangliae* (humpback whale) (TSSC, 2025h) + Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (Threatened Species Scientific Committee, 2015b) + Approved Conservation Advice for *Rhincodon typus* (whale shark) (Threatened Species Scientific Committee, 2015a) Management is also consistent with the zoning of the Australian marine parks, and their management plans in that risks have been reduced to ALARP, e.g., implementation of spill response activities will limit impacts, thereby conserving the marine park values which and other habitats critical to the diversity and value of the protected areas.
Are risks and impacts consistent with Santos's Environmental Management Policy?	Yes – Aligns with Santos's Environmental Management Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes (see ALARP above).

The likelihood of a loss of well control event is extremely low (remote) when considering industry statistics, Santos statistics and the preventive controls in place. This activity will be undertaken concurrently with operations from other Varanus Island Hub commonwealth facilities, as such the mitigations and controls described in the accepted VI Hub Cth Ops EP, will also be implemented. Additional industry-standard and activity-specific control measures to reduce the chance of a loss of well control event (and minimise impacts) have also been implemented, including (but not limited to) procedures such as the WOMP, safety case, personnel training and awareness, and a spill response plan (the OPEP).

In accordance with Santos's risk assessment process, the residual risk is considered to be Very Low and ALARP. The proposed control measures will reduce the risk of impacts from a loss of well control event to a level that is considered acceptable.

7.9 Hydrocarbon Spill – Marine Diesel Oil

7.9.1 Description of Event

Event	*Worst credible Spill Scenario* It is considered credible that a release of MDO to the marine environment could occur between the support vessels, between a support vessel and the MODU or ISV, or between a passing third party vessel and the MODU, ISV or a support vessel. The worst-case environmental incident resulting from a vessel collision is the rupturing of a vessel fuel tank resulting in the release of MDO to the environment. Vessel collision could occur due to factors such as human error, poor navigation, vessel equipment failure or poor weather. A maximum credible spill volume has been determined based on technical guidance provided by AMSA (2015). This guidance states that for a vessel other than an oil tanker, the maximum credible spill from a collision can be determined from the volume of the largest single fuel tank. In reviewing the general arrangements and fuel tank capacities of the ISV, the largest single fuel tank capacity identified was 186 m^3. *Refuelling incident* There will be no helicopter refuelling on the MODU. The second most significant MDO spill scenario identified is a MODU or ISV refuelling incident (fuel hose failure or rupture, coupling failure or tank overfilling) where fuel bunkering would need to be stopped manually. Fuel released prior to the cessation of pumping as well as fuel remaining in the transfer line may escape to the environment. The AMSA (2015) Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities provides guidance for calculating a maximum credible spill volume for a refuelling spill. The guidance provided by AMSA (2015) for a refuelling spill under continuous supervision is considered appropriate given refuelling will be constantly supervised. The maximum credible spill volume during refuelling is calculated as: transfer rate (150 m^3/hr) x 15 minutes of flow giving a volume of 37.5 m^3. The detection time of 15 minutes is seen as conservative but applicable following failure of multiple barriers followed by manual detection and isolation of the fuel supply. For the purpose of the EP the impacts of a MDO spill of 329 m^3 has been assessed as this is the largest credible MDO spill associated with the activity.
Extent	MDO spill trajectory modelling (RPS, 2021b) indicated that there was some probability of a 329 m^3 WMDO spill extending as follows (using the moderate exposure thresholds) based on a summary from the modelling locations: + Shoreline loading was predicted to occur within 40 km (albeit at very low probability and very low predicted maximum loading of < 1 m^3). + Surface oil was predicted to occur within approximately 41 km. + Entrained oil was predicted to occur within approximately 299 km. + Dissolved hydrocarbons were predicted to occur within approximately 154 km.
Duration	A instantaneous 329 m^3 release of MDO was modelled, replicating the potential duration of a spill arising from a significant collision.

7.9.2 Nature and Scale of Environmental Impacts

Hydrocarbon spills will cause a decline in water quality and may cause chemical (e.g., toxic) and physical (e.g., 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 (i.e., 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, given smaller hydrocarbon spills (from refuelling) will impact a smaller area than a vessel collision.

<u>Potential receptors</u>: Physical environment (water and sediment quality, shoals and banks, benthic habitats, offshore reefs and islands), threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds), protected and significant areas (marine parks, heritage areas, KEFs), socio-economic receptors (fisheries, tourism, recreation and other third-party operators) cultural features and sea country.

A surface release of MDO to the marine environment would result in a localised reduction in water quality in the upper surface waters of the water column near the location of the spill. To ensure conservatism, the MDO release scenario modelling from locations outside of the. Potential impact pathways (physical and chemical) of hydrocarbon exposure for receptors are summarised in **Table 7-18** and potential impacts to receptors found within the EMBA are further described in **Table 7-19**. The locations predicted to receive hydrocarbons above the moderate threshold are within the MEVA described for a LOWC and are also identified as hotspots (Refer **Section 7.6.4.1**). Therefore, a consequence assessment has been conducted on these receptors assuming contact with hydrocarbons from a LOWC event (refer **Appendix H**) which is considered worse than an MDO spill event, therefore impacts described within the EP are conservative. The locations contacted by MDO spill modelling above moderate thresholds are also considered for oil spill response strategies as appropriate (refer Section 5 of the OPEP)

7.9.2.1 Spill Modelling Results

The modelling results (RPS, 2021b) are presented for the fate of hydrocarbon from a vessel collision at the exposure values defined in **Section 7.5.4**, and has been provided for the purposes of risk evaluation, displaying the parameters of:

+ minimum time to contact from moderate and high exposure value
+ maximum hydrocarbon concentration from high exposure value
+ maximum oil loading on shoreline from moderate and high exposure value
+ length of shoreline oiled.

Further parameters required to inform spill response strategies are described in the OPEP. A summary of the modelling results is provided below.

Shoreline accumulation

The maximum oil volume loading on shorelines during a single spill event was predicted as < 1 m^3, at only one receptor (Barrow Island), with a very low probability (at a threshold of > 100 g/m^2) of less than 2%.

Floating oil

Low – Surface oil above the low threshold (1 g/m^2) was predicted to extend up to approximately 48 km from the release location.

Moderate and High – At the moderate threshold (10 g/m^2), surface oiling was reduced in spatial extent to within approximately 41 km of the release location. At the high threshold (50 g/m^2) surface oiling was reduced in spatial extent to within approximately 22 km of the release location.

Receptors predicted to be contacted by surface oiling above the moderate threshold (10 g/m^2) were the Montebello AMP (44% probability) and Barrow – Montebello Surrounds (2% probability).

Entrained oil

Low – Entrained oil at the low threshold (10 ppb) was predicted to primarily occur within approximately 486 km of the release location.

Moderate – At the moderate threshold (100 ppb), predicted contact was reduced in spatial extent primarily within approximately 299 km of the release location.

Receptors predicted to be contacted by entrained oil at the moderate threshold (100 ppb) included Montebello AMP (64% probability), Ningaloo – offshore (44%), Barrow – Montebello Surrounds (22%), Muiron Islands (20%), Southern Islands Coast (16%), Ningaloo – outer coast north (12%), Barrow Island (10%), Ningaloo – outer NW (10%), Thevenard Islands (6%) and Ningaloo Coast North (4%).

Dissolved oil

Low – Dissolved hydrocarbons at the low threshold (10 ppb) were predicted to extend a maximum distance of approximately 250 km from the release location.

Moderate and High – At the moderate threshold (50 ppb), the spatial extent was within approximately 154 km of the release location. Exceedance of the high threshold (400 ppb) was limited to within 1 km of the release site.

Receptors predicted to be contacted by dissolved hydrocarbons at the moderate threshold (50 ppb) included Montebello AMP (20% probability), Ningaloo – offshore (4%), Ningaloo Coast North (2%), Barrow Island (2%) and Barrow – Montebello Surrounds (2%).

7.9.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event include:

- No loss of containment of hydrocarbon to the marine environment [H2-EPO-03].

The control measures applied to prevent hydrocarbon spill from refuelling and vessel collision are shown in **Table 7-24** and the EPS and measurement criteria for this EPO are described in **Table 8-2**.

Selection of oil spill response strategies and associated performance outcomes, control measures and performance standards, including those required to maintain preparedness and for response, are detailed within the OPEP. The OPEP contains an evaluation of oil spill preparedness arrangements to demonstrate that oil spills will be mitigated to ALARP.

Table 7-28: Control measures evaluation – Hydrocarbon Spill – Marine Diesel Oil

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-DC-CM-008 H2-IC-CM-007	Marine assurance standard	Ensures vessels meet Marine assurance standards to reduce the likelihood of unplanned discharge.	Costs associated with personnel time in checking vessel.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented and that the vessels are compliant outweigh the costs. Regulatory requirement must be adopted.
H2-DC-CM-002 H2-IC-CM-002	Lighting will be used as required for safe work conditions and navigational purposes	Ensures the vessels are seen by other marine users. Reduces the risk of collisions with other marine users.	No additional costs to Santos. Standard requirement for vessel navigation lighting and equipment to be compliant with COLREGS / Marine Orders 30: Prevention of Collisions, and with Marine Orders 21: Safety of Navigation and Emergency Procedures.	**Adopted** – The safety benefits of having navigation and lighting equipment and procedures outweighs any cost. This is a maritime requirement
H2-DC-CM-014 H2-IC-CM-012	Seafarer certification	Requires appropriately trained and competent personnel to navigate vessels to reduce interaction with other marine users.	Costs associated with personnel time in obtaining qualifications.	**Adopted** – Benefits considered to outweigh costs and is a legislated requirement.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
H2-DC-CM-016 H2-IC-CM-014	Santos stakeholder consultation strategy	Ensures other marine users, such as commercial fisheries, are aware of upcoming operations so they can plan their business accordingly and impacts can be minimised.	Limited additional costs to Santos. Stakeholders time required to review consultation material and communicate with Santos.	**Adopted** – Benefits considered to outweigh negligible costs. Important control to ensure other marine users are aware of upcoming operations and potential business disruptions. Provides an opportunity for Santos and stakeholders to discuss additional ways of minimising on-water interference and business disruptions.
H2-DC-CM-015 H2-IC-CM-013	Support vessel	Minimises risk of collision through visual identification and avoidance of other vessels	Negligible costs	**Adopted** – Benefits considered to outweigh costs.
H2-DC-CM-017 H2-IC-CM-015	Maritime Notices	Ensures other marine users are aware of the presence of vessels.	Costs associated with the personnel time in issuing notifications and closing out queries and responses.	**Adopted** – Benefits considered to outweigh negligible costs. Maritime requirement to issue maritime notices.
H2-DC-CM-018	MODU identification system	MODU has Automatic Identification System to aid in their detection at sea.	Negligible costs of operating navigational equipment. Standard equipment on MODU.	**Adopted** – Benefits considered to outweigh negligible costs to Santos.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
H2-DC-CM-019	Exclusion zone established around the MODU and ISV	Reduces potential for collision or interference with other marine user activities	Negligible costs, standard industry practice	**Adopted** – Benefits considered to outweigh negligible costs to Santos
H2-DC-CM-004 H2-IC-CM-004	Fuel oil quality	Use of diesel reduces the potential impacts to marine environment in the event of unplanned hydrocarbon spills or leaks during bunkering.	Additional personnel costs of ensuring vessels are using the required fuel.	**Adopted** – Benefits of ensuring procedures are followed outweighs the minimal costs of personnel time.
H2-DC-CM-037 H2-IC-CM-031	MODU and support vessel spill response plans including predrilling source control plan	Implements response plans 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 personal to confirm and check Shipboard Oil Pollution Emergency Plan (SOPEP)/ SMPEP in place.	**Adopted** – Benefits of considered to outweigh costs.
H2-DC-CM-040 H2-IC-CM-032	Accepted OPEP	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently in order 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.
H2-DC-CM-042	Refuelling and chemical transfer procedure	Minimises risk of pollution to ALARP during hydrocarbon transfers between	Personnel costs associated with ensuring procedures are in place and	**Adopted** – Benefits of ensuring procedures are followed and

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
H2-IC-CM-033		MODU, ISV and support vessels.	implemented during refuelling and chemical transfers.	measures implemented outweigh the costs.
H2-DC-CM-009 H2-IC-CM-008	Vessel PMS to maintain vessel DP, engines and machinery.	Vessel equipment is operating within its parameters, reducing the risk of unplanned discharges to the marine environment.	Costs are standard for routine PMS.	**Adopted** – benefits in reducing atmospheric emissions impacts outweigh the minimal costs.
Additional Control Measures				
N/A	Schedule activities to avoid coinciding with sensitive periods for marine fauna present in the operational area	Potential reduction in risk of a hydrocarbon spill to some sensitive receptors	Impracticable to schedule activities to avoid all listed marine fauna due to variability in timing of environmentally sensitive periods and the constant or unpredictable presence of some species. Short duration activity (i.e., a few days) that is low risk to marine fauna.	**Rejected** - Cost is disproportionate to increase in environmental benefit
N/A	No fuel bunkering via hose	Removes spill risk from hose operations.	Cost associated with transfer of MDO via drum or containers. Not possible to modify MODU or ISV to allow additional fuel storage. Cost associated with vessel transit and risk transfer to Health and	**Rejected** - Storage of fuel on MODU and ISV would result in unacceptable transfer of environmental risks to occupational health and safety/ operational

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
			Safety issues with additional trips to port instead. Would significantly increase the schedule to include multiple trips.	risks and would not eliminate risk of MDO spills to sea. Costs associated with implementing control is deemed grossly disproportionate to environmental benefit and low risk activity with standard controls in place.
N/A	Require all support vessels involved in the activity to be double hulled.	Reduces the likelihood of a loss of hydrocarbon inventory in the highly unlikely event of a vessel collision, 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 Also, requiring vessels to be refitted to ensure double hulls would be of high cost.	**Rejected** - Large costs associated with vessel selection and by having an activity schedule determined by vessel availability considered to be grossly disproportionate compared to low risk of a vessel collision and low risk of a large MDO spill.

7.9.4 Environmental Impact Assessment

Description	
Receptors	Physical environment – water quality, Shallow benthic, intertidal and shoreline habitats Threatened/migratory fauna – plankton, invertebrates, marine mammals, marine reptiles, sharks, rays and fish, birds (seabirds and shorebirds) Protected Areas – KEFs, Marine Parks and Commonwealth Heritage Areas

Description	
	Socio-economic – commercial, recreational and traditional fisheries, recreation and tourism, oil and gas industry, cultural heritage and sea country.)
Consequence	III - Moderate

A summary of the consequence assessment for each receptor category is presented below. Potential impact pathways (physical and chemical) of hydrocarbon exposure for receptors are summarised in **Table 7-18**, and potential impacts to receptors found within the MEVA in the event of a LOWC are further described in **Table 7-19**, this encompasses the MEVA and EMBA for a vessel collision resulting in a release of MDO.

Threatened/migratory fauna

A surface release of MDO to the marine environment would result in a localised reduction in water quality in the upper surface waters of the water column. As a light hydrocarbon, MDO undergoes rapid spreading and evaporative loss in warm waters, indicating that a surface slick will be temporary. Under moderate winds (5 m/s), 40% of the initial surface slick is predicted to remain as surface oil after 24 hours, decreasing further to approximately 10% after 48 hours and approximately 1% after 72 hours (RPS, 2021b). The high rate of evaporation means that little MDO will become entrained and few aromatic hydrocarbons are predicted to become dissolved reducing impact to marine fauna. Surface oil, and entrained hydrocarbon 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 affect some species through ingestion of oiled fish (as described in **Table 7-18**).

The MDO EMBA overlaps breeding/foraging BIAs for a number of seabirds. An unplanned release of MDO is not expected to interfere with their breeding activity, but could cause slight secondary effects through ingestion after preening or ingestion of oiled fish (as described in **Table 7-18** and **Table 7-19**).

The humpback whale (migration) and pygmy blue whale (distribution, migration and foraging) BIAs and whale shark foraging BIA overlap the EMBA. An unplanned release of MDO is not expected to interfere with their migration activity. There is the potential for behavioural disruption to the local population as individuals traverse the area affected with potential for coating of baleen (in whales) and ingestion of oiled prey (plankton/fish) as described in **Table 7-18** and **Table 7-19**.

The EMBA overlaps nesting/internesting BIAs for the flatback green and hawksbill turtles. Nesting and/or mating occurs at turtle nesting beaches and rookeries approximately 45 km from the operational area (west coast of Barrow Island)., Therefore, turtle behaviour could be disrupted with the potential to threaten turtle populations (as described in **Table 7-19**), particularly those at significant rookeries on Barrow Island and Montebello Islands.

Deteriorating water quality/chemical and terrestrial discharge is identified as a potential threat to turtles in the marine turtle recovery plan, and some bird and shark species. Habitat modification, degradation and disruption, pollution and/or loss of habitat are also identified as threats to sharks, birds, cetaceans and turtles in conservation management and recovery plans. Given the offshore location of the release, and volume of potential hydrocarbon release there is little potential for modification to or a decrease in the availability of quality habitat (shorelines/subsurface). Shoreline accumulation may present a major disruption to shoreline individuals (as described in **Table 7-19**). However, there is very little potential for shoreline accumulation, with volumes ashore expected to be < 1 m^3. Volumes of accumulated hydrocarbon may result in a reduction in area available for seabirds and/or turtle species. The quality of habitat (shorelines/subsurface) may be reduced for a period, with recovery over the medium term (decades).

Physical environment and habitats

In the event of MDO release, hydrocarbons that reach nearshore environments have the potential to impact benthic coral reefs and mangrove areas which may result in a decrease in ecological values given

Description
toxicity impacts associated with hydrocarbon exposure. The quality of habitat may be reduced for a significant period with recovery over the medium term (two to ten years). As described above, accumulated hydrocarbons on shorelines could impact marine fauna that utilize beaches such as shorebirds and turtles, dependent upon the timing of a spill. Beaches on the Ningaloo Coast, Barrow Island and Montebello Islands are important for green turtles, and to a lesser extent hawksbills turtles and flatback turtles, while Muiron Islands has a regionally important nesting site for loggerhead turtles. Impacts to turtles could occur from surface hydrocarbons if MDO accumulates on nesting beaches. However, there is very little potential for shoreline accumulation, with volumes ashore expected to be < 1 m^3. Entrained hydrocarbon could also contact sandy beaches at high tide. Such impacts would be most likely to nesting females as they move up and down beaches or to turtle hatchlings as they emerge from nests six to eight weeks following nesting. The quality of habitat available to the turtles will be reduced, with recovery over the medium term. *Protected areas* The MDO EMBA intersects several Marine Parks, AMPs, Commonwealth Heritage Areas and marine management areas. Combined, these areas support all the habitats and faunal groups described above. Impacts to the habitat/fauna receptors described above therefore have an impact on the values of these reserves which could have flow-on effects to tourism revenue of coastal communities that provide access to these marine reserves. *Socio-economic receptors* There is the potential for hydrocarbons to temporarily disrupt fishing activities if the surface or entrained hydrocarbon moves through fishing areas. However, the high rate of evaporation means that little MDO will become entrained and few aromatic hydrocarbons are predicted to become dissolved. It is possible that there could be accumulation of oil in fish tissues to the extent that could result in hydrocarbon tainting of fish flesh. Connell and Miller (1981) compiled a summary of studies listing the exposure value concentrations at which tainting occurred for hydrocarbons. The results contained in their review indicate that tainting of fish occurs when fish are exposed to ambient concentrations of 4 to 300 ppm (4,000 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 the volume of oil that could potentially be released, it is possible 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. This would most likely be the case for fisheries species that utilise shallow waters around the Lowendal, Barrow and Montebello Islands and could occur through direct impacts to fish or to fish habitats (e.g., seagrass, coral reef, mangrove habitats). Entrained and surface oil could impact pearl farming activities at the Montebello Islands. Given that pearl oysters are filter feeders, entrained oil droplets could create negative impacts through ingestion and accumulation of hydrocarbon compounds in oyster tissues or interference with respiratory structures. Such impacts could lead to sub-lethal (e.g., reduced oyster growth rates, reduced reproductive success) or at worst lethal impacts. Given that dissolved hydrocarbons could reach acutely toxic levels, mortality could occur. *Cultural Heritage and Features* Surface shoreline hydrocarbons accumulation predicted volumes ashore to be < 1 m3in the event of a significant spill, the EMBA may overlap cultural features in the marine environment. Potential impacts to cultural features from a hydrocarbon spill may include decline in traditional food sources and /or mortality of fauna with cultural significance. EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country.

Description	
A number of oil and gas operators operate within the EMBA with existing projects and infrastructure in place as well as continuing drilling and exploration programs. An unplanned hydrocarbon release has the potential to disrupt these activities, with associated economic impact, albeit on a temporary basis. Tourism could also be affected by a spill, either from reduced water quality/shoreline oiling preventing recreational activities or reducing aesthetic appeal or from impacts to habitats and marine fauna as described in **Table 7-18** and **Table 7-19.**	
Likelihood	B – Unlikely
A worst-case hydrocarbon release resulting from a vessel collision could result in major disruption and long-term effects on the receiving environment. Impacts could decrease local populations and result in loss of critical habitats; however, recovery would be expected within decades. With the proposed control measures in place to prevent releases, any decline in local populations or degradation of habitats is considered unlikely and therefore the activity will be conducted in a manner that is considered acceptable. The likelihood of a hydrocarbon release occurring due to a vessel collision/bunkering is limited given the set of mitigation and management controls in place. Subsequently the likelihood of a vessel collision releasing hydrocarbons to the environment resulting in a major consequence is assessed as Unlikely (b).	
Residual Risk	The residual risk associated with this hazard is **Low**

7.9.5 Demonstration of As Low As Reasonably Practicable

The use of vessels is integral to activity and therefore vessels and associated risks of unplanned hydrocarbon releases, cannot be completely eliminated.

Offshore refuelling is standard industry practice and oil pollution legislation (Protection of the Sea (Prevention of Pollution from Ships) Act 1983 and MARPOL Annex I) has been developed to safeguard against the risk of a hydrocarbon spill occurring during refuelling. Other hydrocarbon types such as HFO, IFO have specifically not been selected for this Activity (only MDO will be used in the operational area) to ensure potential environmental impacts are reduced to ALARP.

The combination of the standard prevention control measures (which reduce the likelihood of the event happening), and the spill response strategies (which may reduce the consequence) together reduce the overall hydrocarbon spill risk.

No additional controls have been identified and given the controls in place detailed above, the assessed residual risk for this impact is Low and cannot be reduced further. It is considered therefore that the impact of the activities conducted is reduced to ALARP.

In terms of spill response activities, Santos will implement oil spill response as specified within the OPEP. A detailed ALARP assessment on the adequacy of arrangements available to support spill response strategies and control measures is presented in the OPEP.

The North-west Marine Parks Network Management Plan states that 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 of the marine parks identified with the EMBA (Director of National Parks, 2018) without an authorisation issued by the Director, provided that the actions are taken in accordance with an EP that has been accepted by NOPSEMA, and the Director 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.

7.9.6 Demonstration of Acceptability

Table 7-29: Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – residual risk is ranked as Low
Is further information required in 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' Environmental Hazard Identification and Assessment Procedure, which considers principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – management consistent with OPGGS(E)R 2023 Regulations. Santos has considered the values and sensitivities of the receiving environment, including but not limited to: + conservation values of the identified protection priorities (**Section 7.5.5.4**) + relevant species recovery plans, conservation management plans and management actions, including but not limited to those listed in . The following material published in relation to threatened and migratory species within the EMBA identifies habitat degradation / modification, pollution or oil spills as a threat: + Approved Conservation Advice for Green Sawfish (Threatened Species Scientific Committee, 2008a) + Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015a) + Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities, 2013a) + Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (Department of the Environment, 2014) + Conservation Advice *Rhincodon typus* Whale Shark (Threatened Species Scientific Committee, 2015a) + Conservation Management Plan for the Blue Whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2015-2025 (Commonwealth of Australia, 2015b)

	+ Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the *Environment Protection and Biodiversity Act 1999* 2011-2021 (Department of Sustainability, Environment, Water, Population and Communities, 2012) + Conservation Advice for *Balaenoptera physalus* (fin whale) (Threatened Species Scientific Committee, 2015b) + Conservation Advice for *Balaenoptera borealis* (sei whale) (Threatened Species Scientific Committee, 2015c) + Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake) (Threatened Species Scientific Committee, 2010a) + Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake). (Threatened Species Scientific Committee, 2010b) + Recovery Plan for Marine Turtles in Australia 2017 – 2027 (Commonwealth of Australia, 2017) + Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2020b) + Wildlife Conservation Plan for Migratory Shorebirds (Commonwealth of Australia, 2015c) + National Recovery Plan for Albatrosses and Petrels (Commonwealth of Australia, 2022a) + Conservation Advice *Limosa lapponica menzbieri* Bar-tailed Godwit (Northern Siberian) (Threatened Species Scientific Committee, 2016e) + Conservation Advice *Numenius madagascariensis* Eastern Curlew (Threatened Species Scientific Committee, 2015g) + Conservation Advice *Calidris canutus* red knot (Threatened Species Scientific Committee, 2016c) + Approved Conservation Advice for *Rostratula australis* (Australian Painted Snipe) (Threatened Species Scientific Committee, 2013) + National Recovery Plan for the Australian Painted Snipe (*Rostratula australis*) (Commonwealth of Australia, 2022c) Management is also consistent with the zoning of the Australian marine parks, and their management plans in that risks have been reduced to ALARP, e.g., implementation of spill response activities will limit impacts, thereby conserving the marine park values

	which and other habitats critical to the diversity and value of the protected areas.
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environmental Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – no concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above

Given the control measures in place to prevent a vessel collision and refuelling incidents and the low frequency of significant volume MDO spills that occur in the industry, the likelihood of a loss of containment event during the activity is low. The risks from MDO spills are well understood and the activities will be managed in accordance with relevant legislation and standards. The control measures proposed are consistent with applicable actions described in the relevant recovery plans and approved conservation advice and no stakeholder concerns have been raised regarding this aspect.

With the implementation of industry standard and activity-specific control measures to reduce the chance of an MDO spill event (and minimise impacts), the residual risk is assessed to be Low and ALARP. Control measures will reduce the risk of impact from MDO spill to a level that is acceptable.

7.10 Minor Hydrocarbon Releases

7.10.1 Description of Event

Event	Causes for accident hydrocarbon releases (other than diesel release from a vessel collision or bunkering, and LOWC) include: + hydraulic fluids, lubricant oils and (stored) waste oils + ROV failure (including oil seal, hydraulic system hose and quick disconnect system failures) + loss of primary containment (drums, tanks, intermediate bulk containers [IBCs], etc) due to handling, storage and dropped objects (e.g., swinging load during lifting activities) + vessel or MODU pipework failure or rupture, hydraulic hose failure, inadequate bunding + lifting – dropped objects damaging diesel infrastructure (hoses, pipes, tanks, etc) + formation fluids from flaring drop out during well testing. The MODU/vessels main engines and equipment such as pumps, cranes, winches, power packs and generators require MDO for fuel and a variety of hydraulic fluids and lubricating oils for efficient operation and maintenance of moving parts. These products are present within the equipment and also held in storage containers and tanks on the MODU, ISV and support vessels. Small hydrocarbon leaks could occur from loss of primary containment due to handling, storage and dropped objects (during lifting activities). Volumes are likely to be small and limited to the volume of individual containers (e.g., IBC, 44-gallon drums) stored on the deck of vessels or the MODU. The credible spill for this scenario is considered to be the loss of an IBC (1 m^3) during transfer from a support vessel to the MODU or ISV. Equipment deployed overboard during drilling or installation activities (e.g., ROV operations) can result in unplanned discharges (of hydraulic fluids) directly to the marine environment due to equipment failure, equipment interactions with the vessel thrusters and/or accidental contact with subsea infrastructure. The largest credible hydrocarbon spill from ROV operations would be an accidental release of approximately 0.05 m^3 (50 L) of hydraulic fluid from the deployed ROV. Well testing is conducted to evaluate any hydrocarbon-bearing formations for possible flow characteristics and to clean the wellbore prior to production operations. Hydrocarbon flaring may be interrupted by pressure drops, incomplete combustion, or higher than anticipated drilling fluid content in the flaring system during well testing. As a result of flaring drop out, formation fluids may subsequently be discharged into the marine environment. Similarly, some flowback cushioning fluids may accidentally be released during well testing. Hydrocarbon spilt volumes due to drop out from flaring and well testing are difficult to estimate. Given the automatic and manual systems in place during flaring, the accidental release of hydrocarbon is expected to be low (less than 500 L). Base oil utilised during well testing is stored in pits on the MODU, in the event of structural failure during bunkering, there is the possibility of a release to the marine environment. Minor accidental loss of other hydrocarbon-based liquids (e.g., used lubricating oils, cooking oil, and hydraulic oil) to the marine environment could also occur via tank pipework failure or rupture, hydraulic hose failure, inadequate bunding and/or storage,

	insufficient fastening or inadequate handling which could result in impacts to water quality and hence sensitive environmental receptors.
Extent	The relative low volumes are expected to rapidly disperse into the marine environment. Below toxic/harmful threshold concentrations are expected to occur at short distances from the hydrocarbon release point. In the event of a worst-case spill, potential impacts beyond the operational area are not expected.
Duration	Potentially toxic/harmful threshold concentrations limited to a very short period immediately following release.

7.10.2 Nature and Scale of Environmental Impacts

Potential receptors: Physical environment (water and sediment quality, benthic habitats), threatened, migratory or local fauna (marine mammals, marine reptiles, sharks and rays, fish and birds), protected areas (Montebello AMP) and socio-economic receptors (commercial fishing).

Hydraulic fluids and lubricating fluids behave similarly to MDO when spilt in the marine environment (for information on MDO behaviour in the marine environment refer to **Section 7.5.3.2**). Hydraulic fluids are medium oils of light to moderate viscosity and have a relatively rapid spreading rate and, like 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 slightly slower.

7.10.2.1 Physical environment

Minor volumes of hydrocarbons released to the marine environment may lead to contamination of the water column in the vicinity of the MODU, ISV and support vessels. The potential impacts would most likely be highly localised and restricted to the immediate area surrounding the spill, with rapid dispersal to concentrations below impact thresholds likely to occur in the open ocean (**Section3.2.1**).

Due to the small volumes and expected rapid dispersal to concentrations below impact thresholds, impacts to water quality are not expected to cause flow-on effects to sediment quality or benthic habitats. There is no emergent or intertidal habitat that could be impacted by a surface spill and spilled hydrocarbons at minor volumes are unlikely to reach shorelines.

7.10.2.2 Threatened migratory or local fauna

The minor and short-term changes to water quality that may result are not predicted to impact on marine fauna (e.g., pelagic fish and sharks, marine mammals, marine reptiles and seabirds). As summarised in **Table 3-10**, the internesting BIAs for marine turtles, and BIAs for whales (migration and distribution) and whale shark (foraging) overlap the operational area, therefore these receptors may be present. A number of recovery plans and conservation advice for threatened and migratory species that may occur within the operational area (**Table 3-11**) identify marine pollution and deteriorating water quality (chemical discharge) as a threat to the species.

Small hydrocarbon spills are unlikely to have an ecological effect on threatened or migratory fauna, given the small volumes that could be released, and the open ocean environment. Physical coating of marine fauna or lethal/sub-lethal toxicity effects from any accidentally released hydrocarbons, is considered unlikely given the expected low concentrations and short exposure times.

7.10.2.3 Protected areas

Given the distance from the operational area to the nearest protected area (Montebello Marine Park, 32 km), no impacts to protected areas will credibly occur from a minor hydrocarbon release.

7.10.2.4 Socio-economic receptors

Given the localised and temporary impacts of an unplanned hazardous liquid spill, any impact to commercial fishing, tourism and recreation activities is considered unlikely.

7.10.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event include:

+ No loss of containment of hydrocarbon to the marine environment [H2-EPO-03].
+ No unplanned objects, emissions or discharges to sea or air [H2-EPO-04].
+ No injury or mortality to EPBC Act 1999 and WA *Biodiversity Conservation Act 2016* listed fauna during activities [H2-EPO-05].

The control measures considered for this event are shown in **Table 7-26**, and EPS and measurement criteria for the EPOs are described in **Table 8-2**.

Table 7-30: Control measures evaluation

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
Standard Control Measures				
H2-DC-CM-031 H2-IC-CM-025	Dropped object prevention procedures	Impacts to environment are reduced by preventing dropped objects and by retrieving dropped objects where possible. Minimises drop risk during MODU lifting operations. Ensures lifting equipment certified and inspected.	Personnel costs involved in implementing procedures and in incident reporting.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh costs.
H2-DC-CM-032 H2-IC-CM-026	Hazardous chemical management procedures	Reduces the risk of spills and leaks (discharges) to sea by controlling the storage, handling and clean-up.	Personnel cost associated with implementation of procedures and permanent or temporary storage areas.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh costs.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
H2-DC-CM-024 H2-IC-CM-020	Chemical selection procedure	Reduced toxicity to marine environment through ensuring only environmentally acceptable chemicals discharged to sea.	Potential additional cost and delays of chemical substitution.	**Adopted** – Benefits of ensuring procedures are followed outweighs costs.
H2-DC-CM-025 H2-IC-CM-021	General chemical management procedures	Potential impacts to the environment are reduced through following correct procedures for the safe handling and storage of chemicals.	Personnel costs associated with ensuring procedures are in place and implemented during inspections.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh the costs of personnel time.
H2-DC-CM-033 H2-IC-CM-027	Maritime Dangerous Goods Code	Dangerous goods managed in accordance with IMDG Code to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction.	Cost associated with implementation of code/procedure.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh costs.
H2-DC-CM-043 H2-IC-CM-034	ROV inspection and maintenance procedures	Maintenance and pre-deployment inspection on ROV completed as scheduled to reduce the risk of hydraulic fluid releases to the marine environment.	Additional personnel costs of ensuring procedures in place and followed.	**Adopted** – Benefits of ensuring procedures are followed outweigh costs.
H2-DC-CM-040 H2-IC-CM-032	Accepted OPEP	Implements response plan to deal with an unplanned hydrocarbon	Personnel and administrative costs associated with preparing documents,	**Adopted** – Regulatory requirement must be adopted.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		spills quickly and efficiently in order to reduce impacts to the marine environment.	ongoing management (spill response exercises) and implementation of OPEP.	
H2-DC-CM-037 H2-IC-CM-031	MODU and support vessel spill response plans including predrilling source control plan	Implements response plans 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 personal to confirm and check Shipboard Oil Pollution Emergency Plan (SOPEP)/ SMPEP in place.	Adopted – Benefits of considered to outweigh costs.
H2-DC-CM-039	Drilling and Completions Management Process	Well integrity control measures reduce the risk of unplanned discharges to the marine environment during well testing.	Cost associated with developing and implementing procedure	**Adopted** – Benefits of ensuring procedures are followed outweighs costs.
H2-DC-CM-007	Well test procedures	Includes control measures that reduce the risk of hydrocarbons from entering the marine environment.	Cost associated with implementing procedures.	**Adopted** – Benefits of ensuring procedures are followed outweighs costs.
H2-DC-CM-009 H2-IC-CM-008	Vessel PMS to maintain vessel DP, Engines and machinery	Reduces the potential for unplanned hydrocarbon releases from vessel equipment and machinery because	Costs are standard for routine PMS.	**Adopted** – Benefits in reducing atmospheric emissions impacts outweigh the minimal costs.

CM Reference	Control Measure	Environmental Benefit	Potential Cost / Issues	Evaluation
		equipment is operating within its parameters.		

7.10.4 Environmental Impact Assessment

Description	
Receptors	Physical environment (water and sediment quality, benthic habitats) Threatened, migratory or local fauna (marine mammals, marine reptiles, sharks, fish, rays and birds)
Consequence	I – Negligible
In the event of a minor hydrocarbon spill, the quantities would be limited to approximately 1 m^3 for the loss of the contents of an IBC, or 50 L for ROV hydraulic fluid. The small volumes, dilution and dispersion from natural weathering processes such as ocean currents are such that spills will be limited in area and duration. The number of receptors present at the activity location are expected to be limited to a small number of transient individuals. The susceptibility of marine fauna to hydrocarbons is dependent on hydrocarbon type and exposure duration; however, given that exposures would be limited in extent and duration, exposure to marine fauna from this hazard is considered to be low. The small volumes of worst-case discharges are such that, the impacts to receptors will decline rapidly with time and distance at the sea surface. Rapid dilution at depth would also result in the impacts to receptors declining rapidly with time and distance. Deteriorating water quality and marine pollution are identified as potential threats to a number of marine fauna species in relevant recovery plans and conservation advice () and to MNES (DoE, 2013). With control measures in place, the activity will be conducted in a manner that reduces potential impacts to ALARP and an acceptable level. Toxic impacts are not expected to the benthic community due to the water depths. Near the sea surface, fish are able to detect and avoid contact with surface slicks and as a result, fish mortalities rarely occur in open waters from surface spills (Kennish, 1997; Scholz et al., 1992). Pelagic fish species are therefore generally not highly susceptible to impacts from hydrocarbon spills. In offshore waters near to the release point, pelagic fish are at risk of exposure to the more toxic aromatic components of the hydrocarbons. Pelagic fish in offshore waters are highly mobile and comprise species such as tunas, sharks and mackerel. Due to their mobility, it is unlikely that pelagic fish would be exposed to toxic components for long periods in this spill scenario. The more toxic components would also rapidly evaporate and concentrations would significantly diminish with distance from the spill site, limiting the potential area of impact. The potential minor hydrocarbon releases are not expected to significantly impact the receiving environment with control measures proposed to prevent releases and therefore the activity will be conducted in a manner that is considered acceptable. Given that a minor hydrocarbon spill would not result in a decreased population size at a local or regional scale or long term reduction to water and sediment quality it is expected that a spill of this nature would result in a Negligible (I) consequence.	
Likelihood	B – Unlikely
A small hydrocarbon liquid release has reduced likelihood due to a number of controls being in place, Which include: + the control measures in place to prevent spills	

Description	
+ the procedures in place to clean up a spill. Consequently, the likelihood of releasing minor volumes of hydrocarbons to the environment, is considered Unlikely (B).	
Residual Risk	The residual risk associated with this hazard is **Very Low**

7.10.5 Demonstration of As Low As Reasonably Practicable

Storage and use of hydraulic and lubricating oils/fluids for equipment and machinery, including for ROV operations, are required to undertake the activity, so their removal from the activity is not viable. Well testing is also likely to be required during the activity to evaluate the formation and clean the wellbore prior to production operations. A thorough set of control measures have been proposed to ensure the risks of minor hydrocarbons spills and leaks occurring and subsequent impacts are minimised. The resulting impacts to marine fauna that could potentially result from a spill of this size would be negligible, with potential impacts restricted to a small number of individuals within a localised area. The assessed residual risk for this impact is low and cannot be reduced further without grossly disproportionate cost. Therefore, the risk is ALARP.

7.10.6 Demonstration of Acceptability

Is the consequence ranked as Very Low to Medium?	Yes – maximum minor hydrocarbon spill residual risk is ranked as Low.
Is further information required in 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' Environmental Hazard Identification and Assessment Procedure which considers principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – management consistent with SOLAS 1974 and *Navigation Act 2012*, Marine Order 91 (Marine pollution prevention – oil) and with relevant recovery plans and conservation advice for species that may occur in the operational area. The following material published in relation to threatened and migratory species within the EMBA identifies habitat degradation / modification, pollution or oil spills as a threat: + Approved Conservation Advice for Green Sawfish (Threatened Species Scientific Committee, 2008a) + Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015a) + Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of

	Sustainability, Environment, Water, Population and Communities, 2013a) + Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (Department of the Environment, 2014) + Conservation Advice *Rhincodon typus* Whale Shark (Threatened Species Scientific Committee, 2015a) + Conservation Management Plan for the Blue Whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2015-2025 (Commonwealth of Australia, 2015b) + Conservation Advice for *Balaenoptera physalus* (fin whale) (Threatened Species Scientific Committee, 2015b) + Conservation Advice for *Balaenoptera borealis* (sei whale) (Threatened Species Scientific Committee, 2015c) + Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake) (Threatened Species Scientific Committee, 2010a) + Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake). (Threatened Species Scientific Committee, 2010b) + Recovery Plan for Marine Turtles in Australia 2017 – 2027 (Commonwealth of Australia, 2017) + Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2020b) + Wildlife Conservation Plan for Migratory Shorebirds (Commonwealth of Australia, 2015c) + National Recovery Plan for Albatrosses and Petrels (Commonwealth of Australia, 2022a) + Conservation Advice *Numenius madagascariensis* Eastern Curlew (Threatened Species Scientific Committee, 2015g) + Conservation Advice *Calidris canutus* red knot (Threatened Species Scientific Committee, 2016c)
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.

Are risks and impacts consistent with stakeholder expectations?	Yes – no concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above.

With the control measures in place to prevent the accidental release of minor volumes of hydrocarbons, and potential social and environmental impacts and risk well understood and considered low, the environmental risk associated with a minor hydrocarbon release is considered acceptable.

8 Implementation Strategy

Regulations
Regulation 22(1) Implementation Strategy for the Environment Plan
The environment plan must contain an implementation strategy for the activity in accordance with this regulation.
Regulation 22(16) Implementation Strategy for the Environment Plan
The implementation strategy must comply with the Act, the regulations and any other environmental legislation applying to the activity.

The specific measures and arrangements that will be implemented in the event of an oil pollution emergency are detailed within the Varanus Island Hub Operations OPEP (EA-60-RI-00186.02).

Stakeholder engagement is assessed separately for the requirements of the activities. Ongoing stakeholder management strategies are discussed in **Section 4**.

8.1 Environmental Management System

OPGGS(E)R 2023 Requirements
Regulation 22(2) Implementation Strategy for the Environment Plan
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 standards set out in the environment plan are being met.

The Santos Health, Safety and Environmental Management System (HSEMS) exists to support its moral, professional and legal obligations to undertake work in a manner that does not cause harm to people or the environment. The HSEMS is a framework of policies, standards, processes, procedures, tools and control measures that, when used together by a properly resourced and competent organisation, ensure:

+ a common HSE approach is followed across the organisation
+ HSE is proactively managed and maintained
+ the mandatory requirements of HSE management are implemented and are auditable
+ HSE management performance is measured and corrective actions are taken
+ opportunities for improvement are recognised and implemented
+ workforce commitments are understood and demonstrated.

This implementation strategy is designed to meet the requirements of the EP which require that:

+ environmental impacts and risks continue to be identified for the duration of the activity and reduced to ALARP

+ control measures are effective in reducing environmental impacts and risks to ALARP and acceptable levels
+ environmental performance outcomes and standards set out in this EP are met
+ stakeholder consultation is maintained throughout the activity as appropriate.

8.2 Environmental Management Policy

Santos' Environment, Health and Safety Policy (**Appendix A**) clearly sets out Santos' strategic environmental objectives and the commitment of the management team to continuous environmental performance improvement. This EP has been prepared in accordance with the fundamentals of this policy. By accepting employment with Santos, each employee and contractor is made aware during the recruitment process that he or she is responsible for the application of this policy.

8.3 Hazard Identification, Risk and Impact Assessment and Controls

Hazards and associated environmental risks and impacts for the proposed activities have been systematically identified and assessed in this EP (refer to **Sections 6** and **7**). The control measures and EPS that will be implemented to manage the identified risks and impacts, and the environmental performance outcomes that will be achieved, are detailed below in **Table 8-1.**

To ensure that environmental risks and impacts remain acceptable and ALARP during the activity and for the duration of this EP, hazards will continue to be identified, assessed and controlled as described in **Section 8.11** and **Section 8.12**.

Any new, or proposed amendment to a control measure, EPS or EPO will be managed in accordance with the Environment Management of Change Procedure (EA-91-IQ-10001) (**Section 8.11.2**).

Oil spill response control measures and environmental performance standards and outcomes are listed in the Varanus Island Hub Operations OPEP (EA-60-RI-00186.02).

8.4 Environmental Performance Outcomes

To ensure environmental risks and impacts will be of an acceptable level, environmental performance outcomes for this EP have been defined and are listed in **Table 8-1** for planned activities and unplanned events, those relating to oil spill response are listed in the Varanus Island Hub Operations OPEP (EA-60-RI-00186.02). These outcomes will be achieved by implementing the identified control measures to the defined environmental performance standards.

Table 8-1: EPOs

Reference	EPO
H2-EPO-01	Reduce impacts on other marine users through the provision of information to relevant stakeholders such that they are able to plan for their activities and avoid unexpected interference.
H2-EPO-02	No introduction of marine pest species.
H2-EPO-03	No loss of containment of hydrocarbon to the marine environment.
H2-EPO-04	No unplanned objects, emissions or discharges to sea or air.
H2-EPO-05	No injury or mortality to EPBC Act 1999 and WA Biodiversity Conservation Act 2016 listed marine fauna during activities

Reference	EPO
H2-EPO-06	Reduce impacts to air and water quality from planned discharges and emissions from the activities.
H2-EPO-07	Seabed disturbance limited to planned activities and defined locations within the operational area.
H2-EPO-08	Reduce impacts to marine fauna from lighting on vessels and MODU through limiting lighting to that required by safety and navigational lighting requirements.
H2-EPO-09	Do not displace marine turtles from habitat critical to the survival of the species or disrupt biologically important behaviours from occurring within biologically important areas.

8.4.1 Control Measures and Performance Standards

The control measures that will be used to manage environmental impacts and risks and the associated statements of performance required of the control measure (i.e., EPS) are listed in **Table 8-2** and **Table 8-3**. The naming convention of the control measure reference number in the table is related to and identifies the activity that the control measure will be implemented for. Control measures to be implemented for drilling and completions have the format H2-DC-CM-XXX, while control measures to be implemented for the subsea installation and pre-commissioning have the format H2-IC-CM-XXX.

Measurement criteria outlining how compliance with the control measure and the expected environmental performance could be evidenced are also listed.

All control measures, EPS and associated measurement criteria relating to preparedness and response operations are contained within the Varanus Island Hub Operations OPEP (EA-60-RI-00186.02).

8.4.1.1 Drilling and Completion Activities

Table 8-2: Drilling and Completion Activities - Control measures, EPOs and measurement criteria activity

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
Halyard-2 Drilling & Completion					
Procedure for interacting with marine fauna	H2-DC-CM-001	Vessel(s) comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) 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.	H2-DC-CM-001-EPS-001	No report of marine fauna incidents from vessels. Completed vessel statement of conformance	H2-EPO-05 H2-EPO-09
		Any vessel strikes with cetaceans will be reported in the National Ship Strike Database	H2-DC-CM-001-EPS-002	Conformance checked on Santo's receipt of incident report.	
		Helicopter(s) contractor procedures comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA 91 11 00003) which ensures compliance with Part 8 of the *Environment Protection and Biodiversity Conservation Regulations 2000*, which includes controls for minimising interaction with marine fauna.	H2-DC-CM-001-EPS-003	Helicopter contractor procedures align with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003).	
Lighting will be used as required for safe work conditions and	H2-DC-CM-002	Vessel/MODU navigation lighting and equipment is compliant with COLREGS / Marine Orders 30: Prevention of Collisions,	H2-DC-CM-002-EPS-001	Vessel certification confirms compliance with applicable regulations	H2-EPO-01 H2-EPO-03 H2-EPO-08 H2-EPO-09

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
navigational purposes		and with Marine Orders 21: Safety of Navigation and Emergency Procedures.			
Waste incineration	H2-DC-CM-003	Waste incineration managed in accordance with MARPOL Annex VI, except incineration within the 500 m temporary safety exclusion zone shall not occur.	H2-DC-CM-003-EPS-001	Completed waste record book/ recording system or completed inspection checklist	H2-EPO-04 H2-EPO-06
Fuel oil quality	H2-DC-CM-004	MARPOL-compliant fuel oil will be used during the activity.	H2-DC-CM-004-EPS-001	Fuel bunkering records and/or relevant purchase records.	H2-EPO-03 H2-EPO-04 H2-EPO-06
Air pollution prevention certification	H2-DC-CM-005	Pursuant to MARPOL Annex VI, MODU and support vessel(s) will maintain a current International Air Pollution Prevention (IAPP) Certificate as relevant to vessel class which certifies that measures to prevent ozone-depleting substance (ODS) emissions, and reduce NO_x, SO_x and incineration emissions during the activity are in place.	H2-DC-CM-005-EPS-01	Current international air pollution prevention certificate.	H2-EPO-04 H2-EPO-06
Ozone-depleting substance handling procedures	H2-DC-CM-006	Ozone-depleting substances (ODS) managed in accordance with MARPOL Annex VI to reduce the risk of an accidental release of ODS to air.	H2-DC-CM-006-EPS-01	Completed ODS record book/ recording system or completed inspection checklist	H2-EPO-04 H2-EPO-06
Well test procedures	H2-DC-CM-007	Regulator accepted MODU Safety Case Revision for well testing includes control measures that reduce the risk of	H2-DC-CM-007-EPS-001	Regulator -accepted safety case revision for well testing	H2-EPO-03 H2-EPO-04

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		hydrocarbons from entering the marine environment (where applicable).			H2-EPO-05 H2-EPO-06
		Santos Well Test Program checklists completed to ensure safety and environmental control measures are implemented.	H2-DC-CM-007-EPS-002	Completed well test program checklist	
		Burner pilots to remain ignited during a well test to reduce the risk of hydrocarbons being released to sea and air.	H2-DC-CM-007-EPS-003	Incident report of flare drop-out	
		Burner monitored by a dedicated flare watcher during a well test to identity and communicate an unplanned flare drop-out.	H2-DC-CM-007-EPS-004	Incident report of flare drop-out	
		In the event of a flare drop-out or hydrocarbon being observed on the sea surface then liquid flaring, and if applicable the well test, shall cease and the event investigated and corrected before proceeding.	H2-DC-CM-007-EPS-005	Incident report of flare drop-out or unplanned hydrocarbon release	
		During a well test, formation water and completion fluids containing hydrocarbons must be: + flared with hydrocarbons, or + stored in tanks on-board and shipped ashore for disposal, or + treated through an oil-water filtration system to reduce the oil in water to	H2-DC-CM-007-EPS-006	Completed operational reports	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		<30ppm concentration before being disposed to sea or + Stored in tanks on-board and shipped ashore for disposal			
		Oil-water filtration equipment will be: + designed to reduce oil-in-water to less than 30 ppm + calibrated prior to use + Monitor for oil-in-water content to assess the performance of the filtration equipment.	H2-DC-CM-007-EPS-007	Completed operational reports and inspection checklists	
Marine Assurance Standard	H2-DC-CM-008	Vessels selected and on-boarded in accordance with the Offshore Marine Assurance Procedure (SO-91-ZH-10001) to ensure contracted vessels are operated, maintained and manned in accordance with industry standards (for example, Marine Orders) and regulatory requirements (this EP) and the relevant Santos procedures mentioned in this EP.	H2-DC-CM-008-EPS-001	Completed documentation demonstrates procedure requirements	H2-EPO-01 H2-EPO-03 H2-EPO-04 H2-EPO-05 H2-EPO-06
Vessel PMS to maintain vessel DP. Engines and machinery	H2-DC-CM-009	Documented maintenance program is in place for equipment on vessels that provides a status on the maintenance of equipment.	H2-DC-CM-009-EPS-001	Vessel daily/weekly records, IMCA Common Marine Inspection Document (CMID), vessel contractor written verification demonstrates	H2-EPO-03 H2-EPO-04 H2-EPO-05 H2-EPO-06

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
				compliance with PMS, and/or CMMS records.	
Well flowback procedure	H2-DC-CM-010	Regulator accepted MODU Safety Case Revision for well testing includes control measures that reduce the risk of hydrocarbons from entering the marine environment (where applicable).	H2-DC-CM-010-EPS-001	Regulator -accepted safety case revision for well flowback.	H2-EPO-04 H2-EPO-06
		Santos Well Flowback Program checklists completed to ensure safety and environmental control measures are implemented.	H2-DC-CM-010-EPS-002	Completed well flowback program checklist.	
		High efficiency burner heads and a specialist noise silenced flare will be utilised during well flowback to ensure effective flaring of hydrocarbons.	H2-DC-CM-010-EPS-003	Well test design report	
		Oil burner pilots to remain ignited during a well flowback to reduce the risk of hydrocarbons being released to sea and air.	H2-DC-CM-010-EPS-004	Incident report of flare drop-out.	
		Gas line pilots will be used and will remain ignited during a well flowback to reduce the risk of hydrocarbons being released to air	H2-DC-CM-010-EPS-005	Completed well flowback program checklist	
		Burner monitored by a dedicated flare watcher during a well flowback to identify and communicate an unplanned flare drop-out.	H2-DC-CM-010-EPS-006	Incident report of flare drop-out.	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		In the event of a flare drop-out or hydrocarbon being observed on the sea surface then liquid flaring, and if applicable the well flowback, shall cease and the event investigated and corrected before proceeding.	H2-DC-CM-010-EPS-007	Incident report of flare drop-out or unplanned hydrocarbon release.	
		Two burner booms provided on the MODU to allow for redundancy and operation in all weather conditions.	H2-DC-CM-010-EPS-008	Well test design report	
		During a well flowback, formation water and completion fluids containing hydrocarbons must be: + Flared with hydrocarbons, or + Treated through an oil-water filtration system before discharge to sea at an oil in water concentration of <30 ppm, or + Stored in tanks on-board and shipped ashore for disposal.	H2-DC-CM-010-EPS-009	Completed operational reports.	
		Oil-water filtration equipment will be: + Designed to reduce oil-in-water to <30 ppm + Calibrated prior to use; and + Monitored for oil-in-water content to assess the performance of the filtration equipment.	H2-DC-CM-010-EPS-010	Completed operational reports.	
		No extended production tests for assessing reservoir depletion, and maximum rate will	H2-DC-CM-010-EPS-011	Completed operational reports.	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		only be used to remove solids from the well.			
Anchoring and equipment deployment management	H2-DC-CM-011	No planned anchoring of the MODU within the operational area.	H2-DC-CM-011-EPS-001	MODU move report records no anchoring of the MODU within the operational area	H2-EPO-03 H2-EPO-07 H2-EPO-09
		No planned anchoring of the ISV or support vessel(s) within the operational area.	H2-DC-CM-011-EPS-002	Daily Vessel Reports	
		If anchoring or placement of equipment is required vessels will anchor or place equipment on seabed only at Santos pre-approved locations.	H2-DC-CM-011-EPS-003	Incident database records show no anchoring or placement of equipment occurred at non-approved locations	
		Support vessels anchoring near subsea infrastructure must keep an anchor watch and an hourly log of anchor wire lengths and tensions to ensure that the vessel does not drag an anchor, in accordance with the Mooring Operations Procedure (QE-91-IT-10001).	H2-DC-CM-011-EPS-004	Records of anchor watch	
		All anchor operations will be performed with the active fairlead away from infrastructure	H2-DC-CM-011-EPS-005	Completed operational reports or logs	
		Should pre-laying of anchors be selected the anchor pattern will also be pre-set to	H2-DC-CM-011-EPS-006	Completed Anchor Pattern report	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		minimise dropped object risk, with provision for additional anchors for cyclone preparedness to minimise risk of anchor drag.			
MODU station keeping system	H2-DC-CM-012	MODU station keeping system maintains the MODU at the desired location.	H2-DC-CM-012-EPS-001	No station keeping incidence recorded	H2-EPO-07 H2-EPO-09
		For an anchored MODU, anchors positioned and maintained at locations defined in the rig mooring analysis to reduce risks to seabed habitat and petroleum infrastructure.	H2-DC-CM-012-EPS-002	Completed mooring report	
		All parts of the (pre-laid) MODU mooring system deployed to sea are recovered within 3 months of MODU departure to mitigate consequences from objects remaining in the marine environment.	H2-DC-CM-012-EPS-003	Mooring recovery recorded in an operational report	
Recovery of all deployed equipment	H2-DC-CM-013	All equipment deployed during any activity will be recovered within three months of the end of the activity	H2-DC-CM-013-EPS-001	Operational records and survey record. GPS coordinates of any unretrieved equipment incidents (for compliance reporting)	H2-EPO-07 H2-EPO-09
Seafarer certification	H2-DC-CM-014	Vessel crew are trained and competent, in accordance with Flag State regulations, to navigate vessels.	H2-DC-CM-014-EPS-001	Training records.	H2-EPO-01 H2-EPO-03

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
Support vessel	H2-DC-CM-015	At least one support vessel is available at all times to monitor the MODU 500 m temporary safety exclusion zone to identify and communicate with any approaching third-party vessels.	H2-DC-CM-015-EPS-001	Daily Vessel Report and/or operations daily report	H2-EPO-01 H2-EPO-03
		Support vessel(s) will be equipped with an automatic identification system (AIS) and radar.	H2-DC-CM-015-EPS-002	Completed inspection report	
		Monitoring of surrounding marine environment is undertaken from vessel bridge.	H2-DC-CM-015-EPS-003	Bridge log or equivalent	
Santos stakeholder consultation strategy	H2-DC-CM-016	Santos will notify all relevant stakeholders listed, or as revised, in 4-X of relevant activity details prior to commencement, including activity timing, vessel movements, proposed cessation date and vessel details.	H2-DC-CM-016-EPS-001	Santos correspondence to relevant stakeholders	H2-EPO-01 H2-EPO-03
		If the MODU departs and returns from the operational area, relevant maritime notices will be updated.	H2-DC-CM-016-EPS-002	Records of correspondence to relevant stakeholders	
		All correspondence with external stakeholders is recorded.	H2-DC-CM-016-EPS-003	Saved consultation records	
		Santos' Consultation Coordinator is contactable before, during and after completion of the planned activity to ensure stakeholder feedback is evaluated	H2-DC-CM-016-EPS-004	Consultation Coordinator contact details provided to relevant persons in all correspondence	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		and considered during the operational activity phases.			
Maritime Notices	H2-DC-CM-017	Information provided to either the Australian Maritime Safety Authority (AMSA), Department of Defence (DoD) Australian Hydrographic Office (AHO) and/or nearest port authority on MODU arrival and departure so that the maritime industry is aware of activities.	H2-DC-CM-017-EPS-001	Transmittal records demonstrate notification of activity prior to the MODU arrival and departure.	H2-EPO-01 H2-EPO-03
MODU identification system	H2-DC-CM-018	MODU has an Automatic Identification System (AIS) to aid in its detection at sea.	H2-DC-CM-018-EPS-001	Completed inspection checklist or MODU specification documentation	H2-EPO-01
Exclusion zone established around the MODU	H2-DC-CM-019	A 500 m temporary exclusion zone is defined around the MODU during the activity.	H2-DC-CM-019-EPS-001	Notice to Mariners placed with AHO outlining the exclusion zone around the MODU.	H2-EPO-01
Pre-lay anchors are marked with surface buoys when MODU is not connected	H2-DC-CM-020	Pre-lay anchors marked with surface buoys when MODU is not moored	H2-DC-CM-020-EPS-001	Compliance documentation for MODU move procedure.	H2-EPO-01
Personnel are prohibited from recreational fishing activities on MODU, ISV or support vessels	H2-DC-CM-021	Personnel are prohibited from recreational fishing activities on vessels.	H2-DC-CM-021-EPS-001	Induction records confirm no fishing prohibition is communicated to all personnel	H2-EPO-01

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
Waste (Garbage) management procedure	H2-DC-CM-022	Waste management procedure implemented to reduce the risk of unplanned release of waste to sea. The procedure includes standards for: + bin types + lids and covers + waste segregation + bin storage.	H2-DC-CM-022-EPS-001	Completed inspection checklist	H2-EPO-04 H2-EPO-05 H2-EPO-06
		No waste (garbage) discharged to sea, unless the waste is food waste disposed in accordance with MARPOL Annex V.	H2-DC-CM-022-EPS-002	Completed garbage disposal record book or recording system and/or completed inspection checklists	
		Pursuant to MARPOL Annex V, placards displayed to notify personnel of waste disposal restrictions.	H2-DC-CM-022-EPS-003	Completed inspection checklist.	
Deck cleaning and product selection	H2-DC-CM-023	Deck cleaning products planned to be released to sea meet the criteria for not being harmful to the marine environment according to MARPOL Annex V.	H2-DC-CM-023-EPS-001	Safety data sheet (SDS) and product supplier supplementary data as required	H2-EPO-04 H2-EPO-06
				Completed inspection checklist	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
Chemical selection procedure	H2-DC-CM-024	Chemicals planned for discharge to sea from the MODU are risk assessed as per the Drilling Fluid and Chemical Selection in Drilling Activities Procedure (EA-91-II-00007). This includes chemicals used in potable water systems.	H2-DC-CM-024-EPS-001	Completed Santos risk assessment.	H2-EPO-03 H2-EPO-04 H2-EPO-05 H2-EPO 06
		Firefighting foam used on board the MODU, ISV and support vessels which may be discharged to sea during testing has been risk assessed as per Santos' Drilling Fluid and Chemical Selection in Drilling Activities Procedure (EA-91-II-00007), and deemed ALARP.	H2-DC-CM-024-EPS-002	Completed Santos risk assessment.	
		Drilling, completions and cement chemicals potentially discharged to sea are assessed in accordance with Santos' Offshore Division Drilling Chemical Selection and Approval Process (EA-91-II-00007) to be Gold/Silver/D or E rated through OCNS, PLONOR substances listed by OSPAR, or have a complete risk assessment prior to use.	H2-DC-CM-024-EPS-003	Completed Santos risk assessment.	
General chemical management procedures	H2-DC-CM-025	SDS available for all chemicals to aid in the process of hazard identification and chemical management	H2-DC-CM-025-EPS-001	Completed inspection checklist.	H2-EPO-03 H2-EPO-04 H2-EPO-05 H2-EPO 06
		Chemicals managed in accordance with SDS in relation to safe handling and	H2-DC-CM-025-EPS-002	Completed inspection checklist.	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		storage, spill response and emergency procedures, and disposal considerations			
Sewage treatment system	H2-DC-CM-026	Pursuant to MARPOL Annex VI, MODU and support vessel(s) have a current International Sewage Pollution Prevention Certificate which certifies that required measures to reduce impacts from sewage disposal are in place (as applicable to vessel class).	H2-DC-CM-026-EPS-001	Current International Sewage Pollution Prevention Certificate	H2-EPO-06
		Sewage discharged in accordance with MARPOL Annex IV.	H2-DC-CM-026-EPS-002	Completed inspection checklist.	
		Preventive maintenance on sewage treatment equipment is completed as scheduled.	H2-DC-CM-026-EPS-003	Maintenance records and/or completed inspection checklist.	
Oily water treatment system	H2-DC-CM-027	Oily mixtures (bilge water) only discharged to sea in accordance with MARPOL Annex I.	H2-DC-CM-027-EPS-001	Completed inspection checklist.	H2-EPO-06
				Oil record book or log.	
		Preventative maintenance on oil filtering equipment completed as scheduled.	H2-DC-CM-027-EPS-002	Maintenance records or evidence of maintenance in operational reports or completed inspection checklist.	
		Pursuant to MARPOL Annex I, a MODU and support vessel(s) will have an International Oil Pollution Prevention (IOPP) Certificate which certifies that required measures to	H2-DC-CM-027-EPS-003	Current IOPP	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		reduce impacts of planned oil discharges are in place (as applicable to vessel class).			
Cuttings management system	H2-DC-CM-028	All well returns to the MODU are diverted to shale shakers, except if drilling with seawater. The recovered drilling fluid is recycled to the mud pits and separated drilled cuttings/solids diverted overboard. If drilling with seawater, cuttings/solids returned to the MODU are diverted overboard.	H2-DC-CM-028-EPS-001	Daily Mud Report.	H2-EPO-06
		The shale shakers are fitted with screens that meet API standards for solids removal particle size cut points.	H2-DC-CM-028-EPS-002	Inspection records or operational reports	
		Centrifuges are used as required to remove additional finer drilled cuttings/solids that are too small for the shale shakers to remove.	H2-DC-CM-028-EPS-003	Daily Mud Report.	
		Shale shakers are inspected by a dedicated shale shaker hand while drilling to ensure: + shakers are running and screens vibrating + shaker screens are not damaged or blinding.	H2-DC-CM-028-EPS-004	Daily or weekly Mud Report.	
		If drilling with non-aqueous fluid (NAF), the average oil-on-cuttings discharged to sea shall not exceed 10% for a well	H2-DC-CM-028-EPS-005	Completed operational reports.	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		In the event that the average oil-on-cuttings of <10% for a well cannot be achieved, cuttings will be retained in enclosed containers and shipped ashore in accordance with jurisdictional requirements.	H2-DC-CM-028-EPS-006	Completed operational reports	
Inventory control procedure	H2-DC-CM-029	Only residual water-based fluid systems, brine, completion chemicals, cement and cement spacer within MODU mud pits and surface tanks that is no longer required will diverted overboard.	H2-DC-CM-029-EPS-001	End of Well Report	H2-EPO-06
		Non-aqueous fluid (NAF) and base oil operational readiness checklist completed prior to taking product onto the MODU, or prior to mixing or circulating if the product is already on the MODU. The following will be checked: + Systems of work + Equipment + Maintenance + Deck drainage + Spill containment + Valves and lines + hoses.	H2-DC-CM-029-EPS-002	Completed operational checklist	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		Non-aqueous fluid (NAF) within MODU mud pits that is no longer required will not be released to sea2F[4].	H2-DC-CM-029-EPS-003	Completed operational reports	
		+ If non-aqueous fluid (NAF) has been displaced out of the well bore, only interface fluids with residual oil content of <1% will be discharged overboard if no longer required.	H2-DC-CM-029-EPS-004	Completed operational reports	
		Unusable inventories of bulk cement, drilling fluid solid additives, brine and drill water on-board the MODU managed according to the decision list in **Table 6-22**. Includes disposal in the event of an emergency (e.g. cyclone).	H2-DC-CM-029-EPS-005	End of Well Report Completed decision log	
Quality control limits for Barite	H2-DC-CM-030	The contaminant limit concentrations in barite used for the drilling meets the below standard: + Mercury (Hg) – 1 mg/kg dry weight in stock barite + Cadmium (Cd) – 3 mg/kg dry weight in stock barite	H2-DC-CM-030-EPS-001	Records show barite used for the drilling meets the below standard: + Mercury (Hg) – 1 mg/kg dry weight in stock barite	H2-EPO-06

[4] Note that the product will be back loaded to a support vessel and/or left on the MODU for future use.

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
				+ Cadmium (Cd) – 3 mg/kg dry weight in stock barite	
		All barite is selected in accordance with API specifications which has limitations on all contaminant concentrations.	H2-DC-CM-030-EPS-002	Mud reports show all mud is API standard.	
Dropped object prevention procedure	H2-DC-CM-031	MODU Safety Case includes the following control measures for dropped objects that reduce the risk of objects entering the marine environment: + Lifting equipment certification and inspection + Lifting crew competencies + Heavy-lift procedures + Preventative maintenance on cranes.	H2-DC-CM-031-EPS-001	NOPSEMA-accepted Safety Case. Completed inspection checklist. Details contained in incident documents	H2-EPO-03 H2-EPO-04 H2-EPO-05
		Lifting operations managed in accordance with MODU, ISV and the support vessels work instructions or procedures.	H2-DC-CM-031-EPS-002	MODU work instructions or procedures.	
		MODU, ISV and the support vessels objects dropped overboard are recovered to mitigate the environmental consequences from objects remaining in the marine environment, unless the environmental consequences are negligible, or safety risks are disproportionate to the environmental consequences.	H2-DC-CM-031-EPS-003	Fate of dropped objects detailed in incident documents.	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		When it is necessary for the MODU mooring line to traverse over subsea infrastructure the anchor must be decked on the support vessel and double secured.	H2-DC-CM-031-EPS-004	Completed operational reports or logs	
		All lifts will be performed in safe deployment zones to minimise risks to subsea infrastructure	H2-DC-CM-031-EPS-005	Completed operational reports or logs	
		Defined a 'handling zone' to the North-North-West for deployment and handling of large infrastructure including XT and BOP	H2-DC-CM-031-EPS-006	Completed operational reports or logs	
		All critical lifts will also be subject to independent Validation and Verification.	H2-DC-CM-031-EPS-007	Completed operational reports or logs	
Hazardous chemical management procedures	H2-DC-CM-032	For hazardous chemicals including hydrocarbons, the following standards apply to reduce the risk of an accidental release to sea: + Storage containers closed when the product is not being used + Storage containers managed in a manner that provides for secondary containment in the event of a spill or leak + Storage containers labelled with the technical product name as per the safety data sheet (SDS)	H2-DC-CM-032-EPS-001	Completed inspection checklist.	H2-EPO-03 H2-EPO-04 H2-EPO-05

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		+ Spills and leaks to deck, excluding storage bunds and drip trays, immediately cleaned up + Storage bunds and drip trays do not contain free flowing volumes of liquid + Spill response equipment readily available.			
Maritime Dangerous Goods Code	H2-DC-CM-033	Dangerous goods managed in accordance with International Maritime Dangerous Goods Code (IMDG Code) to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction.	H2-DC-CM-033-EPS-01	Completed Multimodal Dangerous Goods Form for OSV transfers or Completed inspection checklist Completed inspection checklist.	H2-EPO-03 H2-EPO-04 H2-EPO-05
Bulk solid transfer procedure	H2-DC-CM-034	Bulk solids transferred in accordance with bulk transfer procedures to reduce the risk of an unintentional release to sea. The procedures include standards for: + Hose integrity: certified hoses will be used + Hose flotation: bulk hoses in the water fitted with flotation collars + Valve alignment: a MODU supervisor checks that all valves are lined up correctly	H2-DC-CM-034-EPS-001	Completed procedural documents, for example work permits, job safety analysis forms, checklists etc. Spill details contained in incident documentation	H2-EPO-04 H2-EPO-05

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		+ Communications: constant radio communications between MODU control room and vessel + Inventory control: MODU control room monitors tank fill levels or air vents watched to detect tank overfill + Emergency shutdown available and tested before each transfer operation.			
Compliance with the *Biosecurity Act 2015* and associated regulations	H2-DC-CM-035	Vessels are managed to low risk in accordance with the Santos IMSMP Invasive Marine Species Management Plan (EA-00-RI-10172) prior to movement or transit into or within the invasive marine species management zone, which requires: + assessment of applicable vessels using the IMSMP risk assessment + the management of immersible equipment to low risk.	H2-DC-CM-035-EPS-001	Completed risk assessment demonstrating MODU, equipment and vessels are 'low risk'.	H2-EPO-02
		Pursuant to the Biosecurity Act 2015 and Australian Ballast Water Management Requirements 2017, support vessels carrying ballast water and engaged in international voyages shall manage ballast water so that marine pest species are not introduced.	H2-DC-CM-035-EPS-002	Records show Ballast Water Management is implemented. Records show ballast water record book or log is maintained	H2-EPO-02
		Vessels receive entry clearance from DAWE (Seaports) as necessary (or as	H2-DC-CM-035-EPS-003	Records show a complete Questionnaire for	H2-EPO-02

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		applicable to their location and movements).		Biosecurity Exemptions for Biosecurity Control Determination issued to Seaports at least one month in advance where practicable	
Bulk liquid transfer procedure	H2-DC-CM-036	Bulk liquids transferred in accordance with bulk transfer procedures to reduce the risk of a release to sea. The procedures will require: + Hose integrity: certified hoses will be used + Hose flotation: bulk hoses in the water fitted with floatation collars + Hose connections: hoses used for hydrocarbons fitted with hammer union connections at the MODU’s manifold, self-sealing (dry-break) connections at the vessel end and self-sealing break-away connections when two or more hoses are joined together	H2-DC-CM-036-EPS-01	Completed procedural documents, for example work permits, job safety analysis forms, checklists, etc.	H2-EPO-04

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		+ Valve alignment: a MODU/ISV supervisor checks that all valves are lined up correctly + Tank venting: air vents for hydrocarbon storage tanks bunded if there is a risk of spill to deck + Supervision: dedicated hose watch person while pumping bulk product + Communications: constant radio communications between MODU control room and vessel + Inventory control: MODU control room monitors tank fill levels + Emergency shutdown available and tested before each transfer operation.		Spill details contained in incident documentation	
MODU and support vessel spill response plans including predrilling source control plan	H2-DC-CM-037	MODU, ISV and support vessel(s) have and implement a Shipboard Oil Pollution Emergency Plan (SOPEP), or Shipboard Marine Pollution Emergency Plan (SMPEP), pursuant to MARPOL Annex I.	H2-DC-CM-037-EPS-001	Approved SOPEP or SMPEP.	H2-EPO-03 H2-EPO-04 H2-EPO-05
		SOPEP or SMPEP spill response exercises conducted at least every three months to ensure personnel are prepared.	H2-DC-CM-037-EPS-002	Spill exercise records or evidence of a spill exercise in an operational report	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		Prior to the drilling there will be a source control plan in place.	H2-DC-CM-037-EPS-003	Source control plan	
MODU Planned Maintenance System (PMS).	H2-DC-CM-038	Documented maintenance program is in place for equipment on MODU that provides a status on the maintenance of equipment.	H2-DC-CM-038-EPS-01	MODU daily/weekly records and/or maintenance records	H2-EPO-03 H2-EPO-04 H2-EPO-05
Drilling and Completions Management Process	H2-DC-CM-039	Regulator accepted Well Operations Management Plan (WOMP) includes control measures for well integrity that reduce the risk of an unplanned release of hydrocarbons.	H2-DC-CM-039-EPS-01	Regulator-accepted WOMP.	H2-EPO-03 H2-EPO-04 H2-EPO-05
		Regulator accepted MODU Safety Case includes control measures for well control that reduce the risk of an unplanned release of hydrocarbons.	H2-DC-CM-039-EPS-02	Regulator-accepted Safety Case.	
		Santos Critical Acceptance Criteria for critical well operations and integrity aspects are achieved. Critical Acceptance Criteria will be selected based on the well objectives and Santos' Drilling and Completions Management Process technical standards, being: + location, rig moves and support + well control equipment	H2-DC-CM-039-EPS-03	Completed Critical Acceptance Criteria (CAC) in well program	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		+ well barriers + drilling and completions fluids + surveying and trajectory control + casing, liner and tubing + cement + wellhead and production trees + completion components.			
Accepted OPEP	H2-DC-CM-040	In the event of an oil spill to sea, the Santos OPEP requirements are implemented to mitigate environmental impacts.	H2-DC-CM-040-EPS-01	Completed incident documentation.	H2-EPO-03 H2-EPO-04 H2-EPO-05
Pre-campaign commencement assurance check	H2-DC-CM-041	Prior to each campaign commencement, an assurance check will be undertaken in accordance with Santos Environment Management of Change Procedure (EA-91-IQ-10001) (Noting that a pre-campaign check will not be required prior to the first campaign under this EP if it is commenced within 12 months of EP acceptance). This involves a documented review of the EP to ensure: + the activity details are current + changes in legislation are identified and considered in relation to the proposed drilling activity	H2-DC-CM-041-EPS-001	Completed Assurance Check form.	H2-EPO-03 H2-EPO-04 H2-EPO-05

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		+ stakeholder consultation has been completed and stakeholder concerns addressed + potential impacts and risks are still relevant + oil spill scenario is appropriate + EPOs and EPS are appropriate + activity is acceptable and ALARP in accordance with the EP.			
Refuelling and chemical transfer procedure	H2-DC-CM-042	All vessels that are involved in at sea bunkering or chemical transfer will have appropriate procedure in place to reduce risk of spill to sea which may include requirements, as appropriate for vessel size, such as: + hose integrity: certified hoses will be used + hose floatation: bulk hoses in the water fitted with floatation collars + hose connections: hoses used for hydrocarbons fitted with self-sealing + (dry-break) connections and self-sealing break-away connections when two or more hoses are joined together + valve alignment: a vessel supervisor checks that all valves are lined up correctly	H2-DC-CM-042-EPS-01	Audit Records. Inspection Records. Refuelling procedure.	H2-EPO-03

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		+ tank venting: air vents for hydrocarbon storage tanks bunded if there is a risk of spill to deck + supervision: dedicated hose watch person while pumping bulk fuel + communications: constant radio communications between two vessels + inventory control: a vessel supervisor monitors tank fill levels + emergency shutdown: vessel emergency pumping stop tested before each transfer operation bunkering drill requirements.			
ROV inspection and maintenance procedures	H2-DC-CM-043	Preventative maintenance on ROV completed as scheduled to reduce the risk of hydraulic fluid releases to sea.	H2-DC-CM-043-EPS-001	Maintenance records or evidence of maintenance in operational reports.	H2-EPO-03 H2-EPO-04 H2-EPO-05
		ROV pre-deployment inspection completed to reduce the risk of hydraulic fluid releases to sea.	H2-DC-CM-043-EPS-002	Completed pre-deployment inspection checklist.	
Decision list for managing bulk powders and brines remaining on the MODU at the end of the drilling campaign	H2-DC-CM-044	Decision criteria for remaining bulk products, in order of priority: - retain - sell - minimise - transfer to alternative MODU	H2-DC-CM-044-EPS-001	Decision record for management of residual bulk powders and brines.	H2-EPO-04 H2-EPO-05 H2-EPO-06

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
No disposal of bulk cement, barite and bentonite at the end of the drilling campaign	H2-DC-CM-045	Elimination of the disposal of bulk cement, barite and bentonite at the end of drilling campaign to the marine environment, means that potential impacts associated with the trace amounts of heavy metals of concern (cadmium and mercury) within stock material will not be discharged to the environment. This further eliminates the potential impacts on the benthic environment and water quality.	H2-DC-CM-045-EPS-001	Decision record for management of residual bulk barite.	H2-EPO-04 H2-EPO-05 H2-EPO-06
Testing and maintenance of emergency shutdown systems and shutdown/safety valves	H2-DC-CM-046	Emergency shutdown systems and shutdown/ safety valves are routinely tested and maintained to ensure integrity and function is maintained. Their testing criteria and test frequency are specified within: + PS-06 ESD and Blowdown: Emergency Shutdown Valves (ESDVs including HIPPS) (QE-00-RG-00218), which prevents the escalation of events by isolating the process plant and/or utility equipment; + PS-07 ESD and Blowdown: Reservoir Isolation (including Surface-controlled Subsurface Safety Valves and Christmas tree valves) (QE-00-RG-00219), which applies to surface-controlled subsurface safety valves, Christmas tree valves and wellhead	H2-DC-CM-046-EPS-001	CMMS records.	H2-EPO-03 H2-EPO-04

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		control panel to isolate the well inventories; + PS-08 ESD and Blowdown: Safety Instrumented Systems (QE-00-RG-00220), which applies to the logic solver modules holding the safety logic; and + PS-10 ESD and Blowdown: Pressure Safety Valves (QE-00-RG-00222), which applies to all pressure safety valves on pressure-containing equipment and pipework to prevent a loss of containment from equipment and piping by controlled disposal via the flare systems or an alternative safe location.			
Incident response plan detailing the requirements for preparedness and response to emergencies and crises to protect people and the environment.	H2-DC-CM-047	In the event that the integrity of a pipeline/valve is compromised or there is an unplanned hydrocarbon release from: + from a subsea pipeline; or + a subsea wellhead. the Varanus Island Incident Response Plan (QE-00-ZF-00044) is initiated to activate the Isolation of the flowline/ pipeline/ wells.	H2-DC-CM-047-EPS-001	Varanus Island Incident Response Plan (QE-00-ZF-00044) CMMS records.	H2-EPO-03 H2-EPO-04
	H2-DC-CM-048	Santos's Asset Integrity Management Program (QE-91-IP-00302) complied with, which includes the framework of policies,	H2-DC-CM-048-001	Certification and test records confirm compliance with project-	H2-EPO-03

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
Well services procedures and criteria		procedures, and performance standards for production operation assets.		specific procedures and Asset Integrity Management Programme (QE-91-IP-00302).	
		Well Acceptance Criteria for critical well operations and integrity aspects are achieved. Well Acceptance Criteria will be selected based on the well objectives and Santos's Offshore Drilling and Completions technical standards.	H2-DC-CM-048-002	Completed well acceptance criteria in well program. Incident records confirm no breach of containment.	
Interface Management Plan	HC-DM-CM-049	Interface Management Plan, detailing permitted activities to reduce the safety and environmental risks and impacts. Specifically: + Halyard-1 and Spar-2 will be shut-in at the XTs (During drilling activities); + The subsea production system (SPS) depressurised (prior to the MODU entering the field); + All XTs will be isolated (Halyard-1, Halyard-2 and Spar-2) during ISV well tie in works; and + Pressure in the entire GES subsea production system will be reduced to 13 bar to prevent flammable plume at sea level and minimise LOC risks during ISV well tie in works.	HC-DM-CM-049-001	Produced, approved and implemented Interface Management Plan	H2-EPO-03 H2-EPO-04

8.4.1.2 Subsea Installation and Pre-commissioning Activities

Table 8-3: Subsea Installation Activities - Control measures, EPOs and measurement criteria

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
Halyard-2 Installation and Pre-commissioning					
Procedure for interacting with marine fauna	H2-IC-CM-001	Vessel(s) comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) 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.	H2-IC-CM-001-EPS-001	No report of marine fauna incidents from vessels. Completed vessel statement of conformance	H2-EPO-05 H2-EPO-09
		Any vessel strikes with cetaceans will be reported in the National Ship Strike Database	H2-IC-CM-001-EPS-002	Conformance checked on Santo's receipt of incident report.	
		Helicopter(s) contractor procedures comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which ensures compliance with Part 8 of the *Environment Protection and Biodiversity Conservation Regulations 2000*, which includes controls for minimising interaction with marine fauna.	H2-IC-CM-001-EPS-003	Helicopter contractor procedures align with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003).	

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Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
Lighting will be used as required for safe work conditions and navigational purposes	H2-IC-CM-002	Vessel/MODU navigation lighting and equipment is compliant with COLREGS / Marine Orders 30: Prevention of Collisions, and with Marine Orders 21: Safety of Navigation and Emergency Procedures.	H2-IC-CM-002-EPS-001	Vessel certification confirms compliance with applicable regulations	H2-EPO-01 H2-EPO-03 H2-EPO-08 H2-EPO-09
Waste incineration	H2-IC-CM-003	Waste incineration managed in accordance with MARPOL Annex VI, except incineration within the 500 m temporary safety exclusion zone shall not occur.	H2-IC-CM-003-EPS-001	Completed waste record book/ recording system or completed inspection checklist	H2-EPO-04 H2-EPO-06
Fuel oil quality	H2-IC-CM-004	MARPOL-compliant fuel oil will be used during the activity.	H2-IC-CM-004-EPS-001	Fuel bunkering records and/or relevant purchase records.	H2-EPO-03 H2-EPO-04 H2-EPO-06
Air pollution prevention certification	H2-IC-CM-005	Pursuant to MARPOL Annex VI, MODU and support vessel(s) will maintain a current International Air Pollution Prevention (IAPP) Certificate as relevant to vessel class which certifies that measures to prevent ozone-depleting substance (ODS) emissions, and reduce NO_x, SO_x and incineration emissions during the activity are in place.	H2-IC-CM-005-EPS-01	Current international air pollution prevention certificate.	H2-EPO-04 H2-EPO-06
Ozone-depleting substance	H2-IC-CM-006	Ozone-depleting substances (ODS) managed in accordance with MARPOL	H2-IC-CM-006-EPS-01	Completed ODS record book/ recording system	H2-EPO-04 H2-EPO-06

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
handling procedures		Annex VI to reduce the risk of an accidental release of ODS to air.		or completed inspection checklist	
Marine Assurance Standard	H2-IC-CM-007	Vessels selected and on-boarded in accordance with the Offshore Marine Assurance Procedure (SO-91-ZH-10001) to ensure contracted vessels are operated, maintained and manned in accordance with industry standards (for example, Marine Orders) and regulatory requirements (this EP) and the relevant Santos procedures mentioned in this EP.	H2-IC-CM-007-EPS-001	Completed documentation demonstrates procedure requirements	H2-EPO-01 H2-EPO-03 H2-EPO-04 H2-EPO-05 H2-EPO-06
Vessel PMS to maintain vessel DP. Engines and machinery	H2-IC-CM-008	Documented maintenance program is in place for equipment on vessels that provides a status on the maintenance of equipment.	H2-IC-CM-008-EPS-001	Vessel daily/weekly records, IMCA Common Marine Inspection Document (CMID), vessel contractor written verification demonstrates compliance with PMS, and/or CMMS records.	H2-EPO-03 H2-EPO-04 H2-EPO-05 H2-EPO-06
Anchoring	H2-IC-CM-009	No planned anchoring of the MODU within the operational area.	H2-IC-CM-009-EPS-001	MODU move report records no anchoring of the MODU within the operational area	H2-EPO-03 H2-EPO-07 H2-EPO-09
		No planned anchoring of the ISV or support vessel(s) within the operational area.	H2-IC-CM-009-EPS-002	Daily Vessel Reports	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		If anchoring or placement of equipment is required vessels will anchor or place equipment on seabed only at Santos pre-approved locations.	H2-IC-CM-009-EPS-003	Incident database records show no anchoring or placement of equipment occurred at non-approved locations	
		Support vessels anchoring near subsea infrastructure must keep an anchor watch and an hourly log of anchor wire lengths and tensions to ensure that the vessel does not drag an anchor, in accordance with the Mooring Operations Procedure (QE-91-IT-10001).	H2-IC-CM-009-EPS-004	Records of anchor watch	
		All anchor operations will be performed with the active fairlead away from infrastructure	H2-IC-CM-009-EPS-005	Completed operational reports or logs	
		All anchor operations will be performed with the active fairlead away from infrastructure	H2-IC-CM-009-EPS-006	Completed operational reports or logs	
Recovery of all deployed equipment	H2-IC-CM-010	All equipment deployed during any activity will be recovered within three months of the end of the activity	H2-IC-CM-010-EPS-001	Operational records and survey record. GPS coordinates of any unretrieved equipment incidents (for compliance reporting)	H2-EPO-07 H2-EPO-09

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
All equipment installed on the seabed designed such that it can be fully removed.	H2-IC-CM-011	All equipment installed on the seabed designed such that it can be completely removed during decommissioning	H2-IC-CM-011-EPS-01	Design documentation to describe removal method for equipment installed on the seabed during this EP.	H2-EPO-07 H2-EPO-09
Seafarer certification	H2-IC-CM-012	Vessel crew are trained and competent, in accordance with Flag State regulations, to navigate vessels.	H2-IC-CM-012-EPS-001	Training records.	H2-EPO-01 H2-EPO-03
Support vessel	H2-IC-CM-013	At least one support vessel is available at all times to monitor the MODU 500 m temporary safety exclusion zone to identify and communicate with any approaching third-party vessels.	H2-IC-CM-013-EPS-001	Daily Vessel Report and/or operations daily report	H2-EPO-01 H2-EPO-03
		Support vessel(s) will be equipped with an automatic identification system (AIS) and radar.	H2-IC-CM-013-EPS-002	Completed inspection report	
		Monitoring of surrounding marine environment is undertaken from vessel bridge.	H2-IC-CM-013-EPS-003	Bridge log or equivalent	
Santos stakeholder consultation strategy	H2-IC-CM-014	Santos will notify all relevant stakeholders listed, or as revised, in 4-X of relevant activity details prior to commencement, including activity timing, vessel movements, proposed cessation date and vessel details.	H2-IC-CM-014-EPS-001	Santos correspondence to relevant stakeholders	H2-EPO-01 H2-EPO-03

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		If the MODU departs and returns from the operational area, relevant maritime notices will be updated.	H2-IC-CM-014-EPS-002	Records of correspondence to relevant stakeholders	
		All correspondence with external stakeholders is recorded.	H2-IC-CM-014-EPS-003	Saved consultation records	
		Santos' Consultation Coordinator is contactable before, during and after completion of the planned activity to ensure stakeholder feedback is evaluated and considered during the operational activity phases.	H2-IC-CM-014-EPS-004	Consultation Coordinator contact details provided to relevant persons in all correspondence	
Maritime Notices	H2-IC-CM-015	Information provided to either the Australian Maritime Safety Authority (AMSA), Department of Defence (DoD) Australian Hydrographic Office (AHO) and/or nearest port authority on MODU arrival and departure so that the maritime industry is aware of activities.	H2-IC-CM-015-EPS-001	Transmittal records demonstrate notification of activity prior to the MODU arrival and departure.	H2-EPO-01 H2-EPO-03
Navigational charting of infrastructure.	H2-IC-CM-016	AHO is notified of locations and descriptions of infrastructure remaining on title	H2-IC-CM-016-EPS-001	Records demonstrate that AHO has been notified of locations of final infrastructure remaining	H2-EPO-01
Personnel are prohibited from recreational	H2-IC-CM-017	Personnel are prohibited from recreational fishing activities on vessels.	H2-IC-CM-017-EPS-001	Induction records confirm no fishing prohibition is	H2-EPO-01

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
fishing activities on MODU, ISV or support vessels				communicated to all personnel	
Waste (Garbage) management procedure	H2-IC-CM-018	Waste management procedure implemented to reduce the risk of unplanned release of waste to sea. The procedure includes standards for: + bin types + lids and covers + waste segregation + bin storage.	H2-IC-CM-018-EPS-001	Completed inspection checklist	H2-EPO-04 H2-EPO-05 H2-EPO-06
		No waste (garbage) discharged to sea, unless the waste is food waste disposed in accordance with MARPOL Annex V.	H2-IC-CM-018-EPS-002	Completed garbage disposal record book or recording system and/or completed inspection checklists	
		Pursuant to MARPOL Annex V, placards displayed to notify personnel of waste disposal restrictions.	H2-IC-CM-018-EPS-003	Completed inspection checklist.	
Deck cleaning and product selection	H2-IC-CM-019	Deck cleaning products planned to be released to sea meet the criteria for not being harmful to the marine environment according to MARPOL Annex V.	H2-IC-CM-019-EPS-001	Safety data sheet (SDS) and product supplier supplementary data as required	H2-EPO-04 H2-EPO-06

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
				Completed inspection checklist	
Chemical selection procedure	H2-IC-CM-020	Chemicals planned for discharge to sea from the MODU are risk assessed as per the Drilling Fluid and Chemical Selection in Drilling Activities Procedure (EA-91-II-00007). This includes chemicals used in potable water systems.	H2-IC-CM-020-EPS-001	Completed Santos risk assessment.	H2-EPO-03 H2-EPO-04 H2-EPO-05 H2-EPO 06
		Firefighting foam used on board the MODU, ISV and support vessels which may be discharged to sea during testing has been risk assessed as per Santos' Drilling Fluid and Chemical Selection in Drilling Activities Procedure (EA-91-II-00007), and deemed ALARP.	H2-IC-CM-020-EPS-002	Completed Santos risk assessment.	
		Drilling, completions and cement chemicals potentially discharged to sea are assessed in accordance with Santos' Offshore Division Drilling Chemical Selection and Approval Process (EA-91-II-00007) to be Gold/Silver/D or E rated through OCNS, PLONOR substances listed by	H2-IC-CM-020-EPS-003	Completed Santos risk assessment.	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		OSPAR, or have a complete risk assessment prior to use.			
General chemical management procedures	H2-IC-CM-021	SDS available for all chemicals to aid in the process of hazard identification and chemical management	H2-IC-CM-021-EPS-001	Completed inspection checklist.	H2-EPO-03 H2-EPO-04 H2-EPO-05 H2-EPO 06
		Chemicals managed in accordance with SDS in relation to safe handling and storage, spill response and emergency procedures, and disposal considerations	H2-IC-CM-021-EPS-002	Completed inspection checklist.	
Sewage treatment system	H2-IC-CM-22	Pursuant to MARPOL Annex VI, MODU and support vessel(s) have a current International Sewage Pollution Prevention Certificate which certifies that required measures to reduce impacts from sewage disposal are in place (as applicable to vessel class).	H2-IC-CM-022-EPS-001	Current International Sewage Pollution Prevention Certificate	H2-EPO-06
		Sewage discharged in accordance with MARPOL Annex IV.	H2-IC-CM-022-EPS-002	Completed inspection checklist.	
		Preventive maintenance on sewage treatment equipment is completed as scheduled.	H2-IC-CM-022-EPS-003	Maintenance records and/or completed inspection checklist.	
Oily water treatment system	H2-IC-CM-023	Oily mixtures (bilge water) only discharged to sea in accordance with MARPOL Annex I.	H2-IC-CM-023-EPS-001	Completed inspection checklist. Oil record book or log.	H2-EPO-06

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		Preventative maintenance on oil filtering equipment completed as scheduled.	H2-IC-CM-023-EPS-002	Maintenance records or evidence of maintenance in operational reports or completed inspection checklist.	
		Pursuant to MARPOL Annex I, a MODU and support vessel(s) will have an International Oil Pollution Prevention (IOPP) Certificate which certifies that required measures to reduce impacts of planned oil discharges are in place (as applicable to vessel class).	H2-IC-CM-023-EPS-003	Current IOPP	
Spool flushed to displace residual hydrocarbons prior to breaking containment for removal	H2-IC-CM-024	Residual hydrocarbons are displaced prior to breaking containment.	H2-IC-CM-024-EPS-01	Records demonstrate hydrocarbons were flushed.	H2-EPO-06
Dropped object prevention procedures	H2-IC-CM-025	MODU Safety Case includes the following control measures for dropped objects that reduce the risk	H2-IC-CM-025-EPS-001	NOPSEMA-accepted Safety Case. Completed inspection checklist.	H2-EPO-03 H2-EPO-04 H2-EPO-05

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		of objects entering the marine environment: + Lifting equipment certification and inspection + Lifting crew competencies + Heavy-lift procedures + Preventative maintenance on cranes.		Details contained in incident documents	
		Lifting operations managed in accordance with MODU, ISV and the support vessels work instructions or procedures.	H2-IC-CM-025-EPS-002	MODU work instructions or procedures.	
		MODU, ISV and the support vessels objects dropped overboard are recovered to mitigate the environmental consequences from objects remaining in the marine environment, unless the environmental consequences are negligible, or safety risks are disproportionate to the environmental consequences.	H2-IC-CM-025-EPS-003	Fate of dropped objects detailed in incident documents.	
		When it is necessary for the MODU mooring line to traverse over subsea infrastructure the anchor must be decked on the support vessel and double secured.	H2-IC-CM-025-EPS-004	Completed operational reports or logs	

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		All lifts will be performed in safe deployment zones to minimise risks to subsea infrastructure	H2-IC-CM-025-EPS-005	Completed operational reports or logs	
		Defined a 'handling zone' to the North-North-West for deployment and handling of large infrastructure including XT and BOP	H2-IC-CM-025-EPS-006	Completed operational reports or logs	
		All critical lifts will also be subject to independent Validation and Verification.	H2-DC-CM-025-EPS-007	Completed operational reports or logs	
Hazardous chemical management procedures	H2-IC-CM-026	For hazardous chemicals including hydrocarbons, the following standards apply to reduce the risk of an accidental release to sea: + Storage containers closed when the product is not being used + Storage containers managed in a manner that provides for secondary containment in the event of a spill or leak + Storage containers labelled with the technical product name as per the safety data sheet (SDS) + Spills and leaks to deck, excluding storage bunds and drip trays, immediately cleaned up	H2-IC-CM-026-EPS-001	Completed inspection checklist.	H2-EPO-03 H2-EPO-04 H2-EPO-05

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		+ Storage bunds and drip trays do not contain free flowing volumes of liquid + Spill response equipment readily available.			
Maritime Dangerous Goods Code	H2-IC-CM-027	Dangerous goods managed in accordance with International Maritime Dangerous Goods Code (IMDG Code) to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction.	H2-IC-CM-027-EPS-01	Completed Multimodal Dangerous Goods Form for OSV transfers or Completed inspection checklist Completed inspection checklist.	H2-EPO-03 H2-EPO-04 H2-EPO-05
Bulk solid transfer procedure	H2-IC-CM-028	Bulk solids transferred in accordance with bulk transfer procedures to reduce the risk of an unintentional release to sea. The procedures include standards for: + Hose integrity: certified hoses will be used + Hose flotation: bulk hoses in the water fitted with flotation collars + Valve alignment: a MODU supervisor checks that all valves are lined up correctly + Communications: constant radio communications between MODU control room and vessel	H2-IC-CM-028-EPS-001	Completed procedural documents, for example work permits, job safety analysis forms, checklists etc. Spill details contained in incident documentation	H2-EPO-04 H2-EPO-05

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		+ Inventory control: MODU control room monitors tank fill levels or air vents watched to detect tank overfill + Emergency shutdown available and tested before each transfer operation.			
Compliance with the *Biosecurity Act 2015* and associated regulations	H2-IC-CM-029	Vessels are managed to low risk in accordance with the Santos IMSMP Invasive Marine Species Management Plan (EA-00-RI-10172) prior to movement or transit into or within the invasive marine species management zone, which requires: + assessment of applicable vessels using the IMSMP risk assessment + the management of immersible equipment to low risk.	H2-IC-CM-029-EPS-001	Completed risk assessment demonstrating MODU, equipment and vessels are 'low risk'.	H2-EPO-02
		Pursuant to the Biosecurity Act 2015 and Australian Ballast Water Management Requirements 2017, support vessels carrying ballast water and engaged in international voyages shall manage ballast water so that marine pest species are not introduced.	H2-IC-CM-029-EPS-002	Records show Ballast Water Management is implemented. Records show ballast water record book or log is maintained	H2-EPO-02
		Vessels receive entry clearance from DAWE (Seaports) as necessary (or as	H2-IC-CM-029-EPS-003	Records show a complete Questionnaire	H2-EPO-02

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		applicable to their location and movements).		for Biosecurity Exemptions for Biosecurity Control Determination issued to Seaports at least one month in advance where practicable	
Bulk liquid transfer procedure	H2-IC-CM-030	Bulk liquids transferred in accordance with bulk transfer procedures to reduce the risk of a release to sea. The procedures will require: + Hose integrity: certified hoses will be used + Hose flotation: bulk hoses in the water fitted with floatation collars + Hose connections: hoses used for hydrocarbons fitted with hammer union connections at the MODU's manifold, self-sealing (dry-break) connections at the vessel end and self-sealing break-away connections when two or more hoses are joined together + Valve alignment: a MODU/ISV supervisor checks that all valves are lined up correctly + Tank venting: air vents for hydrocarbon storage tanks	H2-IC-CM-030-EPS-01	Completed procedural documents, for example work permits, job safety analysis forms, checklists, etc. Spill details contained in incident documentation	H2-EPO-04

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		bunded if there is a risk of spill to deck + Supervision: dedicated hose watch person while pumping bulk product + Communications: constant radio communications between MODU control room and vessel + Inventory control: MODU control room monitors tank fill levels + Emergency shutdown available and tested before each transfer operation.			
MODU and support vessel spill response plans including predrilling source control plan	H2-IC-CM-031	MODU, ISV and support vessel(s) have and implement a Shipboard Oil Pollution Emergency Plan (SOPEP), or Shipboard Marine Pollution Emergency Plan (SMPEP), pursuant to MARPOL Annex I.	H2-IC-CM-031-EPS-001	Approved SOPEP or SMPEP.	H2-EPO-03 H2-EPO-04 H2-EPO-05
		SOPEP or SMPEP spill response exercises conducted at least every three months to ensure personnel are prepared.	H2-IC-CM-031-EPS-002	Spill exercise records or evidence of a spill exercise in an operational report	
		Prior to the drilling there will be a source control plan in place.	H2-IC-CM-031-EPS-003	Source control plan	
Accepted OPEP	H2-IC-CM-032	In the event of an oil spill to sea, the Santos OPEP requirements are	H2-IC-CM-032-EPS-01	Completed incident documentation.	H2-EPO-03 H2-EPO-04

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		implemented to mitigate environmental impacts.			H2-EPO-05
Refuelling and chemical transfer procedure	H2-IC-CM-033	All vessels that are involved in at sea bunkering or chemical transfer will have appropriate procedure in place to reduce risk of spill to sea which may include requirements, as appropriate for vessel size, such as: + hose integrity: certified hoses will be used + hose floatation: bulk hoses in the water fitted with floatation collars + hose connections: hoses used for hydrocarbons fitted with self-sealing + (dry-break) connections and self-sealing break-away connections when two or more hoses are joined together + valve alignment: a vessel supervisor checks that all valves are lined up correctly + tank venting: air vents for hydrocarbon storage tanks bunded if there is a risk of spill to deck	H2-IC-CM-033-EPS-01	Audit Records. Inspection Records. Refuelling procedure.	H2-EPO-03

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		+ supervision: dedicated hose watch person while pumping bulk fuel + communications: constant radio communications between two vessels + inventory control: a vessel supervisor monitors tank fill levels + emergency shutdown: vessel emergency pumping stop tested before each transfer operation bunkering drill requirements.			
ROV inspection and maintenance procedures	H2-IC-CM-034	Preventative maintenance on ROV completed as scheduled to reduce the risk of hydraulic fluid releases to sea.	H2-IC-CM-034-EPS-001	Maintenance records or evidence of maintenance in operational reports.	H2-EPO-03 H2-EPO-04 H2-EPO-05
		ROV pre-deployment inspection completed to reduce the risk of hydraulic fluid releases to sea.	H2-IC-CM-034-EPS-002	Completed pre-deployment inspection checklist.	
Incident response plan detailing the requirements for preparedness and response to emergencies and crises to protect people and the environment.	H2-IC-CM-035	In the event that the integrity of a pipeline/valve is compromised or there is an unplanned hydrocarbon release from: • from a subsea pipeline; or • a subsea wellhead. the Varanus Island Incident Response Plan (QE-00-ZF-00044) is initiated to	H2-IC-CM-035-EPS-001	Varanus Island Incident Response Plan (QE-00-ZF-00044) CMMS records.	H2-EPO-03 H2-EPO-04

Control Measure	Control Measure Reference	Environmental Performance Standards	EPS Reference	Measurement Criteria	EPO Reference (Table 8-1)
		activate the Isolation of the flowline/ pipeline/ wells.			

8.5 Leadership, Accountability and Responsibility

OPGGS(E)R 2023 Requirements
Regulation 22(3) Implementation Strategy for the Environment Plan
The implementation strategy must establish a clear chain of command, setting out the roles and responsibilities of personnel in relation to the implementation, management and review of the environment plan, including during emergencies or potential emergencies.

Santos' Chief Executive Officer has the overall accountability for the implementation of the Santos HSEMS and Environment, Health and Safety Policy. Santos' Manager – Offshore Drilling and Completions is accountable for ensuring implementation, management and review of this EP.

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 the implementation, management and review of the EP is outlined in **Table 8-4**. It is also outlined in the Varanus Island Hub Operations OPEP (EA-60-RI-00186.02) for oil spill response.

Table 8-4: Chain of comment, key leadership roles and responsibilities

Role	Responsibilities
Drilling and Completions	
Manager – Offshore Drilling & Completions	+ ensures Santos' policies and standards are adhered to and communicated to all employees and contractors + promotes HSE as a core value integral with how Santos does its business + empowers personnel to 'stop-the-job' due to HSE concerns + provides resources for HSE management + ensures a high level of HSE performance and drives improvement opportunities + ensures emergency response plans are in place + maintains communication with company personnel, government agencies and the media + approves MoC documents, if acceptable and ALARP + ensures the annual HSE improvement plan is completed
Santos Drilling Superintendent	+ ensures conformance with environmental performance outcomes and standards in the EP + delegates HSE responsibility and informs these personnel of their responsibilities under the EP + empowers personnel to `stop-the-job' due to HSE concerns + ensures HSE incidents are reported, investigated, corrected and communicated + ensures MODU meets quarantine requirements to operate in Australian waters + ensures HSE inspections and audits are completed and corrective actions implemented + reviews MoC documents

Role	Responsibilities
	+ ensures personnel on the MODU have the necessary qualifications, training and/or supervision.
Santos Supervisors/ MODU Offshore Installation Manager/Vessel Masters	Has overall responsibility for: + implementation and compliance with relevant environmental legislative requirements, EP commitments and operational procedures on the vessel + maintaining clear communication with personnel on board + communicating hazards and risks to the workforce + monitoring daily activities on the vessel/MODU to ensure that the relevant environmental legislative requirements, EP commitments and operational procedures are being followed + maintaining vessels/MODU to all regulatory and class requirements + maintaining their vessel/MODU in a state of preparedness for emergency response + reporting environmental incidents to PIC and ensuring follow-up actions are performed.
Drilling Company Site Representative	Has responsibility for: + implementing EP commitments + ensuring personnel competency + ensuring compliance with procedures and work instructions + being site focal point for onshore/offshore communications + reporting all incidents and potential hazards + leading site-based incident response + implementing corrective actions from environmental incidents and audits.
Santos HSE Team Leader, Drilling and Completions	Has overall responsibility for: + provide advice to ensure compliance with the Santos Environment Health and Safety Policy and this EP + providing operational HSE oversight and advice + facilitating the development and implementation of environmental management of change documents + ensuring EP-required reporting is accurate and timely + ensuring environmental incidents are appropriately investigated + ensuring that appropriate enforcement mechanisms to prevent breaches of this EP are implemented + providing advice to ensure environmental incident reporting meets regulatory requirements (as outlined in the EP) and the Santos internal incident reporting and investigation procedure.
Installation and Pre-commissioning	
Manager Integrated Projects	+ ensures Santos’ policies and standards are adhered to and communicated to all employees and contractors + promotes HSE as a core value integral with how Santos does its business + empowers personnel to ‘stop-the-job’ due to HSE concerns

Role	Responsibilities
	+ provides resources for HSE management + ensures a high level of HSE performance and drives improvement opportunities + ensures emergency response plans are in place + maintains communication with company personnel, government agencies and the media + approves MoC documents, if acceptable and ALARP.
Vessel Master	Has overall responsibility for: + implementation and compliance with relevant environmental legislative requirements, EP commitments and operational procedures on the vessel + maintaining clear communication with personnel on board + communicating hazards and risks to the workforce + monitoring daily activities on the vessel to ensure that the relevant environmental legislative requirements, EP commitments and operational procedures are being followed + maintaining vessels to all regulatory and class requirements + maintaining their vessel in a state of preparedness for emergency response + reporting environmental incidents to Santos and ensuring follow-up actions are carried out.
ISV Company Site Representative	Has responsibility for: + implementing EP commitments + ensuring personnel competency + ensuring compliance with procedures and work instructions + ensures conformance with environmental performance outcomes and standards in the EP + ensures Vessel crew comply with environmental performance standards in the EP. + maintains records of compliance with this EP, i.e. measurement criteria for the control measures and environmental performance standards listed in **Drilling** and Completion Activities + Table 8-2. + ensures compliance with MoC documents. + being site focal point for onshore/offshore communications + reporting all incidents and potential hazards + leading site-based incident response + implementing corrective actions from environmental incidents and audits.
Integrated Project HSE Lead	Has overall responsibility for: + ensuring incident preparedness and response arrangements meet Santos and regulatory requirements + approving the OPEP

Role	Responsibilities
	+ providing ongoing resources to maintain compliance with the OPEP and other Santos incident response requirements.
Support Personnel	
Santos Marine Superintendent	+ ensures conformance with environmental performance outcomes and standards in the EP + delegates HSE responsibility and informs these personnel of their responsibilities under the EP + empowers personnel to `stop-the-job' due to HSE concerns + ensures HSE incidents are reported, investigated, corrected and communicated + ensure vessels meet quarantine requirements to operate in Australian waters + ensures HSE inspections and audits are completed and corrective actions implemented + ensures personnel on the vessels have the necessary qualifications, training and/or supervision.
Santos HSE Manager	Has overall responsibility for: + ensuring incident preparedness and response arrangements meet Santos and regulatory requirements + approving the OPEP + providing ongoing resources to maintain compliance with the OPEP and other Santos incident response requirements.
Consultation Coordinator	+ ensures relevant stakeholders are identified throughout the life of the EP + maintains a stakeholder contact and information database + maintains a Stakeholder Notification Log specific to the EP + maintains records of all stakeholder correspondence specific to the EP + prior to commencement of the activity and on advice of HSE Team Lead, provides a notification to all relevant stakeholders listed, or as revised, in **Table 8-4.** The notification will include information on activity timing, vessel movements and vessel details + on advice of HSE Team Lead, provide cessation notifications to relevant stakeholders identified in **Table 8-4**. + is available before, during and after the activity to ensure opportunities for stakeholders to provide feedback are available + prepares and distributes quarterly consultation updates to relevant stakeholders.
Santos HSE Coordinator(s)	+ ensures the EP is managed and reviewed: monitors conformance with EPOs and EPS, and the implementation strategy in the EP + prepares, maintains and distributes the environmental compliance register + completes regular HSE reports, inspections and audits + completes HSE inductions and promotes general awareness + collates HSE data and records + contributes to HSE incident management and investigations

Role	Responsibilities
	+ provides operational HSE oversight and advice + facilitates the development and implementation of MoC documents + provides incident reports, compliance reports and notifications to NOPSEMA + ensures stakeholder consultation and communication requirements have been fulfilled + ensures subcontractors are communicated the EP requirements.
HSE Team Lead – Security and Emergency Response	Has overall responsibility for: + overarching incident and crisis management responsibility + managing the Crisis Management Team and IMT personnel training program + reviewing and assessing competencies for Crisis Management Team, IMT, and field-based Incident Response Team members + managing the Duty roster system for Crisis Management Team and IMT personnel + managing the maintenance and readiness of incident response resources and equipment. + reviews MoC documents
Senior Oil Spill Response Advisor	Has overall responsibility for: + providing upfront and ongoing guidance, framework, and direction on preparation of this OPEP + developing and maintaining arrangements and contracts for incident response support from third-parties + developing and defining objectives, strategies and tactical plans for response preparedness defined in this OPEP and IRP + undertaking assurance activities on arrangements outlined within the OPEP.

8.6 Workforce Training and Competency

OPGGS(E)R 2023 Requirements
Regulations 22(4) Implementation Strategy for the Environment Plan
The implementation strategy must include measures to ensure that each employee or contractor working on, or in connection with, the activity is aware of his or her 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 that each employee and contractor is aware of his or her responsibilities in relation to the EP and has appropriate training and competencies.

8.6.1 Activity Inductions

All personnel on the MODU, ISV and support vessels will complete an induction that will include a component addressing their EP responsibilities. Induction attendance records for all personnel will be maintained. Inductions will include information on:

+ Santos’ Environment, Health and Safety Policy (**Appendix A**)

- regulatory regime (NOPSEMA regulations)
- operating environment (e.g., nearby protected marine areas, sensitive environmental periods)
- interaction with other marine users (i.e., topic to reinforce the importance of marine communications regarding any potential interactions with active commercial fishing)
- activities with highest risk (e.g., invasive marine species and hydrocarbon releases)
- EPOs and environmental management measures (e.g., **Table 8-1** and **Table 8-2**)
- incident reporting and notifications
- regulatory compliance reporting
- management of change process for changes to EP activities
- oil pollution emergency response (e.g., OPEP requirements).

8.6.2 Training and Competency

All members of the workforce on the MODU, ISV and vessels will complete relevant training and hold qualifications and certificates for their role. Santos and its contractors are individually responsible for ensuring that 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 on boarding process and training departments, etc.

Personnel qualification and training records will be sampled before and/or during an activity. Such checks will be performed during the procurement process, facility acceptance testing, inductions, crew change, and operational inspections and audits.

8.6.3 Workforce Involvement and Communication

Daily operational meetings will be held at which HSE will be a standing agenda item. It is a requirement that supervisors attend daily operational meetings and that 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 HSE risks and their controls.

HSE performance will be monitored and reported during the activity, and performance metrics (such as the number of environmental incidents) will be regularly communicated to the workforce. Workforce involvement and environmental awareness will also be promoted by encouraging offshore personnel to report marine fauna sightings and marine pollution (for example, oil on water, dropped objects).

8.7 Asset Management and Maintenance

Ongoing operations and maintenance of infrastructure installed as part of the Halyard-2 Drilling & Completions will be performed consistent with the existing operational and maintenance processes and procedures (refer to **Sections 2.6** and **2.7** of the VI Hub Ops Cth EP (EA-60-RI-10003)).

8.8 Emergency Preparedness and Response

OPGGS(E)R 2023 Requirements
Regulations 22(8) Implementation Strategy for the Environment Plan
The implementation strategy must contain an oil pollution emergency plan and provide for the updating of the plan

The MODU, ISV and support 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 Varanus Island Hub Operations OPEP (EA-60-RI-00186.02) in the event of a hydrocarbon spill. The OPEP details how Santos will prepare and respond to a spill event and meets the requirement of the Regulations.

8.9 Incident Reporting, Investigation and Follow-up

OPGGS(E)R 2023 Requirements
Regulation 22(7) Implementation Strategy for the Environment Plan
The implementation strategy must state when the titleholder will report to the Regulator in relation to the titleholder’s environmental performance for the activity. The interval between reports will not be more than 12 months.
Regulation 22(6) Implementation Strategy for the Environment Plan
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 standards in the environment plan are being met.

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 the incident management systems as appropriate. HSE incidents are investigated and reported in accordance with the Santos Incident Reporting, Investigation and Learning Procedure SMS-HSS-OS07-PD01 which uses root cause analysis.

Environmental recordable and reportable incidents will be reported to NOPSEMA as required, in accordance with **Table 8-4**. The incident reporting requirements will be provided to all crew on board the facilities and support vessels with special attention to the reporting time frames to provide for accurate and timely reporting.

For the purposes of this activity, in accordance with OPGGS(E) Regulations:

+ 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; and
+ 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 an incident 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 following were identified to have a potential consequence level of Moderate or higher if the event were to occur and would therefore be a reportable incident:

+ introduction of invasive marine species (Moderate);
+ marine fauna interaction (Moderate);
+ hydrocarbon release (surface and subsurface) from LOWC (Major); and
+ hydrocarbon release (MDO) (Moderate).

8.10 Reporting and Notifications

OPGGS(E)R 2023 Requirements
Regulation 22(7) Implementation Strategy for the Environment Plan
The implementation strategy must state when the titleholder will report to the Regulator in relation to the titleholder’s environmental performance for the activity and provide that the interval between reports will not be more than 12 months.
Regulation 22(6) Implementation Strategy for the Environment Plan
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 standards in the environment plan are being met.

8.10.1 Notifications and Compliance Reporting

Regulatory, other notification and compliance reporting requirements are summarised in **Table 8-4**.

Table 8-5: Activity notification and reporting requirements

Requirement	Required information	Timing	Type	Recipient
Before the Activity				
Department of Defence Standing arrangement with DoD.	Activity timing, location, description and vessel contact details. Confirm restricted air space status.	At least five weeks before the activity commences where practicable.	Written	DoD: offshore.petroleum@defence.gov.au
AFMA As requested during additional consultation.	Activity timing, location, description and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	AFMA: petroleum@afma.gov.au
AHO Notification Standing arrangement with AHO.	Activity timing, location, description and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	AHO: datacentre@hydro.gov.au
Care for Hedland As requested during additional consultation.	Activity timing, location, description and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	Care for Hedland: coordinator@careforhedland.org.au
DAFF As requested during additional consultation.	Activity timing, location, description and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	DAFF: Petroleum&Fisheries@agriculture.gov.au
DPIRD As requested during additional consultation.	Activity timing, location, description and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	DPIRD: Environment@dpird.wa.gov.au
Pilbara Ports Authority As requested during initial consultation.	Activity timing, location, description and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	Pilbara Port Authority: shipping@pilbaraports.com.au

Requirement	Required information	Timing	Type	Recipient
Recfishwest As requested during additional consultation.	Activity timing, location, description and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	Contact details as provided by Recfishwest
Shire of Ashburton As requested during additional consultation.	Activity timing, location, description and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	Contact details as provided by Shire of Ashburton
WAFIC As requested during additional consultation.	Activity timing, location, description and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	WAFIC: oilandgas@wafic.org.au
Western Rock Lobster As requested during additional consultation.	Activity timing, location, description and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	Contact details as provided by Western Rock Lobster
OPGGS(E) Regulation 54 & 55 – Notifications NOPSEMA must be notified that the activity is to commence.	Complete NOPSEMA's Regulation 54 Start or End of Activity Notification form prior to each campaign.	At least ten days before the campaign activity commences.	Written	NOPSEMA
DEMIRS Standing arrangement with DEMIRS.	Activity timing, location, description and vessel contact details.	At least ten days before the activity commences where practicable.	Written	DEMIRS
AMSA JRCC Standing arrangement with AMSA JRCC.	Activity timing, location, description and vessel contact details.	24 to 48 hours before the activity commences.	Written	AMSA's JRCC: rccaus@amsa.gov.au
During the Activity				
AHO Notification As requested during consultation.	Any changes to the intended operations.	As soon as practicable.	Written	AHO: datacentre@hydro.gov.au

Requirement	Required information	Timing	Type	Recipient
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
AMSA Reporting Under the MoU between Santos and AMSA and as requested by AMSA during consultation.	Any changes to the intended operations.	As soon as practicable.	Written	AMSA's JRCC: rccaus@amsa.gov.au
	Titleholder agrees to notify AMSA of any marine pollution incident[1].	Within two hours of incident.	Oral	AMSA
	POLREP and SITREP available online (refer to OPEP).	POLREP as requested by AMSA following verbal notification. SITREP as requested by AMSA within 24 hours of request.	Written	AMSA
Department of Biodiversity, Conservation and Attractions Reporting Any harm or mortality to fauna listed as threatened under the WA *Biodiversity Conservation Act 2016*.	Notification of any harm or mortality to fauna listed as a threatened species under the WA *Biodiversity Conservation Act 2016* as a result of Santos' activities.	A fauna report will be submitted to DBCA within seven days to fauna@dbca.wa.gov.au.	Written	DBCA

[1] 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 7**.

Requirement	Required information	Timing	Type	Recipient
Department of Biodiversity, Conservation and Attractions Reporting Notification of the event of a hydrocarbon release.	Notification of actual or impending spillage.	As soon as practicable.	Oral or Written	DBCA Pilbara regional office
DCCEEW Reporting Any harm or mortality to EPBC Act 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
	Marine fauna sighting data recorded in the marine fauna sighting database.	As soon as practicable, in any case no later than three months of the end of the activity.	Written	DCCEEW
DPIRD Reporting If marine pests or disease are suspected this must be reported to DPIRD.	Notification of any suspected marine pests or diseases including any organism listed in the Western Australian Prevention List for Introduced Marine Pests and any other non-endemic organism that demonstrates invasive characteristics.	Within 24 hours.	Oral	DPIRD FishWatch
Department of Transport Reporting All actual or impending MOP incidents that are in, or may impact, State waters resulting from an offshore activity.	Notification of actual or impending spillage, release or escape of oil or an oily mixture that is capable of causing loss of life, injury to a person or damage to the health of a person, property or the environment.	Within two hours.	Oral	DoT

Requirement	Required information	Timing	Type	Recipient
	WA DoT POLREP and SITREP available online (refer OPEP).	As requested by DoT after verbal notification.	Written	DoT
Department of Water and Environmental Regulation	Notification of a spill event. Santos will contact DWER on the 24-hour pollution watch hotline 1300 784 782 and email: pollutionwatch@dwer.wa.gov.au	As soon as practicable.	Oral or Written	DWER
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; or if any changes to intended operations (requested through consultation).	The DNP should be made aware of oil / gas pollution incidences which occur within a marine park or are likely to impact on a marine park as soon as possible. Notification should be provided to the 24-hour 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 OPEP (such as	So far as reasonably practicable prior to response action being written.	Oral and written	Director of National Parks

Requirement	Required information	Timing	Type	Recipient
	dispersant, containment) • confirmation of providing access to relevant monitoring and evaluation reports when available • contact details for the response coordinator. Note that the DNP may request daily or weekly Situation Reports, depending on the scale and severity of the pollution incident.			
	Notify if details regarding the activity change and result in an overlap with or new impact to a marine park.	As soon as practicable.	Written	DNP: marineparks@awe.gov.au
OPGGS(E) Regulation 24(c), 47 & 48 – Reportable Incident NOPSEMA must be notified of any reportable incidents. For the purposes of Regulation 24(c), a reportable incident is defined as: • an incident relating to the activity that has caused, or has the potential to cause,	The oral notification must contain: • all material facts and circumstances concerning the reportable incident known or by reasonable search or enquiry could be found out.	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.	Oral	NOPSEMA

Requirement	Required information	Timing	Type	Recipient
moderate to significant environmental damage.	• 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.			
	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 National Offshore Petroleum Titles Administrator
	A written report must contain: • all material facts and circumstances concerning the reportable incident known or by reasonable search or enquiry could be found out • any action taken to avoid or mitigate any adverse environmental	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 NOPTA within seven days after giving the written report to NOPSEMA.	Written	NOPSEMA National Offshore Petroleum Titles Administrator

Requirement	Required information	Timing	Type	Recipient
	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. Consider reporting using NOPSEMA's Report of an Accident, Dangerous Occurrence or Environmental Incident form.			
OPGGS(E) Regulation 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.	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
OPGGS(E) Regulation 51 – Environmental Performance	Report must contain sufficient information to determine whether or not environmental performance outcomes and	A detailed environmental performance report for a twelve month period commencing the date of EP acceptance, shall be	Written	NOPSEMA

Requirement	Required information	Timing	Type	Recipient
NOPSEMA must be notified of the environmental performance at the intervals provided for in the EP.	standards in the EP have been met.	submitted to NOPSEMA within 3 months post reporting timeframe, on annual basis.		
Santos' commitment to include activity in Quarterly Consultation Update until activity ends.	The Quarterly Consultation Update will include the activity. This consultation will cease once the activity has ended.	Quarterly.	Written	The Quarterly Consultation Update is circulated to a broad group of Santos' stakeholders, including many of the stakeholders identified in Section 6.2.
WA Museum As requested during additional consultation.	Notify regulators of the discovery of any suspected UCH identified during the planning, development, operation, or decommissioning.	Within 21 days of the discovery.	Written	DCCEEW Australasian Underwater Cultural Heritage Database at: https://dmzapp17p.ris.environment.gov.au/shipwreck/public/wreck/search.do
Wanparta Aborignal Corporation (WAC): All actual or impending MOP incidents that are in, or may impact, WAC interests, resulting from an offshore activity.	Notification of actual or impending spillage, release or escape of oil or an oily mixture that is capable of causing loss of life, injury to a person or damage to the health of a person, property or the environment.	As soon as practicable	Written	WAC

Requirement	Required information	Timing	Type	Recipient
End of Activity				
OPGGS(E) Regulation 54 – Notifications NOPSEMA must be notified that the activity is completed.	Complete NOPSEMA's Regulation 54 Start or End of Activity Notification form for both notifications.	Within ten days after cessation of each activity campaign.	Written	NOPSEMA
AHO AFMAAMSA JRCC Care for Hedland DAFF DCCEEW Department of Defence DPIRD DEMIRS Recfishwest Shire of Ashburton Western Rock Lobster	Activity cessation notification.	Within ten days after cessation of each campaign.	Written	AHO: datacentre@hydro.gov.au AHS: webmaster@hydro.gov.au AFMA: petroleum@afma.gov.au AMSA's JRCC: rccaus@amsa.gov.au Care for Hedland: coordinator@careforhedland.org.au DAFF: Petroleum&Fisheries@agriculture.gov.au DCCEEW: Petroleum&Fisheries@agriculture.gov.au

Requirement	Required information	Timing	Type	Recipient
				DoD: offshore.petroleum@defence.gov.au DPIRD: Environment@dpird.wa.gov.au DEMIRS: petroleum.environment@dmirs.wa.gov.au Recfishwest Shire of Ashburton Western Rock Lobster
AHO Notification of abandoned equipment in situ	Provide location coordinates and description of equipment abandoned in situ so they can be marked on navigational charts	On completion of the decommissioning campaign	Written	AHO: datacentre@hydro.gov.au
AHO Notification of relinquishment of PSZ	Provide coordinates and description of the PSZ to be relinquished.	On completion of the decommissioning campaign	Written	AHO: datacentre@hydro.gov.au
Commercial Fishers Notification As requested during consultation.	Activity Cessation Notification provided to relevant commercial fishing stakeholders, as agreed with WAFIC or relevant industry body.	Within ten days after cessation of each campaign.	Written	WAFIC oilandgas@wafic.org.au

Requirement	Required information	Timing	Type	Recipient
OPGGS(E) Regulation 22(7) & 51 – Environmental Performance NOPSEMA must be notified of the environmental performance of the activity.	Report must contain sufficient information to determine whether or not environmental performance outcomes and standards in the EP have been met.	A detailed environmental performance report for a twelve month period commencing from the date of EP acceptance, shall be submitted to NOPSEMA within 3 months post reporting timeframe, on annual basis.	Written	NOPSEMA
OPGGS(E) Regulation 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.	Notification advising NOPSEMA of end of all activities to which the EP relates and that all obligations have been completed.	Within 12 months of the final Regulation 54 (2) notification.	Written	NOPSEMA

8.10.2 Monitoring and Recording of Emissions and Discharges

OPGGS(E)R 2023 Requirements
Regulation 34(e) Criteria for Acceptance of Environment Plan
Includes an appropriate implementation strategy and monitoring, recording and reporting arrangements
Regulation 22(6) Implementation Strategy for the Environment Plan
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 standards in the environment plan are being met.

Vessel-based discharges to the marine environment, associated with this activity will be recorded and controlled in accordance with requirements under relevant marine orders.

Santos and contractors will maintain records so that 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. Santos records discharges or emissions (where practicable), to the environment as described in **Table 8-5**.

Table 8-6: Monitoring methods for emissions and discharges

Discharge / Emission	Parameter	Record	Recording Frequency
Chemicals (discharged to the marine environment as per **Sections 6.6** and **6.7**)	Volume	Chemical risk assessment Volumes used will be estimated based on known inventories	For every chemical use with a fate to the marine environment
Oily water	Volume and location	Oil record book* or equivalent	For every discharge
Garbage (including food scraps)	Volume and location	Garbage record book*	For every discharge
Sewage	Volume and location	Sewage record book*	For every discharge
Ballast water	Volume and location	Ballast water record book or log**	For every discharge
Unplanned discharge of solid objects	Volume	Incident report	For every discharge
Unplanned discharge of hazardous liquids	Volume	Incident report	For every discharge
Unplanned hydrocarbon release	Volume	Incident report	For every discharge

* Maintained as per vessel class in accordance with relevant Marine Orders

** Maintained as per *Australian Ballast Water Management Requirements* (Department of Agriculture, Water and the Environment, 2020)

8.11 Document Management

8.11.1 Information Management and Document Control

This EP, as well as approved management of change documents, are controlled documents and 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.

8.11.2 Management of Change

The MoC process provides a systematic approach to initiate, assess, document, approve, communicate and implement changes to EPs and OPEPs.

The MoC process considers Regulations 18, 19, 26(3) to (5), 38 and 39 of the Regulations and determines if a proposed change can proceed and the manner in which it can proceed. The MoC procedure will determine whether a revision of the EP is required and whether that revision is to be submitted to NOPSEMA. For a change to proceed, the associated environmental impacts and risks must be demonstrated to be acceptable and ALARP. Additional stakeholder consultation may be required, depending on the nature and scale of the change. Additional information about the MoC process is provided in **Figure 8-1**.

The MoC procedure also allows for the assessment of new information that may become available after EP acceptance, such as new management plans for Australian Marine Parks, new recovery plans or conservation advice for threatened or migratory species, and changes to the Protected Matters Search results. If a review identifies new information, this is treated as a "Change that has an impact on EP", and the MoC process is followed accordingly.

The MoC procedure also includes an assurance check process which applies the MoC process to long-term (usually five-year multi-activity EPs) EPs that may have lengthy periods of time between use or acceptance and activity commencement. 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.

Accepted MoCs become part of the in-force EP or OPEP, are tracked on a register and are made available on Santos' intranet. Where appropriate, the EP compliance register will be updated so that control measure or EPS changes are communicated to the workforce and implemented. Any MoC will be distributed to the management people identified in **Table 8-3** (excluding the Chief Executive Officer and Directors), and the most relevant management position will ensure the MoC is communicated and implemented, which may include crew meetings, briefings or communications as appropriate for the change.

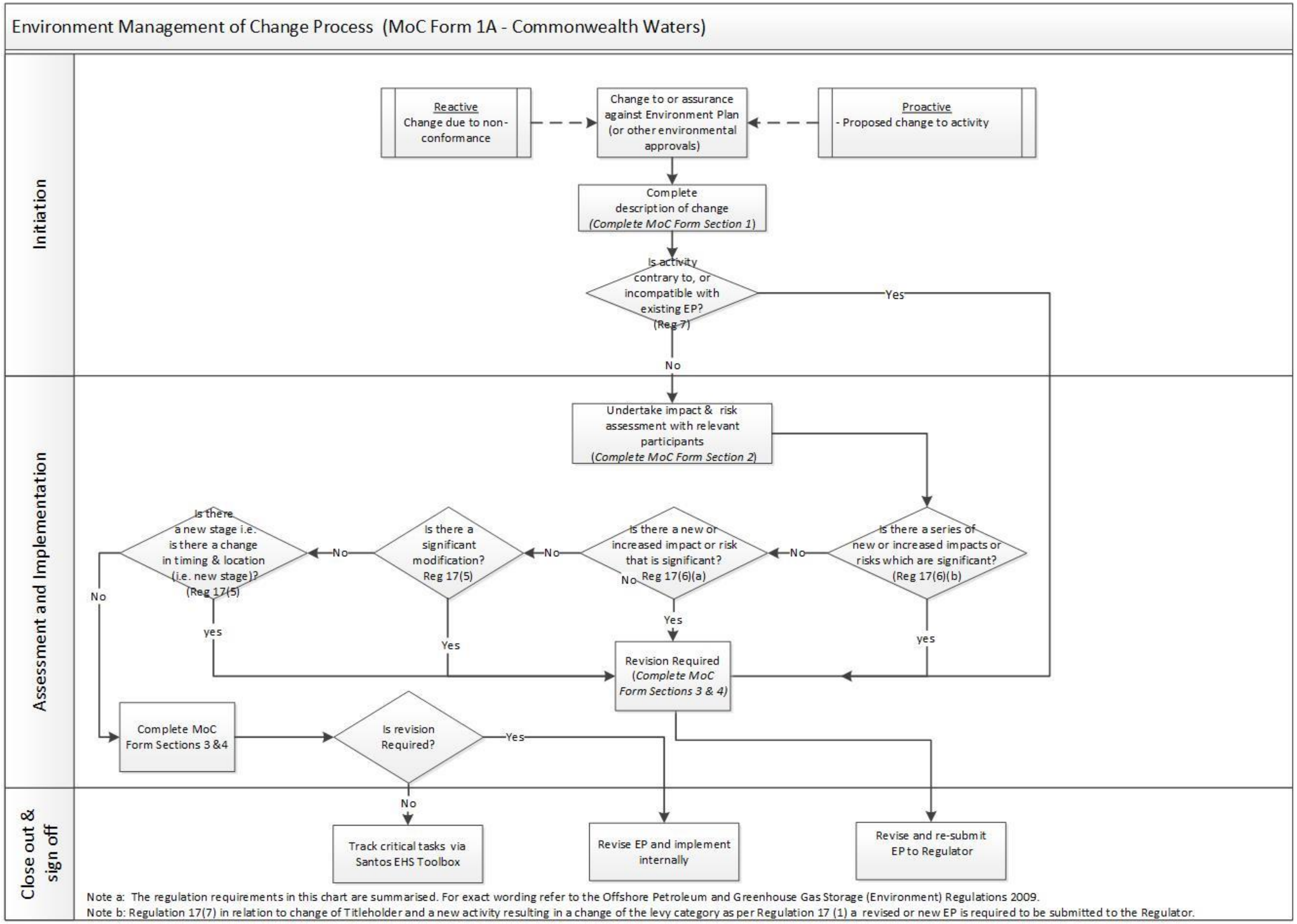

Figure 8.1: EP MoC process

8.11.3 Reviews

This EP has assessed the environmental impacts and risk from the proposed activity during any time of the year. Information and requirements that have informed the assessment of environmental impacts and risks may change, such as:

+ legislation
+ businesses conditions, activities, systems, processes and people
+ industry practices
+ science and technology
+ societal and stakeholder expectations.

To ensure Santos maintains up-to-date knowledge of the industry, legislation and conservation advice, the following tasks are undertaken:

+ maintain membership of the Australian Energy Producers (AEP), which provides a mechanism for communicating potential changes in legislation, industry practice and other issues that may affect EP implementation to relevant personnel in Santos
+ undertake annual spill response exercises to check spill response arrangements and capability are adequate
+ identify stakeholders prior to the activity commencing under this EP via the mechanisms outlined in **Section 4**
+ review the values and sensitivities within the EMBA which includes completing a new Protected Matters Search, reviewing **Appendix C** against relevant legislation to capture and review any relevant updates and incorporate as required, and reviewing any recently known published relevant scientific papers
+ monitoring the AIMS North West Shoals to Shore Research Program, specifically the fish and pearl oyster impact studies;
+ reviewing the DPIRD WA Prevention List for Introduced Marine Pests prior to each survey stage;
+ subscription to NOPSEMA's "The Regulator" issued quarterly;
+ subscribe to various regulator updates
+ have regular liaison meetings with Regulators.

Through maintenance of up to date knowledge, changes to information and requirements that inform the assessment of environmental impacts and risks are identified. If the changes are material to the assessment of environmental impacts and risks from the activity, the EP will be reviewed and any changes required documented in accordance with Santos' MoC procedure (**Section 8.11.2**).

8.12 Audits and Inspections

OPGGS(E)R 2023 Requirements
Regulation 22(5) Implementation Strategy for the Environment Plan
The implementation strategy must provide for sufficient monitoring, recording, audit, management of nonconformance and review of the titleholder's environmental performance and the implementation strategy to ensure that the environmental performance outcomes and standards in the environment plan are being met.

8.12.1 Audits

Santos audit plans and schedules are reviewed and updated at the beginning of each calendar year and cover all Santos facilities and activities. Santos' audit schedule may be amended to accommodate operational priorities, activity risk, personnel availability or high audit demand during certain periods (for example, regulatory audits, contractor audits). Santos will determine if a vessel audit is required following contract award and vessel confirmation.

Audits will be undertaken in a manner consistent with Santos' Management Standard for Assurance (SMS MS15).

Audit scope typically includes a selection of control measures, EPS and EPOs. However, audits may also include other parts of the EP.

Audits findings may include opportunities for improvement and non-conformances. Audit non-conformances are managed as described in **Section 8.12.3**.

8.12.2 Inspections

During an activity, HSE inspections (desktop or vessel based) will be conducted at least once during the activity to identify hazards, incidents and EP non-conformances. These inspections will also check compliance against the EPOs and EPS of this EP (**Table 8-2**) and inform end of activity reporting (**Table 8-4**). Any in-field opportunities for improvement or corrective actions will be discussed during the inspection with the Vessel Master or MODU Offshore Installation Manager.

8.12.3 Non-conformance Management

EP non-conformances will be addressed and resolved by a systematic corrective action process as outlined in Santos' Management Standard for Assurance (MS15) and the Assurance Procedure (ST01). Non-conformances identified by audits and inspections will be entered into Santos' incident and action tracking management system (i.e., 'HSE Toolbox'). Once entered, corrective actions, time frames and responsible persons (including action owners and event validators) will be assigned. Corrective action 'close out' will be monitored using a management escalation process.

8.12.4 Continuous Improvement

For this EP, continuous improvement will be driven by the list below, and may result in a review of the EP with changes applied in accordance with **Section 8.11.2**:

+ improvements identified from the review of business-level HSE key performance indicators
+ actions arising from Santos and departmental HSE improvement plans

- corrective actions and feedback from HSE audits and inspections, incident investigations and after action reviews
- opportunities for improvement and changes identified during pre-activity reviews and MoC documents
- actions taken to address concerns and issues raised during the ongoing stakeholder management process (**Section 4**).

Identified continuous improvement opportunities will be assessed in accordance with the MoC process to ensure any potential changes to this EP, or OPEP, are managed in accordance with the Regulations and in a controlled manner.

8.13 Post acceptance consultation implementation strategy

8.13.1 Post-acceptance consultation implementation strategy – First Nations people and groups, local governments, communities and industry

Santos is committed to appropriate post acceptance consultation implementation for this Activity with relevant government authorities and other relevant interested persons and organisations.

Post acceptance consultation activities for this EP will be principally supported by Santos' regional engagement program for its existing operational footprint in the Carnarvon Basin, with a focus on First Nations people and groups and local governments, communities and industry with interests in the lands and waters of the adjacent Pilbara region.

8.13.1.1 First Nations people and groups

Santos will undertake consultation over the life of the activity with First Nations representative organisations, such as Prescribed Body Corporates (PBCs) and Native Title Representative Bodies.

These engagements will be undertaken principally through Santos' existing regional engagement program, which has a focus on engaging those organisations with closest proximity to Santos' existing, proposed and planned activities in the Carnarvon Basin.

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.

Santos is currently in discussion with four Pilbara PBCs on the establishment of consultation frameworks that will provide for effective and regular engagement on proposed, planned, existing and completed activities. These PBCs are listed below, which have coastal interests from North West Cape to Dampier.

- Nganhurra Thanardi Garrbu Aboriginal Corporation
- Buurabalayji Thalanyji Aboriginal Corporation
- Wirrawandi Aboriginal Corporation
- Ngarluma Aboriginal Corporation

Santos has also identified Murujuga Aboriginal Corporation as a key organisation for engagement as part of the regional engagement program.

Santos plans to grow this regional engagement network to include PBCs in the eastern Pilbara and western Kimberley to support future activities in the Bedout Basin (north of Port Hedland), given the proximity of proposed activities to these regions.

Engagement of all First Nations organisations will include consideration of culturally appropriate management measures for inclusion within EPs, where First Nations people believe that there may be impacts or risks, or have concerns with regards to:

- Traditional lands and waters

- Sea country interests
- Totemic species
- Other cultural values or sensitivities of importance

8.13.1.2 Local governments, communities and industry

Similarly, Santos will use its existing regional engagement program, to support consultation over the life of the activity in regional communities proximate to Santos' existing, proposed and planned activities.

Representative groups identified by Santos for engagement include:

- Local government – Shire of Exmouth, Shire of Ashburton and City of Karratha
- Local industry – Exmouth Chamber of Commerce and Industry, Onslow Chamber of Commerce and Industry and Karratha and Districts Chamber of Commerce and Industry
- Community Groups – Exmouth Community Liaison Group, Shire of Ashburton Onslow Community Information Sessions

This regional approach is complementary to Santos' existing and ongoing engagement of representative groups for other offshore marine user groups, including commercial fishing organisations.

8.13.2 Post-acceptance consultation implementation strategy – approach

Formal acceptance of the EP will be communicated via the NOPSEMA website. Santos will also provide access to the EP via the NOPSEMA website and will provide details on the Santos website on how to provide ongoing feedback in relation to the drilling and completions Activity.

Activity notifications and reports will be made in accordance with Table 8-4. The notifications and reports are based on legislative requirements, standing arrangements with particular Relevant Persons, Relevant Persons' requests for notification made during Regulation 25 consultation, or as otherwise deemed appropriate by Santos.

Following Activity commencement, Santos will provide quarterly updates on the Activity. The updates will be posted on Santos' website, with notifications to registered / subscribed interested parties.

Santos will apply the regional engagement model described in Section 8.13.1 to consider the preference of with relevant government authorities and other relevant interested persons and organisations when determining the frequency and method of additional updates.

Santos will apply continue to accept, assess and respond to post acceptance consultation feedback during the life of the Activity. Records of any post acceptance consultation will be maintained in an appropriate Santos consultation database.

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 Management of Change process outlined in Section 8.11.2

Santos will maintain a database of relevant authorities, and other relevant interested persons and organisations for this Activity. This includes updating its database in light of post acceptance consultation, including identification of new Relevant Persons.

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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:	Jodie Hatherly, General Counsel and VP Legal, Risk and Governance		
Approved by:	The Board	Version:	3

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Appendix B Legislative Framework

Australian Legislation

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	This Act provides for the preservation and protection from injury or desecration areas and objects that are of significance to Aboriginal people, under which the Minister 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.	Yes	Commonwealth – Department of Agriculture, Water and the Environment	There are no known sites of Aboriginal Heritage Significance within the operational area, but there are within the EMBA. This Act would only apply to the activity if there was a discovery of Aboriginal remains, which is not considered likely to occur given the offshore location of the activity.	**Section 3.2.4** – Protected and significant areas **Section 3.2.6** – Socio-economic Environment
Australian Ballast Water Requirements, Version 7	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.	Yes	Commonwealth – Department of Agriculture and Water Resources	Potential internationally sourced vessel operating in Australian Waters which could have the potential for introduction of Invasive Marine Species and potential ballast water exchange.	**Section 7.2** – Introduction of invasive marine species
Australian Heritage	This Act identifies areas of heritage value listed on the Register of the National Estate	Yes	Australian Heritage Council	There are a number of national heritage places found on the National Heritage List,	**Section 3.2.4** – Protected and significant areas

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
Council Act 2003	and sets up the Australian Heritage Council and its functions.			within the EMBA, as identified by the Act.	
Australian Maritime Safety Authority Act 1990 (AMSA Act)	This Act specifies that AMSA's role includes protection of the marine environment from pollution from ships and other environmental damage caused by shipping. AMSA is responsible for administering the Marine Order in Commonwealth Waters. This Act facilitates international cooperation and mutual assistance in preparing and responding to a major oil spill incident and encourages countries to develop and maintain an adequate capability to deal with oil pollution emergencies. Requirements are given effect through 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.	Yes	AMSA	This Act applies to the use of any vessel associated with operations, and is relevant to the activity in regards to the unplanned pollution from ships.	**Section 7.7** – Hydrocarbon spill – marine diesel oil
Aquatic Resources Management Act 2016	This Act will be the primary legislation used to manage fishing, aquaculture, pearling and aquatic resources in Western Australia. The Act was scheduled for commencement on 1 January 2019; however, this has been deferred while an amendment to the Act is progressed.	Yes	Department of Primary Industries and Regional Development	Vessel movements have the potential to introduce invasive marine species (IMS). This Act was considered during development of the Santos IMS Management Zone and IMS Management Plan (EA-00-RI-10172).	**Section 7.2** – Introduction of invasive marine species

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
Marine Orders	Marine Orders (MO) are subordinate rules made pursuant to the Navigation Act 2012 and Protection of the Sea (Prevention of Pollution from Ships) Act 1983 affecting the maritime industry. They are a means of implementing Australia's international maritime obligations by giving effect to international conventions in Australian law.	Yes	AMSA	Vessel movements, safety, discharges and emissions	**Section 6** and **Section 7**– Planned and unplanned events
Maritime Powers Act 2013	Protects the heritage values of shipwrecks and relics for shipwrecks over 75 years. It is an offence to interfere with a shipwreck covered by this Act. Available historic shipwreck locations covered by international conventions enacted by this legislation have been identified and assessed (as applicable) within this EP.	No	The Department of Immigration and Border Protection	This Act applies to the shipwrecks (over 75 years old) within the EMBA. There is no planned interaction or interference with shipwrecks, and any unplanned impacts is only expected to affect the surface waters.	N/A
Biosecurity Act 2015 Biosecurity Regulations 2016	This Act provides the Commonwealth with powers to take measures of quarantine, and implement related programs as are necessary, to prevent the introduction of any plant, animal, organism or matter that could contain anything that could threaten Australia's native flora and fauna or natural environment. The Commonwealth's powers include powers of entry, seizure, detention and disposal. This Act includes mandatory controls on the use of seawater as ballast in ships and the	Yes	Commonwealth – Department of Agriculture and Water Resources	This Act applies to all internationally sources vessels operating in Australian Waters which could have the potential for the introduction of IMS and potential ballast water exchange.	**Section 7.2** – Introduction of invasive marine species

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
	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.				
Corporations Act 2001	This Act is the principal legislation regulating matters of Australian companies, such as the formation and operation of companies, duties of officers, takeovers and fundraising.	Yes	Commonwealth – Australian Securities and Investments Commission	The titleholder has provided ACN details within the meaning of the Act.	**Section 1.4**
Environment Protection and Biodiversity Conservation Act 1999 EPBC Amendment Regulations 2006	NOPSEMA is the sole assessor for offshore petroleum activities in Commonwealth water (as of 28 February 2014). Under the new arrangements, environmental protection will be met through NOPSEMA's decision-making processes. This Act is the Australian Government's key piece of environmental legislation. The Act focuses on protecting MNES. AMP Management Plans were also developed under this Act.	Yes	Commonwealth – Department of Agriculture, Water and the Environment	This Act applies to all aspects of the activity that have the potential to impact MNES. Appropriate environmental approvals will be sought from NOPSEMA for all operations (this EP) which outlines compliance with the relevant regulations and plans under the Act. Where activities have existing approvals under the Act, these will continue to apply.	**Section 6.1** – Noise emissions **Section 6.2** – Light emissions **Section 6.6**– Operational discharges **Section 6.7** – Drilling discharges **Section 6.8**– Subsea Infrastructure Discharges **Section 7.6, 7.7** and **7.10** – Hydrocarbon release **Section 7.3** – Marine fauna interaction

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
Underwater Cultural Heritage Act 2018	This Act replaces the Historic Shipwrecks Act 1976, and extends protection to other wrecks such as submerged aircraft and human remains. It also increases penalties applicable to damaged sites. The Act came into effect on 1 July 2019.	Yes		No planned interaction or interference to shipwrecks. Potential impact could be due to a hydrocarbon spill but the credible spill is to surface, and therefore shipwrecks are highly unlikely to be impacted. Numerous shipwrecks identified within EMBA.	**Section 7.6, 7.7** and **7.10** – Hydrocarbon release
National Greenhouse and Energy Reporting Act 2007	Introduces 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.	Yes	Commonwealth – Department of Agriculture, Water and the Environment Climate Change Authority	This Act applies to the atmospheric emissions through combustion engine use to operate the vessels and MODU associated with the activity. Implementation of the Act will reduce the impact of GHG emissions associated with vessel use for the installation and pre-commissioning activity, through compliance with MARPOL Annex VI (Marine Order Part 97: Marine Pollution Prevention – Air Pollution), and require the use of low sulphur fuel.	**Section 6.3**– Atmospheric emissions
Maritime Legislation Amendment	This Act implements the requirements of MARPOL 73/78 Annex VI for shipping in Commonwealth Waters.	Yes	Commonwealth, Department of Infrastructure	Implementation of this Act reduces the impact of GHG emissions associated with	**Section 6.3** – Atmospheric emissions

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
(Prevention of Air Pollution from Ships) Act 2007			and Regional Development.	vessel use for the installation and pre-commissioning activity, through compliance with MARPOL Annex VI (Marine Order Part 97: Marine Pollution Prevention – Air Pollution), and require the use of low sulphur fuel.	
Marine Safety (Domestic Commercial Vessel) National Law Act 2012	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.	Yes	Commonwealth – Australian Maritime Safety Authority	All vessel movements associated with the activity will be governed by AMSA marine safety regulations under the Act.	**Section 6.5**– Interaction with other marine users **Section 7.7** – Hydrocarbon spill – marine diesel oil
Navigation Act 2012	An Act regulating navigation and shipping including SOLAS. A number of Marine Orders enacted under this Act apply directly to offshore petroleum exploration and production activities: 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.	Yes	AMSA (operational) Department of Infrastructure and Regional Development Minister for Infrastructure and Regional Development	All vessel movements associated with the activity will be governed by marine safety regulations and Marine Orders under the Act.	**Section 6.5**– Interaction with other marine users **Section 7.7** – Hydrocarbon spill – marine diesel oil

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
Offshore Petroleum and Greenhouse Gas Storage Act 2006 Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023	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 carried out in a manner that does not unduly interfere with other rights or interests, including the conservation of the resources of the sea and sea-bed, such as fishing or shipping. In some cases, where there are particular 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 Environment Regulations provide an objective based regime for the management of environmental	Yes	NOPSEMA	The activity involves cessation of production activities, which is a petroleum activity regulated by NOPSEMA under this Act.	**Section 6**– Risk Assessments for Planned Events **Section 7**– Risk Assessments for Unplanned Events

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
	performance for Australian offshore petroleum exploration and production activities in areas of Commonwealth jurisdiction. Key objectives of the Environment Regulations include: to ensure operations are carried out in a way that is consistent with the principles of ecologically sustainable development to adopt best practice to achieve agreed environment protection standards in industry operations to encourage industry to continuously improve its environmental performance.				
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989	Regulates the manufacture, importation and use of ozone depleting substances (typically used in fire-fighting equipment and refrigerants). Applicable to the handling of any ODS.	Yes	Commonwealth – Department of Agriculture, Water and the Environment	The activity does not include import, export or manufacture activities of ODS. This Act applies where ODS is found on vessel refrigeration systems; however, this is a rare occurrence.	**Section 6.3**– Atmospheric emissions
Protection of the Sea (Powers of Intervention) Act 1981 Protection of the Sea (Powers of	The Act authorises the Commonwealth 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.	Yes	Commonwealth – Department of Infrastructure and Regional Development	This Act applies to vessel discharges and movements associated with the activity. The Act is relevant to the extent that Santos will comply with MARPOL through the following relevant Marine Orders relating to marine	**Section 6.5** – Interaction with other marine users **Section 6.6**– Planned operational discharges **Section 7.4** to **7.10**– Unplanned

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
Intervention) Regulations 1983				pollution prevention have been put in place to give effect to relevant regulations of 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.	hydrocarbon and non-hydrocarbon/ chemical spills **Section 7.2**– Introduction of IMS
Protection of the Sea (Prevention of Pollution from Ships) Act 1983 Protection of the Sea (Prevention of Pollution from Ships) (Orders)	This Act relates to the protection of the sea from pollution by oil and other harmful substances discharged from ships. 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. The following Marine Orders relating to marine pollution prevention have been put in place to give	Yes	Commonwealth – Department of Infrastructure and Regional Development	This Act applies to vessel discharges and movements associated with the activity. The Act is relevant to the extent that Santos will comply with MARPOL through the following relevant Marine Orders relating to marine pollution prevention have been put in place to give	**Section 6.5** – Interaction with other marine users **Section 6.6**– Planned operational discharges **Section 7.4** to **7.10**– Unplanned hydrocarbon and

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
Regulations 1994	effect to relevant regulations of 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.			effect to relevant regulations of 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.	non-hydrocarbon/ chemical spills **Section 7.2**– Introduction of IMS
Protection of the Sea (Civil Liability of Bunker Oil Pollution Damage) Act 2008	This Act implements the requirements for the International Convention on Civil Liability for Bunker Oil Pollution Damage.	Yes	AMSA	This Act applies to diesel refuelling which may be undertaken at sea as part of the activity. Compliance with the Act reduces the risk of bunker oil pollution.	**Section 7.7** – Hydrocarbon spill – marine diesel oil
Protection of the Sea (Harmful Antifouling	This Act relates to the protection of the sea from the effects of harmful anti-fouling systems. It prohibits the use of harmful	Yes	Commonwealth, Department of Infrastructure and Regional	This Act applies to vessel movements in Australian Waters associated with the activity. Vessels are required	**Section 7.2** – Introduction of IMS

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
Systems) Act 2006	organotins in ant-fouling paints used on ships. This is enacted by Marine Order 98 (Marine Pollution – Anti-fouling Systems) 2013.		Development and AMSA	to have biofouling systems in place to prevent introduction of IMS/harmful impact on Australian biodiversity. This is enacted by Marine Order 98 (Marine Pollution – Anti-fouling Systems) 2013.	
State Legislation					
Fish Resources Management Act 1994 Fish Resources Management Regulations 1995	This Act establishes a framework for management of fishery resources and is the nominated lead agency responsible for implementing Western Australian marine biosecurity management requirements through implementation of the Fish Resources Management Act 1994 (FRMA 1994) and associated regulations.	Yes	Department of Primary Industries and Regional Development	Introduction of invasive marine species.	**Section7.2** – Introduction of IMS

International Agreements and Conventions

International Agreements and Conventions	Summary	Relevant to Activity?	Relevant Aspects	EP Section
1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972	Implemented in WA *Marine (Sea Dumping) Act* and *Environmental Protection (Sea Dumping) Act 1981.*	Yes	Sewage, grey water, and putrescible wastes generated from support vessels and MODU. Deck drainage/deck wash-down, cooling, brine, ballast and bilge water from support vessels. Hydraulic fluid released by valve operation on subsea infrastructure. Various discharges from planned maintenance activities.	**Section 6.6**– Planned operational discharges
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 or JAMBA)	This agreement recognises the special international concern for the protection of migratory birds and birds in danger of extinction that migrate between Australia and Japan. Implemented in EPBC Act 1999.	Yes	Only relevant in so far as the credible spill scenario may result in impact to migratory seabirds foraging in area.	**Section 7.6, 7.7** and **7.10** – Hydrocarbon release
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	This agreement recognises the special international concern for the protection of migratory birds and birds in danger of extinction that migrate between Australia and China. Implemented in EPBC Act 1999.	Yes	Only relevant in so far as the credible spill scenario may result in impact to migratory seabirds foraging in area.	**Section 7.6, 7.7** and **7.10** – Hydrocarbon release

International Agreements and Conventions	Summary	Relevant to Activity?	Relevant Aspects	EP Section
China Australia Migratory Bird Agreement or CAMBA)				
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. Implemented in *Hazardous Waste (Regulation of Exports and Imports) Act 1989.*	No	Activity does not involve transboundary movement of hazardous wastes.	N/A
United Nations Convention on Biological Diversity -1992	An international treaty to sustain life on earth.	Yes	Relevant only insofar as the activity may interact with MNES (threatened and migratory species) protected under the EPBC Act.	**Section 6.1 –** Noise emissions **Section 6.2**– Light emissions **Section 6.4**– Seabed disturbance **Section 7.3** – Interaction with marine fauna **Section 7.4** to **7.10**– Unplanned hydrocarbon and non-hydrocarbon/ chemical spills
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	Yes	In the event that worse-case credible spill scenarios may enact a national arrangement for response.	**Section 7.6, 7.7** and **7.10** – Hydrocarbon release **Section 6.9**– Spill response operations

International Agreements and Conventions	Summary	Relevant to Activity?	Relevant Aspects	EP Section
	pollution incident, prompt and effective action is essential.			
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.	Yes	Only relevant in so far as the credible spill scenario may result in impact to MNES protected migratory species.	**Section 7.6, 7.7** and **7.10** – Hydrocarbon release **Section 6.9**– Spill response operations
International Convention for the Establishment of an International Fund for Compensation for Oil Pollution Damage (Fund 92)	This convention ensures compensation is provided for damage caused by oil pollution.	No	Relevant to oil tankers, not supply or support vessels.	N/A
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)*	Yes	Already dealt with through the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* – refer to legislation table.	N/A

International Agreements and Conventions	Summary	Relevant to Activity?	Relevant Aspects	EP Section
	Act 1983, the *Navigation Act 2012* and several Parts of Marine Orders made under this legislation.			
International Convention for the Safety of Life at Sea 1974	This convention is generally regarded as the most important of all international treaties concerning the safety of merchant ships Implemented in the *Air Navigation Act 1920.*	Yes	Only relevant in so far as SOLAS relates to safety aspects of the activity, such as navigation aids which reduce potential for vessel collision and hydrocarbon release to the environment.	**Section 6.5**– Interaction with other marine users
International Convention on Civil Liability for oil pollution damage (1969)	This convention provides a mechanism for ensuring the payment of compensation for oil pollution damage.	No	Relevant to oil tankers.	N/A
International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Convention) 2004	The IMO has been addressing the problem of invasive marine species in ship's ballast water since the 1980s. Ballast water and sediments guidelines were adopted in 1991 and the ballast water convention was adopted in 2004. Recent accession by Finland has triggered the final entry into force of these international requirements. As a result, the International Convention for the Control and Management of Ships Ballast Water and Sediment will enter into force on 8th September 2017 (IMO Briefing 22 2016). It aims to prevent the spread	Yes	Potential internationally sourced vessel operating in Australian Waters which could have the potential for introduction of Invasive Marine Species and potential ballast water exchange.	**Section 7.2** – Introduction of invasive marine species

International Agreements and Conventions	Summary	Relevant to Activity?	Relevant Aspects	EP Section
	of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments. Ballast Water Management systems must be approved by the Administration in accordance with this IMO Guidelines.			
Minamata Convention on Mercury (Australia ratified the convention on 7 December 2021)	The Minamata Convention on Mercury is an international treaty that seeks to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. The Convention covers all aspects of the life cycle of mercury, controlling and reducing mercury across a range of products, processes and industries.	Yes	Relevant to the contaminant limit concentrations in barite. Santos have committed to H2-DC-CM-030Quality Control limits for Barite (relevant to mercury): Mercury (Hg) – 1 mg/kg dry weight in stock barite +Cadmium (Cd) – 3 mg/kg dry weight in stock barite	**Section 6.7** – Drilling Discharges
United Nations Convention on the Law of the Sea (UNCLOS) (1982)	Part XII of the convention sets up a general legal framework for marine environment protection. The convention imposes obligations on State Parties to prevent, reduce and control marine pollution from the various major pollution sources,	Yes	Only relevant to the extent that Santos will comply with MARPOL through the following relevant Marine Orders relating to marine pollution prevention have been put in place to give effect to relevant regulations of Annexes I, II, III, IV, V and VI of MARPOL 73/78:	**Section 6.6**– Operational discharges **Section 7.4** to **7.10**– Unplanned hydrocarbon and non-hydrocarbon/ chemical spills

International Agreements and Conventions	Summary	Relevant to Activity?	Relevant Aspects	EP Section
	including pollution from land, from the atmosphere, from vessels and from dumping (Articles 207 to 212). Subsequent articles provide a regime for the enforcement of national marine pollution laws in the many different situations that can arise. Australia signed the agreement relating to the implementation of Part XI of the Convention in 1982, and UNCLOS in 1994.		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 7.2** – Introduction of invasive marine species
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 December 1993.	Yes	Only relevant to the extent that to reduce impact of GHG emissions associated with vessel use, Santos will comply with MARPOL Annex VI (Marine Orders Part 97: Marine Pollution Prevention – Air Pollution) and require the use of low sulphur fuel. The MODU and support vessels will use diesel, which is a low sulphur fuel.	**Section 6.3**– Atmospheric emissions

Appendix C Santos' Values and Sensitivities of the Western Australian Marine Environment

EA-00-RI-10062

Values and Sensitivities of the Marine and Coastal Environment

PROJECT / FACILITY	All
REVIEW INTERVAL (MONTHS)	12 Months
SAFETY CRITICAL DOCUMENT	NO

Rev	Owner	Reviewer/s Managerial/Technical/Site	Approver
	Senior Environmental Approvals Adviser	Senior Environmental Approvals Adviser	Team Leader-Regulatory Approvals
10	Brendan Dry	Annette McGovern	Dawn MacInnes

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Rev	Rev Date	Author / Editor	Amendment
A	13/05/2014	Oceanica	Technical review
B	13/05/2014	Oceanica	Editorial review
0	30/07/2014	EG/GG	Final
1	30/12/2014	GG	Updated
2	28/07/2016	Jacobs	Updated
3	28/11/2017	Jacobs	Updated
3.1	11/12/2018	Jacobs	Issued for technical review
4	17/12/2018	Jacobs	Issued for use
4.1	09/01/2019	Jacobs	Issued for technical review
5	14/02/2019	Santos	Issued for use
5.1	15/01/2020	CDM Smith	Issued for technical review
6	19/03/2020	CDM Smith	Issued for use
6A	15/11/2020	Astron	Issued Technical review
7	30/11/2020	Astron	Issued for use
7A	25/02/2021	Advisian	Issued for Technical review
8	31/03/2021	Advisian	Issued for use
8A	02/07/2021	Advisian	Issued for technical review
9	09/07/2021	Advisian	Issued for use
9A	5/10/2022	Advisian	Draft for review
9B	14/11/2022	Advisian	Annual update. Issued for use. Will be issued as Rev 10 once additional information to support stakeholder consultation requirements is included.
10	25/01/2023	Santos	Issued for use

Santos

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Appendices

1. Introduction

Santos Energy Limited (Santos) is the titleholder of multiple petroleum titles for exploration, development. operational and title decommissioning activities located in marine waters off north-western Western Australia. With the exception of Bayu-Undan, this document describes the combined existing environment that may be affected (EMBA) by these petroleum activities and includes details of the relevant values and sensitivities of that environment as required by the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* and State Western Australian *Petroleum and Geothermal Energy Resources (Environment) Regulations 2012*, *Petroleum (Submerged Lands) (Environment) Regulations 2012 and Petroleum Pipelines (Environment) Regulations 2012.*

Worst-case hydrocarbon spills, particularly during drilling activities, generally have the largest EMBA of all the environmental impacts and risks managed by Santos. Santos routinely commissions hydrocarbon spill modelling studies to assist in assessing the environmental risk of a hydrocarbon spill. The low hydrocarbon exposure values as defined in NOPSEMA's '*Environmental Bulletin – Oil Spill Modelling*' (April 2019), are used as a predictive tool to set the outer boundaries of the EMBA for a given hydrocarbon spill.

To create the EMBA which defines the spatial extent of the values and sensitivities described herein, all of Santos' available hydrocarbon spill modelling results were merged to create a combined EMBA. The combined EMBA represents the largest possible spatial extent that could be contacted by combining the worst-case spill event modelled for Santos activities to date.

The combined EMBA encompasses the full range of environmental receptors that might be contacted by surface and subsurface hydrocarbons in the highly unlikely event of any worst case oil spill from Santos's activities.

The combined EMBA does not represent the worst case loss of well control event of any one activity.

This document is informed by searches of:

+ the protected matters search tool (PMST) published by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW). PMST searches were undertaken in September 2022 and are provided in Appendix A;
+ published scientific literature and studies, and
+ other State and Territory protected species databases where applicable.

Descriptions of all marine and coastal fauna within the EMBA that may credibly be impacted by Santos' activities are provided, with a focus on protected species that are threatened and migratory. The PMST is performed annually and any changes from this updated search are detailed in a change register (Appendix B). This document is then reviewed annually and updated accordingly.

The PMST searches were made using the combined EMBA. The combined EMBA includes the same spatial data used to produce the figures in Santos' environment plans (EPs), ensuring that the combined EMBA encompasses the full range of environmental receptors that might be contacted by surface and subsurface hydrocarbons at the low exposure level in the highly unlikely event of a worst case oil spill.

Limitations on the PMST required the combined EMBA be subset into a series of small grids. Each grid cell derived from the combined EMBA was then used to perform a PMST search. The results from these PMST searches were then collated and presented in Appendix A.

Figures provided throughout this document are zoomed to the relevant data represented to allow detail to be shown at a readable scale.

1.1 Geographical Extent

The combined EMBA, includes the coastal waters and shoreline habitats of Western Australia (WA) and part of the Northern Territory (NT), encompassing the south of WA to the most northern coastlines of the NT in the north (Appendix A). This area largely approximates the Commonwealth North-West Marine Region (NWMR), the South-West Marine Region (SWMR) and the North Marine Region (NMR). Based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Version 4.0, there are 18 provincial-scale bioregions that occur within the combined EMBA. These bioregions are based on fish, benthic habitat and oceanographic data (IMCRA v. 4.0). Where relevant, the physical, biological and social environments within the combined EMBA are discussed with reference to the IMCRA Provincial Bioregions. The provinces of most relevance (Figure 1-1) are:

North-west Marine Region

+ Northwest Shelf Transition;
+ Timor Province;
+ Northwest Transition;
+ Northwest Province;
+ Northwest Shelf Province;
+ Central Western Transition;
+ Central Western Shelf Transition; and
+ Central Western Shelf Province.

South-west Marine Region

+ Central Western Province;
+ Southwest Shelf Transition;
+ Southwest Transition;
+ Southwest Shelf Province;
+ Southern Province; and
+ Great Australian Bight Shelf Transition.

North Marine Region

+ Northwest Shelf Transition (as above);
+ Timor Transition; and
+ Northern Shelf Province.

Other IMCRA 4.0 bioregions of interest include: Christmas Island Province and Cocos (Keeling) Island Province.

The international waters of south west Indonesia and Timor-Leste (in part) are also included in the combined EMBA and described where relevant throughout this document.

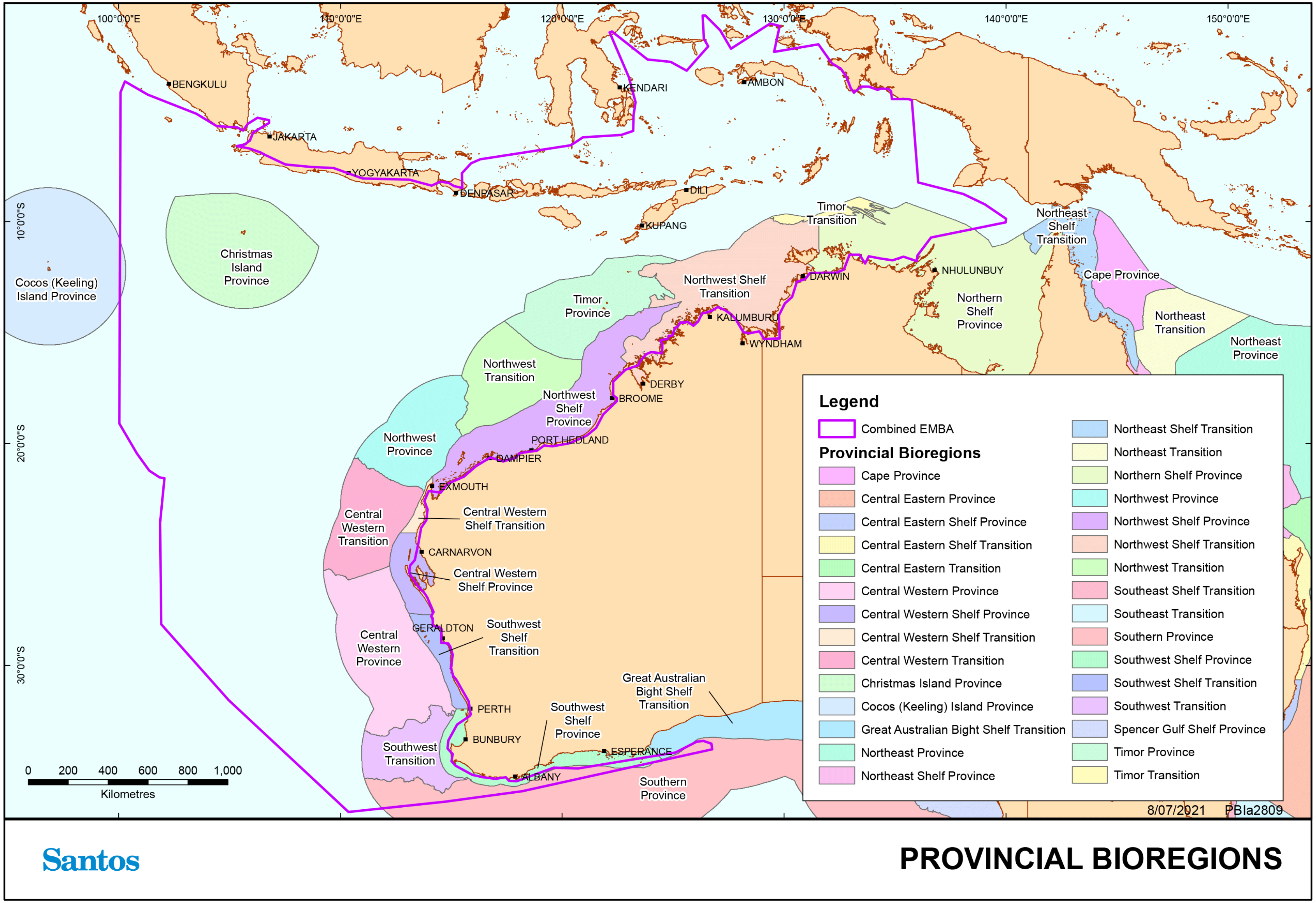


Figure 1-1: EMBA within IMCRA 4.0 Provincial Bioregion

2. Physical Environment

2.1 Geomorphology

2.1.1 Formation History

Approximately 550–160 million years ago, 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 development of an extensive basin that became the site for deposition of sediments (Baker *et al*. 2008 in Department of the Environment, Heritage, Water and the Arts (DEWHA) 2008a). Approximately 135 million years ago the continent broke up resulting in the separation of greater India and Australia. Ocean spreading associated with the continental break-up resulted in the creation of the Argo and Cuvier abyssal plains. Subsidence of the rifted margin resulted in the formation of the Exmouth and Scott plateaux and the Rowley Terrace. The narrow shelf south of North West Cape was formed approximately 130 million years ago as a result of the separation of India and seafloor spreading (Baker *et al*. 2008 in DEWHA 2008a).

The South-west region has been relatively stable throughout its recent geological past. This has shaped a continental shelf that has high wave exposure and is punctuated with coastal features such as island groups and fringing coastal reefs providing sheltered habitats for marine communities (2008a).

2.1.2 Present Day Geological Features

The EMBA consists of five major landform features: continental shelf, continental slope, continental rise, Exmouth plateau and abyssal plain. The majority of the area consists of either continental shelf or continental slope (DEWHA 2008a).

Limited surveys have shown that the continental slope in the combined EMBA comprises diverse geological features such as canyons, plateaux, terraces, ridges, reefs, banks and shoals (DEWHA (2008) (Figure 2-1 and Figure 2-2). These features are significant in that over half of the total area of banks and shoals across Australia's entire marine jurisdiction occurs in the Commonwealth waters from the South Australian border to the Northern Territory border, as well as 39% of terraces and 56% of deeps, holes and valleys (DEWHA 2008a).

An important characteristic of the combined EMBA is the significant narrowing of the continental shelf around North West Cape from the broad continental shelf in the north (Figure 2-3). For example, in the Joseph Bonaparte Gulf (at the NT boundary), the continental shelf is around 400 km wide, whereas at North West Cape the shelf is only 7 km wide – the narrowest of anywhere on the Australian continental margin (DEWHA 2008a). Shelf width affects oceanography with flow on effects to productivity and ecosystem functioning.

The continental shelf north of Cape Leveque is characterised by a rimmed ramp where the waters over the outer margins of the shelf (approximately 50 to 100 m waters depth) are shallower than the middle portions (up to 150 m water depth). The rim at its outer edge is the site of a number of coral reefs including Ashmore, Cartier, Scott and Seringapatam (DEWHA 2008a).

The Indonesian archipelago lies between the Pacific and Indian oceans, and bridges the continents of Asia and Australia. The archipelago is divided into several shallow shelves and deep-sea basins.

Several geomorphic formations within the combined EMBA have been associated with Key Ecological Features (DEWHA 2008a) and these are discussed in Section 10.

2.1.3 Southwest Transition

The Southwest Transition is an offshore deep-water bioregion with a submerged continental fragment as its dominant seafloor feature – the Naturaliste Plateau. The Plateau extends across an area of 90,000 km^2 of which only 29,825 km^2 is within Commonwealth waters. It is located west of Cape Leeuwin and Cape Naturaliste in water depths ranging from 2,000–5,000 m. It is relatively flat with a slight northward dip, and has steep southern and western sides and a more gently sloping northern side. The Plateau is separated from the Australian continent by the Naturaliste Trough and two offshore terraces on the continental slope (average depth 780 m). Submarine canyons incise the northern parts of the slope and parts of the Naturaliste Plateau.

2.1.4 Southwest Shelf Province

The Southwest Shelf Province consists of an area of narrow continental shelf from Rottnest to Point Dempster. For the purposes of this document (EMBA), the northern and western limits of the bioregion are the main focus because it is this portion that falls within the combined EMBA, which are an extension of the seafloor described in the Southwest Shelf Transition (below). It includes features such as limestone ridges, depressions defining an inshore lagoon and a relatively smooth inner shelf plain that meets the South Bank Ridge on the outer shelf, and islands providing important habitat, such as Rottnest Island. The shelf progressively broadens to form the relatively sheltered waters of Geographe Bay before narrowing once again at Cape Mentelle. Within this region lies the Albany canyon system, which contains Bremer Canyon on the south-west coast of Australia. Together with the adjacent shelf break, these canyon systems have been labelled as a ‘key ecological feature’ in the South-west Marine Region (DoNP 2017) due to high productivity and aggregations of cetaceans, including humpback whales (Megaptera novaeangliae), southern right whales (Eubalaena australis), and killer whales (Jones *et al.,* 2019). In particular, Bremer Canyon is known to support periodic sub-surface upwelling, which increases nutrients and sustains higher phytoplankton abundance and primary productivity (Baumgartner 1997). This in turn supports higher abundances of zooplankton, fish, seabirds and cetaceans (Moors-Murphy 2014).

2.1.5 Southwest Shelf Transition

This bioregion consists of a narrow continental shelf, ranging from approximately 40-80 km wide that is noted for its physical complexity. It includes a series of nearshore ridges and depressions that form inshore lagoons, a smooth inner shelf plain, a series of offshore ridges and a steep, narrow outer shelf. The near-shore ridges are formed by eroded limestone reefs and pinnacles that stand 10-20 m above the seafloor. The edge of the inner shelf plain is marked by a series of broken offshore ridges that extend north to the northern limits of the bioregion, where they emerge to support the tropical carbonate reef growth of the Houtman Abrolhos Islands (DEWHA, 2008b).

2.1.6 Southern Province

The Southern Province is the largest bioregion within Australia’s waters stretching from the shelf break south of Kangaroo Island to the southern edge of the Naturaliste Plateau. The bioregion includes the deepest ocean areas within the Australian Exclusive Economic Zone (approximately 5,900 m maximum water depth) and consists of a long continental slope incised by numerous well-developed submarine canyons. Several key ecological features are present within the combined EMBA and include the Albany Canyons Group, the Ceduna and Eyre Terraces (covering approximately 147,150 km^2) and the Diamantina Fracture Zone.

2.1.6.1 Great Australian Bight

The Great Australian Bight Shelf Transition is characterised by the largest seafloor feature of the Region – an extensive flat continental shelf covering 177,130 km^2. The centre of the shelf reaches widths of 260 km narrowing to 80 km at its margins. Geomorphology, sedimentology and hydrodynamics interact to create ideal conditions for carbonate organisms such as molluscs and bryozoans to flourish without being smothered or buried. As a result, carbonate sediments derived from invertebrate skeletons and shells make up over 80 per cent of shelf sediments, making the Bight part of the world's largest modern cool-water carbonate bioregion that extends along Australia's southern margin. Within the wave abrasion zone (0-120 m) sediments are typically rippled and coarse grained, forming a 'shaved shelf' where carbonate accumulation is less than the amount of active erosion and therefore there is a net loss of sediment from the shelf (DEWHA, 2008b).

2.1.7 Central Western Province

This bioregion is characterised by a narrow continental slope that is heavily incised by many submarine canyons as far north as Kalbarri. The Perth Canyon, located at the southern margin of the bioregion, is an order of magnitude larger than any other canyon in the Region (Figure 2-2 and Figure 2-3). The Perth Canyon, formed by erosive processes associated with the ancient Swan River, cuts into the continental shelf at approximately the 150 m depth contour, north-east of Rottnest Island. Other relatively large canyons, such as the Murchison Canyon, occur in the bioregion but little is known about them as they have not yet been studied (DEWHA, 2008b).

The bioregion contains the most extensive area (52,185 km^2) of continental rise on the Australian margin. The continental rise is located on the edge of the Perth Abyssal Plain (103,911 km^2). There is a large terrace known as the Carnarvon Terrace on the continental slope, extending north from the Houtman Abrolhos Islands at an average of 780 m water depth (DEWHA 2008b).

2.1.8 Central Western Shelf Province

This bioregion is located on the Dirk Hartog Shelf and is generally very flat. It varies in width from less than 20 km in the north to around 125 km in the vicinity of Shark Bay. A small area of reef and tidal sandwaves or sandbanks occur at the entrance to Shark Bay and within its vicinity. Other topographic features of the bioregion include a deep hole and associated area of banks and shoals offshore of Kalbarri. The banks and shoals in this bioregion are of note because they occur at latitudes significantly south of banks and shoals elsewhere in the North-west Marine Region (DEWHA, 2008a).

2.1.9 Central Western Transition

The Central Western Transition is characterised by large areas of continental slope, with sediments dominated by muds and sands that decrease in grain size with increasing depth. The slope is incised by numerous topographic features such as terraces (i.e. the Carnarvon Terrace), canyons (i.e. Cloates Canyon and Carnarvon Canyon) and rises. A large part of the bioregion consists of the Cuvier Abyssal Plain. The Wallaby Saddle is another important feature of this bioregion and it is the most extensive area of this type of topographic feature in the North-west Marine Region (DEWHA, 2008a).

2.1.10 Central Western Shelf Transition

The Central Western Shelf Transition is located entirely on the continental shelf and is comprised mainly of sandy sediments. The close proximity of the coast to the shelf break is a significant feature of this bioregion and is an important factor in determining its biodiversity (DEWHA, 2008a).

Ningaloo Reef is the most significant geomorphic feature in the bioregion. It extends south of North West Cape along the Cape Range Peninsula, and stretches for over 260 km. It is the only example in the world of an extensive fringing coral reef on the west coast of a continent (DEWHA, 2008a).

2.1.11 Northwest Province

The bioregion occurs entirely on the continental slope and is comprised of muddy sediments. It is distinguished by a number of topographic features, such as the Exmouth Plateau, terraces and canyons (including the Swan and Cape Range canyons), as well as deep holes and valleys on the inner slope. The Montebello Trough occurs on the eastern side of the Exmouth Plateau and represents more than 90 per cent of the area of troughs in the North-west Marine Region. Significantly, this bioregion contains the steepest shelf break of the North-west Marine Region, along the Cape Range Peninsula near Ningaloo Reef (DEWHA, 2008a).

2.1.12 Northwest Transition

The majority (52 per cent) of the Northwest Transition bioregion occurs on the continental slope, with smaller areas in the north-west of the bioregion located on the Argo Abyssal Plain and continental rise. The sediments of the slope are dominated by sands, whereas the sediments of the abyssal plain/deep ocean floor are dominated by muds. More than 60 per cent of the Argo Abyssal Plain occurs within this bioregion and much of the Northwest transition occurs in water over 4,000 m deep (DEWHA, 2008a).

Other topographic features within the bioregion include areas of rise, ridges, canyons and apron/fans. The bioregion also has reefs such as Mermaid, Clerke and Imperieuse reefs, which are collectively known as the Rowley Shoals (DEWHA, 2008a).

2.1.12.1 Northwest Shelf Province

The Northwest Shelf Province is located almost entirely on the continental shelf, except for a small area to the north of Cape Leveque that extends onto the continental slope. This bioregion includes more than 60% of the continental shelf in the North-west Marine Region (DEWHA, 2008a). The shelf gradually slopes from the coast to the shelf break, but displays a number of seafloor features such as banks/shoals and holes/valleys. These are thought to be morphologically distinct from other features of these types found elsewhere in the North-west Marine Region, and have a different sedimentology (DEWHA, 2008a). For example, the Glomar Shoals occur approximately 30–40 km offshore of Dampier in water depths of between 26–70 m and are distinguished by highly fractured molluscan debris, coralline rubble and coarse carbonate sand. The province also includes the Leveque Rise, a large plateau, and one of only two shelf plateaux within the North-west Marine Region (DEWHA, 2008a).

2.1.12.2 Northwest Shelf Transition

The Northwest Shelf Transition is predominantly located on the continental shelf with a small portion extending onto the continental slope causing waters in the area to be relatively shallow, only up to 330 m. It also consists of geomorphic features that are unique to the Northwest Shelf Transition and not found elsewhere in the North-west Marine Region (DEWHA, 2008a). An example of this is that 90% of the Region’s carbonate banks are located within the Northwest Shelf Transition (DEWHA, 2008a).

The Bonaparte Depression lies within the Northwest Shelf Transition, which is a 45 000 km^2 geomorphic basin that is the only occurrence of its type in the North-west Marine Region (DEWHA, 2008a). The Bonaparte Depression is a relatively flat feature with a higher content of mud and gravel than what is found elsewhere in the Northwest Shelf Transition and it has a number of pinnacles of which form the key ecological feature ‘pinnacles of the Bonaparte Basin’ (see Section 10.1.23).

2.1.12.3 Timor Province

The Timor Province is located on the continental slope. The notable topographical features include the Scott Plateau, the Ashmore Terrace and part of the Rowley Terrace and Argo Abyssal Plain (DEWHA, 2008a). Of these, the Scott Plateau is particularly significant with water depths of up to 3,000 m and being fringed by spurs and valleys (DEWHA, 2008a). The Scott Plateau is also separated from Rowley Terrace by canyons that are up to 50 million years old (DEWHA, 2008a).

The Timor Province encompasses almost half of the reefs in the North-west Marine Region, including Scott Reef, Seringapatam Reef and Ashmore Reef which are all within the combined EMBA (DEWHA 2008a).

2.1.12.4 Timor Transition

The Timor Transition is predominantly shelf terrace and slope, which extend into waters that are 200-300 m deep. The deepest point (300 m) is the Arafura Depression. The Timor Transition is also dominated by a series of canyons that represent a drowned river system from the Pleistocene era (DEWHA, 2008c). The canyons are approximately 80-100 m deep and up to 20 km wide (DEWHA, 2008c).

2.1.12.5 Northern Shelf Province

The Northern Shelf Province consists of large areas of relatively featureless sandy and muddy sediments (DWEHA, 2008c). A significant feature of the Northern Shelf Province is the Gulf of Carpentaria, which is outside the combined EMBA, the majority of the reefs in the Northern Shelf Province are also outside the combined EMBA and form a broken margin around the Gulf of Carpentaria. However, within the combined EMBA is the Arafura Shelf which is characterised by continental shelf, canyons, terraces, the Arafura Sill and the Arafura Depression (DEWHA, 2008c).

2.1.12.6 Christmas Island Province

This bioregion contains the 4th largest abyssal plain/deep ocean floor area and smallest area of slope of all the National Benthic Marine Bioregionalisation (NBMB) bioregions (DEH, 2005a). Due to the similar geomorphology and location adjacent to Indonesia in the tropical Indian Ocean, the fauna contained in this bioregion is probably similar or related to the fauna associated with the Cocos (Keeling) Island bioregion.

2.1.12.7 Cocos (Keeling) Island Province

This bioregion contains the largest abyssal plain/deep ocean floor area of all the NBMB bioregions and is the deepest NBMB bioregion on average due to the relatively large areas of abyssal plain/deep ocean floor (DEH, 2005b). Due to the similar geomorphology and location adjacent to Indonesia in the tropical Indian Ocean, the fauna contained in this bioregion is probably similar or related to the fauna associated with the Christmas Island bioregion. The Cocos basin comprises dominantly flat abyssal plain occurring at water depths around 5,500 km.

2.1.13 Sediments

Terrestrial environments are not a major source of sediment in the area and terrigenous sediments tend to be confined to the inner shelf (generally less than 100 m water depth), particularly in areas adjacent to rivers. Sediments in the area generally become finer with increasing water depth, ranging from sand and gravels on the shelf to mud on the slope and abyssal plain. Joseph Bonaparte Gulf is an exception to this pattern, as sediments with high mud content extend across the inner and mid shelf within the Gulf, graduating to sands and gravels in the Bonaparte Depression.

The distribution and resuspension of sediments on the inner shelf is strongly influenced by the strength of tides across the continental shelf as well as episodic events such as cyclones. Further offshore, on the mid to outer shelf and on the slope itself, sediment movement is primarily influenced by ocean currents and internal tides. Internal tides describe the tidal movement across a slope of water stratified by marked differences in density. Internal tides cause resuspension and net down-slope deposition of sediments on the North West Shelf (DEWHA 2008a).

Surveys conducted over the North West Shelf indicate that similar sediments occur extensively over this geographic region, but with spatial variation in the grain size and origin of the surface sediments.

The ecology of the southwest is also greatly influenced by the lack of river discharge into the Region. The few significant rivers adjacent to the Region flow intermittently and their overall discharge is low. The low discharge of rivers and the generally low rate of biological productivity also results in low turbidity (suspended sediments), making the waters of the Region relatively clear (McLoughlin & Young 1985). Surface sediments in the area are predominantly composed of skeletal remains of marine fauna, with lenses of weathered sands (McLoughlin & Young 1985).

Several geomorphic formations have been associated with Key Ecological Features (DEWHA 2008a) and these are discussed in Section 10.

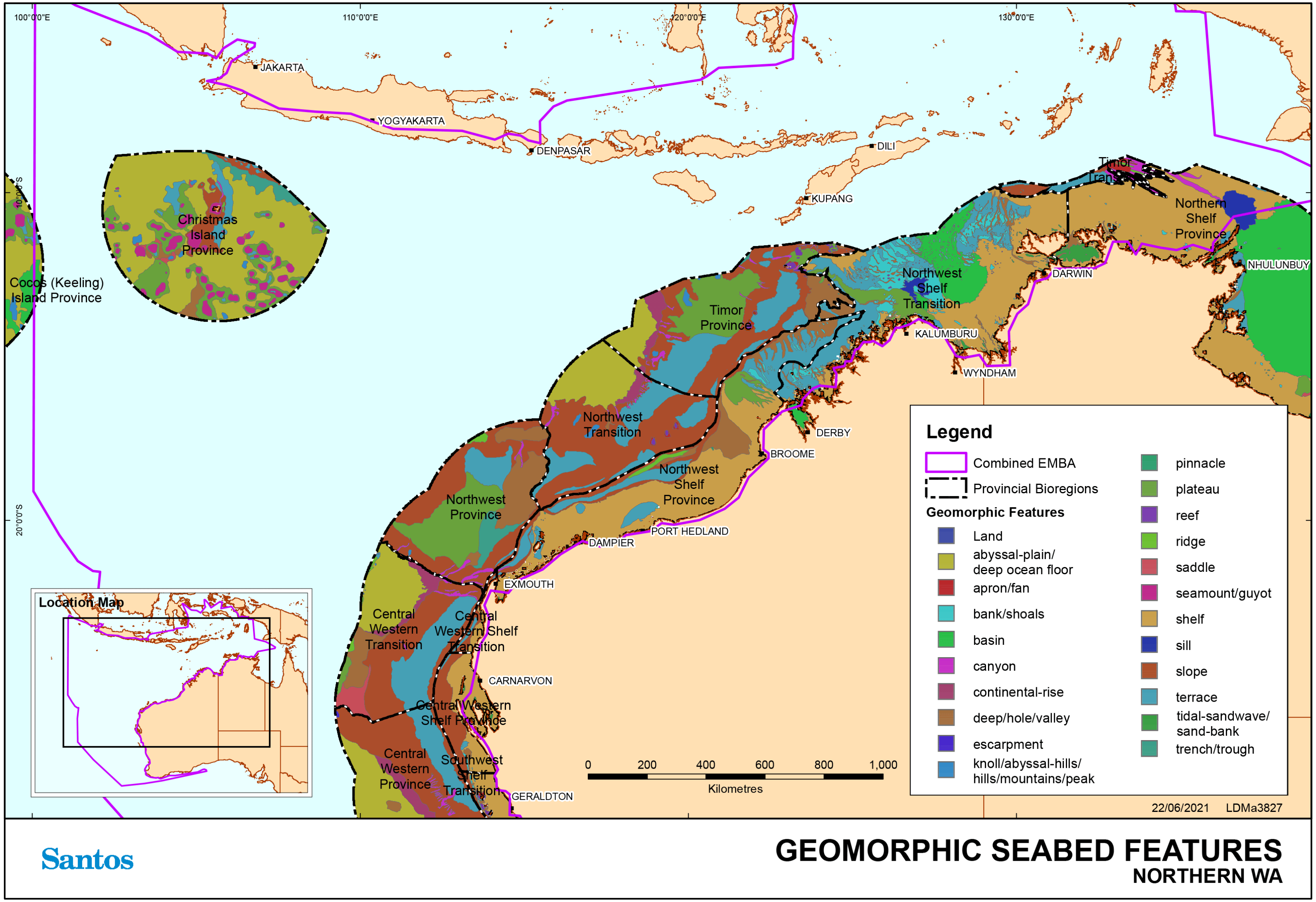


Figure 2-1: Geomorphic/seafloor features of Northern WA

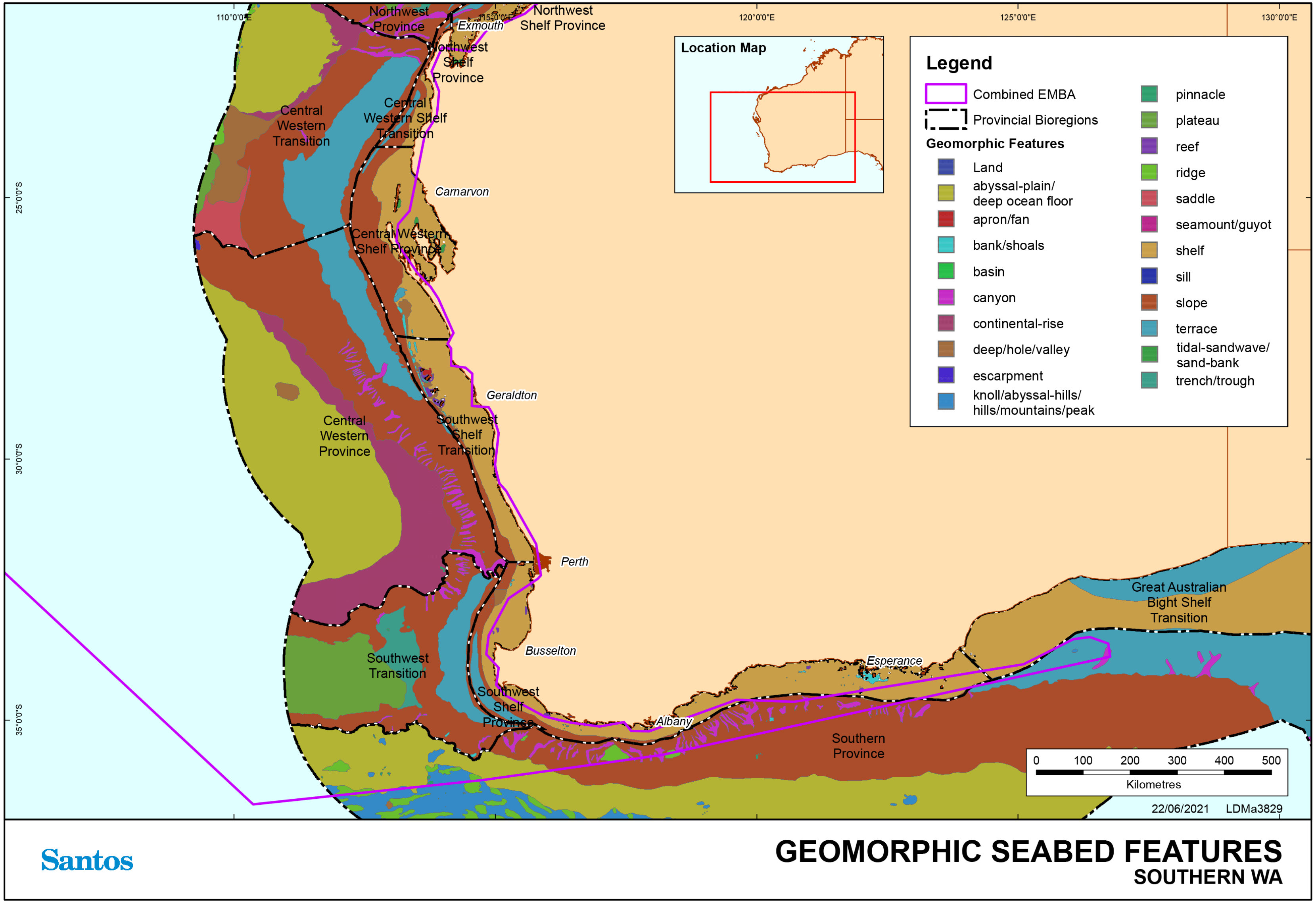
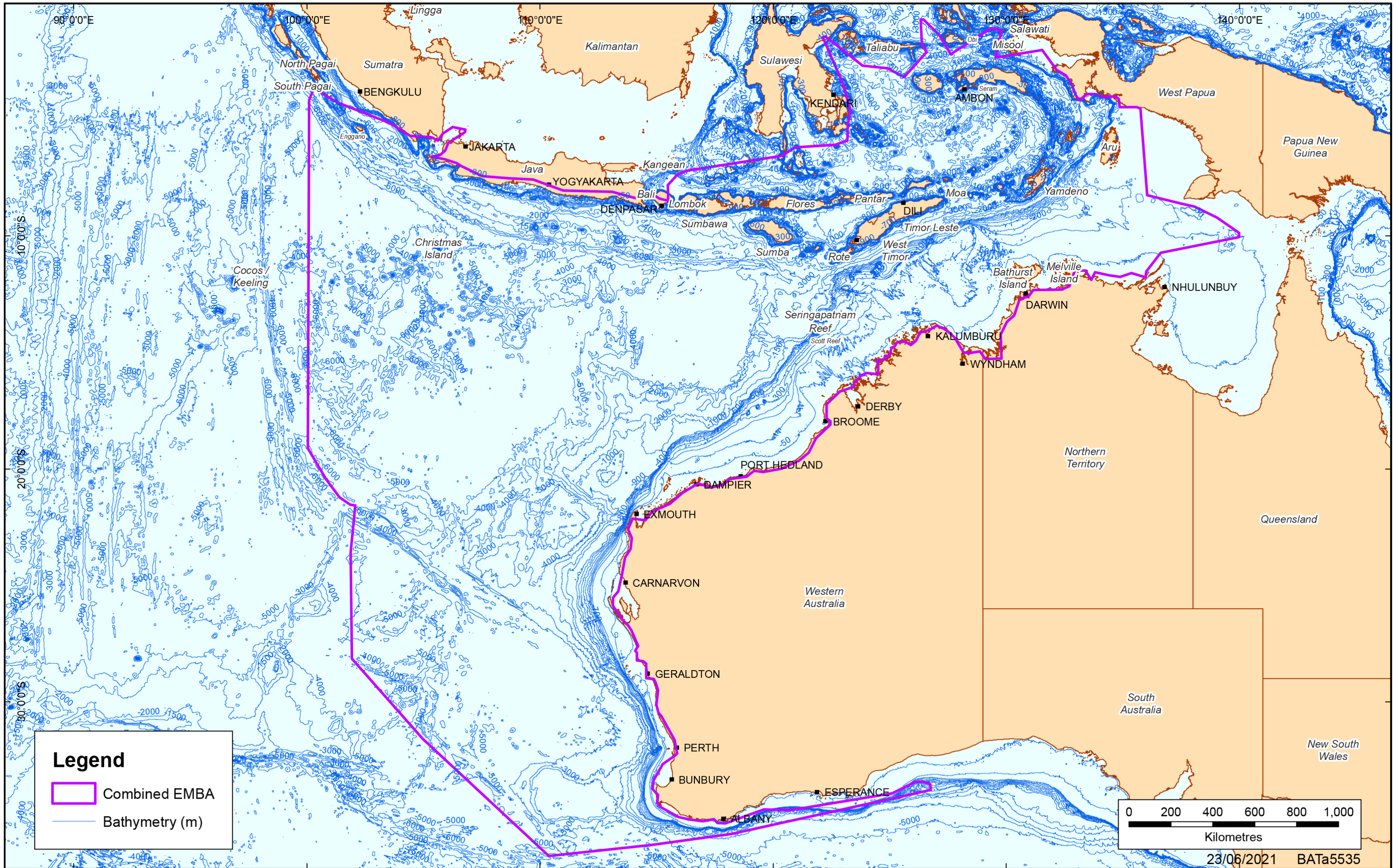


Figure 2-2: Geomorphic/seafloor features of Southern WA

Santos



Santos

BATHYMETRY

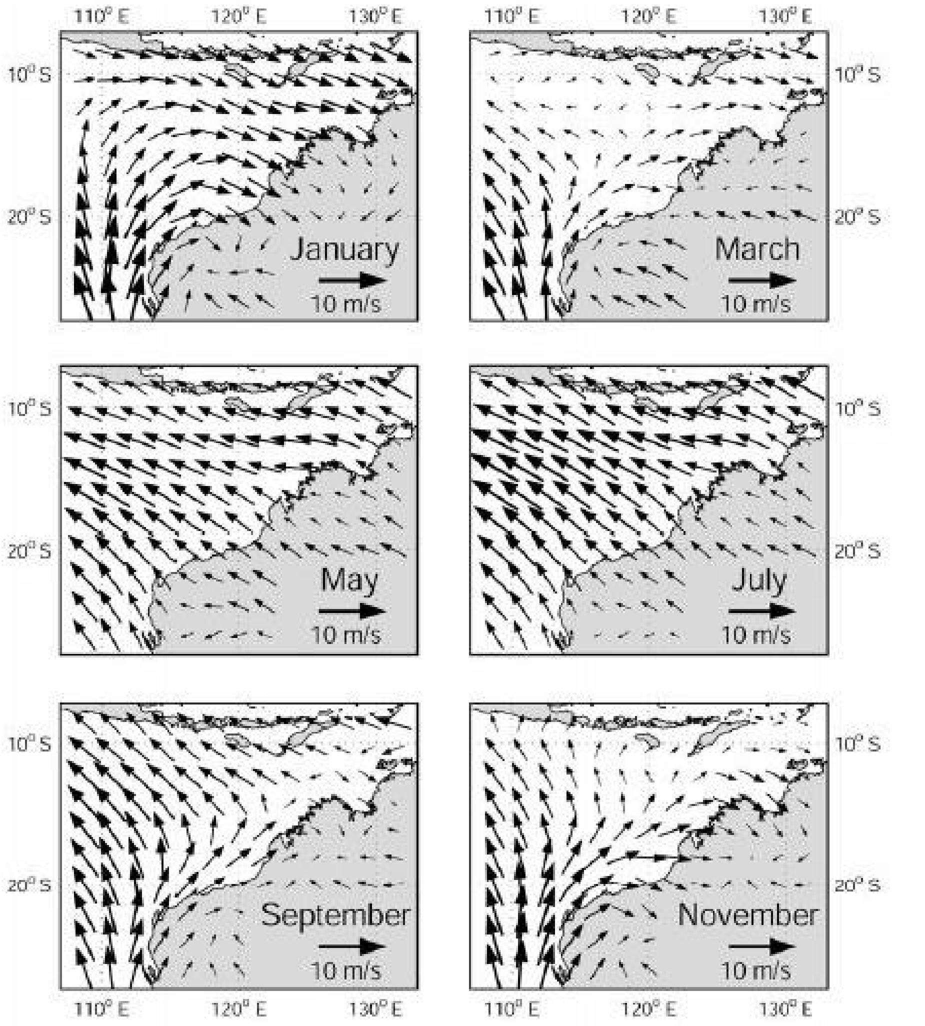
Figure 2-3: Bathymetry of the combined EMBA

2.2 Climate

Waters in northern Western Australia predominantly lie in the arid tropics, experiencing high summer temperatures and periodic tropical cyclones in summer. Rainfall in the region is low, although intense rainfall may occur during the passage of summer tropical cyclones and thunderstorms (Condie *et al.* 2006). Mean air temperatures range from a minimum of 11°C in winter to a maximum of 36°C in summer (Condie *et al.* 2006). Due to the arid climate, daytime visibility in the area is generally greater than 5 nautical miles (SSE 1991).

The summer and winter seasons fall into the periods September–March and May–July, respectively. Winters are characterised by clear skies, fine weather, predominantly strong east to southeast winds and infrequent rain (calculated from NCEP-NCAR dataset measured from 1982 to1999; Condie *et al.* 2006; Figure 2-4).

Summer winds are more variable, with strong south-westerlies dominating. Transitional wind periods, during which either pattern may predominate, can be experienced in April–May and September of each year.



Calculated from NCEP-NCAR dataset measured from 1982 to 1999. Source: Condie *et al.* (2006)

Figure 2-4: Seasonally averaged winds at 10 m above mean sea level

Tropical cyclones generate the most significant storm conditions in the area (SSE 1993). These clockwise-spiralling storms have generated wind speeds 50–120 knots (SSE 1991). Tropical cyclones develop in the eastern Indian Ocean, and the Timor and Arafura Seas during the summer months. Three to four cyclones per year are typical, with the official cyclone season being November through to April (Bureau of Meteorology (BoM) 2013). In Indonesia, the main variable in climate is not temperature or pressure, but rainfall, which varies greatly by month and place, ranging from 997 millimetres (mm) to 4,927 mm.

Waters in the southwest and southern Western Australia experience a Mediterranean style climate that is characterised by cool, wet winters and hot, dry summers. In winter, wind patterns are characterised by a prevailing westerly wind stream. This enables winter cold fronts and strong westerly winds to regularly penetrate the south-west, with cold fronts crossing the coast every week or so. Apart from the passage of storms, typically lasting one day or less, the weather is otherwise mild in winter with winds variable and relatively weak. In summer, cold fronts rarely penetrate into the south of the state with any strength and hot easterly winds prevail.

The Bonaparte Basin and Timor Sea region in the north has a tropical climate. These areas experience a distinct 'wet' season with summer monsoonal conditions from October to March and a distinct 'dry' season with cooler and drier conditions from April to September. The wet season usually comprises south-westerly winds capable of generating thunderstorm activity, high rainfall and cyclones. The dry season usually comprises dry and warm conditions with little rainfall (Fugro, 2015).

2.3 Oceanography

Major drivers of marine ecosystems include ocean currents, tides, waves, temperature and salinity. The dominant offshore sea surface current is the Leeuwin Current (Figure 2-5), which carries warm tropical water south along the edge of Western Australia's continental shelf, reaching its peak strength in winter and becoming weaker and more variable in summer (Condie *et al.* 2006). The current is typically located seaward of the shelf break (200 m isobath) and is a narrow, surface current, extending to a depth of 150 m (BHPB 2005, Woodside 2005) and a width of 50–100 km (DEWHA 2008a). The formation of meanders and eddies are also a feature of the Leeuwin Current and a number of eddies occur south of Shark Bay (DEWHA 2008a). The strength of the Leeuwin Current is influenced by seasonal variability in the pressure gradient (DEWHA 2008a). The Holloway Current is the prevailing seasonal current, travelling south-west along the north West Australian coast in winter and north-east in summer (Brewer et al. 2007). It is a relatively narrow boundary current that flows along the north-west shelf at between 100 m and 200 m depth, flowing towards the north-east in summer and the south-west in winter (Fugro, 2015).

The Indonesian Throughflow is the other important current influencing the upper 200 m of the outer North West Shelf (Woodside 2005). This current brings warm and relatively fresh water to the region from the western Pacific via the Indonesian Archipelago (Figure 2-5). Modelling undertaken by Woodside and Commonwealth Scientific and Industrial Research Organisation (CSIRO) Marine and Atmospheric Research indicates that significant east–west flows occur across the North West Shelf to the north of the North West Cape, possibly linking water masses in the area (Woodside 2005, Condie *et al.* 2006).

Currents in the coastal zone and over the inner to mid-shelf are largely driven by tides and winds, whereas offshore, over the continental shelf, slope and rise are influenced by large scale regional circulation (DEWHA 2008a). Large-scale currents of the Timor and Arafura seas in the north are dominated by the Indonesian Throughflow. Christmas and Cocos (Keeling) Islands territories are located in the eastern Indian Ocean, in the path of the South Equatorial Current that carries the Indonesian Throughflow waters into the Indian Ocean.

The nearshore Ningaloo Current flows northwards opposite to the Leeuwin Current, along the outside of the Ningaloo Reef and across the inner shelf from September to mid-April (BHPB 2005, Woodside 2005). The nearshore Capes Current, which is to the south of the Ningaloo Current, is a seasonal current that appears strongest between Cape Leeuwin and Cape Naturaliste, in the southwest of Western Australia (Pearce and Pattiaratchi 1999). Strong northwards winds between November and March slow the Leeuwin Current and increase the strength of the Capes Current. Localised upwelling is also known to occur in the area (Pearce and Pattiaratchi 1999).

Tides increase in amplitude from south to north, corresponding with the increasing width of the shelf (Holloway 1983). Tides in the area are generally semi-diurnal (i.e. two high tides and two low tides per day) with a spring/neap cycle. The northern area experiences some of the largest tides in the world. In the Kimberley, the daily tidal range is up to 10 m during spring tides and less than 3 m during some neap tides. Mid-shelf tidal currents are predicted to have average speeds of approximately 0.25 knots during neap tides and up to 0.5 knots during spring tides (NSR 1995, WNI 1995).

The wave climate in the northwest is composed of locally-generated wind waves (seas) and swells that are propagated from distant areas (WNI 1995). In summer the seas typically approach from the west and southwest, while in winter the seas typically approach from the south and east. Mean sea wave heights are typically less than 1 m and peak heights of less than 2 m are experienced in all months of the year (WNI 1995). 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).

Indonesian waters, especially the eastern part of the archipelago, play an important role in the global water mass transport system, in which warm water at the surface conveys heat to the deeper cold water in what is known as the great ocean conveyor belt (refer Figure 2-5). The eastern archipelago is the only place in the Pacific Ocean that connects with the Indian Ocean at lower latitudes. The water mass transport from the Pacific to the Indian Ocean through various channels in Indonesia is called Arlindo (Arus Lintas Indonesia), also known as the Indonesian Throughflow (ADB 2014). Surface currents in Indonesian waters are more strongly influenced by circulation from the Pacific Ocean than from the Indian Ocean. The currents are also greatly influenced by the winds of the prevailing monsoon.

Average swell heights are low, around 0.4–0.6 m in all months. The greatest exposure to swells is from the west (SSE 1993). Tropical cyclones have generated significant swell heights of up to 5 m in this area, although the predicted frequency of swells exceeding 2 m is less than 5% (WNI 1996). In the open ocean, sustained winds result in wind-forced currents of approximately 3% of the wind speed (Holloway & Nye 1985).

Tides in the South West Capes area are mixed (i.e. diurnal and semi-diurnal) and generally less than one metre, with a typical daily range of about 0.7 m during spring tides and about 0.5 m during neap tides. Tides of this magnitude produce weak currents compared to wind and wave driven flows (Hill & Ryan 2002 cited in Department of Environment and Conservation (DEC) 2013).

Waters on the continental shelf are usually thermally-stratified, with a marked change in water density at approximately 20 m (SSE 1993). Surface temperatures vary annually, being warmest in March (32°C) and coolest in August (19°C). Vertical gradients are related to the seasonality of sea surface temperatures, and are greatest during the warm-water season (SSE 1991). Near-bottom water temperature on the North West Shelf is approximately 23°C, with no discernible seasonal variation.

Salinity is relatively uniform at 34–35 ppt throughout the water column and across the North West Shelf. Due to the low rainfall there is little freshwater run-off from the adjacent mainland (Blaber *et al*. 1985).

Pronounced shifts in water column characteristics can occur following the passage of tropical cyclones (McKinnon *et al*. 2003). Changes in water temperature and salinity characteristics can result from changes in local heating and evaporation following the southward movement of warmer water due to southward-moving cyclones, and can have flow-on effects to primary and secondary productivity (McKinnon *et al*. 2003).

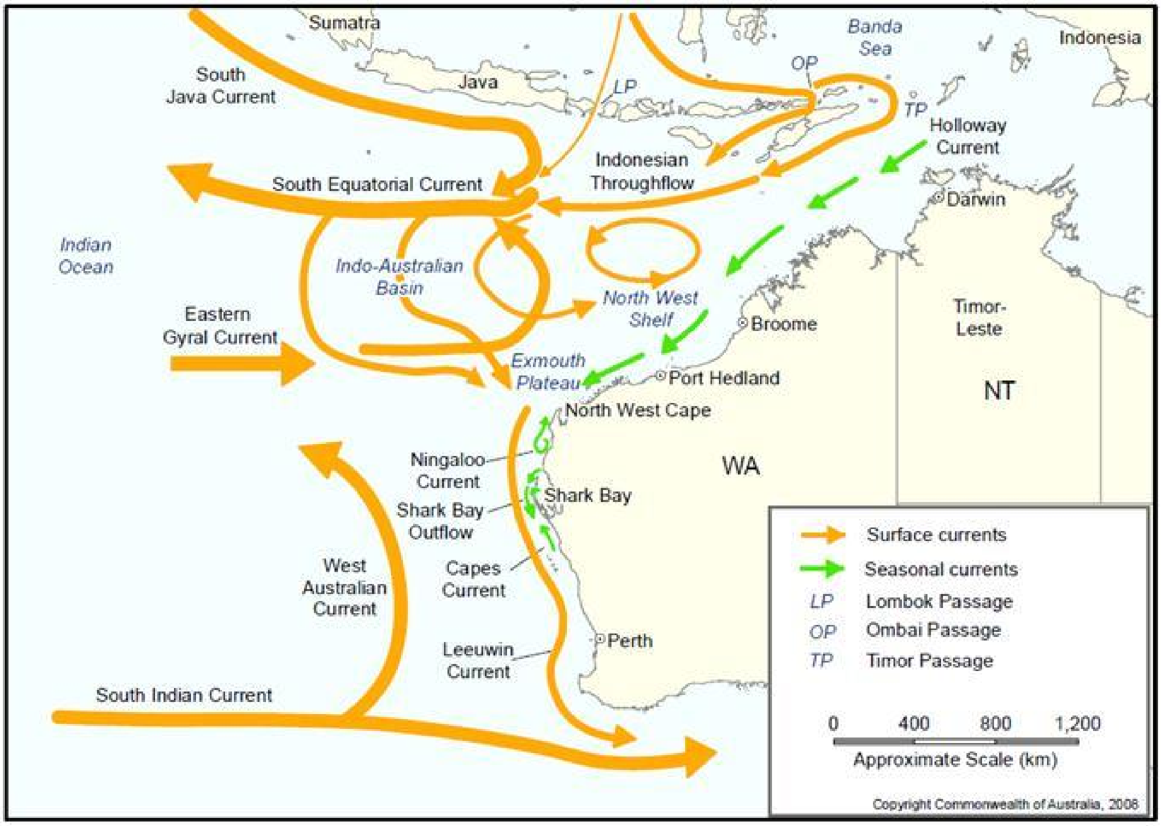


Figure 2-5: Surface currents in the Northern Territory and Western Australia

Source: DEWHA (2008b)

3. Benthic and Pelagic Habitats

Benthic habitats are defined as those subtidal habitats lying below the lowest astronomical tide (LAT). The benthic habitats within waters in the combined EMBA lie at depths ranging from LAT down to more than 6,000 m at Argo and Cuvier abyssal plains (DEWHA 2008a, 2008b, 2008c).

Benthic habitats are partially driven by light availability. Primary producers (photosynthetic corals, seagrasses and macroalgae) are limited to the photic zone, whereas benthic invertebrates including filter feeding communities may be found in deeper waters. The depth of the photic zone varies spatially and temporally and is predominantly dependent on the volumes of suspended material in the water column. The photic zone in the offshore Pilbara is approximately 70 m whereas in oceanic waters in the northwest and coastal waters of the southwest the photic zone may extend to 120 m (DEWHA 2008b). The photic zone in the offshore north extends to 100 m (DEWHA 2008c).

The following section broadly categorises benthic habitats as four biological communities; coral, seagrasses, macroalgae and non-coral benthic invertebrates. These communities are discussed in terms of the 18 IMCRA v. 4.0 bioregions. Some broad scale benthic habitat mapping exists for the Northwest and Central Western Shelf Provinces and this is shown in Figure 3-1.

3.1 Coral Reefs

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 (Conservation and Land Management (CALM) & Marine Parks and Reserves Authority (MPRA) 2005a).

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 also important for protection of coastlines through accumulation and cementation of sediments and dissipation of wave energy (CALM & MPRA 2005a).

The waters in the combined EMBA contain extensive coral communities. Coral reefs in the area fall into two general groups: the fringing reefs around coastal islands and the mainland shore; and large platform reefs, banks and shelf-edge atolls offshore (Woodside 2011). The distribution of corals in area is governed by the availability of hard substrate for attachment and light availability.

Coral reefs are dynamic environments that regularly undergo cycles of disturbance and recovery. Depending on how frequent and severe the disturbances are, recovery can take a few years or more than a decade. Disturbances can include bleaching, cyclones and disease outbreaks (Australian Institute of Marine Science (AIMS) 2011).

Corals in the northwest and central provinces have experienced bleaching events and subsequent recovery. Bleaching is the process where symbiotic algae are expelled from the coral tissue, often leading to the death of the colony. Causes of bleaching include high temperatures (Ningaloo; 2011 and Scott Reef; 1998 and 2016) (information available at AIMS.gov.au), anoxic conditions (Bill's Bay; 2008) or smothering (Waples & Hollander 2008, Gilmour et al. 2013). Coral susceptibility to bleaching and their ability to recover is an important consideration in the context of potential anthropogenic impacts.

Three bioregions (Northwest Province, Central Western Province and Central Western Transition) lie in deep waters below the photic zone. Two bioregions (Southwest Transition and Southern Province) occur in waters that are too cold to support tropical coral reefs species. Photosynthetic corals are not present in either of these locations and hence these bioregions are not discussed further. The EMBA overlaps the deeper waters of the Cocos (Keeling) Island Province, (not those close to shore) which are greater than 4000m deep and therefore photosynthetic corals are not present.

3.1.1 Southwest Shelf Transition

The coral reefs of the Houtman Abrolhos Islands are the most southern extensive coral community along the west coast. Smaller localised pockets do occur as far south as Rottnest Island and even extend to Cape Naturaliste in the Southwest Shelf Province. The reefs around the Abrolhos Islands comprise 211 known species of corals and all but two of the coral species are tropical (Department of Fisheries (DoF) 2012). The greatest diversity and density of corals is found on the reef slopes, shallow reef perimeters and lagoon patch reefs in the more sheltered northern and eastern sides of each of the three limestone platforms that support the island groups (DoF 2012).

3.1.2 Southwest Shelf Province

The Southwest Shelf Province is a nearshore bioregion that extends from Rottnest Island to Point Dempster, approximately 185 km east of Esperance. Adjacent to Commonwealth waters, the extensive area of granite reef (35 203 km2 of reef habitat) and seagrass habitat of the Recherche Archipelago is noted for its high diversity of warm temperate species including 263 known species of fish, 347 known species of molluscs, 300 known species of sponges, and 242 known species of macro-algae (DEWHA, 2008a).

3.1.3 Great Australian Bight Shelf Transition

Few species of scleractinian and soft coral (Orders Stolinifera, Telestacea and Alcyonacea) occur in southern Australia. Three reef-building species occur in shallow waters and >50 species of non-reef-building (ahermatypic) species occur in waters up to 900 m deep. The distribution patterns of corals in the GAB are largely unknown (McLeay et.al, 2003).

3.1.4 Central Western Shelf Province

The Central Western Shelf Province occurs on the continental shelf between Coral Bay and Busselton and is generally flat with depths ranging from 0–100 m. The province includes Shark Bay and Bernier, Dorre and Dirk Hartog Islands.

Studies at Shark Bay recorded 80 species of coral (Marsh 1990). The study determined that salinity and seasonal temperature gradients restrict the distribution of corals to areas that have normal salinity in the western half of the Bay, a few species occur in the metahaline waters but none in the hyper saline areas (Marsh 1990). The eastern shores of Bernier, Dorre and Dirk Hartog Islands provide the most favourable habitats for coral growth due to shelter, and water with relatively small salinity and temperature fluctuations. Some sections of these islands support prolific coral growth (up to 100% cover) both in the sheltered leeward and exposed areas. This bioregion is a transitional zone between the predominantly tropical flora and fauna of the north and temperate flora and fauna further south (CALM & NPNCA 1996).

3.1.5 Central Western Shelf Transition

A significant proportion of this bioregion is covered by the Ningaloo Reef. The Ningaloo Reef is unique in that it is the largest fringing reef in Australia and is the only large reef found on the western side of a continent in the southern hemisphere.

A 300 km section of the coast, from Red Bluff to North West Cape and extending to Bundegi in Exmouth Gulf, is included in the Ningaloo Marine Park. Ningaloo Reef supports variable lagoonal, intertidal and subtidal coral communities along its length. Ningaloo Reef is characterised by a high diversity of hard corals with at least 217 species representing 54 genera of hermatypic (reef building) corals recorded to date (Veron &

Marsh 1988). The most diverse coral communities are found in the shallow relatively clear water, high energy environment of the fringing barrier reef and low energy lagoonal areas to the west of North West Cape (CALM & MPRA 2005a).

Coral diversity reduces with increasing depth, and corals are uncommon at depths greater than 40 m (Waples & Hollander 2008). At depths between 20 and 30 m hard corals have been found to be more dominant in the northern areas of the Ningaloo Marine Park, whereas in southern areas other sessile invertebrates such as sponges, are more prevalent (Waples & Hollander 2008).

3.1.6 Northwest Transition

This bioregion lies mostly over the continental slope and the abyssal plain in deep waters that preclude photosynthetic coral growth (DEWHA 2008a). However, in contrast with the surrounding area, the Rowley Shoals are three distinct reef systems (Mermaid, Clerke and Imperieuse Reefs) approximately 30–40 km apart that rise vertically to the surface from depths of between 500 and 700 m. The marine reef fauna of the Rowley Shoals is considered to be exceptionally rich and diverse, including species typical of the oceanic coral reef communities of the Indo-West Pacific. As many of these species are not found in the inshore tropical waters of northern Australia, such populations are of regional significance (DEWHA 2008a).

A 1993 survey at Mermaid Reef recorded 214 species of scleractinian corals (Done *et al*. 1994) which is comparable to a more recent survey recording 211 species, including 22 new distribution records (McKinney 2009). The Rowley Shoals system has maintained high coral cover and has not been impacted by mass bleaching, despite neighbouring bleaching events reported at Scott reef during 1998 and 2016 (Gilmour *et al., 2021*). Since 1997, mean coral cover has increased through periods of impact and recovery from cyclones, reaching the highest (71%) on record in 2017 (Gilmour *et al.* 2019). The survey found that coral assemblages of the Rowley Shoals are broadly comparable to those found on the reefs of the outer Great Barrier Reef and in the Coral Sea. While the coral fauna is similar to Scott Reef, it differs considerably from that of north-western Australia (Veron 1986). Veron (1986) notes that the clear water of the Rowley Shoals allows coral communities to exist over a great range of depths, while the strong wave action on the outer coral slopes and the wide tidal range result in distinct patterns of zonation.

Recent genetic studies have also shown distinct genetic differences between offshore reef systems, the inshore macrotidal Kimberley region and Ningaloo Coast World Heritage Area reefs (Adam et al. 2022, Gilmour et al. 2016, Underwood 2009, Underwood et al. 2020). This is likely a result of their isolation, with negligible supply of larva from other reefs (Adam et al. 2022, Thomas et al. 2017). These studies highlight the importance of local recruitment in offshore reef systems in order to maintain healthy coral populations, which may reduce their capacity to adapt to rapid environmental change.

3.1.7 Northwest Shelf Province

This province contains numerous small coastal islands in addition to larger archipelago and offshore island groups. Many of these features are surrounded by shallow waters with small barrier and fringing reefs that support coral communities. Key areas recognised for coral communities in this bioregion are discussed below.

The Dampier Archipelago supports coral reefs in shallow waters near islands and submerged pinnacles. The most significant coral reefs have formed along the seaward slopes of Delambre Island, Hamersley Shoal, Sailfish Reef, Kendrew Island and north-west Enderby Island (CALM & MPRA 2005). Field trips in the Dampier Archipelago between 1972 and 1998 recorded 229 species of corals from 57 genera (Griffith 2004). Surveys of the Dampier Port and inner Mermaid Sound recorded approximately 120 coral species from 43 genera (Blakeway & Radford 2005) with coral reefs dominated by acroporids and pocilloporids. The greatest coral cover (up to 70%) was recorded in the eastern half of the archipelago (Wells *et al.* 2003).

The Montebello, Lowendal and Barrow Islands include 315 islands associated with extensive coral reefs, the most significant of which occur in the sheltered waters on the eastern side of the islands. Examples of these significant reefs include Dugong Reef, Batman Reef and reefs along the Lowendal Shelf (DEC & MPRA 2007a). Dominant corals include acroporids and poritids, with greater than 70% cover recorded for some areas (Chevron 2010). Subtidal coral reef communities around the islands are highly diverse, with at least 150 species of hard corals recorded from fringing and patch coral reef areas (DEC & MPRA 2007a).

Coral distribution near the mainland is restricted by lack of light due to natural turbidity. Corals may exist as sparse coral colonies in some locations, rather than extensive coral communities. Within Exmouth Gulf, coral communities are less common but are present on fringing reefs surrounding islands, as solitary corals distributed across areas of hard substrate, or on larger isolated patch reefs.

An epibenthic dredge survey of nearshore areas north of Broome identified 14 species of hard corals from six families (Keesing *et al*. 2011). Limited coral surveys conducted at Broome (15 species) and the Lacepede Islands (ten species) (Veron & Marsh 1988) suggest the species diversity in this locality may be low. However, low species diversity observed during the dredge survey may reflect the limited sampling frequency, limited depth range (11–23 m) or inadequate sampling in habitats considered favourable for the proliferation of hard corals (hard substrate). In contrast, other surveys of nearshore locations in the region have recorded much higher levels of species diversity. Veron and Marsh (1988) stated that 102 species of hard corals have been recorded from the Kimberley coast and nearshore reefs and Cairns (1998) recorded 87 species of azooxanthellate hard coral species from north-western Australian waters.

3.1.8 Northwest Shelf Transition

Coral communities of the Northwest Shelf Transition have historically not been well studied. However, based on the scale of reef development and the diversity of coral species recorded through limited surveys, it is highly likely that further surveys will demonstrate that the Kimberley contains a coral reef province of global significance (Masini *et al*. 2009).

Coral reefs in the province include fringing reefs around coastal islands and some mainland shores. Development of coral communities in inshore areas is limited due to persistent high turbidity. Known examples of coral reefs in the bioregion are given below, however further mapping is required.

Benthic habitat surveys at Adele and Long Islands in 2009 and 2010 revealed extensive development of hard and soft coral communities (Richards *et al*. 2013). Scleractinian coral communities at Adele Island were diverse, supporting 176 species in intertidal and subtidal areas up to 14 m depth. At Long Island approximately 200 species of scleractinian corals were recorded in intertidal and subtidal areas. These surveys also identified two significant and unique habitats; a zone of mixed corallith and rhodolith habitat at Adele Island and an Organ Pipe Coral habitat zone with unusually high benthic cover at Long Island (Richards *et al*. 2013).

Studies by DBCA and the LNG industry indicate that fringing and emergent coral reefs are well developed in the Heyward island group, around islands in the Bonaparte Archipelago, and off mainland shores of Cape Voltaire and Cape Bougainville. Surveys by INPEX of Maret, Bethier and Montalivet islands, which were largely restricted to the intertidal zone, have recorded 280 species of coral from at least 55 genera, making the Kimberley Bioregion the most coral-diverse area in WA (INPEX 2008).

Montgomery Reef has been identified as a key feature in the area. Montgomery Reef is a huge, submerged rock platform covering approximately 400 km^2. Corals occur in the subtidal area around Montgomery Reef, and in the many rock pools on the platform where there is shaded from the sun by algae or rock ledges

(DEWHA 2008a). A survey of benthic habitats at Montgomery Reef was conducted in 2009 by AIMS but a literature search found no published results from this survey (AIMS 2014).

Browse Island is surrounded by a minor fringing coral reef. Assemblages at Browse Island are characteristic of coral platform reefs throughout the Indo-West Pacific region, particularly Cartier Island. Coral diversity was greatest on the reef faces and shallow lagoons, but these areas were of very limited extent (URS 2010a).

Hard corals have been recorded at Echuca Shoals, but the community was low in both species richness and abundance (URS 2010a). The presence of occasional large outcrops suggests that larger coral structures have occurred previously and may still occur elsewhere on the shoal (RPS Environmental 2008).

3.1.9 Timor Province

Although water depths in this province are generally deep (200 m to almost 6,000 m) there are several reefs and islands that are regarded as biodiversity hotspots (DEWHA 2008a).

Ashmore Reef, Cartier Island, Hibernia, Scott and Seringapatam Reefs are areas of enhanced local biological productivity, within an area of relatively unproductive waters. Ashmore Reef National Nature Reserve supports one of the greatest number of coral species of any reef off the West Australian coast, with 255 species of reef-building corals in 56 genera (Veron 1993). Taxonomic revisions and additional surveys have resulted in a net increase in species numbers to 275 (Griffith 1997, Ceccarelli *et al*. 2011). Species are typical of the Indo-pacific region and none are unique or considered endemic. However, 41 species (15% of the total hard coral species at the site) are listed as vulnerable on the IUCN Red List (IUCN 2019). In 1998, hard coral covered an area of around 717 ha at Ashmore Reef. The majority of hard corals occur in the deep lagoon (265 ha) and shallow reef top (315 ha) with small areas in the shallow lagoons, and reef edge/slope habitats (Skewes *et al*. 1999a). The soft, non-reef building corals are less well studied at Ashmore Reef than the hard corals (Hale & Butcher 2013). In 1986, 39 soft coral taxa were recorded within the Ashmore Reef, including the vulnerable blue coral (*Heliopora coerulea*) which was moderately common on the reef flats (Marsh 1993). In 1998, the total cover of soft coral at Ashmore Reef was 323 ha and *Sarcophyton* spp. was the dominant taxa covering around 19 ha in total (Skewes *et al*. 1999b, Hale & Butcher 2013).

The species composition of all the hard coral reefs in the bioregion is very similar and reflects strong links with Indo-West Pacific fauna, largely as a result of the dispersal of coral spawn via regional currents. The reefs and islands in this bioregion are thought to be important biological stepping-stones between centres of biodiversity in the Indo–Pacific and reef ecosystems further south (DEWHA 2008a).

Seringapatam Reef is a regionally important scleractinian coral reef as it has a high biodiversity, which is comparable to Ningaloo Reef. Results from the Western Australian Museum (WAM) survey in 2006 noted 159 species of scleractinian corals with a hard coral cover of approximately 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).

Scott Reef consists of two reefs, North Scott Reef and South Scott Reef, which are separated by a deep (400–700 m) channel. North Scott Reef is an annular reef which encloses a lagoon that is connected to the ocean. South Scott Reef is a crescent-shaped reef which forms an arc and partially encloses another lagoon. 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 50m with corals able to survive at depths of up to 70 m (Woodside Energy Limited *et al.* 2010). Studies at Scott reef have identified over 300 scleractinian coral species in the shallow water habitats alone, from almost 60 genera and 14 different families (Gilmour et al. 2013). The Scott reef system has experienced two mass bleaching events in 1998 and 2016, with the latter showing > 90% decreases in cover of branching corals (Porites, Acropora, Millepora, Isopora and Pocillopoiridae) (Gilmour *et al.,* 2021). Regular monitoring following the 1998 mass bleaching event showed increasing cover of branching corals 5 years post bleaching event, with most coral groups recovering approximately 12 years later (Gilmour *et al.,* 2021).

Hibernia Reef consists of an approximately oval-shaped reef, with large areas of the reef becoming exposed at low tide. Hibernia Reef is also characterised by a deep central lagoon and drying sand flats.

There are a number of shoals and banks in the NMR and NWMR. Relatively few studies have been undertaken of these features with the majority of the understanding derived from the Big Bank Shoals study (Heyward *et al*. 1997), PTTEP surveys initiated in response to the Montara incident (Heyward *et al*. 2010; Heyward *et al.* 2011) and ConocoPhillips baseline surveys undertaken to support the Barossa Area Development (Heyward *et al.* 2017). The PTTEP surveys completed at Ashmore, Cartier and Seringapatam Reefs were undertaken during a coral bleaching disturbance likely to be attributed to regional thermal stress indicated by both *in situ* and satellite-based data for the region. The condition of the reefs communities was consistent with previous surveys within the area and did not indicate any disturbance from the Montara incident (Heyward *et al*. 2010; Heyward *et al.* 2012).

In general, the submerged features are characterised by abrupt bathymetry, rising steeply from the surrounding outer continental shelf at depths of 100 m–200 m. The shoals and banks tend to flatten at depths of 40-50 m, with horizontal plateau areas of several square kilometres generally present at 20-30 m depths (Heyward *et al*. 2010). The shoals and banks support a diverse and varied range of benthic communities, including algae, reef-building soft corals, hard corals and filter-feeders (Heyward *et al.* 1997, Heyward *et al.* 2012). The plateau areas were dominated by benthic primary producer habitat, with interspersed areas of sand and rubble patches (Heyward *et al*. 2012).

3.1.10 Timor Transition

Due to the deep, offshore nature of the Timor Transition (up to 300 m with no coastal areas), there are no corals expected within this area (DEWHA 2008c). However, there is evidence of relic reef next to drainage channels of the outer slope of the Timor Transition. This is thought to be associated with local upwellings of cooler nutrient rich water from the Timor Sea (DEWHA 2008c).

3.1.11 Northern Shelf Province

The Northern Shelf Province contains submerged patch or barrier reefs in areas with approximately 30-50 m depth of water, these mainly occur around the margin of the Gulf of Carpentaria (which lies outside the combined EMBA) (DEWHA 2008c). The majority of the province is relatively featureless with sandy and muddy sediments and this is expected to be the case for the portion of the combined EMBA that overlaps the Northern Shelf Province.

3.1.12 Christmas Island Province

The subsurface marine habitat immediately surrounding Christmas Island consists of a relatively narrow and shallow coral reef shelf about 20 to 100 metres wide in approximately six to 20 metres of water depth. There are caves in some of the island’s rocky sea cliffs that adjoin the coral reef shelves. Coral reef shelves also contain areas of sand and rubble.

The shallow coral reef shelves drop off steeply to the island’s mid and deep-water marine habitats which include outer reef seaward slopes, vertical walls and oceanic waters. The marine boundary of the Christmas Island National Park extends 50 metres seaward from the low water mark, which means that the park has no true deep-water habitats, but some outer reef slopes and vertical walls fall within the park’s waters (DNP, 2012).

3.1.13 International Waters

Important areas outside of the IMCRA bioregions include:

Indonesia (west)

Indonesia has an estimated 75,000 km^2 coral reef ecosystem distributed throughout the archipelago (Tomascik et al. 1997 cited in Hutumo & Moosa 2005). Fringing reefs are the most common reef types with scleractinian corals as being the most dominant and important group. 452 species of hermatypic scleractinian coral were collected from Indonesian waters by Tomascik et al. (1997 cited in Hutumo & Moosa 2005), a study presented by Suharsono (2004 cited in Hutumo & Moosa 2005), indicated that 590 species of scleractinian corals exist in Indonesian waters. *Acropora, Montipora* and *Porites* are the most important reef building corals in Indonesia.

The Lesser Sunda Ecoregion encompasses the chain of islands and surrounding waters from Bali, Indonesia to Timor-Leste. This region contains suitable habitat for corals on shallow water substrates formed by limestone and lava flows and is thought to contain more than 500 species of scleractinian reef-building corals (DeVantier *et al.* 2008). Coral species composition is influenced by regional and local scale seasonal upwellings that typically occur from April to May each year on the southern side of the islands. The ecoregion is considered important for coral endemism, particularly the areas of Bali-Lombok, Komodo, and East Flores. Fringing coral reefs tend to be less developed on the southern, more exposed shorelines (Wilson *et al.* 2011).

The world heritage sites of Siberut and Ujung Kulon are also recognised for their extensive coral ecosystems, as well as marine national parks in the waters and islands surrounding Indonesia, such as Laut Sawu, Teluk Cenderawasih, Bunaken, Kapulauan Wakatobi, Togian Islands, Karimunjawa, the islands of Kepulauan Seribu, the table reefs of Taka Bonerate and the Savu Sea National Marine Conservation Area (refer to Section 9.8).

Majority of these sites form parts of the marine area known as the Coral Triangle, named for its staggering number of corals and associated marine life, situated in the waters of Indonesia, Malaysia, the Philippines, Papua New Guinea, Timor Leste and Solomon Islands (ADB, 2014).

Timor-Leste

See Section 3.1.8 for a description of habitat typical of shoals and banks in the Timor Sea.

3.2 Seagrasses

Seagrasses are biologically important for four reasons:

1. As sources of primary production;
2. As habitat for juvenile and adult fauna such as invertebrates and fish;
3. As a food resource; and
4. For their ability to attenuate water movement and trap sediment (Masini *et al*. 2009).

Twenty-five species of seagrass have been recorded in WA, the highest diversity in the world, and over 30 species of seagrasses have been recorded as occurring within Australian waters (Masini *et al*. 2009). Waters extending from Busselton to the NT border support predominantly tropical species although temperate species are also found, particularly between Busselton and Exmouth (Walker 1987). One species, *Cymodocea angustata*, is endemic to WA (Department of Parks and Wildlife (DPAW) 2013). Other seagrass meadows of note include those around Tiwi Islands which provide significant habitat to a number of species. Seagrass habitats also occur within shallower waters near islands and have potential to occur closer to the Indonesian and Timor-Leste coastlines.

The main seagrasses of the region are small, ephemeral species that grow on soft sediments and have a seed bank in the surficial sediments that allows them to recover quickly from disturbance (Walker 1989). Small, ephemeral species of seagrass tend to form mixed associations with macroalgae (CALM & MPRA 2005, DEC & MPRA 2007a, BHPBIO 2011) and usually covers less than 5% of the substrate (BHPBIO 2011, van Keulen & Langdon 2011).

Areas occupied by seagrass vary markedly both seasonally and interannually and it is not clear why some areas of suitable substrate will support seagrass in one year but not the next. It appears that recruitment to what may otherwise be suitable substrate is haphazard, lending weight to the descriptions of these seagrass communities as ephemeral (CALM & MPRA 2005, DEC & MPRA 2007a).

Four bioregions (Northwest Province, Central Western Province, Central Western Transition and Timor Transition) lie entirely in deep waters below the photic zone. Two bioregions (Southwest Transition and Southern Province) occur in waters that are too cold to support seagrasses. The EMBA overlaps the deeper waters of the Cocos (Keeling) Island Province, (not those close to shore) which are greater than 4000m deep and therefore seagrasses are not present.

Seagrasses are not present hence these bioregions are not discussed further.

3.2.1 Southwest Shelf Province

Geographe Bay is a large relatively sheltered area with that supports extensive beds of tropical and temperate seagrass that have a high diversity of species and endemism (DEWHA 2008a). They are thought to account for about 80% of benthic primary production in the area. These seagrass beds provide important nursery habitat for many shelf species that use the shallow seagrass habitat as nursery grounds for several years before moving out over the shelf to their adult feeding grounds along the shelf break.

The Geographe Bay seagrass meadows are among the most extensive temperate seagrass communities on the west coast (MPRSWG 1994 cited in DEC 2013), and include 10 species from five genera (*Amphibolis, Posidonia, Halophila, Heterozostera* and *Thalassodendron*). Geographe Bay is dominated by stands of the narrowleaf tape-weed (*Posidonia sinuosa*) that covers approximately 70% of Geographe Bay. It has smaller areas of *Posidonia angustifolia*, *Amphibolis griffithii*, *A. antarctica* and minor species, which have irregular distributions both spatially and temporally (Lord 1995 cited in DEC 2013). *Thalassodendron pachyrhizum*, *Posidonia* spp. and *Amphibolis* spp. are also found in depths of between 27 and 45 m (Walker *et al*. 1994 cited in DEC 2013).

3.2.2 Southwest Shelf Transition

Species diversity of seagrasses in this bioregion is the highest in the world, with 14 species occurring (DEWHA 2008a). In total, 10 seagrass species have been recorded at the Abrolhos ranging from small, delicate species to larger, more robust types that grow in large meadows (DoF 2012). Small paddle-weeds grow in protected lagoon areas or deep waters between the islands, such as Goss Passage and the larger species may be found growing on reef as well as in sandy areas (DoF 2012). *Thalassodendron pachyrhizum*, which is encountered growing on the exposed reef crest area, has been recorded at a number of the island groups. There are also two species of wire-weed (*Amphibolis* species), endemic to southern Australia, found at the Abrolhos (DoF 2012). The most abundant seagrass is *Amphibolis antarctica*, while *Amphibolis griffithii* appears to be restricted to bays such as Turtle Bay in the Wallabi Group.

The larger ribbon-weeds (*Posidonia* species) grow in sheltered bays and lagoons where the sand cover is deeper and more stable (e.g. Turtle Bay, the Gap, East Wallabi Island, the lagoon on the west side of West Wallabi Islands and around North Island) (DoF 2012).

Nine species of seagrass are found in the Perth region, including at Rottnest Island where *Amphibolis* thrives in clear waters overlying limestone rock (Amalfi 2006). Seagrasses are a major component of the ecosystem on the Rottnest Shelf, thriving in waters ranging in depth from intertidal to 45m (Amalfi 2006). All of the seagrass species identified with the exception of *Syringodium isoetifolium* and *H. ovalis* are endemic to temperate areas of southern Australia (Amalfi 2006). At Rocky Bay, on the north side of the island where it is protected from big swells and strong south to south-westerly winds, a mix of dense seagrass meadow consisting of *Amphibolis* and *Posidonia* thrive. The meadows around Rottnest Island serve as nurseries for juveniles of many fish species and are home to species such as the cobbler and long-headed flathead (Amalfi 2006).

3.2.3 Great Australian Bight Shelf Transition

The Australian coastline has the highest number of seagrass species of any continent. There are approximately 30 species of seagrasses in Australia belonging to 11 genera. Approximately one third (18 species) of all species known worldwide are endemic in Australia. Of these, 16 species are restricted to temperate waters.

Southern temperate waters have two endemic genera, *Heterozostera* and *Amphibolis*. Many endemic species belong to the genera *Posidonia*. The distribution and abundance of seagrasses is a function of topography and environment. A distinction exists between subtropical and warm temperate types. In southern Australia, species with warm water affinities (*Posidonia, Amphibolis*) decline in number from west to east as water temperatures decrease.

In South Australia, seagrasses cover approximately 9620 km2 and represent one of the largest seagrass ecosystems in the world. Seagrass distribution in the GAB is patchy and limited by exposure to swell. Most seagrass is found in sheltered bays or in the lee of reefs and islands in the eastern GAB. These areas contain nearly 10% of the seagrass meadows found in South Australia. Posidonia species dominate, especially *P. angustifolia, P. coriacea* at the base of cliffs and *P. australis* and *P. angustifolia* in the sheltered lee of fringing reefs. *Amphibolis antarctica* and *Heterozostera tasmanica* are present but less common in sheltered bays of the region (McLeay et al., 2003).

3.2.4 Central Western Shelf Province

Shark Bay contains the largest reported seagrass meadows in the world (approximately 4,000 km^2), as well as some of the most species-rich seagrass assemblages (Walker *et al.* 1989). Twelve species of seagrass are found in the Bay with the dominant species being *Amphibolis antarctica*. Seagrass is a fundamental component of biological processes in Shark Bay; it has modified the physical, chemical and biological characteristics of the Bay and provides food, habitat and nursery grounds for many species (CALM & National Parks and Nature Conservation Authority (NPNCA) 1996).

An inshore survey of benthic habitats near Busselton recorded dense coverage of *Amphibolis* spp. on limestone pavement. *Halophila* spp., *Heterozostera* spp. and *Syringodium isoetifolium* were recorded on sandy substrates (DoF 2007).

3.2.5 Central Western Shelf Transition

Nine species of seagrasses have been found throughout Ningaloo Reef (van Keulen & Langdon 2011). Some delineation of temperate and tropical species exists; however, several species were found throughout the Ningaloo Reef. Halophila ovalis was the most commonly found seagrass at Ningaloo and was generally found growing in sandy patches between coral bomboras. *Amphibolis antarctica* is a large meadow forming species that has been found growing in large clumps in Bateman Bay, north of Coral Bay (van Keulen & Langdon 2011).

3.2.6 Northwest Transition

The Rowley Shoals provide the only suitable shallow substrate for seagrasses in this predominantly deep bioregion. Sparse seagrass is found within subtidal coral reef communities of the Rowley Shoals but is not a major habitat type. Two species of seagrass, *Thalassia hemprichii* and *Halophila ovalis*, have been recorded at Mermaid Reef (Huisman *et al*. 2009). Earlier studies at Mermaid and Imperieuse Reef recorded the above two species and a third species; *Thalassodendron ciliatum* (Walker & Prince 1987).

3.2.7 Northwest Shelf Province

In the Northwest Shelf Province, seagrasses are present but sparsely distributed to depths of approximately 30 m (LEC & Astron 1993, URS 2009, CALM 2005a). The abundance and distribution of tropical (and subtropical) seagrass species can vary greatly due to seasonal changes in water quality (turbidity, light penetration) and conditions (wave action, temperature), with biomass tending to peak in summer (Lanyon & March 1995).

Studies between Quondong and Coulomb Points north of Broome identified seagrass communities of *Halophila* spp. patchily distributed across large areas, from the lower intertidal and out to a depth of approximately 20 m (DEC 2008, Fry *et al*. 2008). Similarly, *Halophila decipiens* was the only seagrass collected from epibenthic dredge studies at five localities near Broome from Gourdon Bay to Packer Island (Keesing *et al.* 2011).

Roebuck Bay is located south of Broome and includes large areas of intertidal mudflats. Extensive seagrass meadows occur in the northern regions of Roebuck Bay and are dominated by *Halophila ovalis* and *Halodule uninervis*. *Halophila minor* and *Halodule pinifolia* have also been reported at this location (Prince 1986, Walker & Prince 1987, Seagrass-Watch 2019).

In the Dampier Archipelago seagrass occurs in the larger bays and sheltered flats of the area (CALM & MPRA 2005). Six species of seagrass, including three Halophila species, have been recorded on the subtidal soft sediment habitats (CALM & MPRA 2005). Seagrasses do not form extensive meadows within the proposed reserves, but rather form interspersed seagrass/macroalgal beds. The largest areas of seagrass are found between Keast and Legendre islands, and between West Intercourse Island and Cape Preston (CALM & MPRA 2005).

Surveys near Onslow found that *Halophila* spp. were the most widespread of the seagrasses in that region. Seagrasses were found to be generally sparsely distributed (<10% cover), occurring in small patches within larger areas of suitable substrate. Small areas of higher (>50%) seagrass cover occurred in shallow clear water areas but were not common (URS 2009, URS 2010b, Chevron 2010).

Similarly, in the Montebello/Barrow Islands Marine Conservation Reserves, seagrasses appear not to form extensive meadows but are sparsely interspersed between macroalgae. Seven seagrass species have been recorded in the Reserves (DEC & MPRA 2007a) with *Halophila* spp. the most common seagrass species on shallow soft substrates and sand veneers. Distributions of these species extend from the intertidal zone to approximately 15m water depth (DEC & MPRA 2007a). Surveys to the northwest and southeast of Barrow Island from 2002 to 2004 did not identify any significant seagrass meadows but confirmed the presence of sparse coverage of *Halophila* and *Halodule* spp. in shallow areas east of Barrow Island (RPS BBG 2005).

A significant meadow of large seagrasses at Mary Anne Reef east of Onslow was identified almost 30 years ago and its presence today is unconfirmed. The meadow was several hundred hectares of *Cymodocea angustata* at 30–50% cover, occurring primarily at a depth of 2–3 m (Walker & Prince 1987).

3.2.8 Northwest Shelf Transition

Extensive and diverse intertidal seagrass meadows are known from islands in the southern Kimberley, particularly in the Sunday Island One Arm Point area (Walker 1995, Walker & Prince 1987). Ten species of seagrasses have been recorded at One Arm Point, with the majority of meadows low to moderate in abundance and dominated by *Thalassia hemprichii* with *Halophila ovalis*, *Halodule uninervis* and *Enhalus acoroides* (Seagrass-Watch 2019).

While some seagrasses have been collected from intertidal sites in the central and north Kimberley (Walker *et al*. 1996, Walker 1997), these areas were not found to be species rich and did not support extensive seagrass meadows like those found in the southern Kimberley.

Subtidal seagrass meadows in the Northwest Shelf Transition are not well mapped, although dugongs are known to feed on seagrass communities in coastal waters of the Joseph Bonaparte Gulf (DEWHA 2008a).

3.2.9 Timor Province

Seagrass has been reported on the reef flats of offshore reefs of this bioregion (Whiting 1999, Hale & Butcher 2013). Five species of seagrass were 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 comprising all age classes from calves to adults (Hale & Butcher 2005).

Similarly, Scott Reef supports five species of seagrass (URS 2006), with *Thalassia hemprichii* most abundant (Skewes *et al*. 1999a, URS 2006). The area of seagrass at Scott Reef is significantly less than that recorded for Ashmore Reef (approximately 100 ha) (Woodside 2011). 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).

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).

Skewes *et al*. (1999a) did not observe any seagrass communities at Hibernia Reef.

3.2.10 Northern Shelf Province

Coastlines adjacent to the Northern Shelf Province contain seagrasses providing habitat to a number of marine species, particularly juvenile tiger prawns, which make up approximately 50% of the total prawn catch in the province. However, majority of these seagrass habitats exist within the Gulf of Carpentaria, which lies outside the combined EMBA.

3.2.11 Christmas Island Province

The subsurface marine habitat immediately surrounding Christmas Island consists of a relatively narrow and shallow coral reef shelf about 20 to 100 metres wide in approximately six to 20 metres of water depth. The sandy areas and some lagoons are also known to support seagrass habitat (DNP 2012).

3.2.12 International Waters

Important areas outside of the IMCRA bioregions include:

Indonesia (west)

Within Indonesian waters, the lower intertidal and upper subtidal zones are considered important areas for the growth of seagrass (Hutumo and Moosa 2005). Pioneering vegetation in the intertidal zone is dominated by *Halophila ovalis* and *Halodule pinifolia* while *Thalassodendron ciliatum* dominate the lower subtidal zones. Wide areas of the Indonesian coastal waters are covered by dense beds of seagrass.

Seagrass habitats are widely distributed across the Lesser Sunda Ecoregion. Preliminary data from the United Nations Environment Program's (UNEP) World Conservation Monitoring Centre (WCMC) has identified the following areas as potential areas of importance for seagrass, many of which are outside the combined EMBA (DeVantier *et al.* 2008):

+ North-west Bali;
+ South-west and west Lombok;
+ North-east Sumbawa;
+ Komodo Islands;
+ Savu; and
+ South coast of Timor-Leste.

The Kepulauan Seribu National Park, Laut Sawu Marine National Park, Bunaken National Park, Karimunjawa Marine National Park and Savu Sea National Marine Conservation Area are also known for their rich diversity of seagrasses (refer to Section 9.8).

3.3 Macroalgae

Macroalgae are important contributors to primary production and nutrient cycling in the region, providing food and habitat for vertebrate and invertebrate fauna. Macroalgae are also recognised for their role in spatial subsidies; the movement of nutrients or energy between neighbouring habitats. Spatial subsidies involving macroalgae include the movement of wrack from macroalgal beds to bare substrates and shorelines (Orr 2004).

Macroalgae are primarily associated with hard substrates. They occur in moderate to high cover on exposed hard substrates, but typically have lower cover on hard substrates that are covered with a veneer of sediment (SKM 2009, BHPBIO 2011). Macroalgae exhibit very high seasonal and interannual variation in biomass (Heyward *et al*. 2006) and distribution, abundance and biodiversity (Rio Tinto 2009, BHPBIO 2011). The distribution of hard substrates therefore indicates areas that may support macroalgal communities, although abundance and diversity may fluctuate annually.

Macroalgae are susceptible to disturbance from factors such as sedimentation, scouring and turbidity but the marked seasonality in biomass, abundance, diversity and distribution suggests macroalgae are likely to be resilient to acute, short-term disturbance acting at local scales. Macroalgae may be more susceptible to impacts acting over longer time scales (years) and at certain times of the year, where recruitment at a regional scale could be affected. Indirect impacts affecting the numbers, distribution and community structure of herbivorous fish can also be expected to have impacts (either positive or negative) on macroalgal habitats (Vergès *et al*. 2011).

Three bioregions (Northwest Province, Central Western Province and Central Western Transition) lie entirely in deep waters below the photic zone. Two bioregions (Southwest Transition and Southern Province) occur in colder waters. The EMBA overlaps the deeper waters of the Cocos (Keeling) Island Province, (not those close to shore) which are greater than 4000m deep and therefore macroalgae are not present.

Macroalgae are not present hence these bioregions are not discussed.

3.3.1 Southwest Shelf Province

Species diversity of macroalgae is very high. The south coast of the bioregion is characterised by a relatively higher diversity of temperate macro-algal species compared with the Southwest Shelf Transition. These colonise the exposed rocky shorelines and rocky reefs (DEWHA 2008a).

3.3.2 Southwest Shelf Transition

The Houtman Abrolhos have known species of benthic algae with macroalgae communities considered important in supporting a diversity of marine life.

More than 340 species of macroalgae (including 54 species of green algae, 71 species of brown algae, and 222 species of red algae) have been recorded from rock platforms around Rottnest Island (Amalfi 2006).

3.3.3 Great Australian Bight Shelf Transition

Seaweed diversity and endemism in temperate waters of Australia is among the highest in the world, perhaps due to the length of the southerly-facing rocky coastline and the long period of geological isolation. The number of species found in southern Australia is 50-80% greater than other temperate regions of the world. A small number of tropical species and isolated species from tropical genera also occur in the GAB.

Oceanic waters of South Australia support one of the world's most diverse seaweed assemblages, with >1200 species recorded. Many species of macroalgae found in South Australian waters extend into the cool temperate waters of Victoria and Tasmania and warmer waters of Western Australia. However, South Australia has the highest concentration of species. The waters of the GAB are clear and allow chlorophyllus plants to live at depths of up to 70 m.

Among the green algae (Chlorophyta), few microscopic forms have been studied; however, a few southern Australian species are recognised in the genera *Ulva* (2) and *Bryopsis* (6). Coenocytic green algae are well represented, including *Codium* (15 species) and *Caulerpa* (19 species). Brown algae (*Phaeophyta*) and red algae (*Rhodophyta*) are particularly diverse. Approximately 43% of the genera (658) and 20% of the species (~4000) of red algae that occur worldwide are found in southern Australia. Over 75% of red algae, 57% of brown algae, and 30% of green algae are endemic to southern Australia (Womersley 1990). Womersley (1984, 1987, 1994, 1996, 1998 and 2003) documents the macroalgae of southern Australia. (McLeay et al., 2003).

3.3.4 Central Western Shelf Province

Although seagrasses are the most visually dominant organisms found in Shark Bay (Walker *et al*. 1989) macroalgae are also a significant component within the system, with 161 taxa of benthic macroalgae reported from the location (Kendrick *et al*. 1990). The seagrass meadows host a large number of epiphytic algal species (Harlin *et al*. 1985, Kendrick *et al*. 1990), which numerically dominate the algal flora of the area. Eighty algal species were epiphytic on the seagrass *Amphibolis antarctica*, and of these, over half have been reported both as epiphytes and benthic algae. Benthic macroalgae can be found growing on occasional subtidal rock (limestone–sandstone) platforms and extensive sand flats that occur throughout Shark Bay, and as drift within seagrass meadows (Kendrick *et al*. 1990).

The benthic algae of Shark Bay are not predominantly temperate as is the case with the seagrasses (Walker *et al*. 1989) and seagrass epiphytes (Kendrick *et al*. 1990). The majority of taxa are either of tropical or cosmopolitan distribution. Their local distribution within Shark Bay is correlated with salinity, with benthic algal species richness lower in areas of high salinity (Kendrick *et al*. 1990).

Limestone platforms occur along the bioregion's coastline and high energy environments are likely to be dominated by large brown algae including *Ecklonia radiata* and *Sargassum* spp. with articulated coralline algae making up the understorey. More diverse algae assemblages may be observed in sheltered locations such as potholes and ledges (DoF 2007).

3.3.5 Central Western Shelf Transition

Macroalgal beds along the Ningaloo coastline are generally found on the shallow limestone lagoonal platforms and occupy about 2,200 ha of the Ningaloo Marine Park and Muiron Islands Marine Management Area (CALM & MPRA 2005a). Macroalgal communities within the area have been broadly described (Bancroft & Davidson 2000). The dominant genera are the brown algae *Sargassum*, *Padina*, *Dictyota* and *Hydroclathrus* spp. (McCook et al. 1995).

3.3.6 Northwest Transition

Although macroalgae is present at the Rowley Shoals, it is not recognised as a key habitat component in the Mermaid Reef Marine National Nature Reserve Plan of Management (EA 2000) or the Rowley Shoals Marine Park Management Plan (DEC & MPRA 2007b).

There is nothing to suggest that the algal flora of the Rowley Shoals is unique within the Indo-Pacific (Huisman *et al*. 2009). A study of macroalgae at 16 locations at Mermaid Reef recorded over 100 species (Huisman *et al*. 2009). The algal flora recorded at the Rowley Shoals represents a small portion of the highly diverse Indo-Pacific flora. The majority of species that were recorded at Mermaid Reef had been previously recorded from mainland north-western Australia or from Indonesia (Huisman *et al*. 2009).

3.3.7 Northwest Shelf Province

Macroalgae are diverse and widespread throughout the Northwest Shelf Province. They are restricted to depths where sufficient light penetrates to the substrate and therefore tend to be most common in shallow subtidal waters down to approximately 20 m depth.

In the nearshore regions of the Pilbara, macroalgae are often a dominant component of the mosaic of benthic organisms found on hard substrates in shallow water. In these shallow waters, regular disturbance to reef habitats from seasonal changes in sedimentation/ erosion patterns and the less frequent impacts of cyclones and storms through sedimentation and scouring may substantially alter the distribution and composition of the benthic communities associated with reefs, including macroalgal habitats (BHPBIO 2011).

Macroalgae dominate shallow (<10 m) submerged limestone reefs and also grow on stable rubble and boulder surfaces in the Dampier Archipelago (CALM & MPRA 2005). Huisman and Borowitzka (2003) reported approximately 200 species of macroalgae from the Dampier Archipelago. Low relief limestone reefs that are dominated by macroalgae, account for 17% (approximately 35,460 ha) of the marine habitats within the proposed Marine Management Area (CALM 2005a).

Epibenthic dredge surveys along the coastline north of Broome identified 43 species of algae from 22 families (Keesing *et al*. 2011). The lower species diversity collected by this study is attributed to the method of collection and limited depth range (11–23 m) (Keesing *et al*. 2011).

Macroalgae occur around the numerous small offshore islands within this bioregion (including Thevenard Island, Airlie Island and Serrurier Island) associated with limestone pavement and protected areas of soft sediments. Dominant species are consistent with those described for the Dampier Archipelago (Woodside 2011).

In the shallow offshore waters of the Pilbara region, macroalgae are the dominant benthic habitat on hard substrates in both the Montebello and Barrow Islands Marine Parks and are the main primary producers (DEC & MPRA 2007a, Chevron 2010). Shallow water habitats outside these marine parks are also likely to support substantial areas of macroalgal habitat wherever conditions are suitable.

Macroalgae occupy approximately 40% of the benthic habitat area in the Montebello/ Lowendal/ Barrow Island region (CALM 2005b). At least 132 macroalgal taxa occur around Barrow Island, with most thought to be widely distributed in the tropical Indo-Pacific region (Chevron 2005).

Macroalgae monitoring around the Lowendal and Montebello Islands since 1996 (The Ecology Lab 1997, IRCE 2002 2003 2004 2006 2007, URS 2009) has found macroalgal cover and biomass to be naturally spatially and temporally variable. *Sargassum* spp. represented 70% of the macroalgal assemblage in 2009, compared to 96% in 2002 (URS 2009). Sargassum spp. cover as a percentage of total macroalgae cover was significantly lower in 2009 than in previous years, primarily due to an increase in filamentous algae at a number of sites (URS 2009).

3.3.8 Northwest Shelf Transition

There is a lack of information regarding the marine benthic flora of north-west Western Australia and no comprehensive marine flora list exists for the region (Huisman 2004). However, about 70 algae species were collected during a survey of intertidal reefs on the central Kimberley coast in 1997 (Walker 1997).

Tropical macroalgae species are typically associated with areas of hard substrate and various types of macroalgae occur on rock platforms intermingled with coral and sponge. Abundance and biomass typically exhibit strong seasonal trends (Heyward *et al*. 2006).

The diversity and abundance of algae in the Kimberley is probably linked to the region’s extreme tidal exposure and highly turbid waters, reducing light penetration and resulting in deposition of fine sediments (Walker 1997). However, the role of algae appears crucial to the growth of reefs in the highly turbid waters of the Kimberley coast and islands (Brooke 1997). *Sargassum* spp. and coralline algae may be dominant (DPAW 2013).

It is also considered that in offshore parts of the Northwest Shelf Transition, there are high levels of primary production, including macroalgae. This is due to light penetration through relatively clear, shallow waters (DEWHA, 2008a). In particular, carbonate banks and reefs in the Northwest Shelf Transition are considered to support macroalgae, therefore macroalgae would be expected to be present within the Carbonate Bank and Terrace System of the Van Diemen Rise key ecological feature, located within the Northwest Shelf Transition.

3.3.9 Timor Province

Macroalgae at Ashmore Reef are estimated to cover over 2,000 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).

Surveys at Scott and Seringapatam Reefs recorded over 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 macroalgae communities of these offshore atolls are unique within the Indo-Pacific (Huisman *et al*. 2009).

3.3.10 Timor Transition

There is a lack of published information regarding macroalage within the Timor Transition. However, the presence of the Shelf Break and Slope of the Arafura Shelf key ecological feature indicates that macroalgae may be present in association with this seabed feature. Upwelling associated with the topography of the shelf break lifts nutrient rich deep ocean water onto the edge of the shelf and into the euphotic zone, leading to enhanced biological productivity (DSEWPAC, 2012).

3.3.11 Northern Shelf Province

Macroalgae is sparse in the Northern Shelf Province (DEWHA, 2008c). However, around reef areas, there have been observations of phytoplankton blooms, thought to occur at localised micro-upwellings of nutrients potentially driven by wind and tidal eddies (DEWHA, 2008c).

3.3.12 Christmas Island Province

Coral reefs are 'turfed' with fine hair-like algae which are grazed by many animals. Some red algae form hard pink crusts which cement sand and dead coral together (DNP, 2012).

3.3.13 International Waters

No information on macroalgae in international waters has been identified other than for Timor-Leste waters.

See Section 3.1.8 for a description of habitat typical of shoals and banks in the Timor Sea.

3.4 Non-Coral Benthic Invertebrates

The offshore marine environment from Busselton to the Northern Territory is overwhelmingly dominated by soft sediment seabeds; sandy and muddy substrates, occasionally interspersed with hard substrates covered with sand veneers, and rarely, exposed hard substrate. In shallow waters, non-coral benthic invertebrates may form part of the mosaic of benthic organisms found on hard substrates, alongside macrophytes and coral colonies. As light reduces with water depth, non-coral benthic invertebrates are the dominant community, albeit at low densities.

Non coral benthic invertebrates feed by filtering small particles from seawater, typically by passing the water over a specialised filtering structure. Examples of filter feeders are sponges, soft and whip corals and sea squirts.

3.4.1 Southwest Transition

There is little available information on benthic biological communities of this bioregion however deep sea crabs, such as the champagne crab and crystal crab are known to inhabit the seafloor of the slope (DEWHA 2008b).

3.4.2 Southwest Shelf Province

East of Albany, the dominant lobster species changes from the western rock lobster to the southern rock lobster. In this bioregion there is a notable increase in the ratio of benthic fish to crustaceans. Crustaceans appear to be less important in structuring shallow benthic communities here than in bioregions to the north and to the south-east of the Murray River mouth, around the Bonney Upwelling and Tasmania (DEWHA 2008b).

3.4.3 Southwest Shelf Transition

The inner shelf of the bioregion, extending between 0-50 m deep, includes distinct ridges of limestone reef with extensive beds of macro-algae (principally *Ecklonia* spp.). These inshore lagoons are inhabited by a diverse range of coralline algae, sponges, molluscs and crustaceans. On the outer shelf and shelf break filter feeding sponges and bryozoans dominate the hard bottom. The reefs around the Houtman Abrolhos islands support 492 known species of molluscs, 110 known species of sponges, 172 known species of echinoderms and 234 known species of benthic algae (DEWHA 2008b). Western rock lobster, the dominant large benthic invertebrate in this bioregion, is considered to be an important part of the food web of the inner shelf.

3.4.4 Southern Province

There is little information available on the benthic biological communities within the bioregion, however it is described as a unique region of deep-sea habitats that includes the Diamantina Fracture Zone Key Ecological Feature. The Diamantina Fracture Zone is described as structurally complex deep water environment of seamounts and numerous closely spaced troughs and ridges, which represents a unique region of deep-sea habitats including 26 endemic species of demersal fish (DSEWPaC) 2012b).

3.4.5 Great Australian Bight Shelf Transition

The invertebrate fauna of the GAB also displays a high degree of endemism (85-95%, Shepherd 1991). South Australia's benthic invertebrate assemblages also include tropical species. Fossils of benthic foraminiferans, nektonic nautiloids and planktonic protists suggest that tropical species have been transported into South Australia by the Leeuwin Current since the Eocene.

Early research in the GAB included an expedition on Australia's first fisheries research vessel, the Southern Endeavour that reported the presence of hydroids, molluscs and sponges. Many of South Australia's invertebrate species are included in the South Australian Handbook Series Marine Invertebrates of Southern Australia. Part I, includes the Porifera, Cnidaria, Platyhelminths, Annelida, Sipuncula, Echiura, Bryozoa and Echinodermata (Shepherd and Thomas 1982); Part II deals solely with the Mollusca (Shepherd and Thomas 1989); and Part III includes the Nemertea, Entoprocta, Phoronida, Brachiopoda, Hemichordata, Pycnogonids and Tunicates (Shepherd and Davies 1997). The most notable group not covered by these books is the Crustacea. Edgar (2000) describes 1200 species of invertebrates, fish, algae and sea grasses that occur in the intertidal zone to 30 m depth between Sydney and Perth (McLeay et al., 2003).

3.4.6 Central Western Province

The understanding of marine life in this bioregion is mostly confined to the demersal fish on the continental slope. The exception to this is the Perth Canyon which, although poorly understood, is known to have unique seafloor features with ecological properties of regional significance.

3.4.7 Central Western Shelf Province

The Central Western Shelf Province occurs on the continental shelf in water depths from 0 to 100 m. Biological communities of the shelf are likely to include a sparse invertebrate assemblage of sea cucumbers, urchins, crabs and polychaetes on sand substrates. Hard substrates are likely to contain sessile invertebrates such as sponges and gorgonians. The biological communities of this bioregion share many similarities with the adjoining temperate region (DEWHA 2008a).

Stromatolites occur in Shark Bay. Although they are a microbial colony (prokaryote), and not an invertebrate (eukaryote), they are described here as a unique benthic biological community. Stromatolites are rock-like structures built by cyanobacteria. Shark Bay's stromatolites are 2,000 to 3,000 years old and are similar to life forms found on Earth up to 3.5 billion years ago. Until about 500 million years ago, stromatolites were the only macroscopic evidence of life on the planet; hence they provide a unique insight into early life forms and evolution. The stromatolites are located in the hypersaline environment of Hamelin Pool and are one of the reasons for the area's World Heritage Listing (DPAW 2009).

3.4.8 Central Western Transition

The Central Western Transition extends from the shelf break to the continental slope with some parts of the bioregion occurring on the abyssal plain. Water depths range from 80 m to almost 6,000 m. Sediments are dominated by muds and sands that decrease in grain size with increasing depth. The present level of understanding of the marine environment in this bioregion is generally poor. The harder substrate of the slope in waters of 200–2,000 m deep is likely to support populations of epibenthic fauna including bryozoans and sponges. These support larger infauna and benthic animals such as crabs, cephalopods, echinoderms and other filter feeding epibenthic organisms. In the deeper waters of the abyss, the benthic communities are likely to be sparse (DEWHA 2008a).

3.4.9 Central Western Shelf Transition

The Central Western Shelf Transition is located entirely on the continental shelf and is comprised mainly of sandy sediments in depths between 0 and 80 m (DEWHA 2008a).

Some sponge species and filter-feeding communities found in deeper waters offshore from the Ningaloo Reef appear to be significantly different to those of the Dampier Archipelago and Abrolhos Islands, indicating that the Commonwealth waters have some areas of potentially high and unique sponge biodiversity (Rees *et al*. 2004).

3.4.10 Northwest Province

The Northwest Province is located entirely on the continental slope in water depths of predominantly between 1,000–3,000 m and is comprised of muddy sediments. Despite the present poor knowledge of the benthic communities on the Exmouth Plateau, information on sediments in the bioregion indicates that benthic communities are likely to include filter feeders and epifauna. Soft-bottom environments are likely to support patchy distributions of mobile epibenthos, such as sea cucumbers, ophiuroids, echinoderms, polychaetes and sea pens.

3.4.11 Northwest Transition

The Northwest Transition is located from the shelf break (200 m water depth) over the continental slope to depths of more than 1,000 m at the Argo Abyssal Plain. Benthic habitat mapping surveys and epibenthic sampling conducted by CSIRO at the continental slope (approximately 400 m water depth) showed that all survey sites predominantly comprised soft, muddy sediment, which was often riffled. Gravel, boulders and small outcrops were occasionally recorded. Epifaunal abundance was similar all sites, with epifauna limited to sparsely distributed isolated individuals. Epifauna included isolated scattered sessile crinoids, anemones, glass sponges and seapens. Occasional non-sessile fauna included urchins, prawns and other decapods, holothurians and sea stars. Modelling indicated a 1 km long beam trawl across the continental shelf (approximately 400 m water depth) would be expected to yield sparse (<20 individuals) and low diversity (<10 species) of epibenthic fauna (≥1 cm body size) (Williams *et al*. 2010). Deeper on the continental slope at approximately 700 m and approximately 1,000 m, habitats were similar to those observed at 400 m (Williams *et al*. 2010).

Although soft sediment habitat may appear monotonous and featureless, there is likely to be some marked differences in terms of ecological functioning and faunal composition between shelf and deep-sea areas, with the 200 m isobath widely believed to represent a key boundary (Wilson 2013, Brewer *et al*. 2007, Gage &

Santos

Tyler 1992). Beyond the 200 m isobath, deep-sea benthic communities rely exclusively on the settling of organic detritus from the overlying water column as a food source. The spatial and temporal distribution of benthic fauna depends on factors such as sediment characteristics, depth and season (Wilson 2013).

Due to contrasting depths, the Rowley Shoals supports a diverse marine invertebrate community including a number of endemic species. Invertebrate species (excluding corals) at the Rowley Shoals include sponges, cnidarians (jellyfish, anemones), worms, bryozoans (sea mosses), crustaceans (crabs, lobsters, etc.), molluscs (cuttlefish, baler shells, giant clams, etc.), echinoderms (starfish, sea urchins) and sea squirts (DEC & MPRA 2007b).

3.4.12 Northwest Shelf Province

This bioregion is located primarily on the continental shelf in water depths from 0 to 200 m (DEWHA 2008a). The sandy substrates on the shelf within this bioregion are thought to support low density benthic communities of bryozoans, molluscs and echinoids (DEWHA 2008a). Sponge communities are also sparsely distributed on the shelf, but are found only in areas of hard substrate. The region between Dampier and Port Hedland has been described as a hotspot for sponge biodiversity (Hooper & Ekins 2004).

Epibenthic dredge surveys in nearshore areas around Broome covered 1,350 m^2 of seabed in depths between 11 and 23 m. The survey recorded 357 taxa comprising 52 sponges, 30 ascidians, 10 hydroids, 52 cnidarians (not including scleractinian corals), 69 crustaceans, 73 molluscs and 71 echinoderms. The most important species on soft bottom habitats in terms of biomass was the heart urchin *(Breynia desorii)*, whilst sponges were the dominant fauna by biomass on hard bottom habitats. The biomass of other filter feeders, especially ascidians, soft corals, gorgonians was also high, indicating the importance of these groups in characterising hard bottom habitats.

In 2007, CSIRO conducted extensive benthic habitat mapping surveys and epibenthic fauna (living on the surface and ≥1 cm body size) sampling in deep waters (100–1,000 m) spanning thirteen sites between Barrow Island and Ashmore Reef running along the continental shelf and across the continental slope of the North West Shelf (Williams *et al*. 2010). At the continental shelf margin (approximately 100 m water depth) Williams *et al*. (2010) reported that similar benthic habitats occurred at each survey site across the breadth of the North West Shelf. Benthic habitats at this depth comprised a mix of riffled muddy sand (sometimes as a veneer over rocky subcrops) together with gravel to pebble-sized rubble, cobbles, boulders and some rock outcrops. Typical epifauna found at these depths included scattered isolated hydroids, sea fans and soft corals and often small sponges. Other fauna observed at some of the sites included scattered isolated sea whips, crinoids, sea pens, urchins and anemones. Epibenthic fauna along the continental shelf margin were quantified as sparse and low diversity (Williams *et al*. 2010). Modelling indicated that a trawl sample of 1 km length would generally be expected to yield approximately 80 individuals represented by 15 species (Williams *et al*. 2010) in 100 m depth waters.

At the shelf edge (approximately 200 m water depth), two sites were surveyed. Both sites were similar to the continental shelf margin, except the northern site mainly comprised coarse material. Epifauna observed at the northern site was similar at 200 m as at 100 m. At the southern site, epifauna included sparse and scattered individual soft corals, anemones, glass sponges and stalked crinoids (Williams *et al.* 2010). Modelling indicated epibenthic fauna were sparse and had low diversity, numbering approximately 20–40 individuals in a 1 km long trawl sample represented by approximately 5–10 species (Williams *et al*. 2010).

Baseline studies undertaken in nearshore areas of the Pilbara (SKM 2009, Rio Tinto 2009, BHPBIO 2011) and offshore areas around Barrow Island (Chevron 2010) have shown that filter feeder communities are a dominant component of benthic habitats in depths >10 m where reduced light appears to inhibit extensive development of hard corals and macroalgae. The pavement habitats between Barrow Island and the mainland are covered by a sediment veneer that appears to periodically move, exposing areas of pavement reef. Sessile benthic organisms that require hard substrates for attachment, such as gorgonians, are frequently seen emerging through a shallow veneer of sand. This type of substrate (sediment veneer) with sparse filter feeder communities is common throughout this area (SKM 2009, Rio Tinto 2009, BHPBIO 2011).

3.4.13 Northwest Shelf Transition

The Northwest Shelf Transition is located on the continental shelf with a small area extending onto the continental slope, with water depths ranging from 0–330 m. Nearshore areas may support significant filter feeding communities but these have not yet been described (Masini *et al*. 2009).

Pipeline route surveys north of the Kimberley in water depths from 10–250 m recorded a seabed largely devoid of hard substrate, with only sparse epibenthic fauna noted on the predominantly sandy substrate. Occasional epibenthic fauna (featherstars, gorgonians, bryozoans, sea urchins, hydroids and sponges) were recorded in areas where rocky substrate or outcrops were present (URS 2010a).

In contrast, benthic surveys at Echuca Shoals identified broad areas of hard substrate with substantial epibenthic fauna. The shallow shoal areas were dominated by a flat 'reef' platform with crinoids, sea whips, soft corals and low densities of hard corals. With increasing depth (25–80 m) soft corals and sponges became increasingly dominant. At greater depths (80–100 m) the density of epibenthic fauna decreased substantially with sea whips and sea fans became dominant (URS 2010a).

3.4.14 Timor Province

The Timor Province is located on the continental slope and abyssal plain and water depths range from 200 m to almost 6,000 m. Benthic studies in this bioregion are scarce, however data from the North West Slope Trawl Fishery suggests that muddy sediments in the Timor Province support significant populations of crustaceans (Brewer *et al*. 2007). Additionally, research into the demersal fish communities of the continental slope has identified the Timor Province as an important bioregion. This is due to the presence of a number of endemic fish species, and two distinct demersal community types associated with the upper slope (water depths of 225–500 m) and mid-slope (water depths of 750–1,000 m) (Last *et al*. 2005). The current understanding of the relationship between demersal fish communities and benthic environments on the continental slope is rudimentary (DEWHA 2008a).

Over 130 species of sponges have been recorded at the Ashmore Reef National Nature Reserve (Russell & Hanley 1993).

Studies of Seringapatam Reef have observed the dominant benthic habitats to include filter feeders, such as sponges, gorgonians, hydroids and seapens (Heyward et al. 2013 cited in ConocoPhillips 2018).

3.4.15 Timor Transition

Carbonate banks and reefs of the Timor Transition have been found to support non-coral communities and benthic invertebrate communities associated with hard substrates (DEWHA, 2008c). Of particular note is the Shelf Break and Slope of the Arafura Shelf key ecological feature which is located within the Timor Transition. This key ecological feature has been recognised for the invertebrates that is hosts, which are thought to be the basis for the offshore food webs in the area (DEWHA, 2008c). Furthermore, the Tributary Canyons of the Arafura Depression key ecological feature is also in the Timor Transition and surveys of this key ecological feature identified around 245 macroscopic species of invertebrates (Wilson, 2005).

3.4.16 Northern Shelf Province

Studies of taxa within the Northern Shelf Province found 684 taxa of infaunal benthic invertebrates in waters deeper than 20 m. However, the Gulf of Carpentaria Basin contains the most significant non-coral benthic habitats within the Northern Shelf Province, which is outside the boundary of the combined EMBA (DEWHA, 2008c).

3.4.17 Christmas Island Province

Three major molluscs grow on Christmas Island's reefs: bivalves, gastropods and cephalopods. Echinoderms include sea stars, brittle stars, feather stars, sea urchins and sea cucumbers (DNP, 2012). The deeper waters connecting Christmas Island to the Cocos (Keeling) Island Province are described below (Section 3.4.18).

3.4.18 Cocos (Keeling) Island Province

The hard substrates that occur on seamounts within the province are likely to provide surfaces and topographical structure for recruitment and growth of passive,sessile, epi-benthic suspension feeders (Genin et al., 1986) such as deep-sea corals, sponges,crinoids, ascidians and bryozoans. Most of the seamounts within the subregion are relatively deep (>2000 m) and the deeper seamounts (>3000 m) are a unique feature of this subregion. Little is known about the communities that live on the tops and slopes of these seamounts. However, it seems likely that their unique position in the water column, and geographically, will support unique benthic and demersal communities (Brewer *et al*., 2009).

3.4.19 International Waters

No information on non-coral benthic invertebrates in international waters has been identified other than for Timor-Leste waters.

See Section 3.1.8 for a description of habitat typical of shoals and banks in the Timor Sea.

3.5 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 over a century in Australia (Richardson *et al.* 2015). The compilation of this data has been made publicly available through the Australian Ocean Data Network (Australian Ocean Data Network 2017) and has been 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 has 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 of primary productivity across Australia are however variable with the South West of Australia experiencing an increase in productivity and northern Australia experiencing no change between 2002-2016 (Evans *et al.* 2016).

Within the combined EMBA, peak primary productivity varies on a local and regional scale. For example, peak phytoplankton biomass in waters surrounding Broome has been observed in May with a high variability recorded in August, whereas recorded phytoplankton biomass in waters surrounding Geographe Bay has been found to peak during winter and is localised close to the coast (Bloundeau-Patissier *et al.* 2011). In general, these peaks are linked to mass coral spawning events, peaks in zooplankton and fish larvae abundance and periodic upwelling. Regional upwelling is most common close to the coast and where surface waters diverge. Despite the suppression of major upwelling along the WA coast by the Leeuwin Current, known key upwelling regions include the Ningaloo region (Hanson & McKinnon 2009) and Cape Mentelle (Pattiaratchi 2007). It is also expected that a high abundance of plankton will occur within areas of localised upwelling in the combined EMBA where the seabed disrupts the current flow.

In waters surrounding Indonesia, seasonal peaks in phytoplankton biomass is linked to monsoon related changes in wind. When the winds reverse direction (offshore vs. onshore), nutrient concentrations decrease/increase because of the suppression/enhancement of upwelling (National Aeronautics and Space Administration (NASA) 2017). Annual variability of phytoplankton productivity in waters surrounding Indonesia is heavily influenced by the El Niño-Southern Oscillation climate pattern (NASA 2017). For example, phytoplankton productivity around Indonesia increases during El Niño events.

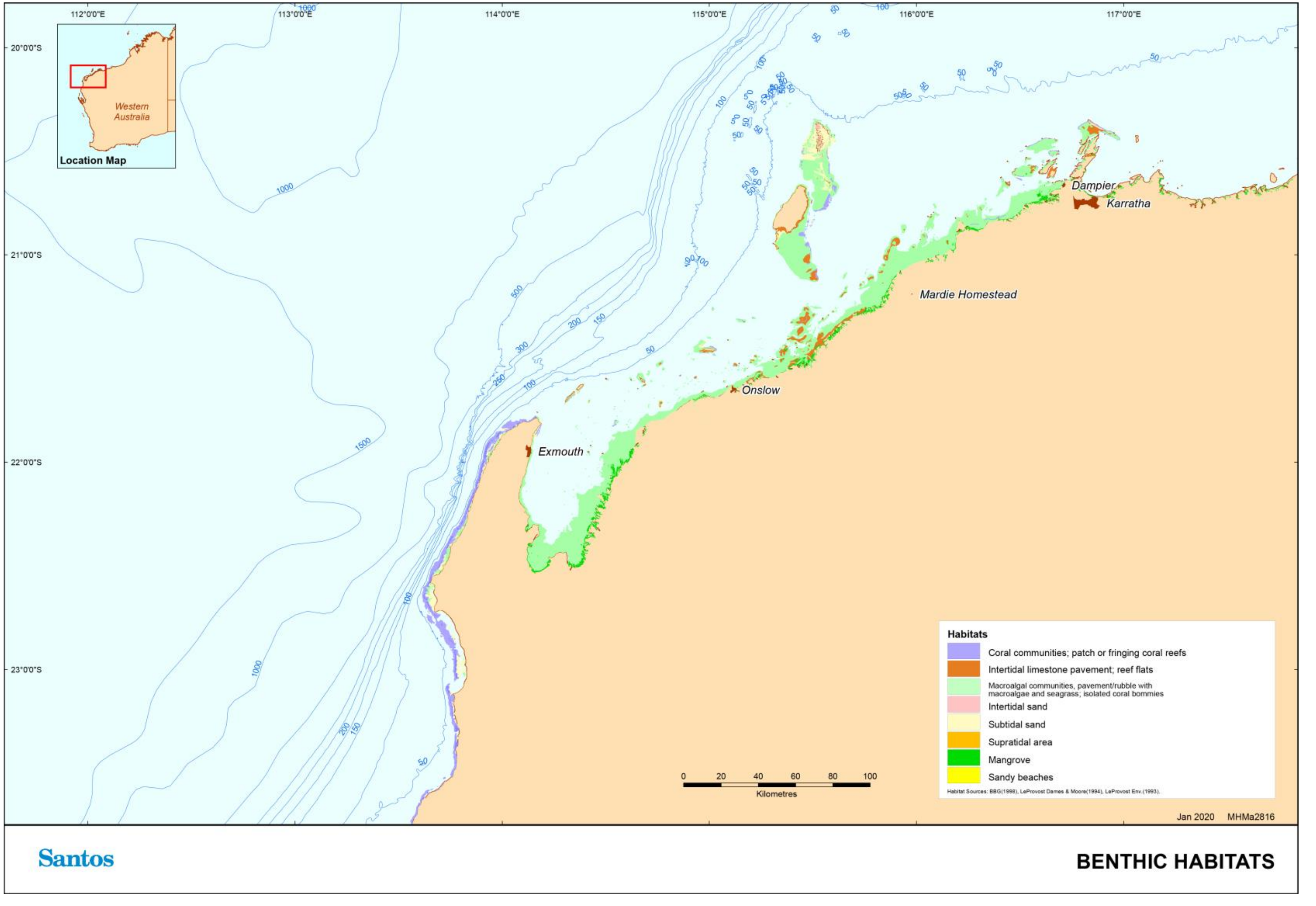


Figure 3-1: Benthic habitats from Coral Bay to Dampier

4. 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 LAT and most often in the intertidal zone.

The following section broadly categorises shoreline habitats as the following biological communities; mangroves, intertidal mud/sand banks, beaches, and rocky shores. These communities are discussed in Sections 4.1- 4.5, in terms of the 18 IMCRA v. 4.0 bioregions where relevant and where information is available.

Figure 3-1 broadly illustrate these habitats within the Northwest Shelf Province and Central Western Shelf Transition. Noting that shoreline habitats of the Cocos (Keeling) Islands are not described as the combined EMBA is restricted to the outermost deep waters of the bioregion.

4.1 Mangroves

Mangroves commonly occur in sheltered coastal areas in tropical and sub-tropical latitudes (Kathiresan and Bingham 2001). Up to eight species of mangroves are found further north in the Central Western Shelf Transition region, but at most locations the dominant mangrove (in terms of area of intertidal zone occupied) is *Avicennia marina*, with the stilt rooted mangrove *Rhizophora stylosa* often occurring as thin zones of dense thickets within the broad zone of *A. marina*. Mangroves are found wherever suitable conditions are present including wave dominated settings of deltas, beach/dune coasts, limestone barrier islands and ria/archipelago shores (Semeniuk 1993). Mangrove plants have evolved to adapt to fluctuating salinity, tidal inundation and fine, anaerobic, hydrogen sulfide rich sediment (Duke *et al.* 1998).

Mangroves are important primary producers and have a number of ecological and economic values. For example, they play a key role in reducing coastal erosion by stabilising sediment with their complex root systems (Kathiresan and Bingham 2001). They are also recognised for their capacity to help protect coastal areas from the damaging effects of erosion during storms and storm surge. Mangroves are also important in the filtration of run-off from the land which helps maintain water clarity for coral reefs which are often found offshore in tropical locations (National Oceanic and Atmospheric Administration (NOAA) 2010). The intricate matrix of fine roots within the soil also binds sediments together.

Mangroves play an important role in connecting the terrestrial and marine environments (Alongi 2009). Numerous studies (e.g. Nagelkerken *et al.* 2000, Alongi 2002, Alongi 2009, Kathiresan and Bingham 2001) have shown mangroves to be highly productive and an important breeding and nursery areas for juvenile fish and crustaceans, including commercially important species (Kenyon *et al*. 2004). They also provide habitat for many juvenile reef fish species.

Mangroves also play an important ecosystem role in nutrient cycling and carbon fixing (NOAA 2010). The trees absorb carbon dioxide from the atmosphere and the organic matter such as fallen leaves forms nutrient rich sediments creating a peat layer that stores organic carbon (Alongi 2009, Ayukai 1998).

The muddy sediments that occur in mangrove forests are home to a variety of epibenthic, infaunal and meiofaunal invertebrates (Kathiresan and 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 estuary, 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 also 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 and Crowley 2000).

The two key State regulatory documents relevant to the protection and management of mangroves in WA are:

- EPA (2001) Guidance Statement for Protection of Tropical Arid Zone Mangroves along the Pilbara Coastline. Guidance Statement No. 1; and
- EPA (2016) Technical Guidance – Protection of Benthic Communities and Habitats.

4.1.1 Great Australian Bight Shelf Transition

Mangrove forests occur at sheltered sites on the South Australian coast and cover an area of approximately 230 km^2. Mangroves are poorly represented in the Great Australian Bight as they show preference for low energy, muddy shorelines, particularly in the tropics. Of the 69 species in the world only one occurs in the eastern part of the GAB, the grey mangrove, Av*icennia marina*. It forms coastal woodlands up to 5 m tall with the most significant stands in the GAB occurring near Ceduna in the east (McLeay, 2003).

4.1.2 Central Western Shelf Province

Shark Bay (in the Central Western Shelf Province) supports the southern-most area of substantial mangrove habitat in Western Australia (Rule *et al*. 2012). The mangroves of Shark Bay comprise only one species, the white mangrove *Avicennia marina*, and these trees occur around the coastline in widely dispersed and often isolated stands of varying size.

4.1.3 Central Western Shelf Transition

The regional mangroves from Exmouth to Broome (within the Central Western Shelf Transition and southern part of the Northwest Shelf Province) represent Australia's only 'tropical-arid' mangroves. The most significant stand of mangroves in the Central Western Shelf Transition is Mangrove Bay on the western side of the Cape Range Peninsula in the Ningaloo Marine Park. This small area of mangrove (37 ha) represents the largest area of mangrove habitat within the Ningaloo Marine Park and is considered extremely important from a biodiversity conservation perspective (CALM 2005).

4.1.4 Northwest Shelf Province

In the Pilbara region, the coast is a complex of deltas, limestone barrier islands and lagoons, with a variable suite of substrates. As a result, mangroves in this region form relatively diverse fringing stands, albeit often stunted in stature but at times quite extensive in area. The mangroves along the Pilbara coastline are the largest single unit of relatively undisturbed tropical arid zone habitats in the world. The area has nine mangrove taxa and a total of 632 km^2 mangroves (MangroveWatch 2014). As with most arid zone mangroves, Pilbara mangroves are characterised by open woodlands and shrublands that are of relatively lower productivity than the mangrove communities of the wet tropics because of the extreme water and salinity stresses that affect the intertidal zone in the Pilbara (EPA 2001). Significant stands of mangroves in the Pilbara include:

- Exmouth Gulf: mangrove assemblages within the Bay of Rest on the western shore of the Gulf and the extensive mangrove system on the eastern shore of the Gulf that extends as a series of tidal flats and creek channels from Giralia Bay to Yanrey Flats (Astron 2014). These areas of mangrove are also designated as 'regionally significant' by the EPA (2001). The importance of these mangroves to the Exmouth Prawn Fishery is discussed in Kangas et al. (2006);

- Mainland coast and nearshore islands: mangrove assemblages at Ashburton River Delta, Coolgra Point, Robe River Delta, Yardie Landing, Yammadery Island and the Mangrove Islands are all designated as 'regionally significant' by the WA EPA (2001) and the EPA will give these mangrove formations the highest degree of protection with respect to geographical distribution, biodiversity, productivity and ecological function; and
- Montebello, Barrow and Lowendal Islands: mangrove assemblages all lay within designated reserves. The mangrove communities of the Montebello Islands are considered globally unique as they occur in lagoons of offshore islands (DEC 2007). Mangrove stands identified on Varanus Island occur on the west coast in discrete patches within the tidal and supratidal zones, at South Mangrove Beach and a small embayment (Astron 2016). Mangrove stands on Varanus Island have been identified as healthy, with similar stands also identified as present on Bridled Island to the north of Varanus Island (Astron 2016).

The mangroves of the Kimberley are particularly diverse and relatively untouched. They occupy a variety of coastal settings including rocky shores, beaches and tidal flats (Cresswell and Semeniuk 2011). They belong to the Indo-Malaysian group of Old World Mangroves centred in the Indian-Pacific area (Cresswell and Semeniuk 2011). Of the eighteen species of mangrove plants known to Australia all are represented in the Kimberley including *Avicennia marina, Aegialitis annulata, Aegiceras corniculatum, Rhizophora stylosa, Ceriops tagal, Osbornia octodonta, Bruguiera exaristata, Camptostemon schultzii, Excoecaria agallocha, Sonneratia alba,* and *Xylocarpus australasicus* (Pendretti and Paling, 2001; Waples, 2007). Of these, ten occur only in the Kimberley (Waples 2007). *Rhizophora stylosa* and *Avicennia marina* are the most common mangrove species along the WA Coast.

Mangroves line much of the coastal area within the western Kimberley (and within the proposed Horizontal Falls Marine Park area). They are known to line the shore in the upper reaches of Talbot Bay and to fringe many of the islands of the Buccaneer Archipelago. There are large stands in the southern section of Dugong Bay. Kingfisher Islands has been noted to exhibit extensive mangroves where 10 species of mangrove have been recorded (Wilson 2013). Mangroves line the shores of the southern coast of Collier Bay and large tracts are found in Walcott Inlet and Secure Bay (Duke *et al.* 2010). The mangroves on the eastern side of the inlet extend about 30 km inland (Gueho 2007, Pendretti and Paling 2001, Zell 2007). Further along the coast mangroves have been identified lining much of the shores of Doubtful Bay. Mangroves are also known to line the shores of the Sale River and have been identified in George Water. For detailed maps of mangrove distribution refer to Pedretti and Paling (2001).

4.1.5 Northwest Shelf Transition

Mangroves are also a prominent feature of the North Kimberley. Fringing mangroves have developed around the edge of Prince Frederick Harbour and to the east of Cape Voltaire extending along the shores of Walmesly Bay and Port Warrender (Zell 2007). This region is humid and *Xylocarpus granatum* is localised here (Cresswell and Semeniuk 2011). The rocky coastline between Cape Pond and Cape Voltaire does not lend itself to mangrove development; instead coastal woodland grows on the shores above high water mark. Mangroves are interspersed with rocky outcrops and beaches around much of the Admiralty Gulf, Vansittart Bay and Napier Broome Bay (with extensive stands around the Drysdale estuary). Cape Londonderry marks the westerly limit of *Scyphiphora hydrophylacea* (Duke *et al.* 2010).

Between Cape Londonderry and Cape Dussejour mangrove communities are sparse, and limited to a few small stands in the bays as this part of the coastline is dominated by high relief rocky shores which are exposed to the prevailing easterly winds (Wilson 1994). Extensive mangroves do however line the shores of the islands and rivers in the Cambridge Gulf, where 12 mangrove species have been recorded (Wilson 2013).

The mangroves of the Ord River are notable in terms of their structural complexity and diversity. Fourteen species of mangrove have been recorded in the boundaries (Pedretti and Paling 2001). The mangroves of the Cambridge Gulf are important for saltwater crocodiles and mangrove bird communities. A unique type of flycatcher which is an intermediate between *Microcea flavigater* and *Microeca tormenti* has been identified in the mangroves of the Cambridge Gulf (Johnstone 1984). Additionally, the area is important for maintaining stocks of the commercially exploited species of the Red-Legged Banana Prawns (*Penaeus indicus)* (Kenyon *et al.* 2004).

Further north, mangroves also occur at the Tiwi Islands. Mangrove communities in the Tiwi Islands are predominantly within tidal creeks and are not expected along the shoreline. The Northern Territory mainland coastline, however, has a number of estuaries and rivers that drain into the surrounding hinterland during the wet season, this includes Darwin Harbour that contains approximately 260 km^2 of mangroves (INPEX, 2010).

4.1.6 Timor Province

Details on habitats in the Timor Province is provided in Section 12.3.12.

4.1.7 Northern Shelf Province

Coastlines within the Northern Shelf Province are described as being dominated by mangroves, which provide significant habitat for commercial and non-commercial fish species. In particular, banana prawns tend to favour mangrove areas with the highest catch of banana prawns being recorded in areas with the highest concentration of mangroves (DEWHA, 2008).

4.1.8 Christmas Island Province

There are no coastal mangroves, but a stand of normally estuarine *Bruguiera gymnorhiza* and *B. sexangula* occurs at Hosnie's Spring (registered as a Ramsar Wetlands site of international importance) about 50 metres above sea level. Two other mangrove species occur on the east coast. *Heritiera littoralis* occurs on the inland terrace above Greta Beach (outside the park) and further south towards Dolly Beach, as well as a discrete stand on the terrace above Dean's Point. *Cynometra ramiflora* occurs in two small stands south of Ross Hill (DNP, 2012).

4.1.9 International Waters

Subawa's south coast in Indonesia is thought to contain the most significant stand of mangroves in the Lesser Sunda Ecoregion (DeVantier 2008). Other significant stands have been mapped at the following locations (DeVantier 2008):

+ North-west and south east Bali;
+ North coast of Nusa Lembongan;
+ North-east and east Sumba;
+ South-west, north-west, north and east Flores and Maumere;
+ Komodo Island, and nearby islands; and
+ South west, south, central and north Timor-Leste.

Several Indonesian National Parks, including Laut Sawu Marine National Park, Karimunjawa National Park, Kepulauan Seribu National Park, Teluk Cenderawasih National Park, Kapulauan Wakatobi National Park, Meru Betiri National Park, Togian Islands National Park, Bali Barat National Park, Savu Sea National Marine

Santos

Conservation Area and the World Heritage sites of Komodo National Park, Siberut and Ujung Kulon contain mangrove forest (refer to Section 9.8).

4.2 Intertidal Mud/Sand Flats

Intertidal mudflats form when fine sediment carried by rivers and the ocean is deposited in a low energy environment. Tidal 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 (Robertson 1988). 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).

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. Mudflats also play a vital role in protecting shorelines from erosion (Wade and Hickey 2008).

4.2.1 Central Western Shelf Province

Shark Bay in the Central Western Shelf Province has a protected intertidal ecological community ‘Subtropical and Temperate Coastal Saltmarsh’, as listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It is the northerly limit for this community and there is a transition zone for many saltmarsh species (CALM 1996). The EPBC ‘Listed Advice’ (DSEWPaC 2013a) reports that sediments associated with these communities generally consist of poorly-sorted anoxic sandy silts and clays, and may have salinity levels that are much higher than seawater due to evaporation. The drainage characteristics of coastal soils, along with tidal patterns and elevation, can strongly influence the distribution of flora and fauna within the Coastal Saltmarsh ecological community (DSEWPaC 2013a).

4.2.2 Northwest Shelf Province

Within Northwest Shelf Province both Roebuck Bay and Eighty Mile beach are areas with significant intertidal mudflats that are used by birds in spring and summer including species listed as threatened under the *Biodiversity Conservation Act 2016* (BC Act) or EPBC Act, or listed on the IUCN Red List of Threatened Species (IUCN 2019). Intertidal mudflats are also an important feature of the Kimberley coast forming in many bays and inlets of the region (Waples 2007). The sediments that dominate these flats are generally of terrigenous origin (Wilson 2013).

The mudflats of the Kimberley coast have been shown to be important for migratory birds of the East Asian-Australasian Flyway, which is estimated to support more than five million migratory shorebirds (Barter 2002, Bennelongia Pty Ltd 2010, Wade and Hickey 2008). The migratory birds visit the mudflats of the Kimberley coast to feed on benthic organisms prior to embarking on a 10,000–15,000 km migration to their breeding grounds in the Artic (Wade and Hickey 2008).

4.2.3 Northwest Shelf Transition

Extensive mud flats are located in Collier Bay, where the highest tidal range in Australia is found. (Wilson 2013, Zell 2007). A study by (Duke *et al*. 2010, Masini *et al*. 2009) also identified fringing mudflats around Walcott Inlet, and Doubtful Bay. The tidal mudflats of Walcott Inlet are up to 5 km wide and support a rich intertidal invertebrate community (Gibson and Wellbelove 2010). These invertebrate communities in turn also support large numbers of waterbirds (Wilson 1994).

Extensive intertidal mudflats occur in Prince Frederick Harbour and are generally backed by mangroves. The mudskipper is known to feed on these mudflats at low tide. Intertidal flats are also a feature of the estuary of the Mitchell River. The mudflats of Port Warrender are known to support 20 shorebird species and tern species and it is likely the other mudflats in the region also support high numbers of birds. The ecological significance of the wetlands of the Mitchell River has been recognised in *A Directory of Important Wetlands in Australia*. Mud and sand flats are also known to surround much of Deep Bay and Napier Broome Bay.

Intertidal sand and mudflats are a common feature of the East Kimberley. Large sand bars are present on the river mouths of the King George River, Berkeley River and Lyne River and intertidal mudflats are extensive along the edges of the Cambridge Gulf. The estuary is wide and very shallow in some sections, and the silt and clay is continually picked up and redeposited by strong tidal currents (Robson *et al.* 2008). The tidal flats of the Ord River in the Cambridge Gulf have been listed as a wetland of international importance for the conservation of waterbirds under the Ramsar convention. The area supports a variety of fauna including shorebirds and mudskippers. Tidal mudflats are also extensive along the coast between the Cambridge Gulf and the WA-NT Border.

Further north, the Tiwi islands have also been identified as containing tidal flats, whilst the extent of these are not well documented they are thought to be closely related to the mangrove habitats at the Tiwi Islands (ConocoPhillips, 2020).

4.2.4 Timor Province

Details on habitats in the Timor Province is provided in Section 12.3.12.

4.2.5 Northern Shelf Province

The subtidal and intertidal communities in Darwin Harbour and around the NT coastline, within the Northern Shelf Province are characterised as including a variety of shoreline habitats, including intertidal mud flats (URS 2010). The Tiwi Islands are also partially located within the Northern Shelf Province and are identified as supporting a number of shoreline habitats including sand and mud flats.

4.2.6 International Waters

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 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; and
+ 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 (refer to Section 9.8).

4.3 Intertidal Platforms

Intertidal platforms are areas of hard bedrock and/or limestone with or without a sediment veneer of varying thickness. These platforms can vary from low to high relief and provide a habitat for a diverse range of intertidal organisms (Morton and Britton in Jones 2004, SKM 2009, 2011, Hanley and Morrison 2012) and some species of shore birds (Garnet and Crowley 2000). They are common within each of the coastal bioregions within the combined EMBA.

4.3.1 Southwest Shelf Province and Southwest Shelf Transition

Intertidal platforms within the Northwest and Southwest bioregions support a mosaic of fauna and flora that typically exhibits strong variability in percent cover, community composition, abundance and diversity both between and within reefs at varying spatial and temporal scales (SKM 2009, 2011). Reef platforms typically exhibit zonation of fauna and flora from upper to lower levels on the intertidal zone, with increasing diversity, abundance and biomass lower in the intertidal (Morton and Britton in Jones 2004, SKM 2009, 2010, 2011, Hanley and Morrison 2012).

On the south coast of the Southwest Shelf Province, the coastal geomorphology changes from the predominant limestone reefs to eroded Precambrian rocks. Intertidal platforms are also common along the Southwest Shelf Transition. Shark Bay in the Central Western Shelf Province has a high diversity of intertidal marine habitats as a result of the diversity of benthic substrate, salinity and the broad geographical features which influence depth, water movement and turbidity (CALM 1996, DSEWPaC 2013b). This includes extensive, limestone platforms (as well as sand flats, mud flats, salt marsh and mangroves and beaches (CALM 1996).

4.3.2 Great Australian Bight Transition

The coastline is subject to moderate to high wave energy and high swells (2-4 m). This region features limestone cliffs interspersed by rocky headlands, narrow intertidal rock platforms, reefs and beaches backed by dune barriers.

The Eyre Region is subject to moderate to high wave energy and features a rocky coast with numerous headlands, sheltered bays, cliffs, shore platforms, beaches backed by dune barriers, offshore islands, seamounts and lagoon deposits in sheltered areas (McLeay, 2003).

4.3.3 Central Western Shelf Province and Transition

Limestone pavements extend out from the beach into subtidal zones, e.g. along the Ningaloo Coast and North West Cape; and higher relief platforms (>0.5 m off high water mark) are also present at a number of headlands along the North West Cape.

4.3.4 Northwest Shelf Province and Northwest Shelf Transition

Large tidal regimes are likely to be the defining environmental factor influencing the distribution of intertidal flora and fauna in the Northwest Shelf Province and Northwest Shelf Transition. The intertidal area of the Kimberley has an extreme tidal range (hypertidal) which creates unique environmental conditions and habitats not seen else anywhere else in the world. As a remote area many of the habitats are untouched and they are recognised as having significant conservation value (DPaW 2013). DPaW (2013) reports that as a result of the monsoonal influxes of freshwater and land-derived nutrients distinctive tropical marine ecosystems have occurred.

4.3.5 Christmas Island Province

Rocky shore platforms occur at many locations around the island, more extensively on the western coastline between North West Point and Egeria Point. There are also tidal rock pools which are maintained by wave splash and tidal surge (DNP, 2012).

4.3.6 International Waters

While no significant areas of intertidal platforms have been identified in international waters, the high energy southern coastlines of the islands of the Lesser Sunda Ecoregion of Indonesia (and also including Timor-Leste) are likely to have areas of exposed pavements consisting of limestone and remnant lava flows (Wilson *et al*. 2011).

4.4 Sandy Beaches

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 are found across the combined EMBA and vary in length, width and gradient. They are interspersed among areas of hard substrate (e.g. sandstone) that form intertidal platforms and rocky outcrops. There is a wide range of variation in sediment type, composition, and grain size along the combined EMBA.

Sandy beaches provide habitat to a variety of burrowing invertebrates and subsequently provide foraging grounds for shorebirds (Garnet and 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 characterize those habitats (Wildsmith *et al.* 2005).

Sandy habitats are important for both resident and migratory seabirds and shorebirds (refer Section 8). 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 and Crowley 2000). Sandy beaches can also provide an important habitat for turtle nesting and breeding (see marine turtles Section 6.1).

4.4.1 Southwest Shelf Province

The hooded plover (*Thinornis rubricollis*) is a shorebird found on several beaches within the South West capes. Hooded plovers live on sandy surf beaches and prefer beaches backed by dunes rather than cliffs (DEC 2013). In addition to this, beaches in the South West province provide a variety of socio-economic values including tourism, commercial and recreational fishing, and support other recreational activities.

4.4.2 Southwest Shelf Transition

Sandy beaches throughout the Abrolhos host breeding populations of the Australian sea lion. The Abrolhos represent the northernmost breeding population of Australian sea lions. The current population at the Abrolhos is estimated to be approximately 90 individuals (DoF 2012).

In addition to this, beaches in the South West province provide a variety of socio-economic values including tourism, commercial and recreational fishing, and support of other recreational activities.

4.4.3 Central Western Shelf Province

Sandy beaches are found along the coastline at Shark bay within the marine park which is further described in Section 12.3.2.

4.4.4 Northwest Shelf Province

Eighty Mile Beach Marine Park is one of the Australia's largest uninterrupted sandy beaches (stretching 220 km) and is an important feeding grounds for small wading birds that migrate to the area each summer, travelling from countries thousands of kilometres away (DEC 2012a). It is also a listed Ramsar wetland (see Section 9 on Protected Areas).

4.4.5 Northwest Shelf Transition

Sand habitat within the Camden Marine Park is mainly associated with shorelines and inlets on both mainland and island shores. Some beach deposits on islands in the Kimberley are composed of skeletal carbonate sand, while they may also consist of sediments from inland areas carried to the sea by rivers and gullies (DPaW 2013). The sediment coarseness of the sand may vary, and may also be littered with dead shell, rock and/or coral material. Sea cucumbers that ingest sand and filter out microscopic food are often common in this habitat DPaW 2013).

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

Generally, in this region, sand habitat is adjacent to either dense mangrove stands or rocky cliffs (DPaW 2013). Beaches can be highly influenced by tide and weather conditions. Those that overlie rock are likely to shift and be ephemeral in nature.

4.4.6 Timor Province

Details on habitats in the Timor Province is provided in Section 12.3.12.

4.4.7 Christmas Island Province

These are formed of sand and of coral and shell rubble, often with limestone outcrops. Dolly and West White Beaches are the two largest beaches in the island, while Dolly and Greta Beaches hold sufficient sand to provide habitat for hermit and ghost crabs and to enable green turtles to dig nests (DNP, 2012).

4.4.8 International Waters

The southern coastlines of the islands of the Lesser Sunda Ecoregion of Indonesia and Timor-Leste are known to contain sandy beaches consisting of soft black sand, formed by volcanic activity. Within this region, a number of National Parks are considered important sites for turtle nesting beaches, including the Meru Betiri National Park (refer to Section 9.8).

The World Heritage site of Ujung Kulon is also a known site of sandy beaches, as well as the marine national parks of Kepulauan Seribu and Taka Bonerate which are also known as important turtle nesting sites (See Section 9.8).

4.5 Rocky Shorelines

Rocky shorelines are found across the combined EMBA and are often indicative of high energy areas (wave action) where sand deposition is limited or restricted (perhaps seasonally or during a cyclone). They are formed from limestone pavement extending out from the beach into subtidal zones, for example along the

Ningaloo Coast and North West Cape; higher relief platforms (>0.5 m off high water mark) are also present at a number of headlands along the North West Cape. This habitat is also widespread heading south towards Perth.

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 limestone karsted 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 and Britton cited in Jones 2004). For example, oyster catchers and ruddy turnstones feed along beaches and rocky shorelines (see seabirds in Section 8.2.2).

4.5.1 International Waters

The Lesser Sunda Ecoregion contains numerous rocky shores, particularly on the exposed southern coastlines of the islands that make up the ecoregion. Areas of rocky shores include the following (DeVantier 2008):

- The Bukit Peninsula and Nusa Penida areas of Bali;
- South Lombok;
- South-east Sumbawa;
- Nusa Tengara;
- Sumba; and
- Timor-Leste, including Roti Island, Fatu and Atapupu.

The World Heritage site of Ujung Kulon is also known for its coastline of rocky outcrops, among other ecosystems (see Section 9.8).

4.6 International Shorelines

The EMBA extends to the Indonesian, West-Timor and Timor-Leste coastline. The coastlines of these countries support a range of habitats and communities, including sand and gravel beaches, rocky shores and cliffs, intertidal mudflats, mangroves, seagrass and coral reefs (Tomascik et al. 1997; Asian Development Bank 2014). The coastal waters provide habitat for a number of protected species, including humphead wrasses, marine turtles, giant clams, some mollusc species, crustaceans, cetaceans (dolphins and whales) and dugongs, and commercially important species of fish, shrimps, and shellfish (Asian Development Bank, 2014). Nearshore waters also support significant capture fisheries (commercial and subsistence) that contribute to the nation’s economy and employment (Asian Development Bank 2014).

5. Fish and Sharks

Fish distributions in the combined EMBA are discussed with respect to the IMCRA Provincial Bioregions which were defined using CSIRO's 1996 regionalisation of demersal fish on the continental shelf to the shelf break, and their 2005 regionalisation of demersal fish on the continental slope to approximately 1,200 m depth (DEH 2006). The EPBC species listed as threatened and migratory found in the combined EMBA, according to the Protected Matters search (Appendix A), are shown in Table 5-1 along with their WA and NT conservation listings (as applicable) and discussed in Section 5.2 below.

The following WA conservation codes apply to WA conservation significant fauna:

+ Threatened species (listed under the *Biodiversity Conservation Act 2016* (WA) (BC Act)):
  - Critically endangered
  - Endangered
  - Vulnerable
+ Specially protected species (listed under BC Act):
  - Migratory
  - Species of special conservation interest (conservation dependant fauna)
  - Other specially protected species
+ Priority species (non-statutory state based administrative process):
  - Priority 1, 2 and 3: poorly-known species – possible threatened species that do not meet survey criteria or are otherwise data deficient. Ranked in order of priority. In urgent need of further survey.
  - Priority 4: species that are adequately known, are either: rare but not threatened; meet criteria for near threatened; or delisted as threatened species within last five years for reasons other than taxonomy. Requiring regular monitoring.

The following NT conservation codes apply to NT conservation significant fauna:

+ Threatened wildlife (listed under the Territory Parks and Wildlife Conservation Act 1976 (TPWC Act))
  - Extinct in the wild
  - Critically endangered
  - Endangered
  - Vulnerable
+ Protected wildlife (listed under the Territory Parks and Wildlife Conservation Act 1976)
  - Wildlife in a Territory park, reserve, sanctuary, wilderness zone or area of essential habitat
  - Any vertebrate that is indigenous to Australia

A detailed account of commercial and recreational fisheries that operate in the region is provided in in the Commercial Fisheries Section 14.7 and detailed in *The State of the Fisheries Report* 2018/2019 (Gaughan *et al.*, 2020).

Table 5-1: EPBC listed fish and shark species in the combined EMBA

Species	Conservation Status				Likelihood of occurrence in EMBA	BIA in EMBA
	EPBC Act 1999	BC Act 2016[1]	Other WA Conservation Code	*TPWC Act 1976*		
Cape range cave gudgeon, Blind gudgeon (*Milyeringa veritas)*	Vulnerable	Vulnerable	-	-	Species or species habitat known to occur within area.	None - No BIA defined
Balstons pygmy perch (*Nannatherina balstoni*)	Vulnerable	Vulnerable	-	-	Species or species habitat likely to occur within area.	None - No BIA defined
Blind cave eel (*Ophisternon candidum)*	Vulnerable	Vulnerable	-	-	Species or species habitat known to occur within area.	None - No BIA defined
Blackstriped dwarf galaxias, Black-stripe minnow (*Galaxiella nigrostriatal*)	Endangered	Endangered	-	-	Species or species habitat known to occur within area.	None - No BIA defined
Grey nurse shark (*Carcharias taurus*)	Vulnerable	Vulnerable	-	Listed nationally	Species or species habitat known to occur within area.	None - BIA not found in EMBA
White shark, Great white shark (*Carcharodon carcharias*)	Vulnerable & Migratory	Vulnerable	-	-	Foraging, feeding or related behaviour known to occur within area.	Yes – Refer to Table 5-3
Whale shark (*Rhincodon typus*)	Vulnerable & Migratory	Migratory	-	Listed nationally	Foraging, feeding or related behaviour known to occur within area.	Yes – Refer to Table 5-3
Northern river shark, New guinea river shark (*Glyphis garricki)*	Endangered	-	Priority 1	Endangered	Breeding likely to occur within the area.	None - BIA not found in EMBA
Speartooth shark *(Glyphis glyphis)*	Critically Endangered	-	-	Vulnerable	Species or species habitat known to occur within area.	None - BIA not found in EMBA
Dwarf sawfish, Queensland sawfish (*Pristis clavata)*	Vulnerable & Migratory	Migratory	Priority 1	Vulnerable	Breeding known to occur within area.	Yes – Refer to Table 5-3

[1] The Wildlife Conservation (Specially Protected Fauna) Notice 2018 has been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of threatened, extinct and specially protected species under Part 2 of the BC Act.

Species	Conservation Status				Likelihood of occurrence in EMBA	BIA in EMBA
	EPBC Act 1999	BC Act 2016[1]	Other WA Conservation Code	*TPWC Act 1976*		
Freshwater sawfish, Largetooth sawfish, River sawfish, Leichhardt's sawfish, Northern sawfish (*Pristis pristis*)	Vulnerable & Migratory	Migratory	Priority 3	Vulnerable	Species or species habitat known to occur within area.	Yes – Refer to Table 5-3
Narrow sawfish, Knifetooth sawfish (*Anoxypristis cuspidate)*	Migratory	Migratory	-	-	Species or species habitat known to occur within area.	None - No BIA defined
Green sawfish, Dindagubba, Narrowsnout sawfish (*Pristis zijsron)*	Vulnerable & Migratory	Vulnerable	-	Vulnerable	Breeding known to occur within area.	Yes – Refer to Table 5-3
Oceanic whitetip shark (*Carcharhinus longimanus*)	Migratory	-	-	-	Species or species habitat likely to occur within area.	None - BIA not found in EMBA
Shortfin mako, Mako shark *(Isurus oxyrinchus)*	Migratory	Migratory	-	-	Species or species habitat likely to occur within area .	None - No BIA defined
Longfin mako *(Isurus paucus)*	Migratory	Migratory	-	-	Species or species habitat likely to occur within area.	None - No BIA defined
Reef manta ray, Coastal manta ray *(Manta alfredi)*	Migratory	Migratory	-	-	Species or species habitat known to occur within area.	None - No BIA defined
Giant manta ray *(Manta birostris)*	Migratory	Migratory	-	-	Species or species habitat known to occur within area.	None - No BIA defined
Porbeagle, Mackerel shark *(Lamna nasus)*	Migratory	Migratory	-	-	Species or species habitat may occur within area.	None - No BIA defined
Orange Roughy, Deep-sea Perch, Red Roughy *(Hoplostethus atlanticus)*	Conservation Dependent	-	-	-	Species or species habitat likely to occur within area	None - No BIA defined
Blue Warehou *(Seriolella brama)*	Conservation Dependent	-	-	-	Species or species habitat known to occur within area	None - No BIA defined
Scalloped Hammerhead (*Sphyrna lewini)*	Conservation Dependent	-	-	-	Species or species habitat known to occur within area	None - No BIA defined

Species	Conservation Status				Likelihood of occurrence in EMBA	BIA in EMBA
	EPBC Act 1999	BC Act 2016[1]	Other WA Conservation Code	*TPWC Act 1976*		
School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark *(Galeorhinus galeus)*	Conservation Dependent	-	-	-	Species or species habitat likely to occur within area	None - No BIA defined
Southern Bluefin Tuna *(Thunnus maccoyii)*	Conservation Dependent	-	-	-	Breeding known to occur within area	None - No BIA defined
Southern Dogfish, Endeavour Dogfish, Little Gulper Shark (Centrophorus zeehaani)	Conservation Dependent	-	-	-	Species or species habitat likely to occur within area	None - No BIA defined

5.1 Regional Surveys

Within the combined EMBA a number of important geographical areas for fish exist, including Ningaloo Marine Park, Montebello/Barrow Island Marine Park, Abrolhos Marine Park and the Rowley Shoals.

5.1.1 Southwest Shelf Province

At least 150 species have been identified within the capes region as being reef-associated (Hutchins 1994 cited in DEC 2013). Of these, 77% are warm temperate species, 18% are subtropical species and 5% are tropical (DEC 2013).

The most abundant finfish species across the region identified during surveys were the Maori wrasse (*Opthalmolepis lineolatus*), red banded wrasse (*Pseudolabrus biserialis*), McCulloch scalyfin (*Parma mccullochi*), and western king wrasse (*Coris auricularis*). The yellow headed hulafish (*Trachinops noarlungae*), black headed puller (*Chromis klunzingeri*), rough bullseye and common bullseye (*Pempheris multiradiata* and *P. klunzingeri*) were also common at Eagle Bay and Geographe Bay (Westera *et al.* 2007 cited in DEC 2013).

5.1.2 Southwest Shelf Transition

A total of 389 finfish species have been recorded at the Abrolhos (DoF 2012). The Abrolhos and their surrounding coral and limestone reef systems consist of a combination of abundant temperate macroalgae with coral reefs, supporting substantial populations of large species such as baldchin groper and coral trout. Some of the species occurring in the Abrolhos are dependent on larvae carried southward by the Leeuwin Current from areas further north, such as Shark Bay or Ningaloo Reef. Similarly, populations of some of the species occurring at Rottnest Island are dependent on larvae generated from breeding populations at the Abrolhos (DoF 2012).

More than 20 species of sharks have been identified at the Abrolhos (DoF 2012). These sharks include:

- Port Jackson sharks (Heterodontus portusjacksoni);
- Tiger shark (Galeocerdo cuvier);
- Whaler sharks (Carcharhinus brachyurus); and
- Wobbegongs (Orectolobus maculatus).

Santos

Abrolhos waters are considered to be an important food source for sharks, due to the resident fish populations. Various species of rays have been recorded at the Abrolhos. These include the manta ray and the white spotted eagle ray (DoF 2012).

5.1.3 Southern Province

The demersal fish assemblages inhabiting the shelf break and slope resemble those found on the Southeast Marine Region's continental slope more than those of the Central Western Province. The canyons south of Kangaroo Island and adjacent shelf break appear to be important areas for biological productivity and for spawning and aggregation for a range of marine species, particularly during winter. The Albany Group of submarine canyons south of Albany and Esperance are also considered important for biological productivity that attracts feeding aggregations (DEWHA 2008b).

Scientists have described 463 species of fish on the slope of this bioregion, of which 26 are endemic. Only one extensive study of slope fish communities, undertaken during the late 1980s, has been conducted in this bioregion. There is a lower proportion of bottom-feeding demersal fish in this bioregion compared with the west coast, which appears to relate to greater availability of food such as meso-pelagic fish like myctophids (lantern fish) in the water column. Commercial fish landings taken from the shelf break and down the upper and mid-slope include orange roughy, blue grenadier, Bight redfish, school shark, gummy shark, angel shark, gemfish, deep water flatheads, leatherjackets, latchets, stingrays and stingarees (DEWHA 2008b).

Fisheries scientists and some fishers speculate that species such as blue grenadier and western gemfish may have spawning aggregations amongst the submarine canyons and other prominent geological features rising from the seafloor on the slope adjacent to Esperance and Hopetoun. The Diamantina Fracture Zone represents a unique but virtually unknown region of deep-sea habitat and experts speculate it is highly likely that marine communities in this area comprise unique species with high biodiversity. The physical complexity of numerous troughs and ridges and complex water circulation that occurs in this area support these assertions. A number of KEFs are defined which support enhanced productivity and aggregations of marine life (Section 10) (DEWHA 2008b).

5.1.4 Great Australian Bight Shelf Transition

Of the 600 species of fish occurring in southern Australia, 370 are recorded from South Australian waters (Scott et al. 1980). Species restricted to South Australia that occur in the GAB include the coastal stingaree (*Urolophus orarius*) and the crested threefin (*Norfolkia cristata*.

In South Australia, 77 species of fish are utilised commercially. The main fishes targeted by commercial fishers in the GAB are southern bluefin tuna (*Thunnus maccoyii)*, sardine (*Sardinops sagax*), school shark (*Galeorhinus galeus*), gummy shark (*Mustelus antarcticus*), bronzewhaler shark (*Carcharhinus brachyurus*), snapper *(Pagrus auratus*), King George whiting (*Sillaginodes punctata*) and deepwater species such as deepwater flathead (*Neoplatycephalus conatus*), bight redfish (*Centroberyx gerrardi*), deep sea trevalla (*Hyperoglyphe antarctica*) and orange roughy (*Hoplostethus atlanticus*). Surveys conducted by the CSIRO in the GAB between 1965 and 1989 collected information on species composition, sizes, and distribution patterns of fishes. Surveys were conducted by trolling (1979, 1981) and demersal (1978-81), pelagic (1979) and mid-water trawling (1978, 1980-81). CSIRO also have data from Russian surveys conducted in the GAB in 1965-1974.

Recreational fishers in the GAB target Australian salmon (*Arripis truttacea*), mulloway (*Argyrosomus japonicus*), snapper (*Pagrus auratus*), King George whiting (*Sillaginodes punctata*), Australian herring (*Arripis georgiana*) and yellowtail kingfish (*Seriola lalandi*) (Mcleay et al., 2003; DEWHA, 2008b).

5.1.5 Central Western Shelf Province

The Central Western Shelf Province is located near Shark Bay and is the northern limit of a transition region between temperate and tropical marine fauna. Of the 323 fish species recorded from Shark Bay, 83% are tropical species with 11% warm temperate and 6% cool temperate species (CALM 1996).

5.1.6 Central Western Shelf Transition

Ningaloo is the largest fringing coral reef in Australia, forming a discontinuous barrier that encloses a lagoon that provides habitat for many fish species. Gaps that regularly intercept the main reef line provide channels for water exchange with deeper, cooler waters (CALM 2005). Ningaloo Reef is a well known biodiversity hotspot, supported by the direct link between the reef and the ancient reef systems found closer to the equator by the Leeuwin Current (Kemps 2010). Approximately 500 species of fish have been reported to inhabit the reef (Kemps 2010). The Piercam project from inception in 2005 to 2013, identified 165 fish species from 50 families at the Point Murat Navy Pier alone, located within the Ningaloo Marine Park (Whisson & Hoschke 2013).

Seasonal aggregations of whale sharks occur at Ningaloo each year (CALM 2005). There is limited data available on species diversity and distribution of sharks in the Ningaloo area as chondrichthyan biodiversity for the area has not been specifically recorded. Despite this, it is possible that the Ningaloo Reef Marine Park contains the largest and most diverse collection of sharks on the Australian coastline (Stevens *et al.* 2009). It was estimated in 2009 by Last and Stevens (cited in Stevens *et al.* 2009), that there are likely to be 118 species of chondrichthyan fishes occurring in the park. Of these species, 59 are shark species predicted to be found at depths of less than 200 m (Stevens *et al.* 2009).

The lagoon at Ningaloo Reef appears to provide a juvenile habitat and nursery area for shark species such as the grey nurse shark (*C. taurus*), black-tipped reef shark (*Carcharhinus melanopterus*) and other reef sharks (Carcharhinidiae) (Stevens *et al.* 2009). A study conducted on the distribution and abundance of elasmobranches in the Ningaloo Marine Park, in 2009, tracked the movements of six key shark species. Species such as *Galeocerdo cuvier* (tiger shark) and *Sphyrna mokarran* (great hammerhead) were found to remain for brief time periods in the park, in contrast to other species found to re-visit the Ningaloo area (Stevens *et al.* 2009). Several species of sharks within Ningaloo have been identified as key indicator species for the health of the system (Stevens *et al.* 2009).

Barrow Island includes Biggada Reef, an ecologically significant fringing reef, and the Montebello Islands comprise over 100 islands, the majority of which are rocky outcrops; providing fish habitat (DEC 2007a). Within the Barrow/Montebello region, at least 380 fish species have been recorded (de Lestang & Jankowski 2017). Most species exhibit wide distributions, with local species composition closely resembling that of the Dampier Archipelgao. Coral habitats support the most diverse fish community in this region, comprising, among others, many species of damselfish (Pomacentridae), parrotfish (Scaridae), snappers (Lutijanidae) and groupers (Serranidae) (de Lestang & Jankowski 2017). The region's macroalgal habitats are considered important nursery areas for a diverse range of fish species, such as emperor (Lethrinidae), threadfin bream (Nemipteridae), tuskfish (Labridae) and trevally (Carangidae) (de Lestang & Jankowski 2017).

Ramsar wetlands within the area (e.g. Eighty Mile Beach and Ashmore Reef National Nature Reserve) can also provide important habitat for fish (see Section 9.1.3).

5.1.7 Central Western Transition

The biological communities of the Central Western Transition are thought to be distinctive owing to the proximity of deep oceans areas to the continental slope and shelf, resulting in close interaction between pelagic species of the Cuvier Abyssal Plain and those of the slope and shelf (DEWHA 2008a).

The present level of understanding of the marine environment in this bioregion is generally poor. The diversity of fish and cephalopod species changes with depth, generally decreasing species numbers with increasing depth. The demersal slope fish bioregionalisation identified some endemism in communities in this bioregion (Last *et al*. 2005), however, it is lower than other areas of the North-west Marine Region (DEWHA 2008a).

Bentho-pelagic fish, such as deep-water snappers (e.g. *Paracaesio* spp, and *Eletis* spp.), hatchetfish (*Argyropelecus* spp.), dragonfish (*Melacosteus* spp.), viperfish (*Chauliodus* spp.) and a number of eels species migrate between the benthic and pelagic systems, forming an important link between these systems (DEWHA 2008a).

Transient fish species through the Central Western Transition bioregion include southern bluefin tuna (migrating to and from spawning grounds), broadbill swordfish (*Xiphius gladius*), bigeye tuna (*Thunnus obesus*), yellowfin tuna (*Thunnus albacares*) and striped marlin (*Tetrapturus audax*). Pelagic sharks also range across the bioregion following schools of pelagic fish (DEWHA 2008a).

5.1.8 Central Western Province

The Perth Canyon appears to be an important ecological feature attracting krill and fish aggregations that in turn attract larger species such as predatory fish and pygmy blue whales (DSEWPaC 2012). Demersal slope fish assemblages in this bioregion are characterised by high species diversity. Scientists have described 480 species of demersal fish that inhabit the slope of this bioregion and 31 of these are considered endemic to the bioregion. Demersal fish on the slope in this bioregion in particular have high species diversity compared with other more intensively sampled oceanic regions of the world. Below 400 m water depth demersal fish communities are characterised by a diverse assemblage where relatively small, benthic species (grenadiers, dogfish and cucumber fish) dominate.

5.1.9 Northwest Transition

The Northwest Transition bioregion may support sparse populations of bentho-pelagic fish and cephalopods in low densities. Pelagic fish species likely to be present include grenadiers and hatchetfish (*Argyropelecus* spp.) as well as transient populations of highly mobile pelagic fish. Adult and juvenile southern bluefin tuna are through to migrate through this bioregion on their way to and from spawning grounds in the north-eastern Indian Ocean (DEWHA 2008a).

The slope habitat of this bioregion is associated with important populations of demersal fish species and supports the second richest demersal fish assemblage nationally (Last *et al*. 2005). Over 508 fish species have been identified on the slope in this area and 64 of these species are endemic. The high diversity and endemism of the demersal fish fauna indicates important interactions between physical processes and trophic structures in this bioregion. For more information on the slope habitat for fish and sharks, refer to Section 10.1.19.

The Rowley Shoals within the Northwest Transition comprise three oceanic reef systems approximately 30–40 km apart, namely Mermaid Reef, Clerke Reef and Imperieuse Reef. The Shoals are thought to provide a source of invertebrate and fish recruits for reefs further south and as such are regionally significant (DEC 2007b).

5.1.10 Northwest Shelf Province and Northwest Province

The demersal zone of the North West Shelf (which includes the Northwest Province and Northwest Shelf Province) hosts a diverse assemblage of fish of tropical Indo-west Pacific affinity, with up to 1,400 species known to occur, with a great proportion of these occurring in shallow coastal waters (Allen *et al*. 1988). Last *et al*. (2005) and Fox and Beckley (2005) described the North-west Province as being characterised by a high level of endemism and species diversity. Certain areas of increased biological activity (e.g. Glomar Shoals) attract demersal fish species such as Rankin cod, red emperor, crimson snapper and spangled emperor that are exploited by commercial trawl and trap fisheries (Sainsbury *et al*. 1992, Fletcher and Santoro 2013).

The shallow waters (<30 m) of the Dampier Archipelago, in the Northwest Shelf Province, support a characteristic and rich fish fauna of 650 species from a variety of habitats including coral and rocky reefs, mangroves, sand and silty bottoms and sponge gardens (Hutchins 2003 & 2004). The majority of these species are found over hard substrate, but significant numbers are also found from soft bottom and mangrove areas. The outer islands of the Archipelago are inhabited predominantly by coral reef fishes whereas inner areas close to the mainland are occupied by mangrove and silty-bottom dwellers. The inter-island passages have a relatively rich soft bottom fauna. EPBC Act protected fish species within the Dampier Archipelago include the dwarf sawfish (*Pristis clavata*), freshwater sawfish (*Pristis pristis*) and narrow sawfish (*Anoxypristis cuspidate*).

The fish fauna of the archipelago is less diverse than the islands of the West Pilbara to the south, but are closely related to the fauna at the offshore Montebello Islands (Hutchins 2004). The fish fauna of Barrow/ Lowendal/ Montebello Islands are widespread throughout the Indo-west Pacific region.

Within the southern portion of the Northwest and Northwest Shelf Province, small pelagic fish (e.g. lantern fishes) comprise a third of the total fish biomass (Bulman 2006) and inhabit a range of marine environments, including inshore and continental shelf waters. These small pelagic fish play an important ecological role, not only for this particular area but for the entire NWMR. They feed on pelagic phytoplankton and zooplankton and provide a food source for a wide variety of predators such as marine mammals, sharks, large pelagic fish and seabirds, thus providing a vital link between many of the region's trophic systems (Mackie *et al*. 2007).

Pelagic fish in the Northwest and Northwest Shelf Province include tuna, mackerel, herring, pilchard and sardine, and game fish such as marlin and sailfish (BBG 1994, Brewer *et al*. 2007), some of which are targeted by both commercial and recreational fishers. In particular, adult and juvenile southern bluefin tuna are thought to migrate through the North West Shelf on their way to and from spawning grounds in the north-eastern Indian Ocean. However, the timing of these migrations and the use of regional currents to assist their migration is still unclear. The oceanic waters of the North West Shelf are also believed to provide important spawning and nursery grounds for a number of large pelagic fish species. Table 5-2 provides a summary of the key fish species and likely timing of their spawning in the region (DoF correspondence).

5.1.11 Northwest Shelf Transition

Creek systems, mangroves and rivers, and ocean beaches within this region provide habitat for a variety of species including barramundi, tropical emperors, mangrove jack, trevallies, sooty grunter, threadfin and cods (Fletcher and Santoro 2013). The offshore atolls and the continental shelf waters in the Northwest Shelf Transition are also geographically important for fish species. They support species of recreational and commercial interest, including saddle-tail snapper and red emperor, cods, coral and coronation trout, sharks, trevally, tuskfish, tunas, mackerels and billfish (Gaughan et al. 2019).

The Rowley Shoals within the Northwest Shelf Transition comprise three oceanic reef systems approximately 30–40 km apart, namely Mermaid Reef, Clerke Reef and Imperieuse Reef. The Shoals are thought to provide a source of invertebrate and fish recruits for reefs further south and as such are regionally significant (DEC 2007b). See Section 11 on State Marine Parks and Nature Reserves for further details on important geographical areas for fish.

Table 5-2: Spawning and aggregation times of key commercially caught fish species within the North West Shelf

Species		Month											
Species Common Name	Species Latin Name	J	F	M	A	M	J	J	A	S	O	N	D
Blacktip shark	*Carcharhinus tilstoni* and *C. limbatus*												
Goldband snapper	*Pristipomoides multidens*												
Rankin cod	*Epinephelus multinotatus*												
Red emperor	*Lutjanus sebae*												
Sandbar shark	*Carcharhinus plumbeus*												
Spanish mackerel	*Scomberomorus commerson*												
Pink snapper	*Pagrus auratus*												
Baldchin groper	*Choerodon rubescens*												
Crystal (snow) crab	*Chaceon spp.*												
King George whiting	*Sillaginodes punctate*												
Spangled emperor	*Lethrinus nebulosus*												
Pearl oyster	*Pinctada maxima*												
Blue-spotted emperor	*Charaxes cithaeron*												
Dusky whaler	*Carcharhinus obscurus*	May occur throughout the year											
Whiskery shark	*Furgaleus macki*												
Gummy shark	*Mustelus antarcticus*	Peak pupping periods unknown											
Fish	other species	Timing of spawning activity varies between species											

5.1.12 Timor Province

The diversity of demersal fish assemblages on the continental slope in the Timor Province (as well as the Northwest Transition and the Northwest Province) is high compared to elsewhere along the Australian continental slope (DSEWPaC 2012). Elements of the Timor Province are not well known, due to limited survey data in the northern limits of the region. The province is geographically extensive and includes 418 fish species, 64 of which are endemic to the region (Last *et al.* 2009). Key indicator species include *Bembrops nelsoni*, *Bythaelurus* sp., *Halicmetus* sp., *Malthopsis* spp, *Neobythites australiensis*, *Nobythites bimaculatus*, *Neobythites macrops*, *Neobythites soelae*, *Parapterygotrigla* sp., *Physiculus roseus* (Last *et al.* 2005).

Scott and Seringapatam Reefs are regionally important for the diversity of their fauna, including 558 fish species (Department of the Environment (DoE) 2014). Scott Reef has enormous habitat diversity and is considered a hot spot for fish, with five endemic species (DoE 2014). Scott 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 (DoE 2014).

The diversity of fish at Ashmore Reef is also higher than other comparable reefs in the bioregion with over 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).

5.1.13 Timor Transition

Records show that the Timor Transition hosts at least 284 demersal fish species (DEWHA, 2008c). The Timor Transition is also known to have a number of pelagic species that are prominent in the open water environment, including some which also have pelagic larval stages in the area (DEWHA, 2008c). The North Marine Bioregional Plan Profile specifically describes pelagic species found within the trough of the Timor Transition including snaggle-teeth fish, hatchet fish and lantern fish (DEWHA, 2008c). The soft-edge/slope of the Timor Transition is also known to support whale sharks and threadfin fish species, with the canyons and channels having distance genetic stocks of red snapper (DEWHA, 2008c).

5.1.14 Northern Shelf Province

Records of the fish species in the Northern Shelf Province show that the majority of available information shows an abundance of fish species in the Gulf of Carpentaria, which is outside the combined EMBA. However, other fish species, including sharks and sawfish are known to occur within the estuarine waters and coastal waters of the Northern Shelf Province (DEWHA, 2008c).

Within the combined EMBA, the Arafura Shelf supports a number of submerged reefs that are used for breeding and aggregation of a number of fish species including mackerel, mangrove jack and snapper (DEWHA, 2008c). Sea snakes and shark species have also been observed in the reef areas (DEWHA, 2008c). Furthermore, the Canyons of the Arafura Depression key ecological feature, which is also within the combined EMBA, is specifically identified as attracting aggregations of predatory fish, whale sharks and sawfish (DEWHA, 2008c).

5.1.15 Christmas Island Province

The Christmas Island Province is in deep, offshore waters (2,200 m – 6,000 m depth range). The island's predominantly intact fringing reefs and adjacent waters support a number of marine and coastal ecosystems and species, including over 600 fish species, with most being typical of the Indian Ocean region. These waters provide habitat for pelagic finfish species including tuna (*Thunnus* sp.) and wahoo (*Acanthocybium solandri*), and some demersal species such as ruby snapper (*Etelis carbunculus)*. The island has more than 50 reef fish species that are not found anywhere else in Australia (although some species may also occur at the neighbouring Cocos Islands) (DNP, 2014).

5.1.16 Cocos (Keeling) Islands Province

The bulk of fish species are widespread or Indo-west Pacific in origin, which points to the significance of the Indonesian Throughflow current in delivering larval recruits to the island. About two thirds of fish species are shared with Christmas Island. A range of pipefish (syngnathidae) have been sighted in with eight identified at the Cocos (Keeling) Islands. This list is biased towards the shallow habitats where data has been collected by divers. There are likely to be more species occurring in these territories than recorded (e.g. in deeper water, on seamounts, slopes etc) (Brewer et al 2009).The province has an intermediate level of primary productivity due to the distance from upwelling events such as those associated with the Java coast. However, the shallower seamounts would be likely to have some significant upwelling or associated with them, which in turn will produce increased productivity and populations of pelagic fish such as bigeye (*Thunnus obesus*) and yellowfin tuna (*T. albacares*).

5.2 Fish Species

Four species of fish listed as Threatened under the EPBC Act (Table 5-1) were identified in the Protected Matters search (Appendix A):

- Balston's pygmy perch (*Nannatherina balstoni*);
- Black-stripe minnow (*Galaxiella nigrostriata*);
- Blind gudgeon (*Milyeringa veritas*); and
- Blind cave eel (Ophisternon candidum).

In addition the Barrow cave gudgeon *(Milyeringa justitia*) has been identified as relevant threatened species under the BC Act. This species is not listed under the EPBC Act.

5.2.1 Blind Gudgeon, Balston's Pygmy Perch and Blind Cave Eel

Both the blind gudgeon (*Milyeringa veritas*) and blind cave eel (*Ophisternon candidum*) are known to occur on the Cape Range Peninsula (in the Central Western Shelf Transition) (Humphreys and Feinberg 1995), and a related species of the genus Milyeringa, the Barrow cave gudgeon *(Milyeringa justitia*) has also been noted at Barrow Island (Humphreys 1999). The Barrow cave gudgeon is listed as Vulnerable under the WA BC Act. They have been recorded in waters ranging from fresh to seawater at depths of up to 33 m in caves and 50 m in wells and bores. Both species are restricted to either caves or groundwater (Humphreys and Blyth 1994) and are the only two vertebrate animals known from Australia for this (DoE 2014a).

The Balston's pygmy perch distribution ranges from Moore River (75 km north of Perth) at the northern extent to Two Peoples Bay near Albany. This freshwater species is typically associated with shallow waters near riparian vegetation and is considered to have low salinity tolerance, making it unlikely to occur in estuarine conditions (DoEE, 2016).

5.2.2 Syngnathids

The EPBC Protected Matters search also identified 72 'listed marine species of fish which are largely from the family Syngnathidae (Appendix A). Syngnathids are a group of bony fishes that include seahorses, pipefishes, pipehorses and sea dragons, although taxonomic uncertainty still surrounds a number of these (DEWHA 2012a). Knowledge about the distribution, abundance and ecology of syngnathids is limited, although no species is currently listed as threatened or migratory.

5.3 Sharks, Rays and Sawfishes

The diversity of marine environments in the waters within the NWMR has led to a rich fauna of cartilaginous fish (sharks and rays). Of the approximately 500 shark species found worldwide, 19% (94) are found in the region (DEWHA 2008a). The EPBC Act Protected Matters search (Appendix A) identified five species of shark and three species of sawfishes listed as threatened within the search area between southwest WA and northern NT (Table 5-1), including:

- Grey nurse shark (*Carcharias taurus*);
- Great white shark (*Carcharodon carcharias*);
- Northern river shark (*Glyphis garricki*);
- Whale shark (*Rhincodon typus*);
- Speartooth shark (Glyphis glyphis);

- Dwarf sawfish (*Pristis clavata*);
- Freshwater sawfish (*Pristis pristis*); and
- Green sawfish (*Pristis zijsron*).

In addition, the oceanic whitetip shark (*Carcharhinus longimanus*), the narrow sawfish (*Anoxypristis cuspidate*), two species of ray, the reef manta ray (*Manta alfredi*) and giant manta ray (*Manta birostris*), the porbeagle (*Lamna nasus*) and the longfin (*Isurus paucus*) and shortfin (*Isurus oxyrinchus*) mako sharks are listed as migratory within the search area (Table 5-1).

The Biologically Important Areas (BIAs) for relevant species detailed above are illustrated in Figure 5-1, Figure 5-2 and Figure 5-3.

5.3.1 Grey Nurse Shark

The grey nurse shark (*Carcharias taurus*) is listed as vulnerable under the EPBC Act and the BC Act, and may be found within the combined EMBA. In Australia, the grey nurse shark is now restricted to two populations, one on the east coast from southern Queensland to southern NSW and the other is predominantly found around the southwest coast of WA, but has been recorded on the North West Shelf (DEWHA 2012b, Pogonoski *et al*. 2002). It is believed that the east and west coast populations do not interact, and ongoing research will probably confirm that the populations are genetically different (Last and Stevens 2009).

While it is thought that grey nurse sharks have a high degree of site fidelity, some studies (McCauley 2004) suggest that grey nurse sharks move between different habitats and localities, exhibiting some migratory characteristics. 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 in the vicinity of inshore rocky reefs and islands (Pollard *et al*. 1996). The species has been recorded at varying depths but is generally found between 15–40 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).

No grey nurse shark BIAs were identified in the combined EMBA.

5.3.2 Great White Shark

The great white shark (*Carcharodon carcharias*) is listed as vulnerable and migratory under the EPBC Act and is listed as vulnerable under the BC Act. In Australia, great white sharks have been recorded from central Queensland around the south coast to northwest WA but may occur further north on both coasts (Last and Stevens 2009). There are no known aggregation sites for white sharks in the North-west marine region, but the species has been recorded in North West Shelf waters during humpback migrations (DEWHA 2012b). They are widely but not evenly distributed in Australian waters and are considered uncommon to rare compared to most other large sharks (CITES 2004).

Study into great white shark populations is difficult (Cailliet 1996) given the uncertainty about their movements, emigration, immigration and difficulty in estimating the rates of natural or fishing mortality.

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 2009). The relevant great white shark BIAs in the combined EMBA are detailed in Table 5-3 and is shown on Figure 5-1 (DoEE 2019b).

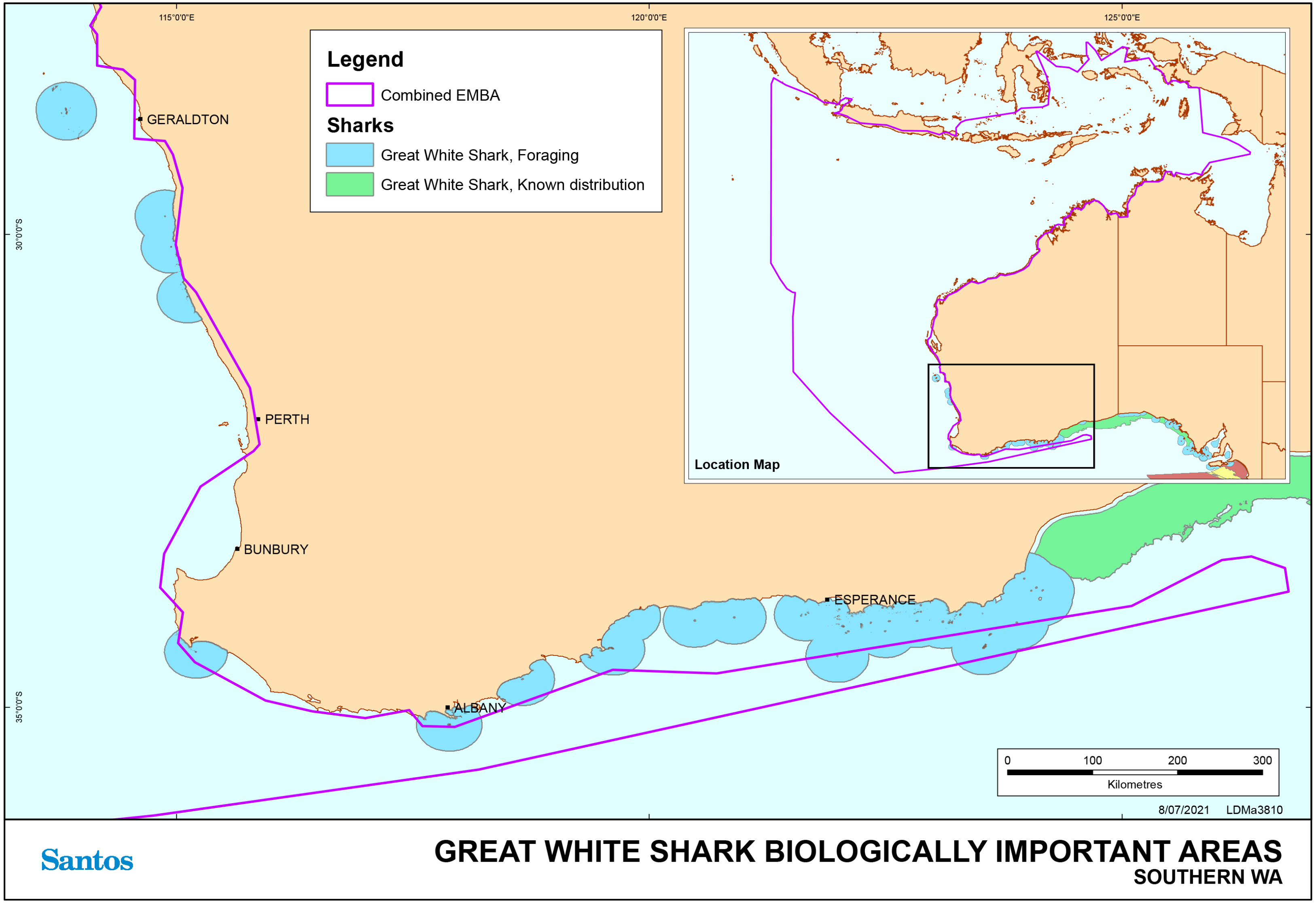


Figure 5-1: Biologically important area – great white shark

5.3.3 Northern River Shark

The northern river shark (*Glyphis garricki*) is listed as endangered under the EPBC Act and is one of the rarest species of shark in the world. Adults only recorded in marine habitats, whereas neonates, juveniles and subadults recorded in freshwater, estuarine and marine environments. It is also listed as a Priority 1 conservation species in WA and as Endangered under the NT *Territory Parks and Wildlife Conservation Act 1976*.

The associated recovery plan (Sawfish and River Sharks Multispecies Recovery Plan, Commonwealth of Australia 2015) identifies adults and juveniles are being known in WA marine waters north of Derby. Pupping and juvenile sharks are identified as known to occur in Cambridge Gulf and pupping is also identified as likely to occur in King Sound. Under the associated recovery plan all areas where aggregations of individuals have been recorded displaying biologically important behaviours such as breeding, foraging, resting or migrating are considered critical to the survival of the species unless population data suggests otherwise.

5.3.4 Whale Shark

The whale shark (*Rhincodon typus*) is listed as vulnerable and migratory under the EPBC Act and is also listed as a specially protected species under the BC Act as a species of special conservation interest (conservation dependent fauna). The species is also classified as vulnerable on the World Conservation Union's Red List of Threatened Species (Norman 2005) and are protected under the WA *Conservation and Land Management Act 1984, NT Territory Parks and Wildlife Conservation Act 1976* and WA *Fish Resources Management Act 1994*.

The whale shark is the largest of all fish (>18 m; Borrell *et al*. 2011; Chen *et al*. 1997, Compagno 2001) and is a migratory species with worldwide geographical ranges between 30º N and 35º S (Last and Stevens 2009). Whale sharks are mostly epipelagic, whereby they spend a large amount of time in the top 200 m of the ocean (Tyminski *et al*. 2015), with a significant portion being spent at surface (<20 m) (Rowat & Brooks, 2012). This leads to an increased potential risk of vessel collision, which has been demonstrated from tracking data of 348 individuals (across all areas of distribution) showing a 92% horizontal and nearly 50% vertical space overlap with persistent large vessel (>300 gross tons) traffic (Womersley *et al.* 2022). There is a general lack of knowledge on many aspects of whale shark biology, however, the species is known to have a slow rate to sexual maturity, with field based studies from the Maldives estimating male sexual maturity to be approximately 25 years (Perry *et al.* 2018), with females potentially maturing even later (Pierce *et al.* 2021). This 'slow' life-history strategy places whale sharks at increased vulnerability to anthropogenic impacts (Pierce *et al.* 2021).

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. 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). However, recent studies analysing fatty acids within whale shark tissue, suggest the species may also feed on benthic food sources, such as floating macroalgae (Meekan *et al.,* 2022; Courturier *et al.,* 2013*; Marcus* et al., 2016).

One of the best-known aggregation sites for whale sharks occurs along the central and NW coast of Western Australia from March to July and is focused at Ningaloo Reef, within 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 and Stevens 2007). The timing of this aggregation coincides with a pulse in seasonal productivity that results in large abundances of tropical krill on which these filter feeding sharks feed (Meekan *et al*. 2006, Jarman and 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 deep. A tourist industry based on snorkelling with the sharks in this area has developed over the last 15 years and is now estimated to be worth over $4 million annually to the local economy of the Ningaloo region.

Estimates of the size of the population participating in the Ningaloo aggregation are between 300 and 500 individuals (Meekan *et al*. 2006), but research indicates that the Ningaloo population of whale sharks is declining (Bradshaw *et al*. 2007).

Whale sharks are known to be highly migratory with migrations of 13,000 km being recorded (Eckert and 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 Western Australian population migrate through the North West Shelf. Wilson *et al*. (2006) tagged 19 whale sharks in 2003 and 2004, with long term movements patterns successfully recorded from six individuals. All travelled northeast 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 North West Shelf (Harriet Alpha 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). Whale sharks are well known to occur in the Christmas Island territory. There is evidence that the Christmas Island territory is on the migration route for many individuals, but they are rarely sighted within the Cocos (Keeling) Islands territory.

A common method for monitoring individual whale sharks is the use of variations in spot patterns, which has recently been tested to be 100% successful based on 154 photographic and genetic markers (Meenakshisundaram, 2021).

A biologically important area for whale sharks is located in northern WA, offshore of the Pilbara and Kimberley coastline, and broadly follows the 200 m isobath. The relevant whale shark BIAs in the combined EMBA are detailed in Table 5-3 and is shown on Figure 5-2.

DBCA has a wildlife management program to manage whale shark interactions in reserves - *Whale shark management with particular reference to Ningaloo Marine Park, Wildlife Management Program no. 57 (2013).*

5.3.5 Speartooth Shark

The speartooth shark (*Glyphis glyphis)* is a medium sized shark found in tidal rivers and estuaries within the Northern Territory and Queensland (DAWE, n.d). It is listed as critically endangered under the EPBC Act and Vulnerable under the NT *Territory Parks and Wildlife Conservation Act 1976.*

There are three distinct geographical locations where the speartooth shark is known to occur with only one of these areas within the combined EMBA, the Van Diemen Gulf.

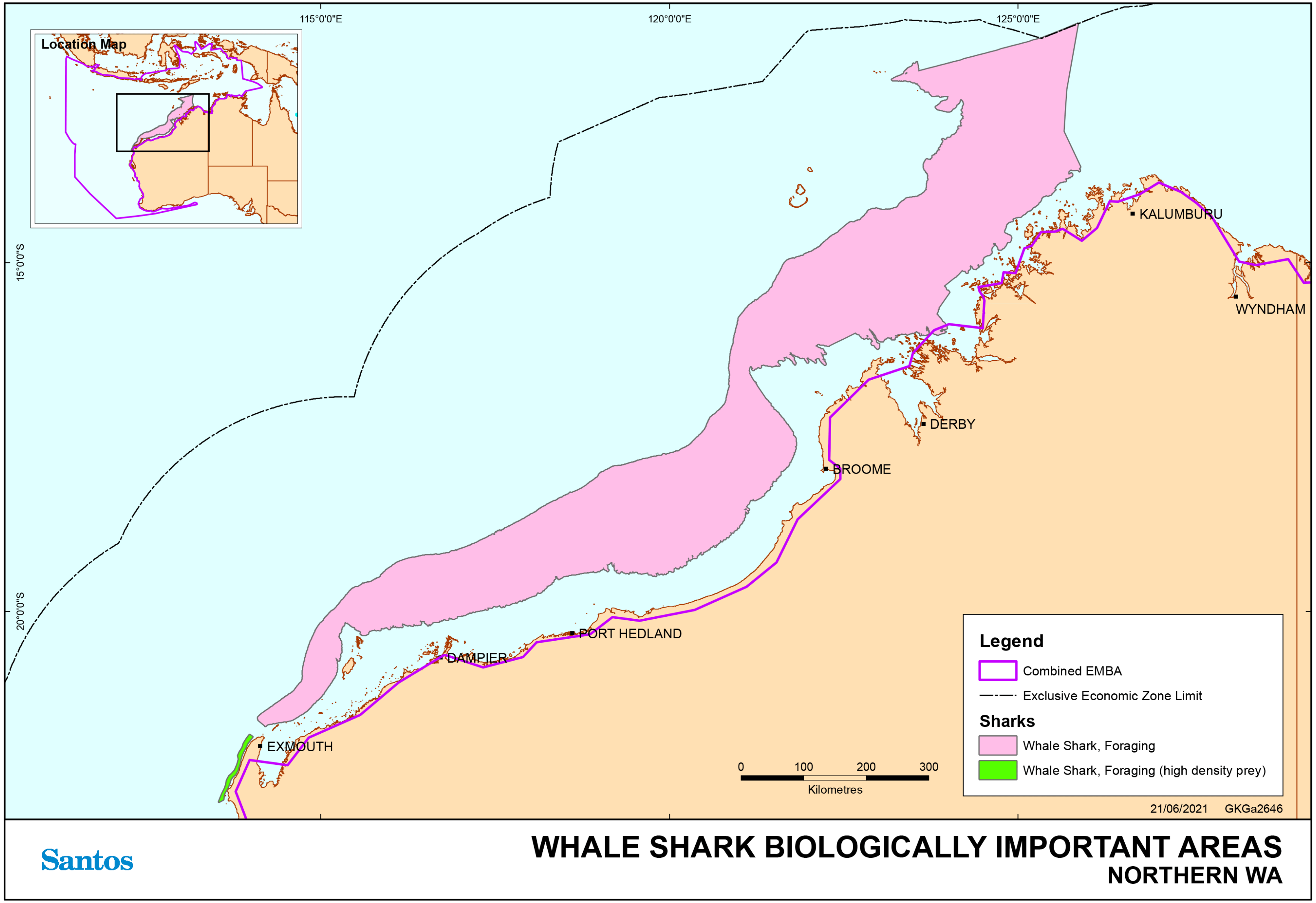


Figure 5-2: Biologically important area – whale shark

5.3.6 Dwarf Sawfish

The dwarf sawfish (*Pristis clavata*) is listed as vulnerable under the EPBC Act and thought to be restricted to Australia (DoE 2014b). It is also listed as a Priority 1 conservation species in WA and as Vulnerable in the NT. The Australian distribution of the dwarf sawfish is considered to extend across northern Australia and along the Kimberley and Pilbara coasts (Last and Stevens 2009, Stevens *et al*. 2005). However, the majority of records of dwarf sawfish in WA and the NT have come from 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*. 2004). Adults are known to seasonally migrate back into inshore waters (Peverell 2007); although it is unclear how far offshore the adults travel as captures in offshore surveys are very uncommon. The species' range is restricted to brackish and salt water (Thorburn *et al*. 2007).

The recovery plan identifies pupping as known to occur in the King Sound, the Cambridge Gulf and 80 Mile Beach, with pupping likely to occur identified at a number of locations along the Pilbara and Kimberly Plan (Commonwealth of Australia, 2015). Under the associated recovery plan all areas where aggregations of individuals have been recorded displaying biologically important behaviours such as breeding, foraging, resting or migrating are considered critical to the survival of the species unless population data suggests otherwise.

The relevant sawfish BIAs in the combined EMBA are detailed in Table 5-3 and are shown on Figure 5-3.

5.3.7 Freshwater and Green Sawfish

The freshwater sawfish (*Pristis pristis) (*also previously listed as the Largetooth sawfish*)* and green sawfish (*Pristis zijsron)* are listed as vulnerable under the EPBC Act. The freshwater sawfish is listed as a Priority 3 conservation species in WA, while the green sawfish is listed as Vulnerable under the BC Act and both species are listed as Vulnerable in the NT under the *Territory Parks and Wildlife Conservation Act 1976.*

The freshwater species are wider-ranging than the dwarf sawfish and are also found in the Indo-west Pacific (DoE 2014c, DoE 2014d). Important areas for sawfishes include King Sound, and the Fitzroy, Durack, Robinson and Ord rivers for the freshwater sawfish; and Cape Keraudren for the green sawfish (Stevens *et al*. 2008, Thorburn *et al*. 2007, 2008).

Sawfishes generally inhabit inshore coastal, estuarine and riverine environments. The freshwater sawfish has been recorded in north-west Australia from rivers (including isolated water holes), 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 less saline waters during the wet season to give birth (Peverell 2005) and freshwater river reaches play an important role as nursery areas (DoE 2014c).

The green sawfish 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 2014d).

Short-term tracking has shown that green sawfish appear to have limited movements that are tidally influenced, and they are likely to occupy a restricted range of only a few square kilometres within the coastal fringe, with a strong association with mangroves and adjacent mudflats (Stevens et al. 2008).

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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).

Baseline surveys undertaken for Chevron's Wheatstone project identified green sawfish habitat and nursery area for juveniles within the north-eastern lagoon of the Ashburton Delta and in Hooley Creek near Onslow. Distribution of sawfish in these creeks is spatially and seasonally variable due to changing tidal and environmental conditions. However, they typically return to inshore waters to breed and pup during the wet season (i.e. January) (Chevron 2011).

The relevant sawfish BIAs in the combined EMBA are detailed in Table 5-3 and are shown on Figure 5-3.

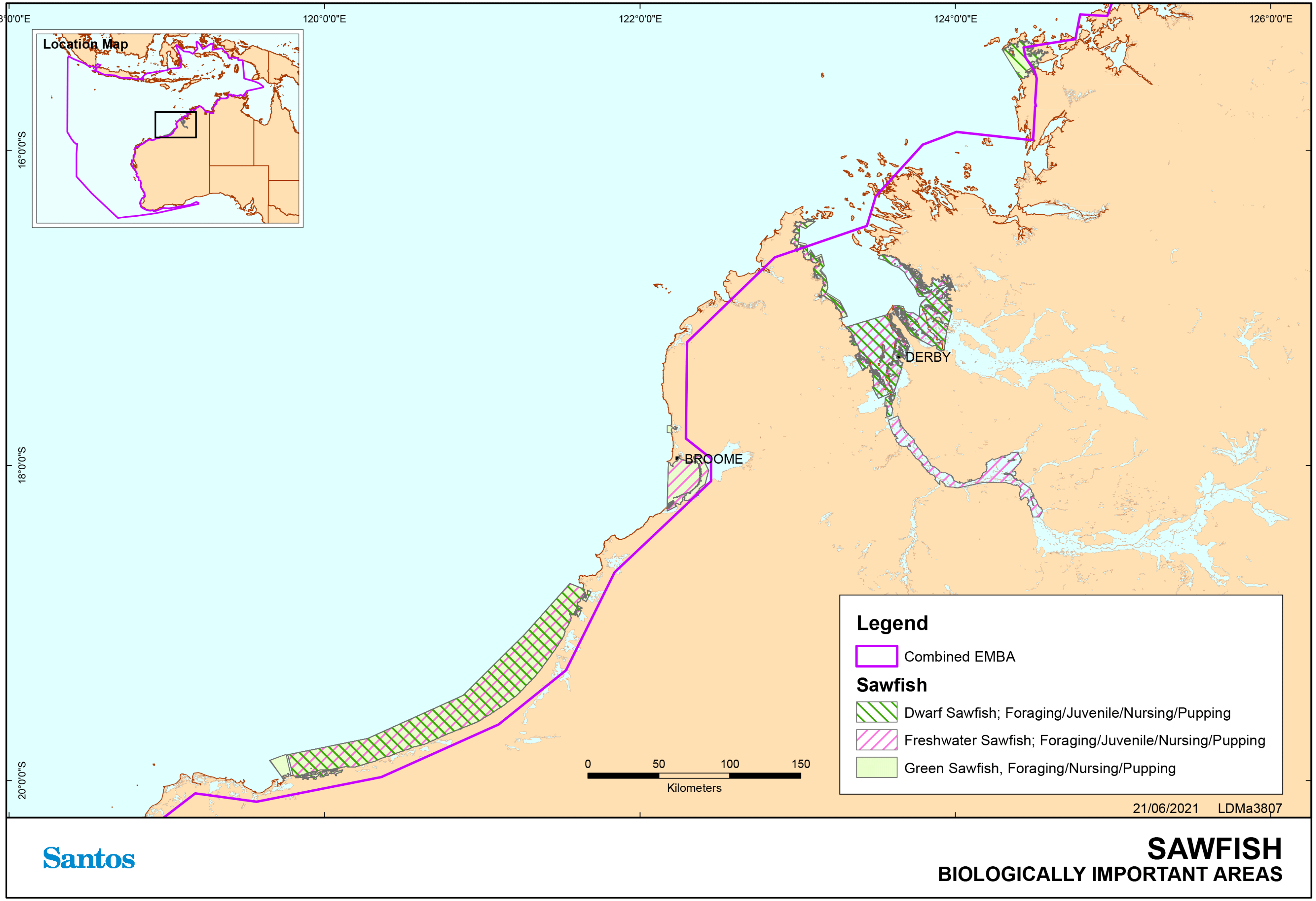

Figure 5-3: Biologically important areas – sawfish

5.3.8 Narrow Sawfish

The narrow sawfish (*Anoxypristis cuspidata*) is listed as migratory under the EPBC Act. It is a marine or marginal (brackish water) species found from inshore waters to a depth of 40 m (Compagno *et al.* 2006). Though details of its ecology are not precisely known, it probably spends most of its time on or near the bottom in shallow coastal waters and estuaries. A study showed the narrow sawfish to be the most abundant amongst the sawfish sampled in the Gulf of Carpentaria (Peverell, 2005) which holds some consistency with the offshore distribution of the species as shown by a study of Northern Prawn Fishery by-catch. Peverell (2005) also used catch data of offshore surface net fisheries to conclude that narrow sawfish also inhabit the mid-water column and can thus be described as a benthopelagic animal. The narrow sawfish is known to form aggregations of mature females during the months of October to November. Its Australian distribution is unclear though it is most common in the Gulf of Carpentaria with southward ranges extending to Broad Sound in Queensland and the Pilbara Coast (circa 116°E), Western Australia (Last & Stevens 2009).

5.3.9 Giant Manta Ray / Reef Manta Ray

The giant manta ray appears to be a seasonal visitor to coastal or offshore sites. Giant manta rays are often seen aggregating in large numbers 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 (*Mobula birostris*) 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 birostris*) 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 100–2,000 individuals). A proportion of the individuals in some populations undertake significant coastal migrations (IUCN 2019). Since the species is migratory it is possible that individuals may be encountered in the operational area, however, given that they generally do not aggregate in large groups, high numbers are not expected to be encountered during the activities.

5.3.10 Oceanic Whitetip Shark

The oceanic whitetip shark (*Carcharhinus longimanus*) is listed as migratory under the EPBC Act. The oceanic whitetip shark is widespread throughout tropical and subtropical waters of the world (30° N to 35° S) (IUCN 2020). They are an oceanic and pelagic species that regularly occurs in waters of 18 to 28°C, usually >20°C (IUCN 2020). Within Australian waters, they are found from Cape Leeuwin (Western Australia) through parts of the Northern Territory, down the east coast of Queensland and New South Wales to Sydney (Last and Stevens 2009). They are usually found in surface waters, though can reach depths of >180 m (Castro et al. 1999). They have occasionally been recorded inshore but are more typically found offshore or around oceanic islands and areas with narrow continental shelves (Fourmanoir 1961, Last and Stevens 1994).

5.3.11 Shortfin Mako and Longfin Mako Sharks

The shortfin mako and longfin mako sharks are listed as migratory under the EPBC Act. The longfin mako is widely distributed but rarely encountered oceanic shark that ranges from Geraldton around the north coast to at least Port Stephens in New South Wales (DSEWPaC 2012). The shortfin mako 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.

5.3.12 Porbeagle (Mackerel Shark)

The porbeagle (mackerel shark) (*Lamna nasus*) is listed as migratory under the EPBC Act. The porbeagle is wide-ranging, typically occurring in oceanic waters off the continental shelf, although they occasionally enter coastal waters (Francis *et al*. 2002 cited in DoE 2014e). The porbeagle is known to undertake seasonal migrations, although the timing and details of these migratory movements are not well understood (Saunders *et al.* 2011 cited in DoE 2014e).

5.4 Biologically Important Areas / Critical Habitat – Fish

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 DAWE, however, they have no legal status, but are designed to assist decision making under the EPBC Act. They are not designed to identify protected areas, but may inform such processes. Table 5-3 below provides an overview of BIAs in the combined EMBA for fish.

The DAWE may make recovery plans for threatened fauna listed under the EPBC Act. The EPBC Act requires that 'habitat critical to the survival of the listed threatened species' is identified in recovery plans, and summary of relevant recovery plans is listed in Section 13.2. BIAs may overlap these sites, but may be identified for other purposes. DAWE state that the criteria used to identify 'habitat critical to the survival of the species' are more complex than those used to identify BIA. Specifically, the Sawfish and River Sharks Multispecies Recovery Plan (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"*.

In addition, both the EPBC Act and WA BC Act and associated regulations (2018) provide for the listing of critical habitat - habitat 'critical to the survival of the threatened species'. To date no critical habitat in WA has been listed under either Act. No provision is made under the Territory Parks and Wildlife Conservation Act 1976 for listing critical habitat.

Table 5-3: Biologically important areas – fish

Species	Scientific name	Aggregation area and use	Specific geographic locations for species
Great white shark	*Carcharodon carcharias*	Foraging – associated with pinniped colonies in the mid-west and south west and waters off Bremer Bay	Waters off pinniped colonies throughout the South-west Marine Region Waters off Bremer Bay
Whale shark	*Rhincodon typus*	Foraging (high density prey) – Ningaloo Reef Foraging – Wider Ningaloo Region	Ningaloo Marine Park and adjacent Commonwealth waters Northward from Ningaloo along 200 m isobath
Dwarf sawfish	*Pristis clavata*	Foraging – Eighty Mile Beach, King Sound, Camden Sound Nursing - Eighty Mile Beach, King Sound, Fitzroy River and May Robinson River Pupping – Eighty Mile Beach, King Sound, Fitzroy River and May Robinson River Juvenile – King Sound, Fitzroy River and May Robinson River	Eighty Mile Beach Camden Sound - eastern shore Fitzroy River Mouth, May and Robinson River - tidal tributaries King Sound (inshore waters)
Freshwater sawfish	*Pristis pristis*	Nursing – King Sound Foraging – King Sound, Roebuck Bay, Eighty Mile Beach Pupping – Roebuck Bay, Eighty Mile Beach Juvenile – Roebuck Bay	Eighty Mile Beach King Sound - tidal tributaries Roebuck Bay
Green sawfish	*Pristis zijsron*	Pupping – Cape Keraudren, Eighty Mile Beach, Roebuck Bay, Willie Creek, Cape Leveque Foraging - Cape Keraudren, Roebuck Bay, Cape Leveque, Camden Sound Nursing - Cape Keraudren, Eighty Mile Beach, Ashburton River and Hooley Creek near Onslow	Eighty Mile Beach Camden Sound Cape Keraudren Cape Leveque Roebuck Bay Willie Creek Ashburton River Hooley Creek

6. Marine Reptiles

Thirty-four species of listed marine reptiles under the Commonwealth EPBC Act are known to occur in Australian waters in the combined EMBA, according to the Protected Matters search (Appendix A). An examination of the species profile and threats database (DoEE 2019) showed that some listed reptile species are not expected to occur in significant numbers in the marine and coastal environments in the combined EMBA due to their terrestrial distributions. Hence, these species are not discussed further.

Of the remaining reptile species identified in the Protected Matters search (Appendix A), eight are listed as threatened and seven are listed as migratory. These species are show in Table 6-1 along with their WA and NT conservation listings (as applicable)[2]. BIAs within the combined EMBA area discussed in Table 6-3.

Table 6-1: EPBC listed marine reptile species in the combined EMBA

Species	Conservation Status				Likelihood of occurrence in EMBA	BIA in EMBA
	EPBC Act 1999	BC Act 2016	Other WA Conservation Code	*TPWC Act 1976*		
Green turtle (*Chelonia mydas*)	Vulnerable Migratory	Vulnerable	-	-	Breeding known to occur within area	Yes – refer to Table 6-3
Flatback turtle (*Natator depressus*)	Vulnerable Migratory	Vulnerable	-	-	Breeding known to occur within area	Yes – refer to Table 6-3
Hawksbill turtle (*Eretmochelys imbricata*)	Vulnerable Migratory	Vulnerable	-	Vulnerable	Breeding known to occur within area	Yes – refer to Table 6-3
Loggerhead turtle (*Caretta caretta*)	Endangered Migratory	Endangered	-	Vulnerable	Breeding known to occur within area	Yes – refer to Table 6-3
Olive ridley turtle (*Lepidochelys olivacea*)	Endangered Migratory	Endangered	-	-	Breeding known to occur within area	Yes – refer to Table 6-3
Leatherback turtle (*Dermochelys coriacea*)	Endangered Migratory	Vulnerable	-	Critically Endangered	Foraging feeding or related behaviour known to occur within area	Yes – refer to Table 6-3

[2] An overview of WA fauna conservation codes is provided in Section 5 (fish and sharks).

Species	Conservation Status				Likelihood of occurrence in EMBA	BIA in EMBA
	EPBC Act 1999	BC Act 2016	Other WA Conservation Code	*TPWC Act 1976*		
Short-nosed seasnake (*Aipysurus apraefrontalis*)	Critically Endangered	Critically Endangered	-	-	Species or species habitat known to occur within area	None - No BIA defined
Leaf-scaled seasnake (*Aipysurus foliosquama*)	Critically Endangered	Critically Endangered	-	-	Species or species habitat known to occur within area	None - No BIA defined
Salt-water crocodile *(Crocodylus porosus)*	Migratory	Migratory	-	-	Species or species habitat likely to occur within area	None - No BIA defined

6.1 Marine Turtles

Six species of marine turtle occur in, use the waters, and nest on sandy beaches, in and around the combined 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 6-1).

These six species are listed on the EPBC Act List of Threatened Species as either 'endangered' or 'vulnerable' and all six species are also listed as 'migratory'. They are also listed as threatened species under the BC Act and the hawksbill turtle, loggerhead turtle and leatherback turtle are also protected under the NT *Territory Parks and Wildlife Conservation Act 1976.*

A summary of the different habitat types used during the various life stages of marine turtle species identified in the combined EMBA is given in Table 6-2.

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Table 6-2: Summary of habitat types for the life stages of the six marine turtle species in the combined EMBA (DSEWPaC, 2012b)

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.	Currently unknown for North West Shelf region.	Offshore from nesting beaches.	Little is known for North West Shelf region but expected to occur either en-route or adjacent to nesting beaches.	Not recorded within North West Shelf region.	Not recorded within North West Shelf region.
	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.	Poorly studied for North West Shelf region by generally prefer high energy, relatively narrow, steeply sloped, coarse-grained beaches.	Not recorded within North West Shelf region.	Not recorded within North West Shelf region.
	Internesting	Shallow coastal waters within several kms of nesting beach. Inter-nesting buffers of 20 km identified around all nesting habitats.	Shallow nearshore waters within 5-60 km of nesting beach. Inter-nesting buffers of 40-60 km identified around all nesting habitats.	Shallow coastal waters within several kilometres of nesting beach. Inter-nesting buffers of 20 km identified around all nesting habitats.	Shallow coastal waters within several kilometres of nesting beach. Inter-nesting buffers of 20 km identified around all nesting habitats.	Not recorded within North West Shelf region. Inter-nesting buffers of 20 km identified around all nesting habitats.	Not recorded within North West Shelf region.
	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 feed 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.

6.1.1 Loggerhead Turtle

The loggerhead turtle (*Caretta caretta*) has a worldwide distribution, living and breeding in subtropical to tropical locations (Limpus 2008b). Breeding aggregations in Australia occur on both the east coast (Queensland and NSW) and the west. The annual nesting population in Western Australia 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 2008b). Loggerhead turtles have one genetic breeding stock within Western Australia (Commonwealth of Australia 2017a).

The WA distribution of sandy beach nesting areas extends from Shark Bay to the southern area of the North West Shelf, with occasional late summer nesting crawls recorded as far north as Barrow and Varanus Islands and the Lowendal and Rosemary Islands (DSEWPaC 2012d). Major nesting locations include the Muiron Islands, the Ningaloo Coast south to Carnarvon and the islands around Shark Bay, which includes Dirk Hartog Island, one of the principal nesting and internesting sites in WA (Limpus 2008). The Recovery Plan for Marine Turtles in Australia (2017) identifies the Muiron Islands (as a principal rookery), and all waters within a 20 km radius as habitat critical to the survival of loggerhead turtles (Commonwealth of Australia 2017a).

Estimates of up to 5,000 female loggerhead turtles have been predicted within the Ningaloo Marine Park and Muiron Islands Marine Management Area (Waayers 2010). Earlier surveys found higher proportions of nesting loggerheads in the southern areas of the reserves (CALM 2005a). Aerial surveys conducted in 2000 and 2001 in the Exmouth region recorded only 12 sightings in Commonwealth waters and these turtles were most likely loggerheads (BHP 2005). In a survey commissioned by Santos around the islands in the Exmouth Region, loggerhead turtles were recorded nesting on Flat Island north of the Exmouth Gulf which was the first time they had been recorded in that location (Astron 2014). Loggerhead nesting and breeding occurs from November to March, with a peak in late December/early January (Limpus 2008b).

Foraging areas are widespread for loggerhead turtle populations and migrations from nesting to feeding grounds can stretch thousands of kilometres, including feeding grounds as far north as the Java Sea of Indonesia for the WA population (Limpus 2008b). Loggerhead turtles have also been sighted in the Christmas and Cocos (Keeling) Islands. Shark Bay has been identified as an important foraging habitat for loggerhead turtles (Commonwealth of Australia 2017a). Loggerhead turtles are carnivorous and feed primarily on benthic invertebrates from depths of up to approximately 50 m to near shore tidal areas including areas of rocky and coral reef, muddy bays, sand flats, estuaries and seagrass meadows (Limpus 2008b).

Figure 6-1 illustrates the BIAs and habitat critical (draft) for loggerhead turtles (as defined in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017a).

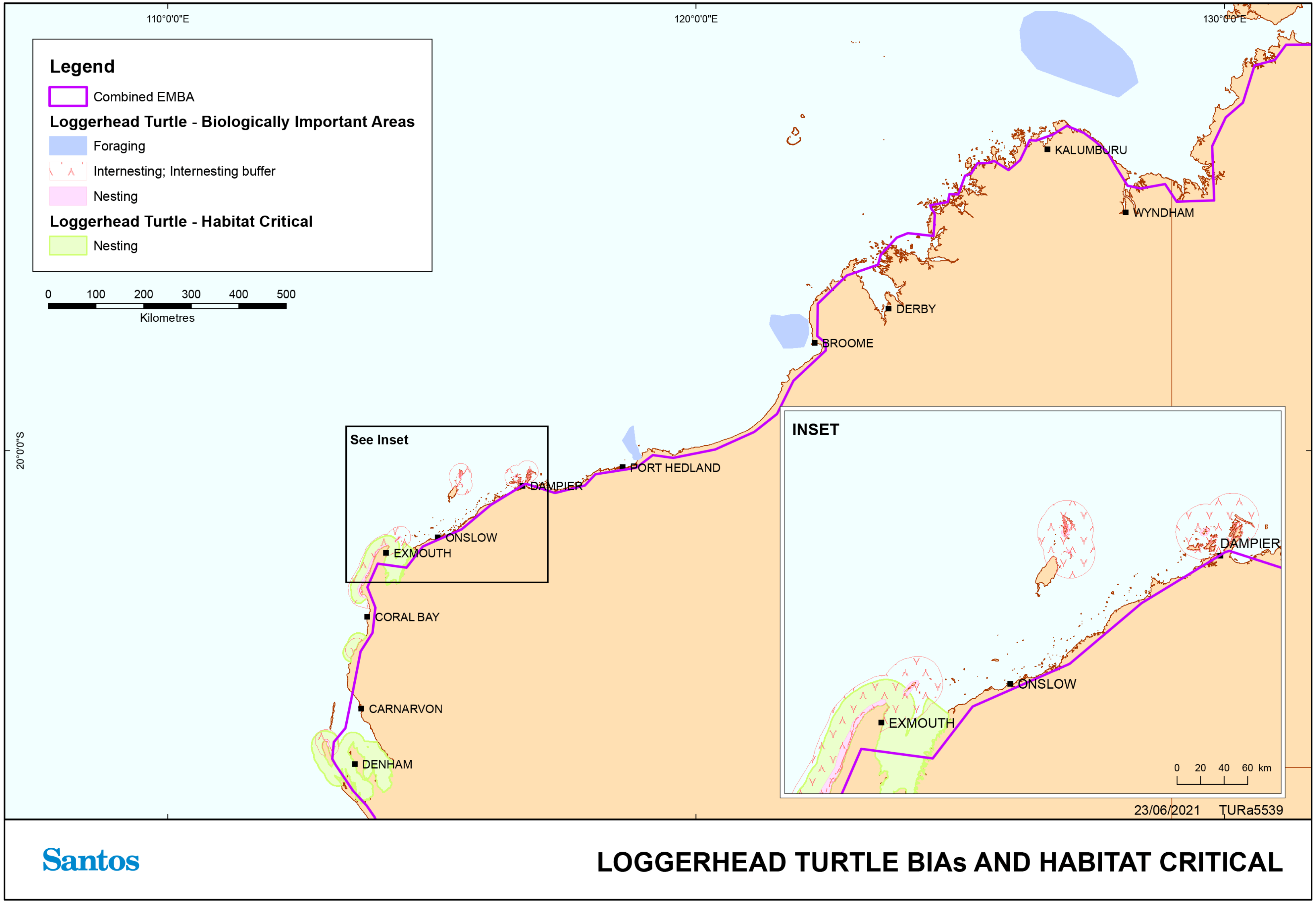

Figure 6-1: Biologically Important Areas and Habitat Critical – Loggerhead Turtle

6.1.2 Green Turtle

Australian population of green turtles is estimated to be approximately 70,000 and is divided into seven genetically distinct breeding aggregations. The species is widespread and abundant in WA and NT waters with an estimated 20,000 individuals occurring, arguably the largest population in the Indian Ocean (Limpus 2008a). There are three distinct breeding stocks in WA waters which include: the North west Shelf stock, the Scott-Browse stock and the Ashmore Stock (Commonwealth of Australia 2017a).

The North west Shelf population is one of the largest in the world and the most significant rookery is the western side of Barrow Island (Prince 1994, Limpus 2008a). Other principal rookeries include the Lacepede Islands, Montebello Islands, Dampier Archipelago, Browse Island and North West Cape (Prince 1994, Limpus 2008a, DSEWPaC 2012b). See Table 6-3 for a complete list.

Surveys by Waayers (2010) within the Ningaloo Marine Park and Muiron Islands Marine Management Area estimated up to 7,500 female green turtles used these areas. In 2014, Santos commissioned a survey of the islands in the Exmouth Region which found that North and South Muiron Islands were significant nesting sites for green turtles with over 100 green turtles nesting overnight on one beach at North Muiron Island (Astron 2014). The green turtle is also known to breed in large numbers in the dunes above the extensive beaches found on Serrurier Island, with counts indicating the island supports the second largest rookery in the Pilbara (Oliver 1990).

Lower density green turtle nesting has also been recorded on Jurabi coast, Thevenard Island, Lowendal Islands and in Exmouth Gulf (Limpus 2008a). Only low numbers of green turtles have been observed nesting on Varanus Island, as well as Airlie Island (Pendoley Environmental 2011). From monitoring undertaken in 2016/17 by Santos on Varanus Island; three green turtles were observed to nest over a four week tagging effort (Astron 2017).

Green turtles have also been recorded nesting in the Bonaparte or Van Diemen Gulf bioregions and some nesting has been recorded on the west coast of Bathurst Island in the Tiwi Islands and Melville Island. BIAs for Green turtles occur on the north coast of the Tiwi Islands and an internesting buffer has been defined 20 km from the Tiwi Islands with internesting expected between October and April (DoEE, 2017).

Green turtle nesting abundance and timing fluctuates significantly from year to year depending on environmental variables, locality and food availability (Pendoley Environmental 2011). Nesting of green turtles has been recorded from August to March on Serrurier Island (Woodside 2002), from December to March along coast adjacent to Ningaloo (CALM 2005a) and from October to February on Varanus Island (Pendoley Environmental 2011). On Barrow Island, mating aggregations may commence from October with peak nesting from December to January, with hatchlings emerging through summer and early autumn. However, nesting on Barrow Island has been recorded all year round (Chevron 2005 and 2008, Pendoley 2005). Nesting on the Scott Reef-Sandy Islet and Browse Island has been observed all year round with peaks between December and January (Commonwealth of Australia 2017a).

In northern and eastern Australia, fluctuations in green nesting numbers have been linked the Southern Oscillation Index (Limpus & Nicholls, 1994, Limpus & Nicholls, 1988) and sea surface temperatures (Solow et al., 2002). In the NT nesting sites occur mostly from the western end of Melville Island to near the border with Queensland (Northern Territory Government, n.d). There are also four nationally significant nesting sites in the NT being the Cobourg Peninsula, the mainland from Gove to the northern edge of Blue Mud Bay, the southeast of Groote Eylandt and the northern beaches of islands in the Sir Edward Pellew group (Northern Territory Government, n.d). The Cobourg Peninsula genetic stock of Green turtles is the closest to those found within the combined EMBA on the Tiwi Islands. The nesting period for these are between October and April with the peak nesting period occurring between December and January.

Green turtles nest on both Christmas and Cocos (Keeling) Islands, though in low densities on Christmas Island. Up to 100 green turtles nest per year on Cocos (Keeling) Islands, mainly on the north atoll. Green turtles nesting on both Christmas and Cocos (Keeling) Islands are likely to be unique genetic stocks. They also use shallow reef habitats on both islands to forage (Brewer et al, 2009).

The re-nesting period for female green turtles is approximately five years (Hamann *et al*. 2002).

Green turtles spend the first five to ten years of their life drifting on ocean currents, before moving to reside in shallower benthic habitats, including tropical coral and rocky reefs and seagrass beds. Green turtles have been known to migrate more than 2,600 km between feeding and breeding grounds (Limpus 2008a).

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

Figure 6-2 illustrates the BIAs and habitat critical (draft) for green turtles (as defined in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017a).

Santos

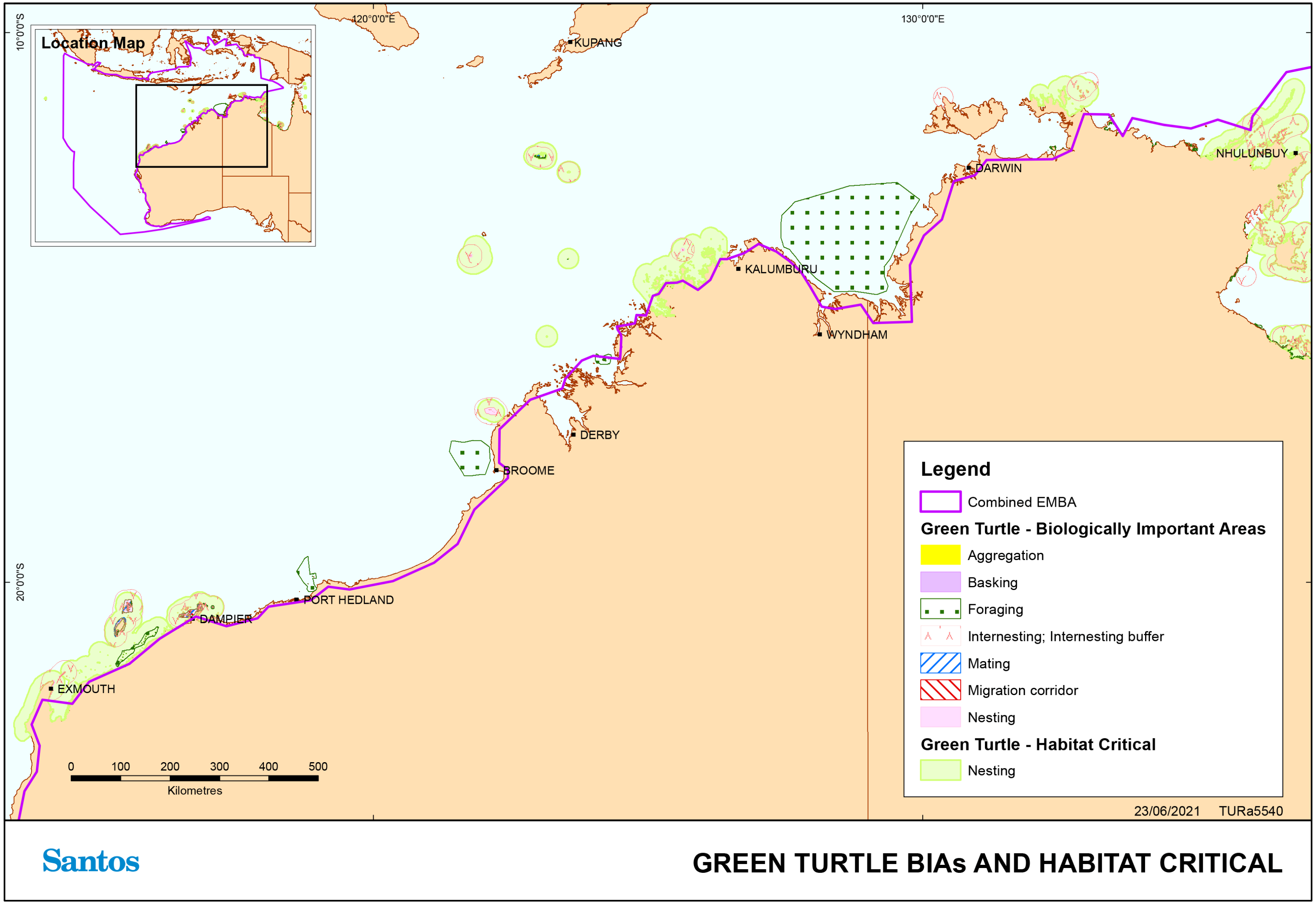

Figure 6-2: Biologically Important Areas and Habitat Critical – Green Turtle

6.1.3 Hawksbill Turtle

Hawksbill turtles (*Eretmochelys imbricata*) have a global distribution throughout tropical and sub-tropical marine waters. The Western Australian stock is concentrated on the North West Shelf (Dampier Archipelago) (Limpus 2009a),and is considered to be one of the largest hawksbill populations remaining in the world. The estimated number of nesting hawksbill turtles in WA waters is between 2,000 and 4,500 individuals (Morris 2004). There is a second major population of Hawksbill turtles in Australia, which is genetically isolated from the North West Shelf population located along the Northern Territory coast and north-eastern Queensland (Northern Territory Government, n.d).

In WA, their nesting range is relatively small and extends from the Muiron Islands to the Dampier Archipelago, a distance of approximately 400 km. The most significant breeding areas, that support hundreds of nesting females annually, are around sandy beaches within the Dampier Archipelago, Montebello Islands, Lowendal Islands and Barrow Island (Pendoley 2005, Limpus, 2009a).

The largest known nesting area for the North West Shelf population is the sandy shoreline of Rosemary Island, within the Dampier Archipelago, particularly on the north-western side of the Island. It is believed that the Rosemary Island rookery may support up to 1,000 nesting females annually (Limpus 2009). Low density nesting is also known from Barrow Island, Airlie Island, Muiron Islands and North West Cape/ Ningaloo coast (Cape Range) (Limpus 2009a). Nesting hawksbills have also been found on NE Regnard Island and SW Regnard Island, confirming the Regnard Islands as hawksbill rookeries (Pendoley Environmental 2009).

The hawksbill turtle nesting population within the Exmouth region is also considered important as the populations in Western Australia represent the largest remaining population in the Indian Ocean (CALM 2005). The best estimate of numbers within the Ningaloo Marine Park and Muiron Islands Marine Management Area is between 20–700 individuals (Waayers 2010).

A snapshot survey of Varanus Island and the Lowendal Islands conducted for Santos during October 2012 found the five most frequented beaches by hawksbills, based on the track counts, were Beacon Island (*n*=43), Parakeelya (*n*=41), Kaia (*n*=40), Rose (*n*=30) and Pipeline (*n*=28). Results of the October 2012 three-day track census program showed that Beacon Island also hosted the highest daily number of overnight emergences by hawksbills and is therefore an important nesting beach for hawksbill turtles (Pendoley Environmental 2013).

On Varanus Island, hawksbill turtle nesting activity is predominantly distributed on the island's east coast, including Pipeline, Harriet, and Andersons beaches (Pendoley Environmental 2019). Individual hawksbill turtles appear to show a strong fidelity to these beaches, often returning to the same beach to nest within the season (Pendoley Environmental 2019). Between 1986 and 2019, a total of 571 individual hawksbill turtles were tagged on Varanus Island. Recent baseline data was collected at the Montebello and Dampier AMPs by Keesing, 2019 showing that only one hawksbill turtle was identified during the survey at the Dampier AMP only. No marine turtle species were identified during the survey at Montebello AMP.

In the NT, nesting occurs on islands rather than on mainland beaches. In particular, NT nesting sites are concentrated around north-eastern Arnhem land and Groote Eylandt (Northern Territory Government, n.d). Within the combined 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 recapture of a single hawksbill at this location (Guinea, 2009). Small numbers of Hawksbill turtles also nest on Cocos (Keeling) Islands (mainly the north island). However, thousands of individuals forage in the shallow reef environments feeding on encrusting algae and sessile invertebrates (Brewer et al , 2009).

Nesting is reported to occur between October and February in WA (Commonwealth of Australia 2017a). Hawksbill turtles have been observed breeding on the North West Shelf between July and March with peak nesting activity around the Lowendal Islands between October and December (Limpus 2009a). In the NT nesting is reported to occur from July – December (Chatto, 1997, 1998).

Female hawksbills skip annual breeding opportunities (Kendall & Bjorkland 2001), presumably due to high energy demands of breeding (Chaloupka & Prince 2012).

Individuals may migrate up to 2,400 km between their nesting and foraging grounds (DSWEPaC 2012a), however a recent tagging study showed that turtles migrating from WA rookeries remain on the continental shelf (< 200 m depth) and within Australian waters during their inter-nesting, migrating and foraging phases (Fossette *et al*. 2021). Satellite tracking of nesting turtles on Varanus Island (32 km) and Rosemary Island has shown adult turtles to feed between 50 and 450 km from their nesting beaches (DSWEPaC 2012a).

Adults tend to forage in tropical tidal and sub-tidal coral and rocky reef habitat where they feed on an omnivorous diet of sponges, algae, jelly fish and cephalopods (DSWEPaC 2012a). Hawksbill turtles are unlikely to spend significant time within offshore waters as it is too deep to act as a feeding ground. However, it is likely they may migrate through those areas.

In order to better quantify and map the important areas used by Hawksbill turtles, AIMS was engaged in 2020 to lead the North West Shoals to Shores Research Program. During this program, AIMS combined available existing satellite tracking data for 20 adult turtle with data from newly deployed satellite tags on 20 adults in the Lowendal Islands and Dampier Archipelago (AIMS, 2021). Results showed that critical habitat designated by the Australian Government for inter-nesting largely protects the nesting areas calculated (AIMS, 2021), however the existing foraging BIAs do not include the majority of foraging areas calculated (AIMS, 2021). While approximately 23% of the hawksbill turtles foraging distribution occurred within MPAs, the existing BIAs are largely underestimating the important foraging areas for the turtles (AIMS, 2021). This supports the results of a joint study conducted by Fossette *et al.* (Fossette *et al., 2021),* which found only 10% of foraging areas utilised by 42 nesting turtles (between 2000 and 2017) were encompassed by the designated foraging BIA. Fossette *et al* (2021) found that the highest overlap of individual turtles occurred within the Migratory BIA corridor.

Figure 6-3 illustrates the BIAs and habitat critical (draft) for hawksbill and olive ridley turtles (as defined in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017a).

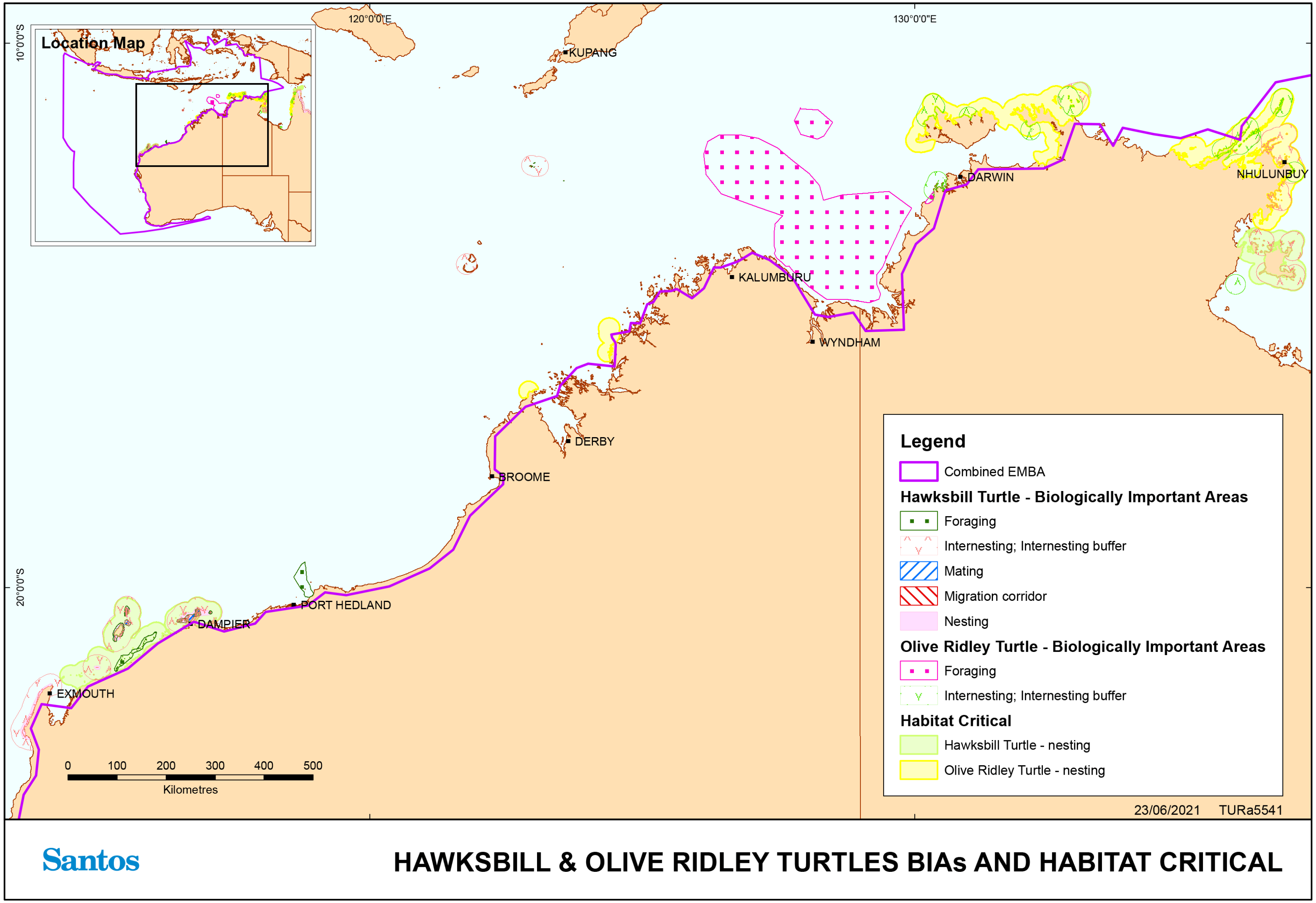

Figure 6-3: Biologically Important Areas and Habitat Critical – Hawksbill and Olive Ridley Turtle

6.1.4 Flatback Turtle

The flatback turtle (*Natator depressus*) has an Australasian distribution, with all recorded nesting beaches occurring within tropical to sub-tropical Australian waters. One third of the total breeding for the species occurs in Western Australia (WA) (Limpus, 2007). The management of the flatback turtle in Australia is broken up into five stocks currently described around Australia; eastern Queensland, Arafura Sea, Cape Domett, South-west Kimberley and Pilbara stocks (Commonwealth of Australia 2017). The Pilbara stock nests throughout the North West Shelf and is characterised by summer nesting (October to March), and the northern stock at Cape Domett breeds mainly in winter (July to September) (Commonwealth of Australia 2017a). The South-west Kimberley stock is also characterised by summer nesting. Populations in western NT are thought to nest all year round with nesting density reaching its peak in July. Populations in northern Australia also nest all year round, with nesting density reaching its peak between June and August (Limpus, 2007).

The southern WA nesting population of flatback turtles occurs from Exmouth to the Lacepede Islands off the Kimberley coast (DSEWPaC 2012c). On the North West Shelf, significant rookeries are centred on Barrow Island especially the east coast beaches (DSEWPaC 2012b). NT populations are typically found in the Gulf of Carpentaria, western Torres Strait, Wellesley Islands Group and Sand Islet.

Montebello Islands, Thevenard Island, Varanus Island, the Lowendal Islands, King Sound and Dampier Archipelago are also significant rookeries (Pendoley 2005, Limpus 2007, Pendoley Environmental 2011). Nesting is also widespread along the mainland beaches from Mundabullangana on the Pilbara coast north, including Cemetery Beach near Port Hedland, Eighty Mile Beach and to Broome (Limpus 2007, DSEWPaC 2012b).

Long term monitoring of flatback turtles nesting in the Port Hedland area, specifically at Cemetery Beach and Pretty Pool Beach, was undertaken between 2004 and 2014. Monitoring results indicated the main nesting season of flatback turtles in the area was between mid-October and January, which is consistent with other rookeries in the Pilbara region including Barrow Island, Mundabullangana, Karratha and Onslow (Waayers and Stubbs 2016). The onset of the nesting season appears to be relatively consistent each year and is thought to be associated with the southern movement of warmer sea surface temperatures along the northern WA coast.

There have been occasional records of nesting by flatback turtles on the Jurabi Coast and Muiron Islands (CALM 2005). During turtle surveys for Santos, WA flatback turtle nesting was recorded on Bessieres Islands (Astron 2014), Serrurier, Flat, Table and Round Island in previous surveys (Pendoley Environmental 2009). Flatback turtle tracks have been seen on Forty Mile beach and evidence of flatback nesting was recorded on the same beach the next day (Pendoley Environmental 2009). Previously the status of the flatback population(s) was undetermined and although not well quantified, it was estimated to be many thousands of females (Limpus 2007). However, Pendoley *et al*. (2014) reported both Barrow Island and Mundabullangana flatback turtles as substantial reproductive populations with 4,000 and 3,500 turtles tagged at each location between 2006/2006 and 2010/2011. Cemetery beach at Port Hedland had approximately 350 turtles were tagged over two seasons of monitoring (2009/2010 and 2011/12).

Satellite tracking of adult (female) flatback turtles shows they use a variety of inshore and offshore marine areas off the east and west coasts of Barrow Island. Females inter-nest close to their nesting beaches, typically in 0–10 m of water (Chevron 2008). However, flatback turtles also travel approximately 70 km and inter-nest in shallow nearshore water off the adjacent mainland coast, before returning to Barrow Island to lay another clutch of eggs. The average inter-nesting period is 13–16 days.

From long-term tagging studies on Varanus Island and Pendoley's observations, it appears that the nesting season for flatback turtles peaks in December and January with subsequent peak hatchling emergence in February and March. Flatbacks have been observed to nest on Varanus Island between November and February (Chevron 2008, Pendoley Environmental 2011 & 2013). Population monitoring of flatback turtles on Varanus Island, calculated from 16 seasons, indicates a mean population estimate of 226 (+/- 97). Modelled flatback turtle populations have shown a slight decline from 2008/09 to 2016/17, which is considered to be part of fluctuations in the natural cycle (Astron 2017). Flatback turtles tend to nest on all beaches on Varanus Island (Astron 2017). Flatback hatching and emergence success is noted as higher compared to that reported for other Western Australian rookeries (Pendoley et al. 2014; cited Astron 2017).

Unlike other sea turtles, the flatback turtle lacks a wide oceanic dispersal phase and adults tend to be found in soft sediment habitats within the continental shelf of northern Australia (DSEWPaC 2012b). Despite having geographically large foraging ranges (>1500 km), genetic differentiation suggests strong natal homing for both males and females (Turner Tomaszewicz *et al*, 2022). Little information is known on the diets of flatback turtles (DSEWPaC 2012b), however, they are believed to forage on primarily soft-bodied invertebrates (Commonwealth of Australia 2017a). Flatback turtles also differ from other species of sea turtles in maturing at a larger size and a likely younger age (<20 years) in comparison to other sea turtle species, indicating they may have a more rapid growth rate in their juvenile (similar to the leatherback turtle, a species with their own family) (Turner Tomaszewicz *et al*, 2022). This information from Turner Tomaszewicz *et al*, 2022 may provide valuable insight for ongoing population assessments and future recovery plans (Turner Tomaszewicz et al, 2022).

Figure 6-4 illustrates the BIAs and habitat critical (draft) for flatback turtles (as defined in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017a).

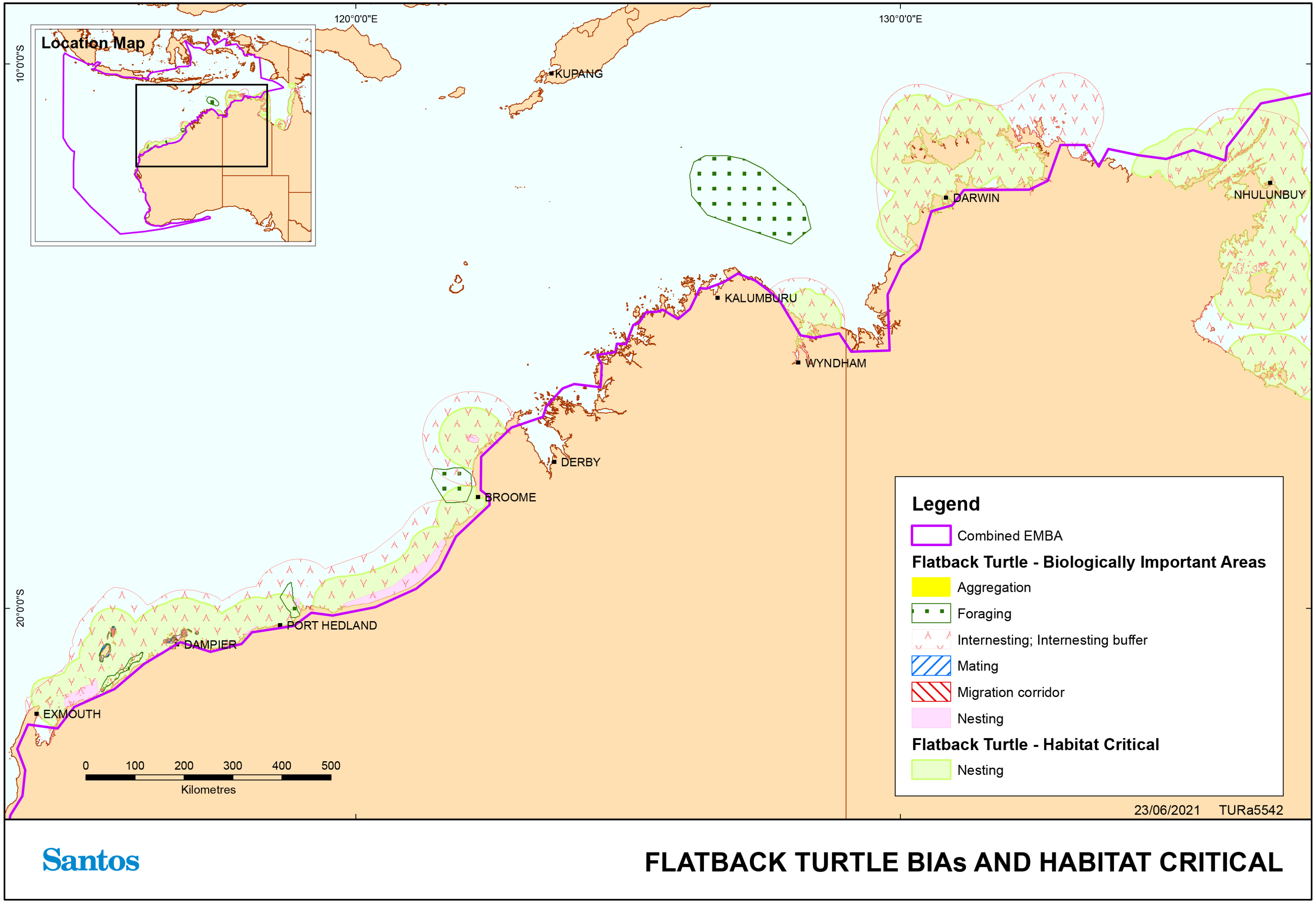

Figure 6-4: Biologically Important Areas and Habitat Critical – Flatback Turtle

6.1.5 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 (Márquez 1990). 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 annum) occurs in southern Queensland and the Northern Territory (Limpus and McLachlin 1994).

There have been several records of leatherback turtles off the coast of WA and NT, but no confirmed nesting sites (Limpus 2009c). Turtle observations have mainly occurred south of the North West Shelf area and in open waters (>200 m deep) (Limpus 2009c). 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 utilise feeding grounds in Australia (Limpus 2009c).

The leatherback turtle will feed at all levels of the water column and is carnivorous feeding mainly on pelagic, soft-bodied marine organisms such as jellyfish, which occur in greatest concentrations in areas of upwelling or convergence (DSEWPaC 2012d). The leatherback turtle is a highly pelagic species with adults only going ashore to breed.

No leatherback turtle BIAs or habitat critical (draft) are found within the combined EMBA.

6.1.6 Olive Ridley Turtles

Olive ridley turtles (*Lepidochelys olivacea*) are the least common turtle species encountered with critical nesting habitat occurring near Vulcan Island, Darcy Island, Prior Point and Llanggi and Cape Leveque (Commonwealth of Australia 2017). They are also known to nest on Tiwi Islands, specifically on the west coast of Bathurst Island and the north coast of Melville Island. The turtles found nesting on the Tiwi Islands is the NT genetic stock whereby the long-term trends of this genetic stock are currently unknown (Commonwealth of Australia 2017). However, the number of females nesting on the Tiwi Islands are considered significant at the genetic stock, national and international level. Nesting of the NT genetic stock can occur year-round with a peak between April and June, and hatchling emergence peaking between June and August (Commonwealth of Australia, 2017).

Internesting habitat, critical to the survival of the olive ridley turtle, encompasses nearshore waters along the north, west and east coasts of the Tiwi Islands. Satellite tracking on a small sample of internesting olive ridley turtles in the region recorded that the individuals remained close to shore (waters depths typically less than 55 m deep) and within 37 km of the nesting beach during the internesting interval (Whiting et al. 2007, Whiting et al. 2005).

The species is known to forage within the shallow benthic habitats of northern WA, the NT and Timor Sea (Limpus 2009), however, it displays unusual behaviour patterns compared to other sea turtles, in being capable of deeper (up to 140 m), benthic and exceptionally long (>2 hour) dives (McMahon *et al.,* 2007). This trait, combined with their long-distance movement patterns (Polovina *et al.*, 2004) is thought to be indicative of less specialist foraging (McMahon *et al.,* 2007). Olive Ridley turtles forage as far south as the Dampier Archipelago-Montebello Islands and have also been sighted in the Christmas and Cocos (Keeling) Islands in the north of the combined EMBA, and is thought to feed primarily on gastropods and small crabs within the benthic, soft-bottomed communities of the continental shelf (Limpus 2009). Their extensive movements and variability in migration patterns suggest this species may be susceptible to a wide range of human activities (McMahon *et al.,* 2007).

BIAs for this endangered species are known to occur in the vicinity of Joseph Bonaparte Depression (DSEWPaC 2012b, Commonwealth of Australia 2017a). See Figure 6-3 for identified olive ridley turtle BIAs and critical habitats (draft) within the combined EMBA (as defined in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017a).

6.2 Seasnakes

Storr *et al*. (1986) estimate nine genera and 22 species of sea snakes occur in WA waters, with 25 listed marine seasnake species being recorded in the search area of WA and NT waters (Appendix A). Little is known of the distribution of individual species, population sizes or aspects of their ecology. Seasnakes are essentially tropical in distribution, and habitats reflect influences of factors such as water depth, nature of seabed, turbidity and season (Heatwole and Cogger 1993). Seasnakes are widespread throughout waters of the North West Shelf in offshore and nearshore habitats. They can be highly mobile and cover large distances or they may be restricted to relatively shallow waters and some species must return to land to eat and rest. In the north-west region of Western Australia, no BIAs have been designated for seasnakes. However, both Ashmore Reef and Cartier Island are characterised for both a high density and high diversity of seasnakes (DSEWPaC 2012b). The limited evidence available suggests that there are no sea snakes in at least the coastal waters of Cocos (Keeling) Islands, and few sea snake sightings in the waters of the Christmas Island territory (Brewer *et al,* 2009).

Two species of seasnakes listed as threatened under the EPBC Act were identified in the Protected Matters search within the combined EMBA (Appendix A):

+ Short-nosed seasnake (*Aipysurus apraefrontalis*); and
+ Leaf-scaled seasnake (*Aipysurus foliosquama*).

6.2.1 Short-nosed Seasnake

The short-nosed seasnake (*Aipysurus apraefrontalis*) is listed as critically endangered under the EPBC Act and the BC Act. It is a fully aquatic, small snake and is 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 (Minton & Heatwole 1975, Guinea and Whiting 2005).

The species prefers the reef flats or shallow waters along the outer reef edge in water depths to 10 m (McCosker 1975, Cogger 2000). The species has been observed during daylight hours, resting beneath small coral overhangs or coral heads in 1–2 m of water (McCosker 1975). Guinea and Whiting (2005) reported that very few short-nosed seasnakes moved even as far as 50 m away from the reef flat and are therefore unlikely to be expected in high numbers in offshore, deeper waters.

6.2.2 Leaf-scaled Seasnake

The leaf-scaled seasnake *(Aipysurus foliosquama)* is listed as critically endangered under the EPBC Act and the BC Act. It occurs in shallow water (less than 10 m in depth), in the protected parts of the reef flat, adjacent to living coral and on coral substrates (DoE 2014). The species is found only on the reefs of the Sahul Shelf in WA, especially on Ashmore and Hibernia Reefs (Minton and Heatwole 1975). The leaf-scaled seasnake forages by searching in fish burrows on the reef flat (DoE 2014).

6.3 Crocodiles

The salt-water crocodile (*Crocodylus porosus*) is a migratory species under the EPBC Act and is also listed as a specially protected species (other specially protected fauna) under the BC Act. In WA, the species is found in most major river systems of the Kimberley, including the Ord, Patrick, Forrest, Durack, King, Pentecost, Prince Regent, Lawley, Mitchell, Hunter, Roe and Glenelg Rivers. The largest populations occur in the rivers draining into the Cambridge Gulf and the Prince Regent River and Roe River systems. There have also been isolated records in rivers of the Pilbara region, around Derby near Broome and as far south as Carnarvon on the mid-west coast (DEC 2009a).

In the NT salt-water crocodile has been found in the Mary, Adelaide, Daly, Moyle, Victoria, Finniss, Wildman, West Alligator, East Alligator, South Alligator, Liverpool, Blyth, Glyde, Habgood, Baralminar, Goromuru, Cator and Peter John Rivers with a total 79 individuals per km identified in these river systems (Fukuda, 2007).

6.4 Biologically Important Areas/Habitat Critical – Marine Reptiles

Table 6-3 provides an overview of BIAs in the combined EMBA for marine reptiles, as identified by the DAWE (Commonwealth) and critical habitats identified in associated recovery plans. The DAWE may make recovery plans for threated fauna listed under the EPBC Act. The EPBC Act requires that 'habitat critical to the survival of the listed threatened species' is identified in recovery plans, relevant recovery plans are listed in Section 13.2[3].

In addition, both the EPBC Act and WA BC Act and associated regulations (2018) provide for the listing of habitat critical - habitat 'critical to the survival of the threatened species. To date no habitat critical in WA has been listed under either Act. No provision is made under the Territory Parks and Wildlife Conservation Act 1976 for listing critical habitat.

[3] Further background information on BIA and identification of critical habitat in recovery plans is provided in Section 5.4.

Table 6-3: Biologically important areas/critical habitats and geographic locations - reptiles

Species	Scientific name	Aggregation area and use	BIAs within EMBA	Habitat Critical within EMBA
Loggerhead turtle	*Caretta caretta*	Nesting, migration, foraging and internesting – Islands and coastline of the Kimberley region and islands of the North West Shelf, Ningaloo coast and Jurabi coast	Cohen Island De Grey River to Bedout Island Dirk Hartog Island Gnarloo Bay James Price Point Lowendal Island Montebello Island Muiron Island Ningaloo Coast and Jurabi coast Rosemary Island Western Joseph Bonaparte Depression	Exmouth and Ningaloo coast Gnaraloo Bay and beaches Shark bay, all coastal and island beaches out the to the northern tip of Dirk Hartog Island
Green turtle	*Chelonia mydas*	Nesting, migration foraging, aggregation, mating, basking and internesting – Offshore islands in the Browse Basin, North West Shelf and Kimberley/Pilbara coastlines Mating/nesting – Dampier Archipelago Basking – Middle Island	Ashmore Reef Barrow Island Browse Island Cartier Island Cassini Island Coral reef habitat west of the Montebello group. Extends the entire length of Montebellos Dampier Archipelago (islands to the west of the Burrup Peninsula) De Grey River area to Bedout Island Delambre Island Dixon Island Greens - inshore tidal and shallow subtidal areas around Barrow Island Hawksbills - shallow water coral reef and artificial reef (pipeline) habitat James Price Point Joseph Bonaparte Gulf Lacepede Island Legendre Island, Huay Island Middle Is. West Coast Barrow Island West Coast and North Coast Montebello Island - Hermite Island, NW Island, Trimouille Island Montebello Islands	Mainland east of Mary island to mainland adjacent to Murrara Island including all offshore islands Ashmore Reef and Cartier Reef Browse Island Scott Reef Adele Island Lacepede Island Dampier Archipelago Barrrow Island Montebello Islands Serrier Island and Thevenard Island Exmouth Gulf and Ningaloo Coast

Species	Scientific name	Aggregation area and use	BIAs within EMBA	Habitat Critical within EMBA
			Montgomery Reef North and South Muiron Island North Turtle Island North West Cape Scott Reef Scott Reef - Sandy Islet Seringapatam Reef String of islands between Cape Preston and Onslow, inshore of Barrow Is North-west of Melville Island	
Hawksbill turtle	*Eretmochelys imbricata*	Nesting, migration, mating, foraging and internesting – Offshore islands in the Browse Basin, North West Shelf and Kimberley/Pilbara coastlines Mating/ nesting/ internesting – Lowendal group, Montebello Islands	Ah Chong and South East Island Ashmore Reef Barrow Island Cartier Island Dampier Archipelago (islands to the west of the Burrup Peninsula) De Grey River area to Bedout Island Delambre Island Delambre Island (and other Dampier Archipelago Islands) Dixon Island Greens - inshore tidal and shallow subtidal areas around Barrow Island Hawksbills - shallow water coral reef and artificial reef (pipeline) habitat Lowendal Island Group Montebello Island - Hermite Island, NW Island, Trimouille Island Montebello Island, Trimoulle and NW islands Ningaloo coast and Jurabi coast Rosemary Island Scott Reef String of islands between Cape Preston and Onslow, inshore of Barrow Island Thevenard Island Varanus Island	Cape Preston to mouth of Exmouth Gulf (including Montebello Islands and Lowendal Islands) Dampier Archipelago (including Delambre Island and Rosemary Island) New Year Island 20 km internesting buffer

Species	Scientific name	Aggregation area and use	BIAs within EMBA	Habitat Critical within EMBA
Flatback turtle	*Natator depressus*	Nesting, migration, mating, aggregation, foraging, internesting – Islands of the North West Shelf and the Pilbara/Kimberley coastlines Mating, nesting – Barrow Island	Eighty Mile beach Barrow Island Cape Domett Cape Thouin/ Mundabullangana/ Cowrie Beach Coral reef habitat west of the Montebello group. Extends the entire length of Montebellos Dampier Archipelago (islands to the west of the Burrup Peninsula) De Grey River area to Bedout Island Delambre Island Dixon Island Holothuria Zone (Northern Kimberley, Holothuria Banks) Intercourse Island James Price Point Lacepede Island Legendre Island, Huay Is Montebello Island - Hermite Island, NW Island, Trimouille Island North Turtle Island Port Hedland, Cemetery Beach Port Hedland, Paradise Beach Port Hedland, Pretty Pool String of islands between Cape Preston and Onslow, inshore of Barrow Is The main nesting beach at Cape Domett is a 1.9-km-long north-west-facing sandy beach on the east of the Cambridge Gulf, East Kimberley, Western Australia (14 48.10S, 128 24.50E), located approximately 80 km north-north-east of the nearest town, Wyndham. Thevenard Island - South coast West of Cape Lambert	Cape Domett and Lacrosse Island Lacepede Islands Eighty Mile beach Cemetary beach Eco Beach Mundabullangana Beach Dampier Archipelago Barrow Island, Montebello Island, coastal islands from Cape Preston to Locker Island Soldier Point to Pirlangimpi including Seafull Island 60 km internesting buffer Brace point to One Tree Point, including all offshore islands 60 km internesting buffer Waigait Beach to south of Point Blaze, including all offshore islands 60 km internesting buffer.

Species	Scientific name	Aggregation area and use	BIAs within EMBA	Habitat Critical within EMBA
			Western Joseph Bonaparte Depression Melville Island, Cobourg Peninsula	
Leatherback turtle	*Dermochelys coriacea*	None within EMBA	None within EMBA	All sandy beaches from Coburg Peninsula to Cape Arnhem including Danger Point and Elcho Island 20 km internesting buffer
Olive ridley turtle	*Lepidochelys olivacea*	Foraging, migration – Joseph Bonaparte Gulf – Kimberley region	Western Joseph Bonaparte Depression Northern Joseph Bonaparte Gulf	Cape Leveque Prior Point and Llanggi Darcy Island Vulcan Island Soldier Point to Pirlangimpi including Seafull Island 20 km internesting buffer Brace Point to One Tree Point, including all offshore islands 20 km internesting buffer Croker Island, Coburg Peninsula, west of Murganella to the West Alligator River 20 km internesting buffer

7. Marine Mammals

Forty-four species of listed marine mammals are known to occur in Australian waters in the combined EMBA, according to the Protected Matters search (Appendix A). An examination of the species profile and threats database (DAWE 2020a) showed that some listed mammal species are not expected to occur in significant numbers in the marine and coastal environments in the combined EMBA due to their terrestrial distributions. Hence, these species are not discussed further.

Of the remaining listed species, five are listed as threatened and migratory, one is listed as threatened and ten are listed as migratory under the Commonwealth EPBC Act (BIAs for marine mammals are discussed in Table 7-3). These species are shown in Table 7-1 along with their conservation listing under the WA BC Act and *Territory Parks and Wildlife Conservation Act 1976* (as applicable).

The section below gives further details on marine mammal species listed as threatened and migratory and a summary is presented in Table 7-2. Identified BIAs are presented in Table 7-3.

In addition, the New Zealand fur-seal *(Arctocephalus forsteri)*, has been identified as a species of relevance to the combined EMBA. The New Zealand fur seal is listed as a protected species under WA BC Act (other specially protected), but not listed as threatened under the EPBC Act.

Table 7-1: Marine mammals listed as threatened or migratory under the EPBC Act

Species	Conservation Status				Likelihood of occurrence in EMBA	BIA in EMBA
	EPBC Act 1999 (Cwth)	BC Act 2016 (WA)	Other WA Conservation Code	TPWC Act 1976		
Sei whale *(Balaenoptera borealis)*	Vulnerable Migratory	Endangered	-	-	Foraging, feeding or related behaviour likely to occur within area	None - No BIA defined
Blue whale *(Balaenoptera musculus)*	Endangered Migratory	Endangered	-	-	Foraging, feeding or related behaviour known to occur within area Migration route known to occur within area	Yes – Refer to Table 7-3
Fin whale *(Balaenoptera physalus)*	Vulnerable Migratory	Endangered	-	-	Foraging, feeding or related behaviour likely to occur within area	None - No BIA defined
Southern right whale *(Eubalaena australis)*	Endangered Migratory	Vulnerable	-	-	Breeding known to occur within area	Yes – Refer to Table 7-3
Humpback whale *(Megaptera novaeangliae)*	Migratory	Special conservation interest and Migratory	-	-	Breeding known to occur within area	Yes – Refer to Table 7-3
Sperm whale *(Physeter macrocephalus)*	Migratory	Vulnerable	-	-	Foraging, feeding or related behaviour known to occur within area	Yes – Refer to Table 7-3
Antarctic minke whale *(Balaenoptera bonaerensis)*	Migratory	Migratory	-	-	Species or species habitat likely to occur within area	None - No BIA defined
Bryde's whale *(Balaenoptera edeni)*	Migratory	Migratory	-	-	Species or species habitat likely to occur within area	None - No BIA defined

Species	Conservation Status				Likelihood of occurrence in EMBA	BIA in EMBA
	EPBC Act 1999 (Cwth)	BC Act 2016 (WA)	Other WA Conservation Code	TPWC Act 1976		
Pygmy right whale *(Caperea marginate)*	Migratory	Migratory	-	-	Foraging, feeding or related behaviour likely to occur within area	None - No BIA defined
Killer whale *(Orcinus orca)*	Migratory	Migratory	-	-	Species or species habitat may occur within area	None - No BIA defined
Australian Humpback Dolphin (Sousa sahulensis)	Migratory (as *Sousa chinensis)*	Migratory	-	-	Breeding known to occur within area	Yes – Refer to Table 7-3
Spotted bottlenose dolphin (Arafura/ Timor Sea Populations) *(Tursiops aduncus)*	Migratory	Migratory	-	-	Species or species habitat known to occur within area	Yes – Refer to Table 7-3
Irrawaddy dolphin (Australian snubfin dolphin) *(Orcaella heinsohni)*	Migratory	Migratory	P4	-	Species or species habitat known to occur within area	Yes – Refer to Table 7-3
Dusky dolphin *(Lagenorhynchus obscurus)*	Migratory	Migratory	-	-	Species or species habitat likely to occur within area	None - No BIA defined
Australian sea lion *(Neophoca cinerea)*	Endangered	Vulnerable	-	-	Breeding known to occur within area	Yes – Refer to Table 7-3
Dugong *(Dugong dugon)*	Migratory	Migratory	-	-	Breeding known to occur within area	Yes – Refer to Table 7-3

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7.1 Threatened and Migratory Species

7.1.1 Sei Whale

Sei whales have a worldwide, oceanic distribution and migrate between low-latitude tropical and subtropical regions during the winter and temperate and subpolar latitudes in summer (Leaper et al. 2008). Sei whales tend to be found further offshore than other species of large whales (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 movements and distribution in Australian waters is not well known (DAWE 2020a). There are no known mating or calving areas in Australian waters (Parker 1978 in DAWE 2020a). The National Conservation Values Atlas currently record no BIAs for this species (DAWE 2020b). Surveys of the Bonney Upwelling (outside of the combined EMBA) between 2000 and 2003 recorded sightings of sei whales feeding during summer and autumn, indicating that this is potentially an important feeding ground (DAWE 2020b).

7.1.2 Blue Whale

Two sub-species 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) (DEWHA 2008a). By this definition all blue whales in waters from Busselton to the NT are assumed to be pygmy blue whales and are discussed below.

Pygmy blue whale populations are distinguishable only acoustically as they do not display morphological differences (Leroy *et al*. 2021). Prior to 2020 there were believed to be three populations of the pygmy blue whale (B. m. brevicauda), however, evidence for a fourth pygmy blue whale acoustic population were found by Cerchio, S. et al. (2020), and a fifth was identified by Leroy et al. (2021).

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), such as the Perth Canyon and adjacent waters (Rennie et al., 2009) and the Great Southern Australian Coastal Upwelling System (Möller et al., 2020). 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).

Tagging surveys have shown pygmy blue whales migrating northward relatively near to the Australian coastline (100 km) until reaching North West Cape after which they travelled offshore (240 km) to Indonesia (Double et al, 2014). Passive acoustic data documented pygmy blue whales migrating along the Western Australian shelf break (Woodside 2012). Tagging data collected by Gales *et al.* (2010) has provided the first definitive link between the blue whales that feed off the Perth Canyon and those that occur around Indonesia. This is movement is concordant with the proposed ‘Tasmania to Indonesia’ population described by Branch *et al.* (2007).

The northern migration passes the Perth Canyon from January to May and north bound animals have been detected off Exmouth and the Montebello Islands between April and August (Double *et al*.

2012a, McCauley & Jenner 2010). A noise monitoring study conducted in 2014-15 recorded pygmy blue whales moving in a northward direction in August 2014 and between late-May to early July 2015 (JASCO Applied Sciences, 2016; McPherson, Craig et al., 2015). During the southern migration, pygmy blue whales pass south of the Montebello Islands and Exmouth from October to the end of January, peaking in late November to early December (Double *et al*. 2012b). No detections of the species were made during the period of their southward migration during the noise monitoring study.

Generally, they 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).

Pygmy blue whales appear to feed regularly along their migration route (i.e. at least once per week or more frequently) and are likely to have multiple food caches along their migratory route (e.g. Rowley Shoals and Ningaloo Reef) (ConocoPhillips 2018).

Recognised feeding areas of significance to this species, located within the combined EMBA include Ningaloo Reef and the Perth Canyon (DoE 2015a). The Ningaloo Reef area has the capacity to offer feeding opportunities to pygmy blue whales through unique biophysical conditions able to support large biomasses of marine species (Double *et al*. 2014).

Surface lunge feeding of pygmy blue whales has been observed at North West Cape and Ningaloo Reef in June (C. Jenner & M-N Jenner, unpublished data, 2001 in Double *et al*. 2014). Outside of the recognised feeding areas, possible foraging areas for pygmy blue whales include the greater region around the Perth Canyon, off Exmouth and Scott Reef in WA (DoE 2015a). These steep gradient features tend to stimulate upwelling and, therefore increased productivity (seasonally variable) (ConocoPhillips 2018). Hence, they provide a favourable foraging area.

Breeding areas have not yet been identified; however, it is likely that pygmy blue whales calve in tropical areas of high localised production such as deep offshore waters of the Banda and Molucca Seas in Indonesia (Double *et al*. 2014, DAWE 2020a). There are no known breeding areas of significance to blue whales in waters from Busselton to the NT.

The BIAs for blue whale and pygmy blue whale are detailed in Table 7-3 and depicted in Figure 7-2 and Figure 7-1. However; a recent study by Thums *et al* (2022) used a combination of passive acoustic monitoring of the Northwest Australian coast (46 instruments from 2006 to 2019) and satellite telemetry data (22 tag deployments from 2009 to 2021) quantified the spatial extent of pygmy blue whale high use areas for foraging and migration and compared these areas to the BIAs. Thums *et al* (2022) designated three important foraging (and/or resting/breeding) areas, including; The Perth Canyon and vicinity, the shelf edge off Geraldton and; the shelf edge from Ningaloo Reef to the Rowley Shoals (not continuous).The study found that the Foraging BIA off the south-west of Western Australia encompassed 83% of the most important areas in that region, however; the 'Annual High Use Foraging' BIA within that BIA only encompassed 7% of the most important area. The most significant overlaps were seen with the Migration BIAs, whereby the most important migration area had an 82% overlap with the part of the Migration BIA that occurs in Australia. The Australian Government may now have to consider this quantitative assessment of important areas in future reviews of the BIAs (Thums *et al* 2022).

Santos

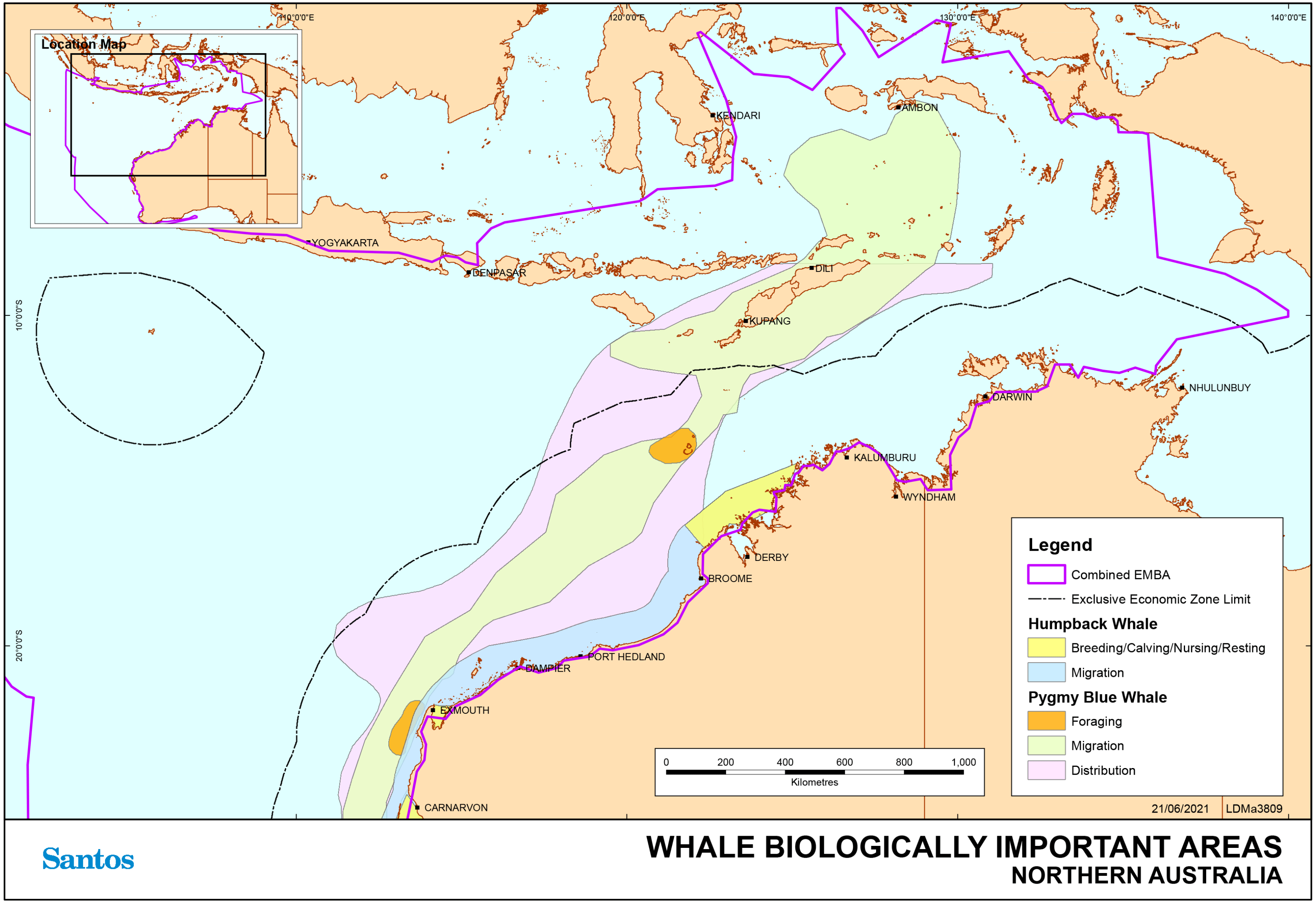


Figure 7-1: Biologically important areas – whales – Northern WA

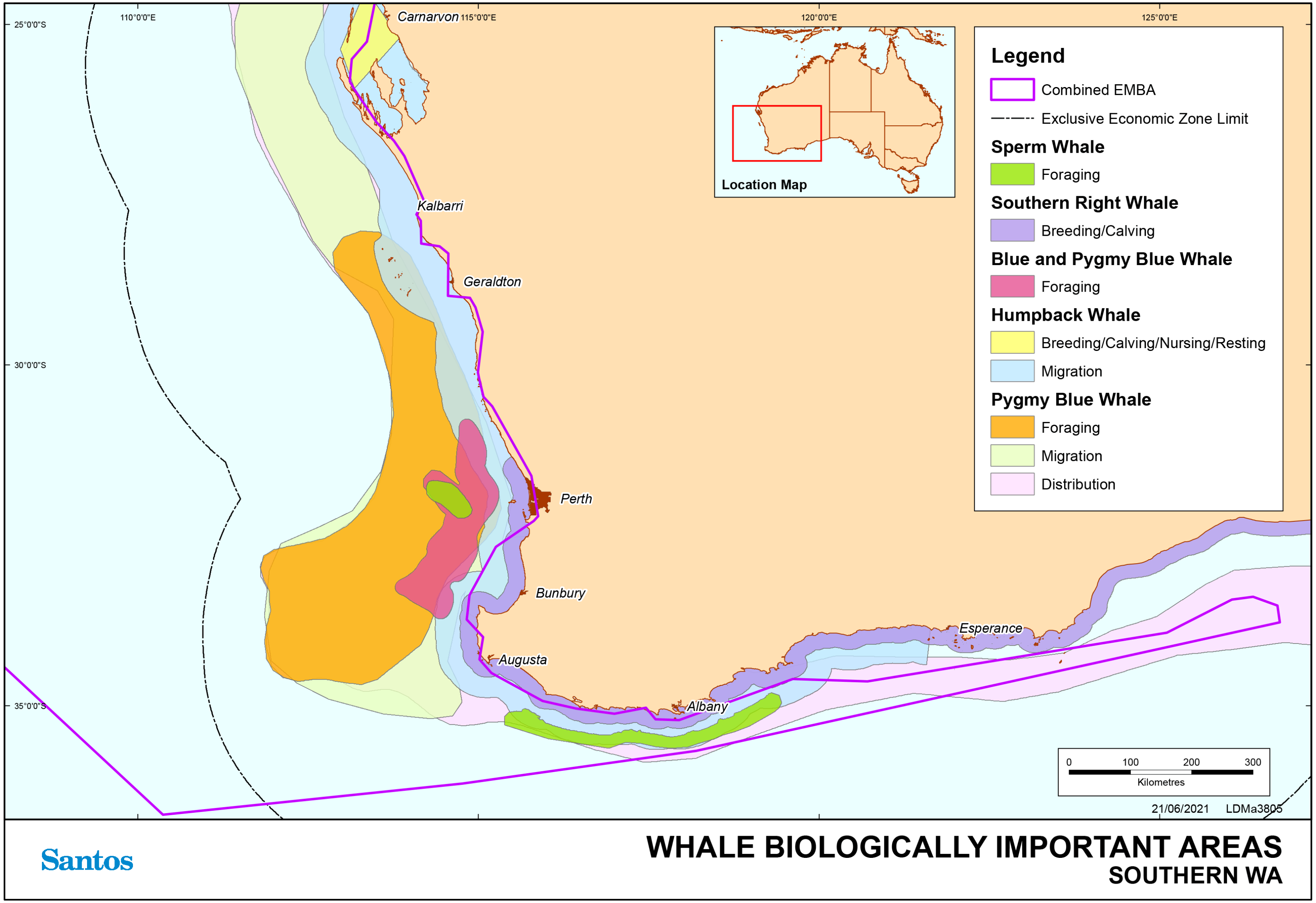


Figure 7-2: Biologically important areas – whales – Southern WA

7.1.3 Fin Whale

Fin whales 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. According to the Species Profile and Threats database (DAWE 2020a); fin whales are thought to be present from Exmouth, along the southern coastline, to southern Queensland.

Migration paths are uncertain but are not thought to follow Australian coastlines (Bannister *et al*. 1996). There is insufficient data to prescribe migration times for fin whales. During summer and autumn this species has been recorded acoustically at the Rottnest Trench.

There are no known mating or calving areas in Australian waters (DoEE 2019a) and no BIAs for the fin whale are currently identified by the National Conservation Values Atlas (DAWE 2020b).

7.1.4 Southern Right Whale

The southern right whale is present in the southern hemisphere between approximately 30° and 60°S. The species feeds in the Southern Ocean in summer, moving close to shore in winter.

In Australian waters, southern right whales range from Perth, along the southern coastline, to Sydney. Sightings have been recorded as far north as Exmouth although these are rare (Bannister *et al*. 1996).

BIAs including calving and aggregation areas are recorded for this species along the southern coastline of Australia (DAWE 2020b). Details on the BIA for southern right whale are provided in Table 7-3 and depicted in Figure 7-2 and Figure 7-1.

7.1.5 Humpback Whale

Humpback whales have a worldwide distribution, migrating along coastal waters from polar feeding grounds to subtropical breeding grounds. Geographic populations are distinct and at least six southern hemisphere populations are thought to exist based on Antarctic feeding distribution and the location of breeding grounds on either side of each continent (Bannister *et al*. 1996). The largest known population of humpback whales breeds along the coast of Western Australia (Branch, 2011, Salgado Kent et al., 2012, IWC, 2014) and has a recognised resting ground in the Exmouth Gulf (Ivine & Kent 2018). The population of humpback whales migrating along the WA coastline was recently estimated to be greater than 33,000 whales and likely increasing at exceptionally high growth rates between 10–12% (Hedley *et al*. 2011, Salgado Kent *et al*. 2012).

Humpback whale populations have increased since being placed on the threatened species list for exploitation from whaling, resulting in a higher abundance of species off our Western Australian coastline. Effective from 26/02/2022, Humpback whales are no longer classed as vulnerable under the EPBC Act, however; they remain a Matter of National Environmental Significance as a listed Migratory Species and Cetacean under EPBC Act Division 3, where it is an offence to kill, injure, take, trade, keep, move or interfere with a cetacean. Humpback whales have been able to thrive and increase in numbers despite the heavy oil and gas exploration. A study presented by Bejder et al (2016) has prompted a review of the species being down listed under Commonwealth legislation and regulations, as they are not eligible for listing as a threatened species under all statutory criteria. The west coast Australian humpback whale population migrates from Southern Polar Ocean 'summer' feeding grounds to their northern tropical 'winter' calving/ breeding grounds in coastal waters of the

Kimberley. The northern migration tends to follow deeper waters of the continental shelf, whilst the southward migration concentrates whales closer to the mainland (Jenner *et al*. 2001; Irvine et al., 2018). Recent satellite tagging of southbound humpback whales indicate that whales generally migrated close to the coastline, within a few tens of kilometres of shore and in a corridor frequently less than 100 km (Double *et al*. 2010). Aerial surveys and noise logger recordings undertaken for Chevron's Wheatstone Project indicated that the main distribution of humpback whales was sighted at an average distance of 50 km from the mainland during the northern migration and 35 km during the southbound migration (RPS 2010a). Woodside have conducted aerial surveys that have confirmed that the reported distribution of migrating humpback whales off the North West Cape is consistent with baseline surveys first conducted in 2000 to 2001 (RPS, 2010 in Woodside 2020).

The precise timing of the migration varies between years by up to six weeks, influenced by water temperature, sea ice distribution, predation risk, prey abundance and the location of feeding grounds (DEWR 2007).

Peak northward migration across the North West Shelf is identified as from late July to early August, and peak southward migration from late August to early September (DoEE 2015c). Data collected between 1995 and 1997 by the Centre for Whale Research indicates that the period for peak northern migration into the calving grounds in the Kimberley is mid to late July. The peak for southern migration is in the first half of September (Jenner *et al.* 2001). Actual timing of annual migration may vary by as much as three weeks from year to year due to food availability in the Antarctic (DMP 2003).

Satellite tagging data collected for migrating northbound humpback whales identified a consistent narrow inshore distribution, unlike the southward migration. There was little evidence that the whales tended to venture further from shore and into deeper water at any point on their northward migration. Whales were seen with calves off the North West Cape outside the 'calving grounds; of Lacepede Islands to Camden Sound. This indicates some potential for this area being used as a 'calving site' as well as a migratory corridor. Consequently, the region from the Lacepede Islands to Camden Sound should not be seen as the exclusive 'calving ground' for this population (Double *et al.* 2012b).

Details on the BIA for humpback whales are provided in Table 7-3 and depicted in Figure 7-2 and Figure 7-1.

7.1.6 Sperm Whale

Sperm whales typically occur in WA along the southern coastline between Cape Leeuwin and Esperance (Bannister *et al.* 1996). Sperm whales are distributed worldwide in deep waters (greater than 400 m) off continental shelves and sometimes near shelf edges, averaging 20 to 30 nautical miles offshore (Hooker et al.1999, Pirotta et al., 2011). 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. Sperm whales have been recorded in deep water off the North West Cape on the west coast of Western Australia (RPS 2010b) and appear to occasionally venture into shallower waters in other areas (RPS 2010b). Details on the BIA for sperm whales are provided in Table 7-3 and are shown in Figure 7-2 and Figure 7-1.

7.1.7 Antarctic Minke Whale

The Antarctic minke whale is distributed throughout the Southern Hemisphere from 55°S to the Antarctic ice edge during the austral summer and has been recorded in all Australian States (Bannister et al. 1996; Perrin & Brownell 2002). Detailed information on timing and location of migrations and breeding grounds on the west coast of Australia is largely unknown. However, it is believed that the Antarctic minke whale migrates up the WA coast to approximately 20°S during Australian winter to feed and possibly breed (Bannister *et al.* 1996).

7.1.8 Bryde's Whale

The Bryde's whale is found all year round in tropic 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 whilst the offshore form is found in deeper waters of 500-1,000 m (DoEE 2019c). 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 (DoEE 2019c). It is however, suggested that the offshore form migrates seasonally, heading towards warmer tropical waters during the winter.

7.1.9 Pygmy Right Whale

The pygmy right whale is considered the most elusive baleen whale and as a result very little is known about the whale's distribution in Australian waters. Records of the pygmy right whale in Australian waters are distributed between 32°S and 47°S and are restricted in the west by the Leeuwin current (Kemper 2002). It is possible that the pygmy right whale will be encountered in the southern extent of the combined EMBA, particularly in coastal areas of upwelling (Kemper 2002).

7.1.10 Killer Whale

The killer whale has a widespread global distribution and has been recorded in waters of all Australian states/territories (Bannister *et al.* 1996). Whilst more commonly found in cold, deeper waters, killer whales have been observed along the continental slope, shelf and shallower coastal areas. Killer whales are known to make seasonal movements and are most likely to follow the migratory routes of their prey, however, little is known about these movements (DoEE, 2019). They are more likely to be observed around seal colonies, with a significant seal colony within the combined EMBA being located in WA at the Abrolhos Islands.

7.1.11 Indo-Pacific Humpback Dolphin

The Indo-pacific humpback dolphin is typically found in water less than 20 m deep but has been recorded in waters up to 40 m deep. This species is generally found in association with river mouths, mangroves, tidal channels and inshore reefs (DoEE 2016a). This species of dolphin is known to have resident groups that forage, feed, breed and calve in the state waters of Roebuck Bay, Dampier Peninsula, King Sound north, Talbot Bay, Anjo Peninsula, Vansittart Bay, Napier Broome Bay and Deception Bay (DoEE 2016a).

The Indo-Pacific humpback dolphin BIA in the combined EMBA is detailed in Table 7-3 and shown on Figure 7-3.

7.1.12 Spotted Bottlenose Dolphin (Indo-Pacific bottlenose dolphin)

The spotted bottlenose dolphin (*Tursiops aduncus*) (Arafura/ Timor Sea populations) is generally considered to be a warm water subspecies of the spotted bottlenose dolphin, occurring in shallow (often <10 m deep) inshore waters (Bannister et al., 1996; Hale et al., 2000). The known distribution of the spotted bottlenose dolphin extends from Shark Bay north to the western edge of the Gulf of

Carpentaria in Australia (DoEE 2016b). The spotted bottlenose dolphin BIA in the combined EMBA is detailed in Table 7-3 and shown on Figure 7-3.

7.1.13 Irrawaddy Dolphin (Australian Snubfin Dolphin)

The Irrawaddy dolphin, also known as the snubfin dolphin (*Orcaella heinsohni*) is known to occur within the waters off northern Australia, extending north from Broome in Western Australia to the Brisbane River in Queensland (DoEE 2016c). 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 close to seagrass beds (DoEE 2016c). The snubfin dolphin was not recorded during any of the aerial surveys undertaken along the Dampier Peninsula coastline in the vicinity of James Price Point but were observed in Roebuck Bay from vessels on several occasions (RPS, 2010b). Based on the extensive survey effort and amenable conditions within the James Price Point coastal area during the survey, it is concluded that this species is seldom found outside of shallow and sheltered bays and inlets (DSD 2010). The Irrawaddy dolphin BIA in the combined EMBA is detailed in Table 7-3 and shown on Figure 7-3.

7.1.14 Dusky Dolphin

The dusky dolphin's distribution is strongly linked to colder waters. In Australia, the dusky dolphin has been sighted in southern Australia from WA to Tasmania. It is presumed to be primarily an inshore species but has been known to move further offshore, possibly due to its desire for colder waters (Gill *et al.* 2000). Dusky dolphins are expected to be limited in their distribution along the WA coastline due to the presence of the southward-flowing warm water of the Leeuwin Current.

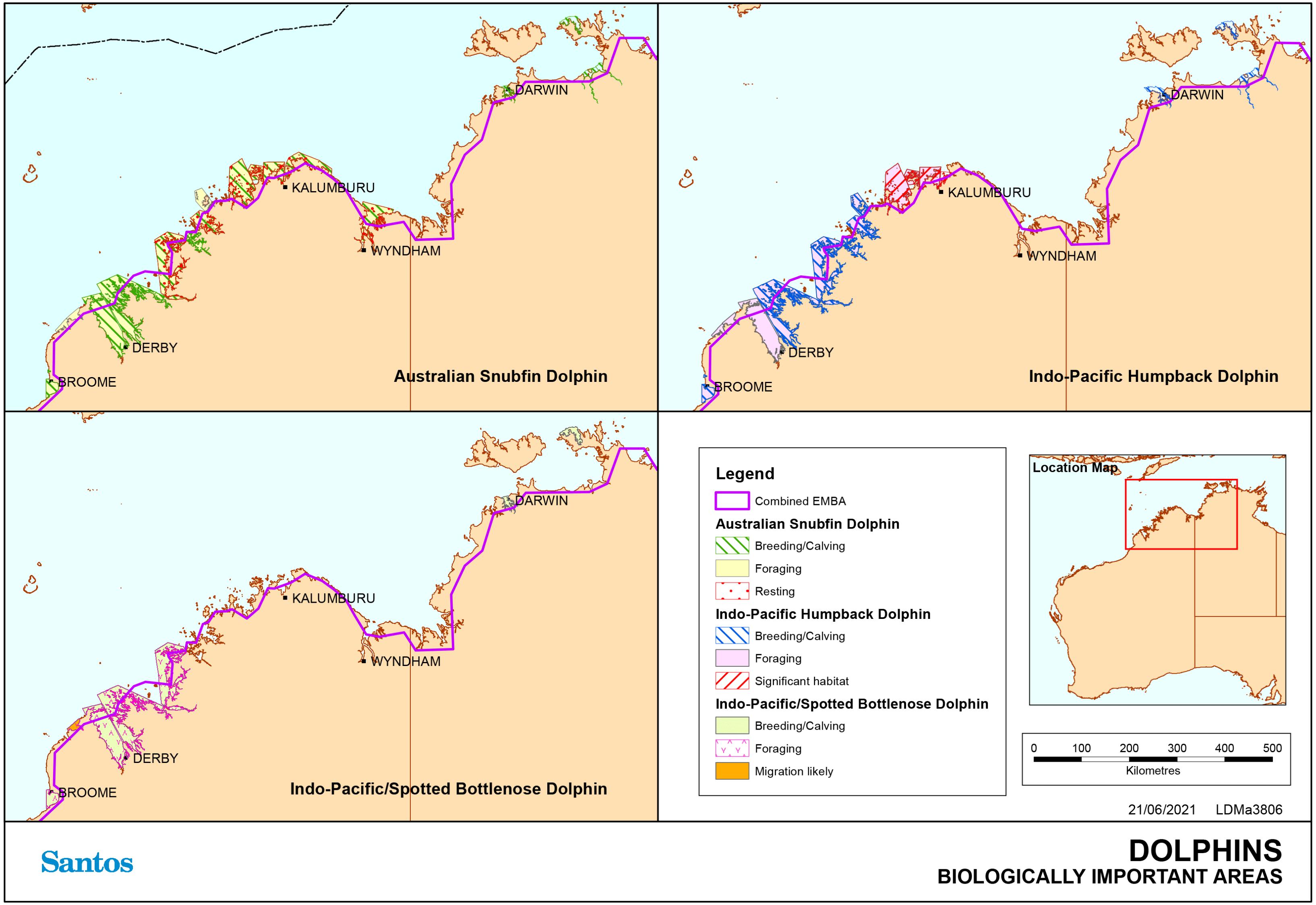


Figure 7-3: Biologically important areas – dolphins

7.1.15 Australian Sea Lion

The Australian sea lion is endemic to Australia. Breeding colonies are found only in South Australian and Western Australian waters. There are currently 76 known Australian sea lion pupping locations along the coast and offshore islands between the Houtman Abrolhos Islands in Western Australia to the Pages Islands in South Australia (DSEWPaC 2013c). The species has also been recorded at Shark Bay (DoE 2014a).

BIAs for foraging, haul-out and breeding sites identified by the National Conservation Values Atlas are located south of the waters from Busselton to the NT (DAWE 2020b). Male Australian sea lions have been recorded foraging in areas up to 60 km away from their birth colonies, with potentially larger dispersal ranges up to 180 km (Hamer *et al*. 2011). However, female Australian sea lions have restricted home ranges, with high rates of natal site fidelity and limited gene flow with other regions (Campbell 2005). The Australian sea lion BIA in the combined EMBA is outlined in Table 7-3 and is depicted in Figure 7-4.

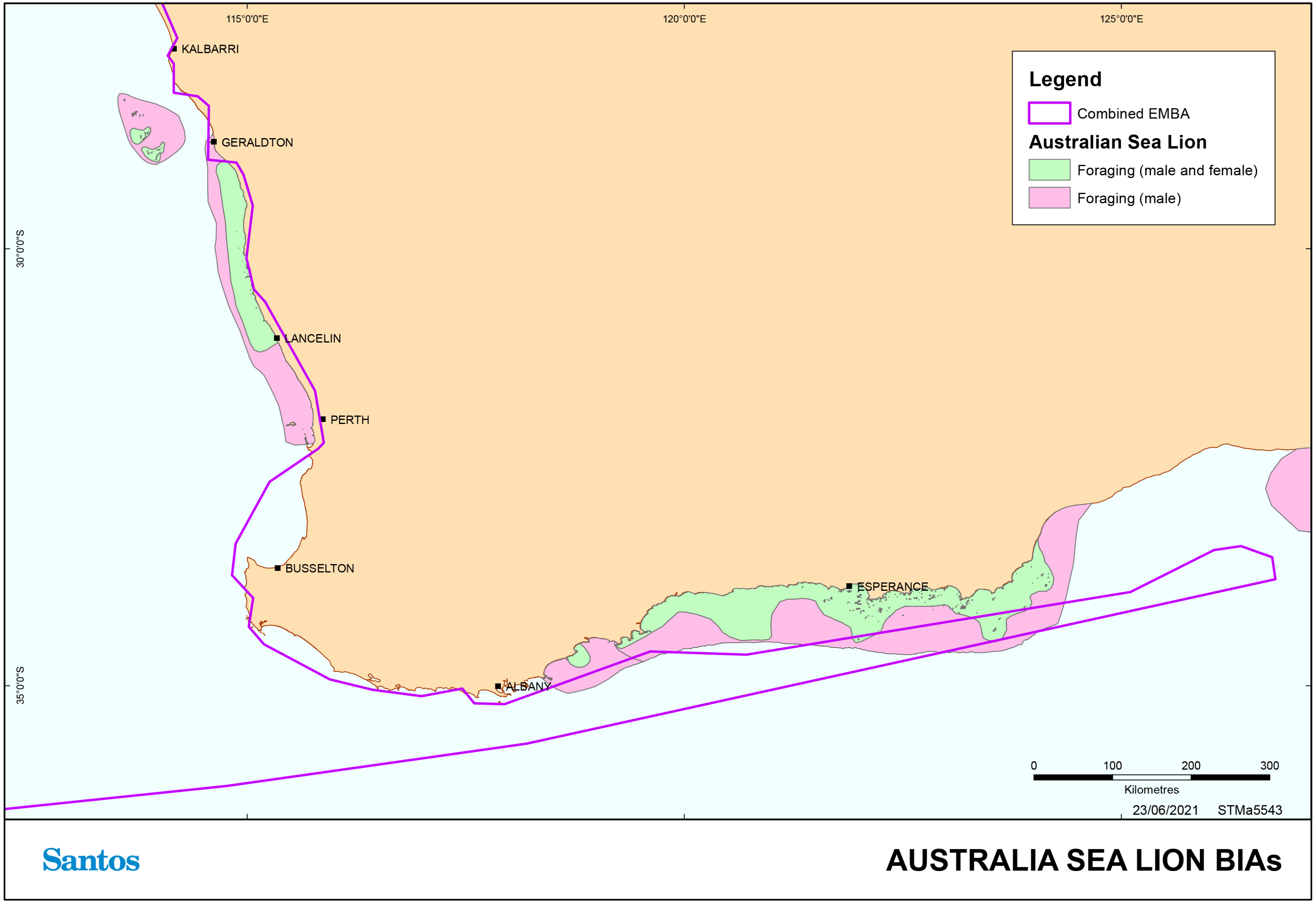


Figure 7-4: Biologically important areas – Australian sea lion

7.1.16 Dugongs

Dugongs (*Dugong dugon*) are large herbivorous marine mammals (up to 3 m) that feed off seagrass and generally inhabit coastal areas. Key populations along the WA coast are principally located at: Shark Bay (the largest resident population in Australia), Ningaloo Marine Park and Exmouth Gulf, the Pilbara coast and offshore areas including Montebello/ Barrow/ Lowendal Islands, and further north at Eighty Mile Beach and off the Kimberley Coast, particularly Roebuck Bay and Dampier Peninsula (Marsh *et al*. 2002; DSEWPaC 2012). Populations are also present at Ashmore Reef, and the north coast of the Tiwi Islands is recognised as a key site for the conservation of dugongs. A well-known major dugong aggregation of approximately 4,400 individuals occurs in waters seaward (within approximately 50 km) of the Tiwi Islands and ranks in the top eight of dugong populations in the world.

Dugong distribution and movement is based on the abundance, size and species of seagrass meadow. Dugongs can migrate hundreds of kilometres between seagrass habitats. Dugongs have been tracked moving long distances of up to 300 km between the Australia mainland and the Tiwi Islands (Whiting et al., 2009). 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, to the south of Melville Island.

Dugongs in the NT coastal waters have been observed foraging in intertidal rocky reef flats supporting sponges and algae as seagrass habitat is thought to be rare in the north marine region bioregion (INPEX, 2010; Whiting et al., 2009). However, seagrass communities are known to exist along the north coast of the Tiwi Islands.

The dugong BIAs in the combined EMBA are detailed in Table 7-3 and shown in Figure 7-5.

7.1.17 New Zealand fur-seal

The New Zealand fur-seal (also known as the long-nosed fur seal) (*Arctocephalus forsteri*) is a specially protected species (other specially protected) under the BC Act. The New Zealand fur seal is found in Ngari Capes Marine Park (two colonies) and along other parts of Australia's southern coast.[4]

[4] Identified as a relevant species through review of *Biodiversity Conservation Act 2016* listed species for marine species without an EBPC Act listing.

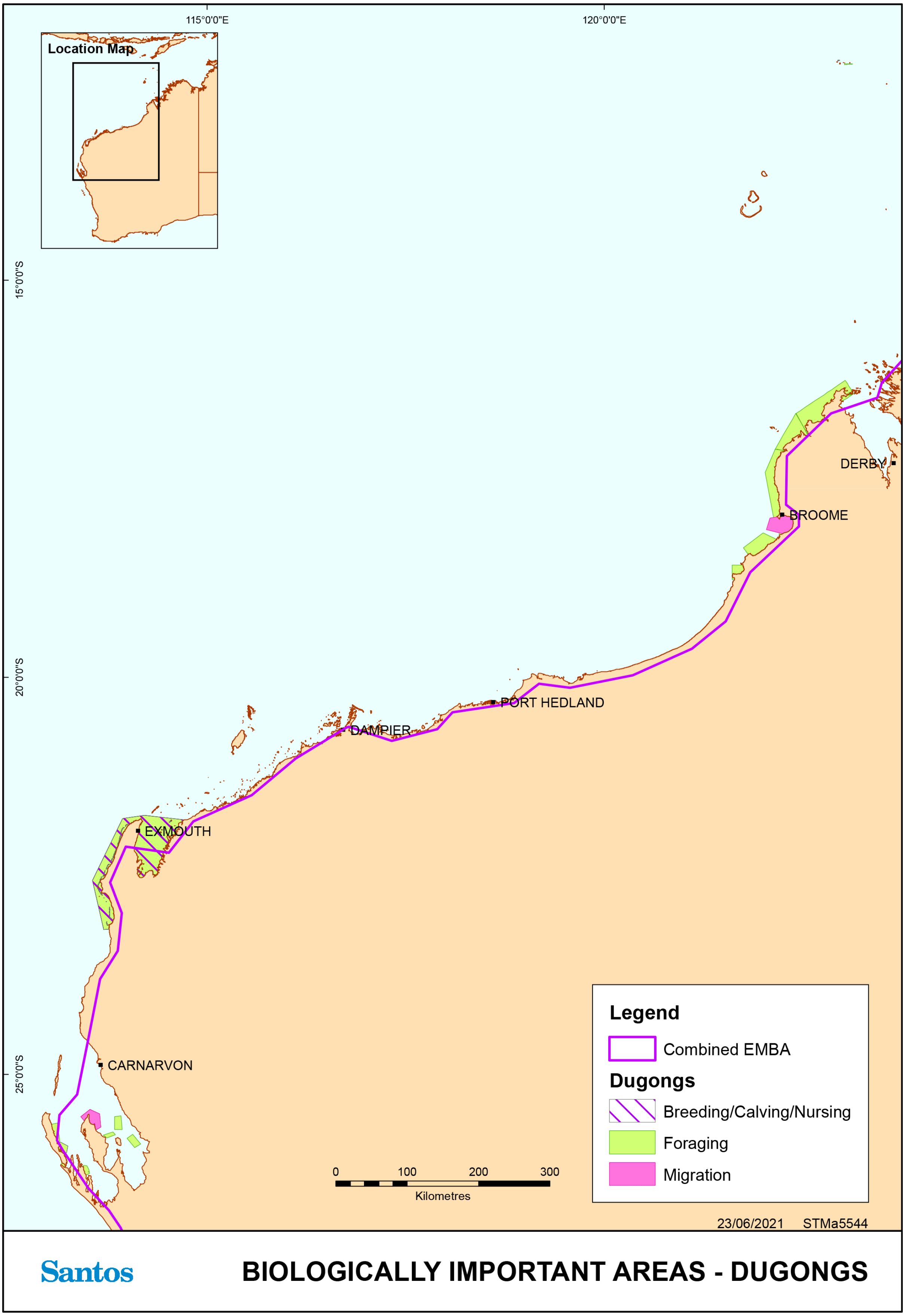


Figure 7-5: Biologically important areas – dugongs

Table 7-2: Summary of information for marine mammals listed as threatened under the EPBC Act

Aspect	Sei whale	Blue and pygmy blue whales	Fin whale	Southern right whale	Humpback whale	Australian sea lion
Species expected in area	Unknown	Yes	Unknown	Unlikely, southern distribution	Yes	Unlikely, southern distribution
Migration depth (m)	Unknown, prefers offshore waters	500-1,000	Unknown	n/a	Up to 100	n/a
Migration seasonality	Unknown	Apr to Aug (north), Oct to Jan (south)	Unknown	n/a	Jun to Nov	n/a

7.2 Biologically Important Areas / Critical Habitat – Marine Mammals

Table 7-3 below provides an overview of BIAs in the combined EMBA for marine mammals

The DAWE may also make recovery plans for threated fauna listed under the EPBC Act. The EPBC Act requires that 'habitat critical to the survival of the listed threatened species' is identified in recovery plans, relevant recovery plans are listed in Section 13.2[5].

In addition, both the EPBC Act and WA BC Act and associated regulations (2018) provide for the listing of critical habitat - habitat 'critical to the survival of the threatened species'. To date no critical habitat in WA has been listed under either Act. No provision is made under the Territory Parks and Wildlife Conservation Act 1976 for listing critical habitat.

Table 7-3: Biologically important areas – marine mammals

Species	Scientific name	Aggregation area and use	BIAs within EMBA
Blue and pygmy blue whales	*Balaenoptera musculus*	Migration – along the continental shelf edge off the WA coastline, extending offshore near Scott Reef and into Indonesian waters Foraging – along Ningaloo reef, around Scott Reef, around the Perth canyon Distribution – along the WA coastline towards and beyond Indonesia.	Blue and pygmy blue whale - Head of the Perth Canyon Outer continental shelf from Cape Naturaliste to south of Jurien Bay Outer Perth Canyon Head of the Perth Canyon Pygmy blue whale - Augusta to Derby. Tend to pass along the shelf edge at depths of 500 m to 1000 m; appear close to coast in the Exmouth-Montebello Islands area on southern migration. From Mandurah to south of Cape Naturaliste, seaward to the 50 m depth contour Indonesia- Banda Sea Ningaloo Perth canyon Scott Reef

[5] Further background information on BIA and identification of critical habitat in recovery plans is provided in Section 5.4.

Species	Scientific name	Aggregation area and use	BIAs within EMBA
Southern right whale	*Eubalaena australis*	Breeding/calving – along the south west and southern coastline of WA/SA	Bunbury area, WA Camac Island/Fremantle, WA Coast Cape Naturaliste to Cape Leeuwin Coast Perth region to Cape Naturaliste Geographe Bay, WA Perth to Kangaroo Island
Humpback whale	*Megaptera novaeangliae*	Breeding/calving/nursing/resting – Kimberley/Coastal North Lacepede Island, Campden Sound, Exmouth Gulf, Shark Bay Migration - northern migration deeper waters of the continental shelf, southward migration – along the WA mainland	Cape Leeuwin to Houtman Abrolhos Cape Naturaliste Cape Naturaliste to Cape Leeuwin Exmouth Gulf Flinders Bay Geographe Bay Houtman Abrolhos Islands Kimberley/Coastal North Lacepede Island, Camden Sound North of Houtman Abrolhos Shark Bay The migration corridor extends from the coast to out to approximately 100 km offshore in the Kimberley region extending south to North West Cape. From North West Cape to south of shark Bay the migration corridor is reduced to approximately 50 km. West coast - Lancelin to Kalbarri West coast- Bunbury to Lancelin including Rottnest Island
Sperm whale	*Physeter macrocephalus*	Foraging - west end of Perth Canyon and Albany Canyons	Western end of Perth canyon Albany Canyons - Immediately south of the continental shelf edge extending over the continental slope
Indo-Pacific humpback dolphin	*Sousa chinensis*	Breeding, calving, foraging – Kimberley coastal waters and islands Significant habitat – unknown behavior – Admiralty Gulf & Parry Harbour and Bougainville Peninsula Significant habitat - Vansittart Bay, Anjo Peninsula	Admiralty Gulf & Parry Harbour Bougainville Peninsula Camden Sound Area - Walcott Inlet, Doubtful Bay, Deception Bay, Augustus Island (Kuri Bay) Carnot & Beagle bay King Sound North and Yampi Sound and Talbot Bay Fjord area near Horizontal Falls King Sound Southern Sector Maret and Biggee Island Pender bay Port Nelson, York Sound, Prince Frederick Harbour Prince Regent River Roebuck Bay Vansittart Bay, Anjo Peninsula Willie Creek

Species	Scientific name	Aggregation area and use	BIAs within EMBA
Indo-Pacific/spotted bottlenose dolphin	*Tursiops aduncus*	Breeding, calving, foraging – Kimberley coastal waters and islands Migration – Pender Bay	Camden Sound Area - Walcott Inlet, Doubtful Bay, Deception Bay, Augustus Island (Kuri Bay) King Sound North and Yampi Sound and Talbot Bay Fjord area near Horizontal Falls King Sound Southern Sector Pender bay Roebuck Bay
Irrawaddy dolphin (Australian snubfin dolphin)	*Orcella heinsohni*	Breeding, calving, foraging, resting– Kimberley coastal waters and islands	Admiralty Gulf and Parry Harbour Bougainville Peninsula Camden Sound Area - Walcott Inlet, Doubtful Bay, Deception Bay, Augustus Island (Kuri Bay) Cape Londonderry and King George River Carnot and Beagle bay King Sound North and Yampi Sound and Talbot Bay Fjord area near Horizontal Falls King Sound Southern Sector Maret and Biggee Island Ord River Pender bay Port Nelson, York Sound, Prince Frederick Harbour Prince Regent River Roebuck Bay Vansittart Bay, Anjo Peninsula Willie Creek
Australian sea lion	*Neophoca cinerea*	Foraging – male and female – Houtman Abrolhos Island, mid-west coast (more restricted spatial extent than males) Foraging – males Houtman Abrolhos Island, mid-west coast down to Perth Breeding – Buller Island, North Fisherman Island, Beagle Island, Albrolhos Island Haul Out Sites – North Cervantes Island, Sandland Island, Albrolhos Island	Houtman Abrolhos Islands Mid-west coast, includes Beagle Island, Fisherman Island, Jurien Bay, Cervantes and Buller Colonies From Recherche Archipelago to Doubtful Islands – Key colonies, Kimberly island, Glenny and Wickham Island. Haul-Off rock
Dugong	*Dugong dugon*	Foraging –Dampier Peninsula, Roebuck Bay, Shark Bay, Exmouth and Ningaloo coastline Migration – Roebuck Bay and North East Peron Peninsula, Shark Bay Breeding/calving/nursing – Exmouth and the Ningaloo coastline	Ashmore Reef - Far West Ashmore Reef - South (located on sea reef side only, not interior) Between Peron Peninsula and Faure Island, Shark Bay Dirk Hartog Island, Shark Bay East of Faure Island, Shark Bay Exmouth Gulf Kimberley coast, Dampier Peninsula

Species	Scientific name	Aggregation area and use	BIAs within EMBA
			Middle Island, Kimberley coast North East Peron Peninsula, Shark Bay North of Faure Island, Shark Bay Pilbara and Kimberley coast near Dampier Peninsula Pilbara and Kimberley coast near James Price Point Roebuck Bay, Broome South Passage, Shark Bay Useless Loop, Shark Bay

8. Birds

Marine waters and coastal habitats in the combined 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. Resident coastal and terrestrial species include osprey (*Pandion cristatus*), white-bellied sea eagle (*Haliaeetus leucogaster*), silver gull (*Larus novaehollandiae*) and eastern reef egret (*Egreta sacra*) (DEWHA 2008a).

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. Seabirds present in the area include terns, noddies, petrels, shearwaters, tropicbirds, frigatebirds boobies and albatrosses (DEWHA 2008a).

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 for millions of migratory shorebirds that travel from Northern Hemisphere breeding grounds to Southern Hemisphere resting and foraging areas. Shorebirds that regularly migrate through the area include the Scolopacidae (curlews, sandpipers etc.) and Charadriidae (plovers and lapwings) families.

Surveys in the area by Santos and other agencies have built a picture of diverse avifauna. A summary of research is discussed below, followed by information on threatened and migratory birds. Wetlands of international importance are discussed in Section 9.1.3.

8.1 Regional Surveys

8.1.1 Abrolhos Islands

The Abrolhos Islands are one of the most significant seabird nesting areas in the eastern Indian Ocean with over two million birds breeding on the islands and small rocky atolls in the Abrolhos (DoF 2012). The mixture of species is unique, as subtropical and tropical species, and littoral and oceanic foragers, share the breeding islands. A total of 95 bird species have been recorded as residents or visitors to the Abrolhos Islands. Of these 35 species are known to breed at the Abrolhos (DoF, 2012):

- Common noddy (rookery – Pelseart Island): The Abrolhos supports 80% of the Australian breeding population of the common noddy (*Anous stolidus*) with up to 250,000 common noddies breed at Pelsaert Island. These birds lay their eggs in spring, but the actual month can vary, depending on their food supply and the weather conditions existing in offshore waters (DoF 2012);
- Caspian tern (rookeries – Leo Island, West Wallabi Island and Pelsaert Island): Unlike other more social terns, Caspian terns (*Hydroprogne caspia*) are usually solitary nesters. There are less than 150 of these breeding at the Abrolhos, across 22 islands (DoF 2012);
- Wedge-tailed shearwaters (rookeries): The Abrolhos are the most important breeding sites in Australia for the wedge tailed shearwater (*Ardenna pacifica*), with between 500,000 and 1,000,000 of these birds breeding there every year, predominantly on West Wallabi Island. The wedge-tailed shearwater breeding colonies at the Abrolhos are the largest in Australia (DoF 2012);

- Bridled tern (rookeries – Gun Island, Leo Island, Pelsaert Island, Little North Island, Fisherman Islands, Beagle Islands and Penguin Island): Bridled terns (*Onychoprion anaethetus*) breed on 90 islands throughout the Abrolhos. These birds fly north for the winter, through Indonesia to waters around the Phillippines. There are approximately 4,000 bridled terns who return to the Abrolhos around October every year to lay their eggs. Bridled terns nest on more islands in the Abrolhos than any other bird species (DoF, 2012);
- Osprey (nesting area – Pelseart Island): Up to 100 eastern ospreys (*Pandion cristatus*) nest at a number of sites throughout all three island groups at the Abrolhos, including nesting platforms made from converted rock lobster pots and stacked fishing equipment on jetties (DoF 2012);
- White-bellied sea eagle (nesting area – West Wallabi Island): At the Abrolhos, there are up to 50 breeding white-bellied sea eagles (*Haliaeetus leucogaster*), spread across all three island groups (DoF 2012);
- Australian lesser noddy (feeding area and rookeries Morley Island, Wooded Island and Pelseart Island): In Australia the Australian lesser noddy is only known to breed in this area and is known to forage between the islands and the continental shelf edge; and
- Other areas rookeries identified for both the wedge-tailed shearwater and bridled tern within the south west area include Lancelin Island, Rottnest Island and Safety Bay.

8.1.2 North West Cape

Avifauna surveys of the North West Cape have recorded 144 bird species, one third of which are seabirds and shorebirds (resident and migratory) (May *et al*. 1983). Approximately 33 species of seabirds and shorebirds are found in the Ningaloo Marine Park with the main breeding areas at Mangrove Bay, Mangrove Point, Point Maud, the Mildura wreck site and Fraser Island (CALM & MPRA 2005a).

8.1.3 Muiron Islands and Exmouth Gulf Islands

Muiron Islands and Exmouth Gulf Islands are generally lacking in published bird observations data. Early indications from surveys commissioned by Santos in 2013/14 indicate that South and North Muiron Islands are regionally significant in terms of wedge-tailed shearwater (*Ardenna pacifica*) nesting, whilst Bessiers and Fly islands are also significant (Surman pers comm. 2013). Nine coastal/terrestrial species and 21 shorebirds were identified on the Muiron and Exmouth Gulf Islands during the first of these surveys and seven bird species were recorded nesting (Surman 2013).

8.1.4 Dampier Archipelago/Cape Preston Region

The Dampier Archipelago/Cape Preston region is a nesting area for at least 16 species of seabirds. Many of the islands and rocks in the area are known breeding grounds for birds, including wedge-tailed shearwaters (*Ardenna pacifica*), Caspian terns (*Sterna caspia*), bridled terns (*Onychoprion anaethetus*) and roseate terns (*Sterna dougallii*). Small islands and islets such as Goodwyn Island, Keast Island and Nelson Rocks provide important undisturbed nesting and refuge sites, and Keast Island provides one of the few nesting sites for pelicans in WA (CALM & MPRA 2005).

8.1.5 Barrow Island Group

Barrow Island and surrounding islands have a diverse avifauna comprising at least 119 species (Chevron 2010), including 11 resident land birds, eight resident seabirds, 17 seabirds, 22 species of migratory waders, six resident shorebirds and 43 irregular visitors (Surman 2003). The avifauna of Barrow Island is thus poor in terms of land birds and waterfowl compared to mainland areas of the Pilbara, but rich in migratory waders and seabirds. Compared to other nearby offshore islands, Barrow Island has substantially more migratory waders but fewer breeding seabirds (Surman 2003).

8.1.6 Lowendal Island Group and Airlie and Serrurier Islands

The Lowendal Island Group has a diverse avifauna comprising 89 recorded species (Dinara Pty Ltd. 1991, Burbidge *et al*. 2000). Six species of resident land birds and six species of raptors have been recorded at the Lowendal Islands (Surman & Nicholson 2012). Up to fourteen seabird species have been observed at any one time during annual surveys of the Lowendal Islands between 2004 and 2012. Surveys at the Montebello Islands have recorded 70 bird species. This includes 12 species of seabirds and 14 species of migratory shorebirds (Burbidge *et al*. 2000).

Wedge-tailed shearwaters have been identified to nest on Varanus, Airlie, Serrurier and Bridled Islands (Astron 2017a). Breeding participation on the islands appears to be largely influenced by pre-breeding oceanographic conditions (Astron 2017a). Monitoring in 2016/17 was undertaken by Santos and demonstrated the colony sizes for wedge-tailed shearwaters to be within or above previously reported ranges (Astron 2017a). This is informed though monitoring that has been undertaken under the Integrated Shearwater Monitoring Program (ISMP), established in 1994.

In 2016/17, areas of potential wedge-tailed shearwater nesting habitat were recorded on Varanus Island (5.53 ha) and Airlie Island (12.47 ha) and surrounding islands of Bridled (2.94 ha), Serrurier (130.89 ha), Abutilon (2.02 ha) and Parakeelya (1.66 ha) (Astron 2017a). The number of wedge-tailed shearwater breeding pairs was also estimated for each of Varanus (1,492 +/- 702), Airlie (600 +/- 124), Bridled (1,039 +/- 342), Serrurier (23,240 +/- 4,341), Abutilon (317 +/- 210) and Parakeelya (172 +/- 138) islands (Astron 2017a).

Other seabird species utilising Abutilon, Beacon, Bridled and Parakeelya islands for nesting include bridled terns, silver gulls, crested terns and lesser crested terns. Monitoring for these seabirds in 2016/17 was also completed by Santos, with monitoring results concluded to support previous trends for all species. Bridled terns mainly utilise Abutilon, Bridled and Parakeelya islands for breeding, with smaller numbers noted on Beacon and Varanus Islands. The bridled terns have not been recorded on Airlie Island and only in very small numbers on Varanus Island (Astron 2017b).

Silver gull numbers appear to be growing across the region (2010/2011). However, reasons for this are unknown but considered possibly to be due to greater prey availability or immigration from the mainland (Astron 2017b). Silver gulls have been found to utilise Bridled, Parakeelya, Abutilon and Beacon islands longer term for breeding. Silver gulls have not been identified to nest on Varanus island and were only recorded nesting on Airlie island for the first time in 2016/17 since monitoring commencement in 2004/05 (Astron 2017b).

The crested tern and lesser crested tern are noted as nomadic breeders that appear to use a consistent subset of islands for breeding. In 2016/17, Beacon Island was the favourable nesting site for the crested tern and lesser crested tern (Astron 2017b). Surveys in the vicinity of Port Hedland (Bennelongia 2011) recorded 23 species of migratory shorebird between 2002 and 2011. Terrestrial/coastal and seabird species were not targeted. A total of 4,248 migratory shorebirds of 18 species were observed during the field survey in April 2011.

8.2 Threatened Species

A Protected Matters search of the combined EMBA identified 33 bird species (Appendix A) listed as threatened under the EPBC Act.

An examination of the Species Profile and Threats database (DAWE 2020a) and The Action Plan for Australian Birds (Garnet 2011) showed that some listed bird species are not expected to occur in significant numbers in the marine and coastal environments in the combined EMBA due to their terrestrial or southern distributions. Hence, these species are not discussed further.

EPBC Act threatened species expected to occur in the area are listed in Table 8-1 along with their WA and NT conservation status (as applicable), and discussed below. There are an additional 51 migratory species listed under the EPBC Act, with these detailed in Section 8.3 (Table 8-3). BIAs for birds are detailed in Table 8-7 and depicted in Figure 8-1 and Figure 8-2.

Table 8-1: Birds listed as threatened under the EPBC Act

Species	Conservation Status				Likelihood of occurrence in EMBA	BIAs in EMBA
	EPBC Act 1999	BC Act 2016	Other WA Conservation Code	*TPWC Act 1976*		
Shorebirds						
Red knot (Calidris canutus)	Endangered, Migratory	Endangered	-	Vulnerable	Species or species habitat known to occur within area	None - No BIA defined
Christmas Island Goshawk (*Accipiter fasciatus natalis*)	Endangered	Endangered	-	-	Species or species habitat known to occur within area	None - No BIA defined
Curlew sandpiper (*Calidris ferruginea*)	Critically endangered, Migratory	Critically endangered	-	Vulnerable	Species or species habitat known to occur within area	None - No BIA defined
Great knot (*Calidris tenuirostris*)	Critically endangered, Migratory	Critically endangered	-	Vulnerable	Roosting known to occur within area	None - No BIA defined
Greater sand plover (*Charadrius leschenaultii*)	Vulnerable, Migratory	Vulnerable	-	Vulnerable	Roosting known to occur within area	None - No BIA defined
Lesser sand plover (*Charadrius mongolus*)	Endangered, Migratory	Endangered	-	Vulnerable	Roosting known to occur within area	None - No BIA defined
Western Alaskan bar-tailed godwit (*Limosa lapponica baueri*)	Vulnerable, Migratory[6]	Vulnerable, Specially protected (migratory)[7]	-	Vulnerable	Species or species habitat known to occur within area	None - No BIA defined
Northern Siberian bar-tailed godwit (*Limosa lapponica menzbieri*)	Critically endangered, Migratory[7]	Critically endangered, Specially protected (migratory)[7]	-	Vulnerable	Species or species habitat known to occur within area	None - No BIA defined
Eastern curlew	Critically endangered,	Critically endangered	-	Vulnerable	Species or species habitat known to	None - No BIA defined

[6] Listed as migratory at species level

Species	Conservation Status				Likelihood of occurrence in EMBA	BIAs in EMBA
	EPBC Act 1999	BC Act 2016	Other WA Conservation Code	*TPWC Act 1976*		
(*Numenius madagascariensis)*	Migratory				occur within area	
Australasian bittern (*Botaurus poiciloptilus)*	Endangered	Endangered	-	-	Species or species habitat known to occur within area	None - No BIA defined
Australian painted snipe (*Rostratula australis)*	Endangered	Endangered	-	Vulnerable	Species or species habitat may occur within area	None - No BIA defined
Seabirds						
Australian lesser noddy (*Anous tenuirostris melanops)*	Vulnerable	Endangered	-	-	Breeding known to occur within area	Yes – refer to Table 8-7
Fairy prion (southern) (*Pachyptila tutur subantarctica)*	Vulnerable	-	-	-	Species or species habitat known to occur within area	None - No BIA defined
Southern royal albatross (*Diomedea epomophora)*	Vulnerable, Migratory	Vulnerable	-	-	Foraging, feeding or related behaviour likely to occur within area	None - No BIA defined
Northern royal albatross (*Diomedea sanfordi)*	Endangered, Migratory	Endangered	-	-	Foraging, feeding or related behaviour likely to occur within area	None - No BIA defined
Amsterdam albatross (*Diomedea amsterdamensis*)	Endangered, Migratory	Critically endangered	-	-	Species or species habitat may occur within area	None - No BIA defined
Antipodean albatross (*Diomedea antipodensis)*	Vulnerable Migratory	-	-	-	Foraging, feeding or related behaviour likely to occur within area	None - No BIA defined
Sooty Albatross (*Phoebetria fusca)*	Vulnerable, Migratory	Endangered	-	-	Species or species habitat	None - No BIA defined

Species	Conservation Status				Likelihood of occurrence in EMBA	BIAs in EMBA
	EPBC Act 1999	BC Act 2016	Other WA Conservation Code	*TPWC Act 1976*		
					may occur within area	
Tristan albatross (*Diomedea dabbenea)*	Endangered, Migratory	Critically endangered	-	-	Species or species habitat may occur within area	None - No BIA defined
Wandering albatross (*Diomedea exulans)*	Vulnerable, Migratory	Vulnerable	-	-	Foraging, feeding or related behaviour likely to occur within area	None - BIA not found in EMBA
Christmas island frigatebird (*Fregata andrewsi)*	Endangered, Migratory	Specially protected (migratory)	-	-	Foraging, feeding or related behaviour known to occur within area	None - No BIA defined
Southern giant petrel (*Macronectes giganteus)*	Endangered, Migratory	Specially protected (migratory)	-	-	Species or species habitat may occur within area	None - BIA not found in EMBA
Northern giant petrel (*Macronectes halli)*	Vulnerable, Migratory	Specially protected (migratory)	-	-	Species or species habitat may occur within area	None - BIA not found in EMBA
Abbott's booby (*Papasula abbotti)*	Endangered	-	-	-	Species or species habitat likely to occur within area	None - No BIA defined
Soft-plumaged petrel (*Pterodroma mollis)*	Vulnerable	-	-	-	Foraging, feeding or related behaviour known to occur within area (high numbers)	Yes – refer to Table 8-7
Blue petrel (*Halobaena caerulea)*	Vulnerable	-	-	-	Species or species habitat may occur within area	None - No BIA defined
Australian fairy tern (*Sternula nereis nereis)*	Vulnerable	Vulnerable	-	-	Breeding known to occur within area. Foraging	Yes – refer to Table 8-7

Species	Conservation Status				Likelihood of occurrence in EMBA	BIAs in EMBA
	EPBC Act 1999	BC Act 2016	Other WA Conservation Code	*TPWC Act 1976*		
					(in high numbers)	
Indian yellow-nosed albatross (*Thalassarche carteri)*	Vulnerable, Migratory	Endangered	-	-	Foraging, feeding or related behaviour may occur within area	Yes – refer to Table 8-7
Shy albatross (*Thalassarche cauta)*	Endangered, Migratory	Vulnerable	-	-	Foraging, feeding or related behaviour likely to occur within area	None - BIA not found in EMBA
White-capped albatross (*Thalassarche steadi)*	Vulnerable, Migratory	Vulnerable	-	-	Foraging, feeding or related behaviour likely to occur within area	None - BIA not found in EMBA
Black-browed albatross (*Thalassarche melanophris)*	Vulnerable, Migratory	Endangered	-	-	Species or species habitat may occur within area	None - BIA not found in EMBA
Campbell albatross (*Thalassarche impavida)*	Vulnerable, Migratory	Vulnerable	-	-	Species or species habitat may occur within area	None - BIA not found in EMBA
Christmas Island white-tailed tropicbird (*Phaethon lepturus fulvus)*	Endangered	-	-	-	Species or species habitat may occur within area	None - No BIA defined

8.2.1 Shorebirds

Red Knot (New Siberian Islands and north-eastern 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).

Curlew Sandpiper

This species 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).

Great Knot

The great knot is a migratory shorebird with a global distribution, breeding in north-east Siberia and spending the non-breeding season along coasts from Arabia to Australia. Non-breeding birds migrate to inlets, bays, harbours, estuaries and lagoons with large intertidal mud and sand flats where they feed on bivalves, gastropods, crustaceans and other invertebrates (Higgins & Davies 1996 in Garnet *et al.* 2011).

Greater Sand Plover and Lesser Sand Plover

The greater sand plover and lesser sand plover are congeners that breed in China, Mongolia and Russia. The greater sand plover spends the non-breeding season along coasts from Japan through southeast Asia to Australasia, while the lesser sand plover spends the non-breeding season along coasts from Taiwan to Australasia (Banford *et al*. 2008). Non-breeding birds occur along all Australian coasts, especially in the north for the greater sand plover and in the east for the lesser sand plover (DAWE 2020a).

Non-breeding birds forage on beaches, salt-marshes, coastal bays and estuaries, and feed on marine invertebrates including molluscs, worms, crustaceans and insects (Marchant & Higgins 1993 in Garnet *et al*. 2011).

Bar-tailed Godwit (Western Alaskan and Northern Siberian Subspecies)

Two subspecies of the bar-tailed godwit exist, as determined by their breeding locations in Siberia and Alaska (Bamford *et al*. 2008). Non-breeding birds migrate to the coasts of Australia. The western Alaskan subspecies occurs especially on the north and east coasts of Australia whilst the northern Siberian subspecies occurs especially along the coasts of north Western Australia (DAWE 2020a).

Non-breeding birds are found on muddy coastlines, estuaries, inlets, mangrove-fringed lagoons and sheltered bays, feeding on annelids, bivalves and crustaceans (Higgins and Davies 1996 in Garnet *et al*. 2011).

Eastern Curlew

The eastern curlew 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).

Australian Painted Snipe

The Australian painted snipe has been recorded at wetlands in all states of Australia (DoE 2014g). The Australian painted snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum Muehlenbeckia or canegrass or sometimes tea-tree (*Melaleuca*). The Australian painted snipe sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber (DoE 2014g).

Australasian Bittern

The Australasian bittern is found in coastal and sub-coastal areas of south-eastern and south-western mainland Australia and the eastern marshes of Tasmania (Birdlife Australia 2017). The Australasian Bittern occurs mainly in freshwater wetlands and, rarely, in estuaries or tidal wetlands (Marchant & Higgins 1990). It favours wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds (e.g. *Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, Bolboschoenus*) or cutting grass (*Gahnia*) growing over a muddy or peaty substrate (Marchant & Higgins 1990). The diet of the Australasian Bittern includes aquatic animals such as small fish, frogs, freshwater crayfish, spiders, insects and small reptiles at night. Breeding occurs during summer from October to January.

All remaining natural habitat (including constructed wetlands) is considered critical habitat for this species. This species is known to occur on the western coastal plain between Lancelin and Busselton and the southern coastal region from Augusta to east of Albany within the combined EMBA (Table 8-7).

8.2.2 Seabirds

Australian Lesser Noddy

This species is usually found only around its breeding islands in the Houtman Abrolhos Islands in Western Australia (Storr *et al*. 1986). 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 DAWE 2020a). 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 DAWE 2020a).

Breeding apparently occurs only on Morley, Wooded and Pelsaert Islands at the Houtman Abrolhos Islands (Higgins and Davies 1996 in DoE 2014b). Mangrove stands support approximately 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 DoE 2014b).

The National Conservation Values Atlas identifies BIAs for this species in the area of the Houtman Abrolhos islands (Table 8-7). The Species Group Report Card – Seabirds (DSEWPaC 2012b) states that the entire Australian population of this species breeds in the South-west Marine Region, south of Busselton.

Albatrosses

A Protected Matters search of the waters in the combined EMBA (Appendix A) identified several albatross species that may occur in the area, comprising of the southern royal albatross, northern royal albatross, Amsterdam albatross, Antipodean albatross, Tristan albatross, sooty albatross, wandering albatross, Indian yellow-nosed albatross, shy albatross, white-capped albatross, black-browed albatross and Campbell albatross. All these species predominantly occur in subantarctic to subtropical waters and breed on islands in the southern oceans (DAWE 2020a).

The National Conservation Values Atlas (DAWE 2020b) and the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC 2011) do not identify any BIAs for these species in the area from Busselton to the NT border. However, a BIA for the Indian yellow-nosed albatross is identified for foraging north to Shark bay and extending east into Bass Strait.

Christmas Island Frigatebird

The Christmas Island frigatebird is a very large seabird. Breeding colonies of the Christmas Island frigatebird is currently confined to Christmas Island in the Indian Ocean (Birdlife International 2019) but forages and roosts widely in south-east Asia and Indian Ocean No breeding colonies have ever been found away from Christmas Island. The Christmas Island Frigatebird predominantly nests in forests on shore terraces that are protected from prevailing south-east trade winds (TSSC 2020a). All forest containing nesting and roosting sites, including currently known nesting and roosting colonies and any other smaller groups of nests and roosts on Christmas Island is considered critical habitat (TSSC 2020a).

Christmas Island Goshawk

The Christmas Island Goshawk is considered to be the rarest endemic bird on Christmas Island, where it occurs in all habitats from primary and marginal rainforests to suitable areas of secondary regrowth vegetation. The total population size is thought to be very small, perhaps as few as 100 adults, and is probably limited by the availability of suitable rainforest habitat.

Crazy Ants pose an unknown but potentially critical threat to the survival of this bird. The National recovery plan for the Christmas Island Goshawk (*Accipiter fasciatus natalis*) aims to downgrade the Christmas Island Goshawk from Endangered to Conservation Dependent, primarily through successful implementation of the Invasive Ants on Christmas Island Action Plan and protection of habitat critical to the survival of the species from clearance. An assessment of goshawk population dynamics is the most essential requirement of this recovery plan, and community awareness and participation in the conservation of this endemic raptor are also important actions.

Southern Giant Petrel

The southern giant petrel is a highly migratory bird with a large natural range. This species occurs from Antarctic to subtropical waters and breeds on the Antarctic continent, peninsular and islands and on subantarctic islands and South America. Breeding occurs annually between August and March (DAWE 2020a).

The National Conservation Values Atlas (DAWE 2020b) and the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC 2011) do not identify any BIAs for this species in the area from Busselton to the NT border.

Northern Giant Petrel

The northern giant petrel occupies the Antarctic Polar Front. In summer, it occurs predominantly in sub-Antarctic to Antarctic waters, usually between 40 and 64° The northern giant-petrel breeds on sub-Antarctic islands. Its breeding range extends into the Antarctic zone at South Georgia. It nests in coastal areas where vegetation or broken terrain offers shelter, on sea-facing slopes, headlands, in the lee of banks, under or against vegetation clumps, below cliffs or overhanging rocks, or in hollows. On Campbell Island, it nests on the edge of the coastal plateau. Tussock-grass is widespread at many breeding sites. Its nests are built in secluded, coastal sites, sheltered by heavy vegetation. On Antipodes Island, it nests under *Senecio antipoda* (DoE 2014d).

The National Conservation Values Atlas (DAWE 2020b) does not identify any BIAs for this species in the area spanning SW WA to the NT border.

Soft-Plumaged Petrel

The soft-plumaged petrel is generally found over temperate and subantarctic waters in the South Atlantic, Southern Indian and western South Pacific Oceans. The species breeds colonially on islands in the southern oceans. Breeding occurs from August to May (Marchant & Higgins 1990 in DAWE 2020a).

A BIA for this species is identified for foraging in seas north to 21°30'S off WA.

Blue Petrel

The blue petrel is marine species of the Sub Antarctic and Antarctic seas. In summer, it occurs mainly over waters of -2 to 2° C in surface temperature, but it also ranges south to the edge of the pack-ice and north to approximately 30° south, or further north over cool currents (DoE 2014e). In the Antarctic, it generally avoids the pack-ice, and only occasionally approaches the edge of the ice. Given the location of the combined EMBA, this species is unlikely to occur.

The National Conservation Values Atlas (DAWE 2020b) does not identify any BIAs for this species in the area spanning SW WA to the NT border.

Abbott's Booby

Currently, Abbott's booby is only known to breed on Christmas Island and to forage in the waters surrounding the island and south-east Asia (TSSC 2020b). 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.

The National Conservation Values Atlas (DoEE 2019b) does not identify any BIAs for this species in the area spanning SW WA to the NT border. Critical habitat is considered all known nesting trees and all forest vegetation within a 200m radius of known nesting trees on Christmas Island (TSSC 2020).

Australian Fairy Tern

The Australian fairy tern is distributed in a large geographic range between Australia, New Zealand and New Caledonia. Three subspecies have been identified, one of which is found in Australia. The Australian fairy tern occurs along the coasts of Victoria, Tasmania, South Australia and WA; occurring as far north as the Dampier Archipelago (DAWE 2020a). The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine islands, wetlands and mainland coastline (Higgins & Davies 1996 in DoE 2014b, Lindsey 1986).

Australian fairy terns nest on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The Australian fairy tern breeds from August to February depending on the location of the breeding colony (Higgins & Davies 1996 in DAWE 2020a). They generally nest in small colonies of up to 100 birds, although larger colonies of more than 1400 pairs have been reported in Western Australia (Hill *et al.* 1988).

The National Conservation Values Atlas (DAWE 2020b) identifies the vicinity of the lower north-west coast (north to Dampier Archipelago) and west coast (south to Peel inlet) as BIAs for foraging. Biologically important breeding areas were also identified scattered along the coast between Shark Bay and the Pilbara (Table 8-7).

Christmas Island White-tailed Tropicbird

The Christmas Island white-tailed tropicbird is endemic to Christmas Island and leaves the island to forage in the warm waters of the Indian Ocean (Garnett 2011). The white-tailed tropicbird roots at sea; only incubating or brooding adults remain on nests on the island at night (Stokes 1988).

The National Conservation Values Atlas (DAWE 2020b) does not identify any BIAs for this species within the combined EMBA.

Fairy Prion (southern)

The fairy prion is distributed off the cold-water coasts of Antarctica and southern Australia and New Zealand. The southern subspecies is known to breed on Macquarie Island, Langdon Point, Davis Point and Bishop and

Clerk islands (Garnett & Crowley 2000). It is estimated that the population of the fairy piron (southern) is a little over 50 pairs (Brothers 1984).

The National Conservation Values Atlas (DAWE 2020b) does not identify any BIAs for this species within the combined EMBA.

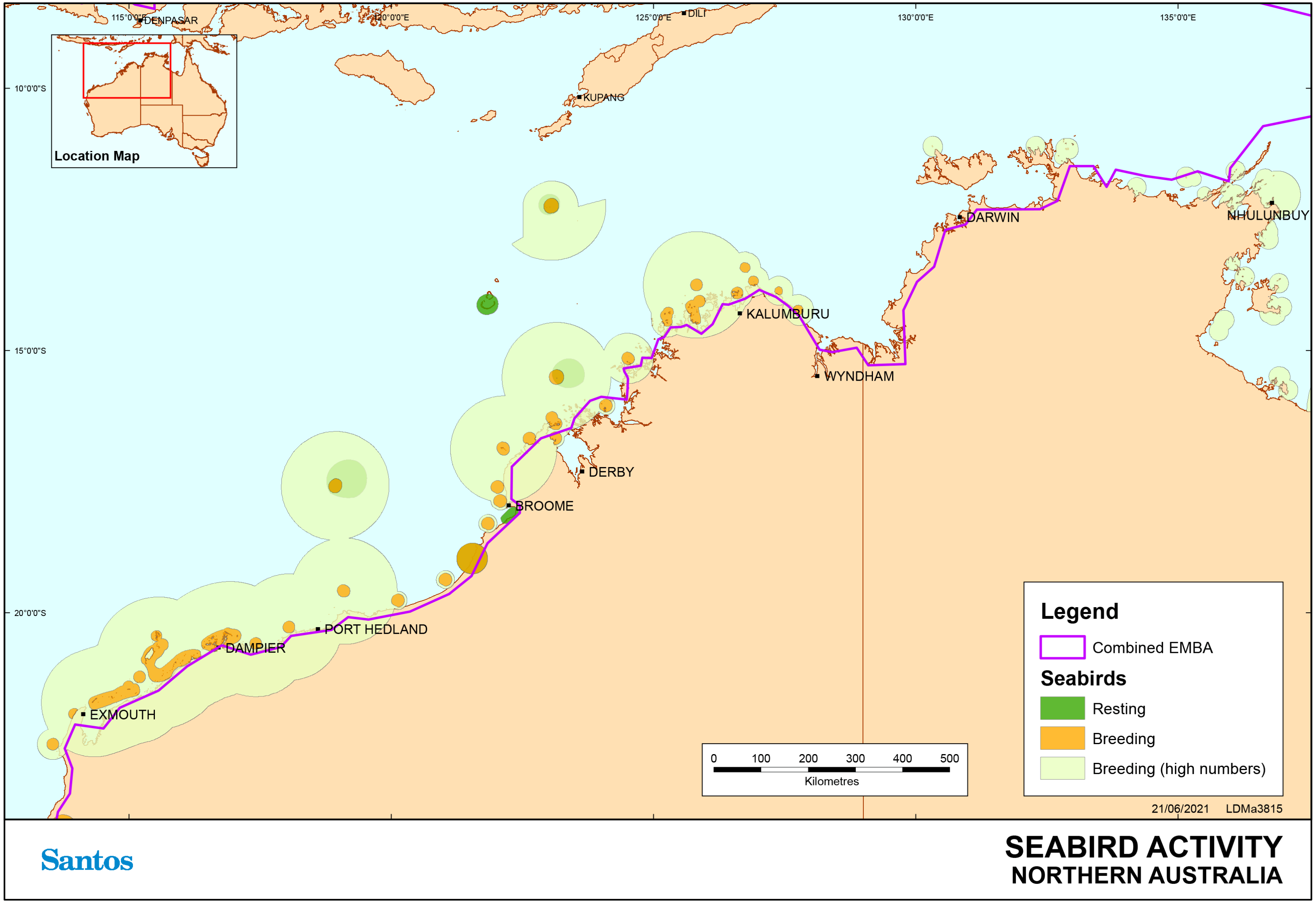


Figure 8-1: Biologically important areas – birds – Northern WA

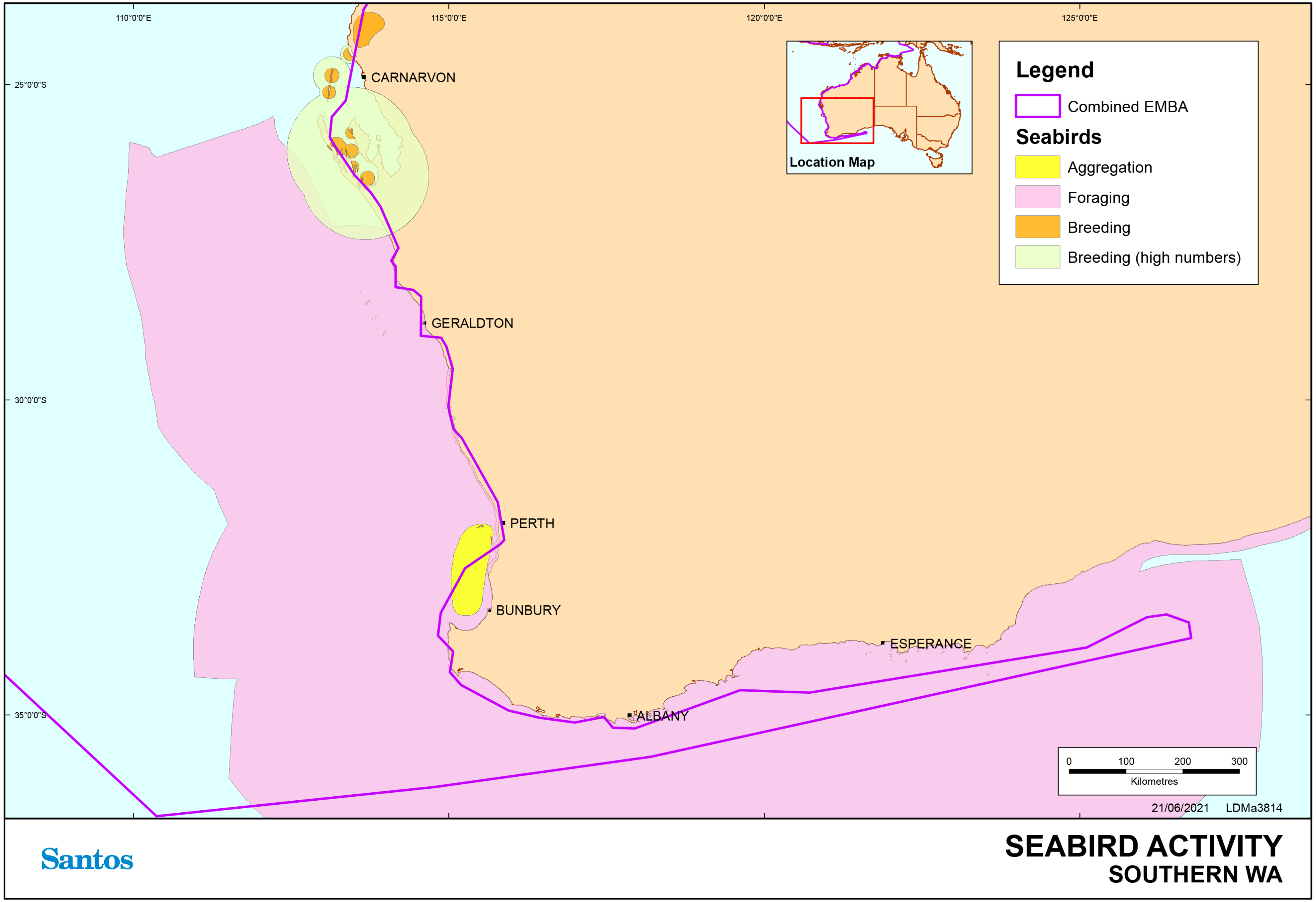


Figure 8-2: Biologically important areas – birds – Southern WA

Table 8-2: Summary of information for birds listed as threatened under the EPBC Act that may be in the combined EMBA

Species	Species Expected in EMBA	Breeding in the Area /Seasonality	Foraging
Shorebirds			
Red knot	Yes	No	Intertidal invertebrates
Curlew sandpiper	Yes	No	Polychaete worms, molluscs and crustaceans taken from shorelines
Great knot	Yes	No	Bivalves, gastropods, crustaceans and other invertebrates taken from shorelines
Greater sand plover/lesser sand plover	Yes	No	Marine invertebrates taken from shorelines
Bar-tailed godwit	Yes	No	Annelids, bivalves and crustaceans taken from shorelines
Eastern curlew	Yes	No	Marine invertebrates associated with seagrass
Australasian bittern	Yes	No	Other small animals, insects, snails and spiders
Australian painted snipe	Yes	No	Seeds and small invertebrates
Western Alaskan bar-tailed godwit	Yes	No	Worms, molluscs, crustaceans, insects
Northern Siberian bar-tailed godwit	Yes	No	Worms, molluscs, crustaceans, insects and some plant material
Seabirds			
Australian lesser noddy	May forage from Kalbarri to Shark Bay	No	Small fish taken from marine and coastal waters (DoE 2014b)
Amsterdam albatross	Low densities	No	Cephalopods, fish and crustaceans taken from marine and coastal waters.
Antipodean albatross	Low densities	No	Cephalopods, fish and crustaceans taken from marine and coastal waters.
Black-browed albatross	Low densities	No	Cephalopods, fish and crustaceans taken from marine and coastal waters.
Campbell albatross	Low densities	No	Cephalopods, fish, salps, jellyfish and crustaceans taken from marine and coastal waters.
Indian yellow-nosed albatross	Low densities	No	Cephalopods, and fish taken from marine and coastal waters.
Northern royal albatross	Low densities	No	Cephalopods, fish, salps and crustaceans taken from marine and coastal waters.
Shy albatross	Low densities	No	Cephalopods, fish and crustaceans taken from marine and coastal waters.
Sooty Albatross	Low densities	No	Cephalopods, fish, crustaceans, siphonophores and penguin carrion taken from marine waters.

Species	Species Expected in EMBA	Breeding in the Area /Seasonality	Foraging
Southern royal albatross	Low densities	No	Cephalopods, and fish taken from marine and coastal waters.
Tristan albatross	Low densities	No	Cephalopods, fish and crustaceans taken from marine waters.
Wandering albatross	Low densities	No	Cephalopods, fish and crustaceans taken from marine and coastal waters.
White-capped albatross	Low densities	No	Cephalopods and fish taken from marine and coastal waters.
Southern & Northern giant petrel	Low densities	No	Scavenges penguin, seal and whale carcasses. Hunts live birds, penguin chicks' cephalopods and krill. Marine and coastal waters (DoE 2014b)
Soft-plumaged petrel	Low densities	No	Cephalopods, fish and crustaceans taken from marine and coastal waters (DoE 2014b)
Australian fairy tern	Yes	Yes Aug to Feb	Bait fish taken from coastal waters
Fairy prion (southern)	Very low densities	No	Small pelagic crustaceans, small fish and squid
Christmas Island frigatebird	Low densities	No	Planktonic crustaceans, fish and squid
Abbott's booby	Low densities	No	Fish and squid
Blue petrel	Low densities	No	Crustaceans, small fish and squid
Christmas Island white-tailed tropicbird	Very low densities	No	Squid and flying fish

8.3 Migratory Species

The EPBC PMST search identified an additional 78 species listed as migratory under the EPBC Act that may occur within the combined EMBA. These species are listed in Table 8-3. All of these species are also listed as migratory under the BC Act, with the exception of the flesh-footed shearwater, which is listed as vulnerable under the BC Act. Those species that are listed as both migratory and threatened under either the EPBC Act and/or BC Act are outlined in Table 8-1 and are not repeated within Table 8-3.

Table 8-3: Summary of migratory birds that may occur within the combined EMBA

Species	Common Name	Likelihood of occurrence in EMBA
Limnodromus semipalmatus	Asian dowitcher	Roosting known to occur within area
Limosa lapponica	Bar-tailed godwit	Species or species habitat known to occur within area
Limosa limosa	Black-tailed godwit	Roosting known to occur within area
Onychoprion anaethetus	Bridled tern	Breeding known to occur within area
Limicola falcinellus	Broad-billed sandpiper	Roosting known to occur within area
Sula leucogaster	Brown booby	Breeding known to occur within area

Species	Common Name	Likelihood of occurrence in EMBA
Hydroprogne caspia	Caspian tern	Breeding known to occur within area
Tringa nebularia	Common greenshank	Species or species habitat known to occur within area
Anous stolidus	Common noddy	Breeding known to occur within area
Tringa totanus	Common redshank	Roosting known to occur within area
Actitis hypoleucos	Common sandpiper	Species or species habitat known to occur within area
Thalasseus bergii	Crested tern	Breeding known to occur within area
Charadrius bicinctus	Double-banded plover	Roosting known to occur within area
Ardenna carneipes	Flesh-footed shearwater	Breeding known to occur within area
Apus pacificus	Fork-tailed swift	Species or species habitat likely to occur within area
Thalasseus bergii	Greater crested tern	Breeding known to occur within area
Fregata minor	Greater frigatebird	Breeding known to occur within area
Pluvialis squatarola	Grey plover	Roosting known to occur within area
Tringa brevipes	Grey-tailed tattler	Roosting known to occur within area
Fregata ariel	Lesser frigatebird	Breeding known to occur within area
Numenius minutus	Little curlew	Roosting known to occur within area
Tringa stagnatilis	Little greenshank	Roosting known to occur within area
Sternula albifrons	Little tern	Breeding known to occur within area
Calidris subminuta	Long-toed stint	Species or species habitat known to occur within area
Sula dactylatra	Masked booby	Breeding known to occur within area
Tringa stagnatilis	Marsh sandpiper	Roosting known to occur within area
Charadrius veredus	Oriental plover	Roosting known to occur within area
Glareola maldivarum	Oriental pratincole	Roosting known to occur within area
Pandion haliaetus	Osprey	Breeding known to occur within area
Pluvialis fulva	Pacific golden plover	Roosting known to occur within area
Calidris melanotos	Pectoral sandpiper	Species or species habitat known to occur within area
Gallinago stenura	Pin-tailed snipe	Roosting known to occur within area
Sula sula	Red-footed booby	Breeding known to occur within area
Phalaropus lobatus	Red-necked phalarope	Roosting known to occur within area
Calidris ruficollis	Red-necked stint	Roosting known to occur within area
Phaethon rubricauda	Red-tailed tropicbird	Breeding known to occur within area
Sterna dougallii	Roseate tern	Breeding known to occur within area
Arenaria interpres	Ruddy turnstone	Roosting known to occur within area
Philomachus pugnax	Ruff (reeve)	Roosting known to occur within area
Calidris alba	Sanderling	Roosting known to occur within area
Calidris acuminata	Sharp-tailed sandpiper	Roosting known to occur within area

Species	Common Name	Likelihood of occurrence in EMBA
Erythrotriorchis radiatus	Short-tailed shearwater	Species or species habitat may occur within area
Ardenna grisea	Sooty shearwater	Species or species habitat may occur within area
Calonectris leucomelas	Streaked shearwater	Species or species habitat known to occur within area
Gallinago magala	Swinhoe's snipe	Roosting known to occur within area
Xenus cinereus	Terek sandpiper	Roosting known to occur within area
Tringa glareola	Wandering Tattler	Roosting known to occur within area
Ardenna pacifica	Wedge-tailed shearwater	Breeding known to occur within area
Numenius phaeopus	Whimbrel	Roosting known to occur within area
Phaethon lepturus	White-tailed tropicbird	Breeding known to occur within area
Tringa glareola	Wood sandpiper	Roosting known to occur within area

Australia is 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, 36 species of migratory shorebirds have been listed as specially protected under both the Commonwealth EPBC Act and the WA BC Act.

Eleven internationally recognised areas that can support shorebird migrations are protected as wetlands of international importance. These wetlands are discussed further in Section 9.1.3.

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 (Commonwealth of Australia 2017b). Site significance can be difficult to assess, particularly for ephemeral inland wetlands. These areas may be used rarely, depending 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 (Commonwealth of Australia 2017b). 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 (Commonwealth of Australia 2017b).

The types of habitat used by migratory shorebirds in Australia vary across the species identified in the PMST search. Migratory shorebirds use both coastal and inland habitats that most commonly include:

+ Coastal habitats: coastal wetlands, estuaries, mudflats, rocky inlets, reefs and sandy beaches, sometimes supporting mangroves; and
+ Inland habitats: inland wetlands, floodplains and grassland areas, often with ephemeral water sources (Commonwealth of Australia 2017b).

Feeding guilds provide an explanation for much of the shorebird distribution pattern in the north Western Australia. For example, Rogers (1999) classified shorebirds (and others) in Roebuck Bay as belonging to seven guilds on the basis of prey choice and foraging method. In order of abundance, these are summarised in Table 8-4.

Table 8-4: Feeding guilds based on prey choice and foraging method (Rogers 1999) adapted from DEC (2003) and Bennelongia (2008)

Feeding habitat	Feeding guild	Species
Sea edge	Tactile hunters of macrobenthos	Great knot, red knot, bar-tailed godwit, black-tailed godwit, Asian dowitcher
Along sandy sea edges or near tidal creeks	Tactile hunters of microbenthos	Curlew sandpiper, red-necked stint, broad-billed sandpiper, marsh sandpiper, sharp-tailed sandpiper
Reefs or mangrove fringes	Visual hunters of slow surface-dwelling prey	Common sandpiper, sooty oystercatcher, pied oystercatcher, silver gull, ruddy turnstone
Sandier western parts of Roebuck Bay, often near-shore	Visual hunters of small fast prey	Grey plover, red-capped plover, greater sand plover, lesser sand plover, grey-tailed tattler, terek sandpiper
Soft mudflats in north-east Roebuck Bay	Visual hunters of fast large prey	Eastern curlew, whimbrel, greenshank, striated heron and black-necked stork
Soft mudflats in north-east Roebuck Bay	Kleptoparasites	Gull-billed tern (robs large crabs from whimbrels)
Creek-lines in eastern Roebuck Bay	Pelagic hunters of nekton (animals of the pelagic zone) and neuston (animals that live on the surface film)	Black-winged stilt, red-necked avocet, reef egret, little egret, great white egret, white-faced heron, royal spoonbill

The Wildlife Conservation Plan for Migratory Shorebirds (DoE 2015) 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.

The following migratory shorebird species are subject to the Wildlife Conservation Plan for Migratory Shorebirds 2015 (DoE 2015).

Table 8-5: Birds subject to the Wildlife Conservation Plan for Migratory Shorebirds 2015

Migratory species	DoEE SPRAT information on distribution within the area of interest
Asian dowitcher	The Asian dowitcher is a regular visitor to the north-west between Port Hedland and Broome. Elsewhere they are sporadic and rare. In the NT, the Asian dowitcher is found in Darwin and Arnhem Land. In WA, the species has been recorded at Albany, Lake McLarty, Lake McLeod, north-east Pilbara and the south-west Kimberley division. It has also been recorded at the Port Hedland Saltworks, Roebuck Bay, Ashmore Reed and Eighty Mile Beach. The Australian population is approximately 500 (Bamford *et al*. 2008).
Bar-tailed godwit	The bar-tailed godwit has been recorded in the coastal areas of all Australian states. In WA, it is widespread around the coast, from Eyre to Derby, with a few scattered records elsewhere in the Kimberley. In the NT populations have been recorded from Darwin and Melville Island. Sites of international importance from WA and the NT include; + Eighty Mile Beach, WA (110,290 individuals); + Roebuck Bay, WA (65,000 individuals); + Milingimbi coast, NT (7,000 individuals); and + Elcho Island, NT (5,000 individuals).

Migratory species	DoEE SPRAT information on distribution within the area of interest
Black-tailed godwit	The black-tailed godwit is found in all states and territories of Australia; however, it prefers coastal regions and the largest populations are found on the north coast between Darwin and Weipa. The population that inhabits Roebuck Bay is approximately 7,374 (>1% of the species total population).
Broad-billed sandpiper	In WA, few records occur in the south-west, but the broad-billed sandpiper may be regular in small numbers at scattered locations, from Warden Lake Nature Reserve and Coramup Creek to Guraga Lake Nature Reserve and Hurstview Lake. Individuals mostly occur on the coasts of the Pilbara and Kimberley between Onslow and Broome but are also recorded north to the mouth of Lawley River, and inland at Lake Daley.
Common greenshank	The common greenshank occurs around most of the coast from Cape Arid in the south to Carnarvon in the north-west. In the Kimberley region, it is recorded in the south-west and the north-east, with isolated records from the Bonaparte Archipelago. WA has three sites of international importance for the common greenshank which include: + Eighty Mile Beach (2,240 individuals); + Wilson Inlet (568 individuals); and + Roebuck Bay (560 individuals). The NT does not have any sites of international importance.
Common redshank	In Western Australia (WA), the species is vagrant to the south-west with records at Peel Inlet, Coodanup, the Gascoyne region, Coral Bay and Carnarvon.
Common sandpiper	WA distribution includes: + Roebuck Bay; and + Nuytsland Nature Reserve. NT distribution includes: + Kakadu National Park; and + Darwin area.
Double-banded plover	The double-banded plover can be found in both coastal and inland areas. There are no nationally significant sites within WA.
Fork-tailed swift	In WA, there are sparsely scattered records of the fork-tailed swift along the south coast, ranging from near the Eyre Bird Observatory and west to Denmark. They are widespread in coastal and subcoastal areas between Augusta and Carnarvon, including some on nearshore and offshore islands. They are scattered along the coast from south-west Pilbara to the north and east Kimberley region, near Wyndham. There are sparsely scattered inland records, especially in the Wheatbelt, from Lake Annean and Wittenoom. They are found in the north and north-west Gascoyne Region, north through much of the Pilbara Region, and the south and east Kimberley (Higgins 1999). In the NT scattered records exist around some offshore islands, mostly south to Victoria River Downs.
Great knot	The great knot has been recorded around the entirety of the Australian coast, with a few scattered records inland. The greatest numbers are found in northern Australia; where the species is common on the coasts of the Pilbara and Kimberley, from the Dampier Archipelago to the Northern Territory border. Important sites for great knot in Western Australia include: + Eighty Mile Beach (169,044 individuals); and + Roebuck Bay (22,600 individuals).
Greater sand plover	In Australia, the greater sand plover occurs in coastal areas in all states, though the greatest numbers occur in northern Australia, especially the north-west. In northern Australia, the species is especially widespread between North West Cape and Roebuck Bay in Western Australia and are sparsely scattered records from the largely inaccessible area between Roebuck Bay and Darwin.

Migratory species	DoEE SPRAT information on distribution within the area of interest
	Internationally important sites within Western Australia include: + Eighty Mile Beach (64,548 individuals); + Roebuck Bay (26,900 individuals); and + Ashmore Reef (1,196 individuals).
Grey plover	In Australia, the grey plover has been recorded in all states, where it is found along the coasts and are recorded frequently between Albany and the northern Kimberley coast. Internationally important sites include: + Eighty Mile Beach (1,650 individuals); + Roebuck Bay (1,300 individuals); + Peel Inlet (600 individuals); and + Nuytsland Nature Reserve (409 individuals).
Grey-tailed tattler	A recent review of the species indicated an estimated 90% of the East Asian-Australasian Flyway population (approximately 45 000 individuals) spend the non-breeding season in Australia (Bamford et al. 2008). There are a few scattered records for the species along the south coast near the Eyre Bird Observatory, Point Malcolm, Rossiter Bay, Shark Lake Nature Reserve and surrounding swampland. It is found in the south-west between Augusta and Cervantes. The grey-tailed tattler is widespread from Houtman Abrolhos and the mainland adjacent to the Kimberley Division. It has also been recorded inland at Lake Argyle and on islands off the coast.
Lesser sand plover	Within Australia, the lesser sand-plover is widespread in coastal regions and has been recorded in all states. It mainly occurs in northern and eastern Australia, in south-eastern parts of the Gulf of Carpentaria, western Cape York Peninsula and islands in Torres Strait, and along the entire east coast, though it occasionally also occurs inland. In Western Australia, the following are important sites: + Eighty Mile Beach (1,575 individuals); + Roebuck Bay (1,057 individuals); + Broome (745 individuals); and + Port Hedland Saltworks (668 individuals).
Little greenshank	The marsh sandpiper is found on coastal and inland wetlands throughout Australia found mainly on the coast in Western Australia. National sites of importance within Western Australia include: + Port Hedland Saltworks (500 individuals); + Peel inlet (276 individuals); and + Eighty Mile Beach (140 individuals).
Long-toed stint	In Western Australia, the species is found mainly along the coast, with a few scattered inland records. On the south coast the Long-toed Stint is found from Esperance to Albany and inland to Lake Cassencarry and Dumbleyung. On the south-west coast the species is known from the Vasse River estuary, Guraga Lake and the Namming Nature Reserve. The species has occasionally been recorded in the Gascoyne Region, around Lake Wooleen, Meeberrie Station and McNeill Claypan. It is widespread around the Pilbara region and the Kimberley Division between Karratha and Wyndham-Kununurra. Inland records include Lake Brown, Hannan Lake, Lake Biolet, Newman Sewage Farm and Lake Gregory.
Oriental plover	Internationally important marine sites: + Eighty Mile Beach, WA (approximately 57 619 individuals); and + Roebuck Bay, WA (Approximately 8 750 individuals).

Migratory species	DoEE SPRAT information on distribution within the area of interest
Oriental pratincole	Internationally important site: + Eighty Mile Beach, WA (2.88 million birds). The species occurs at numerous and widespread sites in northern Australia, especially near the Pilbara and Kimberley coasts of northern WA, and throughout the entire coastline of the NT.
Pacific golden plover	In Western Australia, the species is seldom recorded along the southern or south-western coasts but is more widespread along the Pilbara and Kimberley coasts between North-West Cape.
Pectoral sandpiper	In Australasia, the pectoral sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire.
Red knot	The red knot large numbers are regularly recorded in north-west Australia, with 80 Mile Beach and Roebuck Bay being particular strongholds. The Australian population during the non-breeding period is estimated to be 135 000 (Hansen et al. 2016).
Red-necked phalarope	The red-necked phalarope is a regular at the Port Hedland Saltworks and Rottnest Island, Western Australia. The species is also found at the ICI Saltworks in South Australia.
Red-necked stint	The red-necked stint has been recorded in all coastal regions and found inland in all states when conditions are suitable. The red-necked stint probably travels in flocks and has been observed to feed in dense flocks. The Australian population was estimated at 353,000. Internationally important sites include: + Eighty Mile Beach (60,000 individuals); + Port Hedland Salt Works (23,000 individuals); + Roebuck Bay (19,800 individuals); + Wilson Inlet (15,252 individuals) + Alfred Cove Nature Reserve (10,000 individuals); + Lake Macleod (8,312 individuals); and + Peel Inlet (8,063 individuals).
Ruddy turnstone	The ruddy turnstone is widespread within Australia during its non-breeding period of the year. Australian sites of international importance include: + Eighty Mile Beach (3,480 individuals); + Ashmore Reef (2,230 individuals); + Roebuck Bay (2,060 individuals); + Barrow Island (1,733 individuals); and + Lacepede Islands (1,050 individuals).
Ruff (reeve)	In Western Australia, the species has been recorded at the lower King River and it is mostly found in the south-west region of the state. It has been sighted at the Vasse River estuary, north to Namming Lake and Lake McLarty. It has been periodically recorded at Port Hedland, Kununurra and the Argyle Diamond Mine. There are unconfirmed reports at Curlewis Camp, Millstream Chichester, Broome and Roebuck Bay.
Sanderling	They occur on most of the coast from Eyre to Derby, and also around Wyndham. They are more often recorded on the south and southwest coasts, north to around southern Shark Bay, with more sparsely scattered records further north in Gascoyne and Pilbara Regions and the Kimberley Division. Important sites include: + Eighty Mile Beach (2,230 individuals);

Migratory species	DoEE SPRAT information on distribution within the area of interest
	+ Ashmore Reef (1,132 individuals); and + Roebuck Bay (1,510 individuals).
Sharp-tailed sandpiper	They are widespread from Cape Arid to Carnarvon, around coastal and subcoastal plains of Pilbara Region to south-west and east Kimberley Division (Higgins & Davies 1996). Internationally important sites include: + Eighty Mile Beach (25 000 individuals); and + Port Hedland Saltworks (20 000 individuals). + Lake Gregory (10 000 individuals). + Peel-Harvey system (4 030 individuals).
Streaked shearwater	Exmouth Gulf to the north.
Swinhoe's snipe	No conclusive records exist for this species in Australia so the number of individuals that appear in Western Australia are unknown. In WA the species has been recorded in parts of the Pilbara, the Kimberley, Mount Goldsworthy, Mount Blaize. It has also been found in the north west-regions around the Mitchell Plateau
Terek sandpiper	In Western Australia (WA), the terek sandpiper is rarely seen on the south coast: occasionally around Eyre and several records around Albany. On Swan River plain, it has been recorded between Bunbury and the mouth of the Moore River. The species is widespread in the Pilbara region and Kimberley Division, from Dampier to Wyndham, with occasional records around Shark Bay. Internationally important sites include: + Eighty Mile Beach (8,000 individuals); and + Roebuck Bay (1,840 individuals).
Whimbrel	It is common and widespread from Carnarvon to the north-east Kimberley Division, Western Australia. It is occasionally seen on the south coast of Western Australia and has occasionally been recorded in south-west Western Australia and further north to Shark Bay. Internationally important sites include: + Roebuck Bay (1,020 individuals).
Wood sandpiper	The wood sandpiper has its largest numbers recorded in north-west Australia, with all areas of national importance located in Western-Australia: + Parry Floodplain (Wyndham) (355 individuals) + Camballin (185 individuals) + Lake Argyle (90 individuals) + Shark Bay area, (80 individuals) + Vasse-Wonnerup estuary (61 individuals) + Lake McLarty (64 individuals) + Kogolup Lakes (60 Individuals)

Shorebird migration patterns are seasonal and vary according to species (DSEWPaC 2012). Generally, shorebirds migrate to northern Australia in August to November. Many birds remain in northern Australia but others disperse southwards (Bennelongia 2011). Migratory shorebird numbers on northern beaches peak in November then again in March as the majority of birds begin their return to the northern hemisphere between March and May. Most migratory shorebirds do not breed in Australia and juvenile birds may spend several years in Australia before reaching maturity and returning north to breed (DEWHA 2009).

The Wildlife Conservation Plan for Migratory Seabirds (DoE 2020) seeks to facilitate a nationally coordinated effort to protect and conserve EPBC Act listed seabirds and provides an over-arching framework for their research and management, while encouraging an effort to address threats to seabirds and their habitats.

The following seabird species are subject to the Wildlife Conservation Plan for Migratory Shorebirds 2020 (DoE 2020).

Table 8-6: Birds subject to the Wildlife Conservation Plan for Seabirds 2020

Migratory species	DoEE SPRAT information on distribution within the area of interest
Red-tailed Tropicbird	The Australian population is poorly known owing to the numerous breeding sites and protracted and asynchronous breeding season making an accurate census difficult. The largest population breeds on Christmas Island (>2,000 pairs) with additional key breeding locations on Cocos (Keeling) Group, islands of Ashmore Reef Marine Park, Lord Howe Island, Norfolk Island, Coral Sea Marine Park and two known islands and cays in the Great Barrier Reef Marine Park.
White-tailed Tropicbird	In Australia, the White-tailed Tropicbird (Indian Ocean) breeds in the Cocos-Keeling Islands, at Ashmore Reef and Rowley Shoals off the northern coast of Western Australia. Over the past few years, birds have been sighted with increased frequency on West Island and Home Island (also in the main atoll) in the Cocos-Keeling Islands. The White-tailed Tropicbird (Indian Ocean) ranges widely over the oceans surrounding its breeding locations (Marchant & Higgins 1990). The breeding population of the White-tailed Tropicbird (Indian Ocean) in Australia is estimated at 120 birds.
Broad-billed Prion	The species has an extremely large range extending from the Southern Ocean to the South Atlantic Ocean. Adults are thought to remain in waters adjacent to breeding colonies, however, young birds seem to occur farther north to Australia and South Africa. The global population has been estimated to exceed 15 million individuals (Brooke 2004). The population is suspected to be decreasing owing to predation from invasive species.
Fairy Prion	Two subspecies breed in Australia, turtur and subantarctica. The subspecies subantarctica has previously been detected breeding on two rock stacks off Macquarie Island in 1979 and Bishop and Clerk Island in 1993.
Wedge-tailed Shearwater	The Wedge-tailed Shearwater breeds on the east and west coasts of Australia and on off-shore islands. The species is common in the Indian Ocean, the Coral Sea and the Tasman Sea (Lindsey 1986). In Western Australia breeding occurs on islands off the west coast of WA including the Cocos-Keeling Island. At WA breeding sites there are at least one million breeding pairs.
Flesh-footed Shearwater	The Flesh-footed Shearwater is a locally common visitor to waters of the continental shelf and continental slope off south-western Western Australia to south-eastern Queensland and around Lord Howe Island. Pairs breed on 41 islands off the coast of south-western Western Australia and Lord Howe Island in south-western Western Australia. Flesh-footed Shearwaters have been recorded as vagrants at Norfolk Island and are possibly regular visitors to Norfolk from breeding colonies on Lord Howe Island and around New Zealand (Moore 1985).
Sooty Shearwater	In Australia, there are known colonies on 17 islands, all of which contain fewer than 1,000 pairs, however; Population estimates and trends are unknown.
Short-tailed Shearwater	This species breeds on Tasmanian offshore islands and off the coast of southern Australia, with the bulk of the population in the south-east. National trends are unknown, however the species is monitored at some locations in Tasmania, Victoria and NSW.
Streaked Shearwater	The Streaked shearwater undergoes trans-equatorial migration traveling south during winter, to the coasts of Vietnam, New Guinea, the Philippines, Australia, southern India and Sri Lanka.

Migratory species	DoEE SPRAT information on distribution within the area of interest
	The global population has been estimated to number 3 million individuals.
Lesser Frigatebird	It has been suggested that the frigatebird roost at Weipa and survey data suggests Ashmore Reef Marine Park comprises significant numbers and is believed to account for ≥1% of the global population.
Great Frigatebird	Important populations in Western Australian seas include those at North Keeling Island, the islands of Ashmore Reef Marine Park and Adele Island.
Masked Booby	In Australia, the Masked Booby ranges from the Dampier Archipelago in Western Australia (WA), along the entire north coast and east coast to Brisbane. Individuals regularly occur on islands off Australia, including Lord Howe, Norfolk, Kermadec and the Cocos-Keeling Islands. The total Australian Masked Booby population is estimated to be between 3750–4270 breeding pairs.
Red-footed Booby	This Red-footed Booby is found in tropical islands in most oceans, excluding the eastern Atlantic. It winters at sea in the same area, ranging north of the Tropic of Cancer and south of the Tropic of Capricorn. This species is largely pelagic occurring farther from land than other booby species. The most important breeding population in Australia occurs in Pulu Keeling National Park in the Indian Ocean, which regularly supports more than 30,000 pairs.
Brown Booby	In Australia, the Brown Booby is found from Bedout Island in Western Australia, around the coast of the Northern Territory to the Bunker Group of islands in Queensland with occasional reports further south in New South Wales (NSW) and Victoria. The species is reported further south to Tweed Heads, NSW, and to near Onslow, Western Australia and may be becoming more common in these areas. Within Australian seas, including Christmas and Cocos-Keeling Islands in the eastern Indian Ocean, the total breeding population was 59 940–73 900 pairs in a 1996–97 survey. The global population estimate for the species is 200 000.
Common Noddy	In Australia, the Common Noddy occurs mainly in ocean off the Queensland coast, but the species also occurs off the north-west and central Western Australia coast. The species is also rarely encountered off the coast of the Northern Territory, where only one breeding location with about 100-130 birds is known. In 1996, the total Australian population of the Common Noddy was estimated to be between 174 480 and 214 130 breeding pairs.
Bridled Tern	In Western Australia, Bridled Terns are breeding at Cape Leeuwin (extending round the southern coast to Seal Rocks) north to Shark Bay and in Pilbara region and Kimberley Division. At sea, distribution extends from Cape Leeuwin north to Dirk Hartog Island, with isolated mainland coastal records at Point Maud and Ningaloo, and from Barrow Island to the Dampier Archipelago, and at sea off the Kimberley coast from waters west of the Dampier Peninsula to Ashmore Reef and Joseph Bonaparte Gulf. The total population in Western Australia is estimated to be at least 30 000–40 000 pairs and apparently increasing.
Little Tern	The Australian breeding population can be divided into two major subpopulations (northern and eastern) with the northern subpopulation that breeds across northern Australia, from about Broome in north-western Western Australia through coastal Northern Territory to the Gulf of Carpentaria and eastern Cape York Peninsula.
Caspian Tern	Within Western Australia, the Caspian tern is widespread in coastal regions, from the Great Australian Bight to the Dampier Peninsula. There are sparse records on the coasts east of King Sound and in eastern regions.

Migratory species	DoEE SPRAT information on distribution within the area of interest
	Breeding occurs from the Recherche Archipelago to Dirk Hartog Island and Faure Island in Shark Bay, and also in the Pilbara region from around Point Cloates to North Turtle Island, and more rarely, in the Kimberley.
Roseate Tern	The total global population of the Caspian Tern is estimated to be 240 000–420 000 birds in 2010.
Osprey	The breeding range of the Eastern Osprey around the northern coast of Australia (including many offshore islands) extends from Albany in Western Australia to Lake Macquarie in NSW; with a second isolated breeding population on the coast of South Australia. The species is most abundant in northern Australia, where high population densities occur in remote areas. A population on Barrow Island was estimated at 20 pairs in 1978.

Like many birds, seabirds often migrate after the breeding season. Of these, the migration taken by the Arctic Tern (Sterna paradisaea) is the farthest of any bird, crossing the equator in order to spend the Austral summer in Antarctica (Egevang et al. 2010; Fijim et al. 2013). Other species also undertake trans-equatorial trips, both from the north to the south, and from south to north (DoE 2020).

Other species migrate shorter distances away from the breeding sites, their distribution at sea determined by the availability of food. If oceanic conditions are unsuitable, seabirds will immigrate to more productive areas, sometimes permanently if the bird is young (Oro et al. 2004). After fledging, juvenile birds often disperse further than adults, and to different areas, so are commonly sighted far from a species' normal range. Some species, such as some of the storm petrels, diving petrels and cormorants, rarely disperse at all, staying near their breeding colonies year-round (DoE 2020).

8.4 Biologically Important Areas / Critical Habitat– Birds

Table 8-7 below provides an overview of BIAs in the combined EMBA for birds. The DAWE may make recovery plans for threated fauna listed under the EPBC Act. The EPBC Act requires that 'habitat critical to the survival of the listed threatened species' is identified in recovery plans, relevant recovery plans are listed in Section 13.2[7].

In addition, both the EPBC Act and WA BC Act and associated regulations (2018) provide for the listing of critical habitat - habitat 'critical to the survival of the threatened species'. No provision is made under the Territory Parks and Wildlife Conservation Act 1976 for listing critical habitat.

Table 8-7: Critical habitat/ biologically important areas - birds

Species	Scientific name	Aggregation area and use	Specific geographic locations for species
Australian fairy tern	*Sternula nereis*	Foraging – Kimberley, Pilbara and Gascoyne coasts and islands	Found in the vicinity of lower north-west coast (north to Dampier Archipelago), west coast (south to Peel Inlet) and south coast (from Flinders Bay east to Israelite Bay), including islands (as far offshore as Trimouille Island and Houtman Abrolhos. Pilbara and Gascoyne coasts and islands
Australian lesser noddy	*Anous tenuirostris melanops*	Foraging - Houtman Abrolhos Islands	Houtman Abrolhos Islands

[7] Further background information on BIA and identification of critical habitat in recovery plans is provided in Section 5.4.

Species	Scientific name	Aggregation area and use	Specific geographic locations for species
Bridled tern	*Onychoprion anaethetus*	Foraging - West coast of Western Australia and around to Recherche Archipelago	West coast of WA and around to Recherche Archipelago including offshore waters
Brown Booby	*Sula leucogaster*	Breeding, foraging - Kimberley and northern Pilbara coasts and islands also Ashmore Reef.	Kimberley and northern Pilbara coasts and islands also Ashmore Reef.
Caspian tern	*Sterna caspia*	Foraging - mainly islands (as far offshore as Adele, Bedout, Trimouille and the Houtman Abrolhos)	In WA found on most coasts, mainly islands (as far offshore as Adele, Bedout, Trimouille and the Houtman Abrolhos) and at Lake Argyle, Lake Gregory and Lake MacLeod; accidental elsewhere in the interior.
Common noddy	*Anous stolidus*	Foraging	Around Houtman Abrolhos Around Lancelin Island
Flesh footed shearwater	*Ardenna carneipes*	Foraging, aggregation (pre-migration) - Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef	Foraging from Cape Naturaliste to Eyre, 1-150 km offshore. Pre-departure zone in some years from Rottnest Island to Bunbury.
Greater crested tern	*Thalasseus bergii*	Breeding (high numbers)	Melville Island
Greater frigatebird	*Fregata minor*	Breeding, foraging - Kimberley and Ashmore Reef	Kimberley and Ashmore Reef
Great-winged petrel	*Pterodroma macroptera*	Foraging - Offshore south of Shark Bay	Offshore south of Shark Bay, extending around south-west corner of WA and east past Kangaroo Island
Indian Yellow-nosed Albatross	*Thalassarche carteri*	Foraging - south-west marine region, north to Shark Bay and extending east into Bass Strait	Throughout offshore waters of south-west marine region, north to Shark Bay and extending east into Bass Strait
Lesser crested tern	*Sterna bengalensis*	Breeding, foraging - Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef	Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef
Lesser frigatebird	*Fregata ariel*	Breeding, foraging – Kimberley and Pilbara coasts and islands also Ashmore Reef.	Kimberley and Pilbara coasts and islands also Ashmore Reef.
Little penguin	*Eudyptula minor*	Foraging - Perth to Bunbury	Perth to Bunbury
Little shearwater	*Puffinus assimilis*	Foraging - From Kalbarri to Eucla	From Kalbarri to Eucla including offshore waters
Little tern	*Sternula albifrons*	Breeding, foraging, resting - Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef Resting - Roebuck Bay	Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef Roebuck Bay Ramsar site
Pacific gull	*Larus pacificus*	Foraging –west coast and islands	West coast and islands from Point Quobba (24°30'S) south to Wedge Island (formerly south to Warnbro Sound and at Cape Naturaliste); casual further north (Point Cloates and Lake MacLeod).

Species	Scientific name	Aggregation area and use	Specific geographic locations for species
Red-footed Booby	*Sula sula*	Breeding, foraging - northwest Kimberley and Ashmore reef	Northwest Kimberley and Ashmore reef
Roseate tern	*Sterna dougallii*	Breeding, foraging – Islands and coastline in the Kimberley, Pilbara and Gascoyne regions Resting – Eighty Mile Beach	Eighty Mile Beach (northern end) Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef Low Rocks and Stern Island in Admiralty Gulf North-east and North-west Twin Islets near the mouth of King sound North-western and west coasts and islands from Sir Graham Moore Is (13°50'S), south to Mandurah (32°32'S) and as far offshore as Ashmore Reef, Bedout Island and the Houtman Abrolhos.
Soft plumage petrel	*Pterodroma mollis*	Foraging - seas north to 21°30'S	In WA found in seas north to 21°30'S.
Sooty tern	*Sterna fuscata*	Foraging – Timor Sea	Timor Sea S to 14°30, off northwest coast from Lacepede I SW to 117°E including Abrolhos, Fisherman & Lancelin Is, accidental on lower west coast to Hamelin Bay. Breeding visitor (late Aug - early May) Abrolhos & Lancelin Is; casual winter (Nov - Apr) to Fisherman
Wedge-tailed shearwater	*Ardenna pacifica*	Breeding, foraging – west coast from Ashmore Reef to Carnac I. Kimberley, Pilbara, Gascoyne coasts, Ashmore reef	Breeding (in hundreds of thousands) off west coast from Ashmore Reef (12°15'S) to Carnac Island (32°07'S), and ranging in western seas between 12°00'S and 33°20'S. Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef
White-faced storm petrel	*Pelagodroma marina*	Foraging (in high numbers) - Offshore areas of the south-west marine region and into the adjacent south-east marine region and the north-west marine region to north of Shark Bay	Offshore areas of the south-west marine region and into the adjacent south-east marine region and the north-west marine region to north of Shark Bay
White-tailed tropic bird	*Phaethon lepturus*	Breeding, foraging - Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef	Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef

9. Protected Areas

A number of areas in the combined EMBA are protected under state and federal legislation. Protected areas include World Heritage Areas, Wetlands of International Importance (Ramsar), Wetlands of National Importance, National and Commonwealth Heritage Places, and terrestrial conservation reserves (National Parks, Nature Reserves and Conservation Parks) that bound marine waters. These areas are listed in Table 9-1, and shown in Figure 9-2, Figure 9-3, Figure 9-4 and Figure 9-4 and discussed below. Other protected areas include Key Ecological Features (discussed in Section 10) and State and Commonwealth Marine Parks/Reserves (discussed in Section 11 and Section 12). A Protected Matters search of the combined EMBA (Appendix A) identified several protected areas which were deemed to be irrelevant to Santos' petroleum activities due to their terrestrial location (e.g. Forrestdale and Thomsons Lakes – Ramsar wetland).

The Register of the National Estate (RNE) provides a listing of more than 13,000 natural, historic and indigenous sites of significance. However, in 2012 all references to the RNE were removed from the EPBC Act and the *Australian Heritage Council Act 2003*.The RNE is now maintained on a non-statutory basis as a publicly available archive and educational resource. The RNE places are not discussed further here but are listed in Appendix A.

Table 9-1: Summary of protected areas in waters within the combined EMBA

Area type	Title
World Heritage Area	Shark Bay
	The Ningaloo Coast
	Kakadu National Park
Wetland of International Importance (Ramsar)	Eighty Mile Beach
	Roebuck Bay
	Ashmore Reef National Nature Reserve
	Becher Point wetlands
	Peel-Yalgorup System
	Vasse-Wonnerup System
	Hosnies Spring
	Cobourg Peninsula
	Kakadu National Park
	Ord River Floodplain
	The Dales
Wetlands of National Importance	Ashmore Reef
	Mermaid Reef
	Vasse-Wonnerup Wetland System
	"The Dales", Christmas Island
	Adelaide River Floodplain System
	Eighty Mile Beach System
	Exmouth Gulf East
	Hosnies Spring, Christmas Island

Area type	Title
	Kakadu National Park
	Mary Floodplain System
	Hutt Lagoon System
	Lake Macleod
	Lake Thetis
	Learmonth Air Weapons Range – Saline Coastal Flats
	Leslie (Port Hedland) Saltfields System
	Prince Regent River System
	Roebuck Bay
	Rottnest Island Lakes
	Shark Bay East
	Cape Leeuwin System
	Doggerup Creek System
	Cape Range Subterranean Waterways
	Cobourg Peninsula System
	Daly-Reynolds Floodplain-Estuary System
	Finniss Floodplain and Fog Bay Systems
	Moyle Floodplain and Hyland Bay System
	Murgenella-Cooper Floodplain System
	Ord Estuary System
	Port Darwin
	Shoal Bay - Micket Creek
	Yalgorup System
National Heritage Place	HMAS Sydney II and HSK Kormoran Shipwreck Sites (Historic)
	Batavia Shipwreck Site and Survivor Camps Area 1629- Houtman Abrolhos (Historic)
	Dirk Hartog Landing Site 1616 - Cape Inscription Area (Historic)
	Dampier Archipelago (including Burrup Peninsula) (Indigenous)
	Kakadu National Park (Natural)
	The West Kimberley (Natural)
	The Ningaloo Coast (Natural)
	Shark Bay (Natural)
	Fitzgerald River National Park (Natural)
	Lesueur National Park (Natural)
Commonwealth Heritage Place	Scott Reef and Surrounds – Commonwealth Area
	Ningaloo Marine Area - Commonwealth Waters
	Mermaid Reef - Rowley Shoals

Area type	Title
	Ashmore Reef National Nature Reserve
	Garden Island
	Christmas Island Natural Areas
	Yampi Defence Area
	Learnmonth Air Weapons Range Facility
	Bradshaw Defence Area
	Lancelin Defence Training Area
Threatened Ecological Communities	Monsoon Vine Thickets on the Ridge on the Coastal Sand Dunes of Dampier Peninsula
	Roebuck Bay mudflats
	Subtropical and Temperate Coastal Saltmarsh
	Trombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)
Terrestrial Conservation Reserves e.g. national parks, nature reserves, and conservation parks.	Numerous bounding marine waters – refer to Section 9.6.

9.1 World Heritage Areas

There are two World Heritage Areas located in marine waters of WA, both of which occur in the waters from the South Australian border to the NT border: the Ningaloo Coast and Shark Bay (DEC 2012). One WHA is within the combined EMBA adjacent to NT, although most of the area is terrestrial: Kakadu National Park.

9.1.1 Shark Bay

Shark Bay was included on the World Heritage List in 1991 and is one of the few properties inscribed for all four outstanding natural universal values:

+ An outstanding example representing the major stages in the earth's evolutionary history;
+ An outstanding example representing significant ongoing ecological and biological processes;
+ An example of superlative natural phenomena; and
+ Containing important and significant habitats for in situ conservation of biological diversity.

Since 1997, an agreement established the joint management of the Shark Bay WHA by the Australian Commonwealth government and the Western Australian state government, with the operational responsibility by the Western Australian agencies (DEWHA 2008a). This agreement also created a Community Consultative Committee and a Scientific Advisory Committee, both of which provide advice as required. The entire WHA encompasses islands and peninsulas, with an area of approximately 2.2 million hectares (70% of which is marine waters), and includes the following areas (UNESCO 2020):

+ Hamelin Pool Marine Nature Reserve;
+ Francois Peron National Park;
+ Shell Beach Conservation Park;
+ Monkey Mia Reserve;
+ Monkey Mia Conservation Park;

- Zuytdorp Nature Reserve;
- Bernier, Dorre and Koks Islands Nature Reserves;
- Dirk Hartog Island National Park; and
- Various pastoral leases.

The marine environment of the Shark Bay World Heritage Area is protected as a State Marine Reserve and is discussed further in Section 11.1.3.

9.1.2 The Ningaloo Coast

The Ningaloo Coast was included on the World Heritage List in 2011 and was inscribed for outstanding natural universal values as follows:

- An example of superlative natural phenomena and areas of exceptional natural beauty and aesthetic importance;
- outstanding examples representing major stages of Earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features; and
- the most important and significant natural habitats for in situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

The Ningaloo Coast WHA includes (DEWHA 2010b):

- Ningaloo Marine Park (Commonwealth waters);
- Ningaloo Marine Park (Western Australia state waters);
- Muiron Island Marine Management Area (including the Muiron Islands);
- Jurabi Coastal Park;
- Bundegi Coastal Park;
- Cape Range National Park; and
- Learmonth Air Weapons Range.

The Ningaloo Coast World Heritage Area (including the Muiron Islands) is managed under a plan that is consistent with the World Heritage Convention and Australia's World Heritage management principles. World Heritage Management principles are set out in regulations and cover matters relevant to the preparation of management plans, the environmental assessment of actions that may affect the property and community consultation processes.

The Australian World Heritage management principles are outlined under Schedule 5 of the EPBC regulations (2000). The objective is to ensure that any likely impact of an action on the World Heritage values of the property should be considered. Any action should be consistent with the protection, conservation, presentation or transmission to future generations of the World Heritage values of the property.

The marine environment of the Ningaloo Coast World Heritage Area is protected as a State Marine Park, a Commonwealth Marine Park, and is discussed further in Section 11.1.4 and Section 12.3.4, respectively.

9.1.3 Kakadu National Park

Kakadu National Park was included on the World Heritage List in 1981 and was inscribed for outstanding natural universal values as follows:

+ An example of superlative natural phenomena and areas of exceptional natural beauty and aesthetic importance;
+ outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals; and
+ the most important and significant natural habitats for in situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

The Kakadu National Park WHA covers an area of around 1,916,000ha and is the largest national park in Australia. The WHA is managed by the Director of National Parks who performs functions and exercises powers under the *Environment Protection and Biodiversity Conservation Act 1999* (the Act) in accordance with the park's management plan and relevant decisions of the Kakadu National Park Board of Management. Approximately 50% of Kakadu National Park is Aboriginal land under the Aboriginal Land rights (Northern Territory) Act 1976.

9.2 Wetlands of International Importance (Ramsar)

There are eleven wetlands of international importance (Ramsar wetlands) in waters from the South Australian border to the NT; all were listed in 1990 with the exception of the Cobourg Peninsula which was listed in 1974, Kakadu National Park which was listed in 1980 and further expanded in 1995, Becher Point which was listed in 2001, and The Dales which was listed in 2002. The Ashmore Reef National Nature Reserve (listed in 2002) is also a Commonwealth Marine Park and is discussed further in Section 12.3.12.

9.2.1 Eighty Mile Beach

The Eighty Mile Beach Ramsar site comprises a 220 km beach between Port Hedland and Broome with extensive intertidal mudflats and Mandora Salt Marsh, located 40 km east (Hale & Butcher 2009) totalling 175,487 ha. Eighty Mile Beach is characterised by extensive mudflats supporting an abundance of macroinvertebrates which provide food for large numbers of shorebirds.

Eighty Mile Beach is one of the most important sites for migratory shorebirds in the East Asian Australasian Flyway, with 42 migratory shorebird species recorded at this location. It is estimated that 500,000 shorebirds use Eighty Mile Beach as a migration terminus annually (Hale and Butcher 2009), and more than 472,000 migratory waders have been counted on the mudflats during the September to November period. The location of Eighty Mile Beach makes it a primary staging area for many migratory shorebirds on their way to and from Alaska and eastern Siberia (Hale & Butcher 2009). Although many birds move further on their journey, others remain at the site for the non-breeding period.

Eighty-mile Beach supports more than one per cent of the flyway population (or one per cent of the Australian population for resident species) of 21 waterbirds, including 17 migratory species and four Australian residents. It is one of the most important sites in the world for the migration of Great Knot.

Eighty Mile Beach also supports a high diversity and abundance of wetland birds. A total of 97 wetland bird species have been recorded within the beach portion of the Ramsar site (Hale & Butcher 2009). This includes 42 species that are listed under international migratory agreements CAMBA (38), JAMBA (38) and ROKAMBA

(32) as well as an additional 22 Australian species that are listed under the EPBC Act. In addition, there is a single record for Nordmann's Greenshank (*Tringa guttifer*) from the beach, which is listed as endangered under the IUCN Red List (IUCN 2019).

The Mandora Salt Marsh area contains an important and rare group of wetlands (Lake Walyarta and East Lake), including raised peat bogs, a series of small permanent mound springs and the most inland occurrence of mangroves in WA (Hale & Butcher 2009). A small number of tidal creeks dissect the beach, including Salt Creek which is fed partly from groundwater and has permanent surface water. The Mandora Salt Marsh lakes fill predominantly from rainfall and runoff in the wet season then dry back to clay beds. The mound springs likely come from water deep within the Broome sandstone aquifer rising through fractures in the rock, and resulting in permanent mostly freshwater surface water. Flatback turtles (*Natator depressus*), listed as vulnerable under the EPBC Act, regularly nest at scattered locations along Eighty Mile Beach.

Eighty Mile Beach is used for beach based recreation, including four-wheel driving, motorcycling, fishing and shell collecting. Mandora Salt Marsh is mainly used for cattle grazing. The site is traditionally part of Karajarri Country in the north, Nyangumarta Country in the south and Ngarla Country in the southern end of Eighty Mile Beach. The site has artefacts such as middens, pinka (large baler shells used to scoop and carry water for drinking), wilura (used for sharpening spear heads), axes, and flakes, and kurtanyanu and jungari (grinding stones). The Ramsar wetland is managed under the Eighty Mile Beach Marine Park Management Plan 2014-2024 (DPAW, 2014).

9.2.2 Roebuck Bay

The Roebuck Bay Ramsar site is located at Roebuck Bay near Broome in northern WA totalling 34,119 ha. Roebuck Bay has a large tidal range which exposes around 160 km^2 of mudflat, covering most of the Ramsar site (DoE 2014c). Waters more than 6 m deep at low tide are excluded from the site (Bennelongia 2009). The eastern edge of the site is made up of microscale linear tidal creeks (DoE 2014c).

The intertidal mud and sand flats support a high abundance of bottom dwelling invertebrates (between 300—500 benthic invertebrate species), which are a key food source for waterbirds (Bennelongia 2009). The site is one of the most important migration stop-over areas for shorebirds in Australia and globally. For many shorebirds, Roebuck Bay is the first Australian landfall they reach on the East Asian Australasian Flyway. The total numbers of waders using the site each year is estimated at over 300,000 (DoE 2014c). The northern beaches and Bush Point provide important high tide roost sites.

The site receives tidal seawater as well as fresh surface and groundwater, and the balance between the two influences the residual groundwater salinity and the distribution of plants and animals (DoE 2014c). Mangrove swamps line the eastern and southern edges of the site and extend up into the linear tidal creeks (DoE 2014c). They are important nursery areas for marine fishes and crustaceans, particularly prawns.

Extensive seagrass beds occur in the bay, providing an important feeding ground for dugongs and loggerhead and green turtles (Bennelongia 2009). Flatback turtles nest in small numbers, while marine fish (including sawfish) regularly breed in the tidal creeks and mangroves. Dolphins also regularly use the site (DoE 2014c).

The site is used for recreational or tourism activities such as fishing, crabbing, sightseeing and bird watching. Broome Bird Observatory, a small reserve at the northern end of the site, engages in shorebird research and public education.

Roebuck Bay lies in the traditional estate of Indigenous people belonging to both Jukun and Yawuru groups. The site was an important area for seasonal meetings, exchanging gifts, arranging marriages and settling disputes. Numerous shellfish middens, marking former camping places, can still be seen along coastal cliffs and dunes. Indigenous people continue to make extensive use of Roebuck Bay's natural resources for activities such as gathering shellfish, fishing and hunting. The Ramsar wetland is currently managed under the Preliminary Draft Roebuck Bay Ramsar Site Management Plan (RBWG, 2010).

9.2.3 Ashmore Reef National Nature Reserve

In addition to being listed as a National Nature Reserve, 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 and 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 is the largest of the atolls in the Timor Province bioregion. The three islands within the site are also the only vegetated islands in the bioregion. Each of the wetland types present are in near natural condition and the site has the largest seagrass coverage in the bioregion. The reserve supports 64 species of internationally and nationally threatened species. This includes 41 species of hard reef forming coral, eight fish, six reptiles (including endangered and critically endangered sea turtles and seasnakes), five sea cucumbers, two giant clams, one soft coral and the dugong.

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.

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. The Ramsar site is managed under the Ashmore Reef National Nature Reserve and Cartier Island Marine Reserve Management Plan (Commonwealth of Australia, 2002).

9.2.4 Becher Point

The Becher Point Wetlands Ramsar site is a system of about sixty small wetlands located near Rockingham in south-west Western Australia and covers 677 ha. The wetlands are made up of chains of small, linear ovoid or irregular shaped basins arranged in five groups, each roughly parallel to the coast and separated by sand ridges (DoE 2014l). The wetlands are an example of shrub swamps and seasonal marshes that have formed in an extensive sequence of inter-dunal depressions that have arisen from seaward advancement of the coastline over recent millennia.

The wetlands in the site are shallow and fill seasonally. Rainfall in winter and spring recharges the groundwater, which rise up to waterlog the wetland basins. The wetlands then dry out again for summer to autumn. When flooded the wetlands are mainly freshwater (DoE 2014l).

The wetlands support sedgelands, herblands, grasslands, open-shrublands and low open-forests. The sedgelands that occur within the linear wetland depressions of the Ramsar site are a nationally listed threatened ecological community. At least four species of amphibians and 21 species of reptiles have been recorded within the wetlands, as well as the Southern Brown Bandicoot (DoE 2014l). The Ramsar wetland is managed under the Rockingham Lakes Regional Park Management Plan (DEC, 2010c).

9.2.5 Peel-Yalgorup System

The Peel-Yalgorup System located adjacent to the city of Mandurah in Western Australia, is a large and diverse system of shallow estuaries, coastal saline lakes and freshwater marshes. The site includes the Peel Inlet, Harvey Estuary, Lake McLarty, Lake Mealup and ten Yalgorup National Park wetlands and covers an area of 26, 530 ha (DoE 2014m). Lake Clifton, which is part of the wetlands is one of the few locations in the word where thrombolites occur in inland, hyposaline waters. Thrombalites are underwater rock-like structures that are formed by the activities of microbial communities.

The Peel-Yalgorup System Ramsar site is the most important area for waterbirds in south-western Australia, supporting in excess of 20,000 waterbirds annually (DoE 2014m). It also supports a wide variety of invertebrates and estuarine and marine fish. The Ramsar site is managed under the Swan Coastal Plain South Management Plan (DPAW, 2016c).

9.2.6 Vasse-Wonnerup System

The Vasse-Wonnerup System Ramsar wetland is situated in the Perth Basin, south-western Western Australia and covers an area of 1,115 ha. It is an extensive, shallow, nutrient-enriched wetland system of highly varied salinities. The site is located on a narrow, flat plain separated from the ocean by a narrow system of low dunes. The system is comprised of two former estuaries – the Vasse and Wonnerup lagoons (DoE 2014n).

The system supports tens of thousands of resident and migrant waterbirds of a wide variety of species. More than 33,000 waterbirds have been counted at the Vasse-Wonnerup System and more than 80 species have been recorded in the System including Red-necked Avocets and Black-winged Stilts, Wood Sandpiper, Sharp tailed Sandpiper, Long-toed Stint, Curlew Sandpiper and Common Greenshank (DoE 2014n). This Rasmar site is also managed under the Swan Coastal Plain South Management Plan (DPAW, 2016c).

9.2.7 Hosnies Spring

The Hosnies Spring Ramsar site is located on Christmas Island and is a small area of shallow freshwater streams and seepages, 20–45 metres above sea-level on the shore terrace of the east coast of the island covering an area of approximately 199 ha. The site includes surrounding terrestrial areas with rainforest grading to coastal scrub and includes an area of shoreline and coral reef (DoEE 2019).

The Hosnies Spring Ramsar site supports a unique wetland of Christmas Island with the mangrove forest present at the site unique within the bioregion and possibly worldwide. The two species of mangroves that make up the stand, which normally grow intertidally, grow to a height of 24–37 m above sea level that have been estimated to have persisted for 120,000 years. Additionally, the site is important to blue crabs which rely on the freshwater provided by the spring and as a likely migratory route for the endemic red crab during breeding migrations (DoEE 2019). The Ramsar site is managed under the Christmas Island National Park Management Plan (DNP, 2002).

9.2.8 The Dales

The Dales Ramsar site is located on Christmas Island and is comprised of a near-pristine system of seven watercourses collectively known as The Dales and covers an area of 585 ha. The Dales includes permanent and perennial streams, permanent springs, and include the majority of surface water on the Island. Most rainfall on Christmas Island filters down through the soil and limestone, and surface runoff only occurs after heavy rain. The Dales contain numerous wetland types including surface and karst features, and inland and coastal wetlands (DoEE 2019a).

The Dales support a number of unique ecological and geomorphic features including anchialine cave communities, surface karst including the unique stepped tufa deposits at Hugh's waterfall, a stand of Tahitian chestnuts, a large number of endemic terrestrial species and a significant number of seabirds including Abbott's booby, red-footed booby and the brown booby, all of which breed at the site, and provide essential habitat for the Christmas Island frigatebird (DoEE 2019a). This Ramsar site is also managed under the Christmas Island National Park Management Plan (DNP, 2002).

9.2.9 Cobourg Peninsula

Under the Ramsar convention, the Cobourg peninsula site is listed as a Wetland of International Importance. The site is located 163km north-east of Darwin within the Timor Sea Drainage Division. Within 220’700 hectares, the site covers the entire peninsula and several nearby islands including the Sir George Hope Islands, Sandy Island No. I and II, Allaru Island, High Black Rock and Buford Island. Under the Cobourg Peninsula Aboriginal Land, Sanctuary and Marine act 1996, Cobourg peninsula and surrounding waters was declared a Nation Park (Garig Gunak Barlu National Park) BMT WBM (2011).

The Cobourg site is composed of a diverse coastal and inland wetland types. Wetland types present include intertidal forested wetlands and salt flats, seasonal freshwater marshes and permanent freshwater pools. Ramsar topology identifies ten coastal and ten inland types within the site. The site contains unique biodiversity and wildlife including terrestrial, riverine, freshwater, brackish and coastal/marine ecosystems. Identifiable wetland types include intertidal forested wetland and salt flats, seasonal freshwater marshes, and permanent freshwater pools.

Cobourg Peninsula is listed as a Wetland of International importance due to the diversity of coastal and inland wetland types that support population of threatened species, including a number of endangered turtles. The Cobourg site meets five of the current nine nomination criteria of the Ramsar Convention and is therefore recognised as a representative wetland habitat that is at bioregional level, support of populations of threatened species, support for key life-cycle functions such as marine turtle and waterbird breeding, refugia values, and its importance for supporting fish and nursery spawning habitats BMT WBM (2011). The Ramsar site is managed under the Cobourg Marine Park Plan of Management (DNREAS, 2011).

9.2.10 Kakadu National Park

Kakadu National Park Ramsar site is composed of a diversity of coastal and inland wetland types that range form 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).

9.2.11 Ord River Flood Plains

Site lies within the Victoria-Bonaparte bioregion and contains a wide range of wetland types and includes all inland and marine components. This Ramsar site comprises of Parry Lagoons, Ord Estuary and the False Mouths of the Ord. Parry Lagoons includes both the permanent waterholes, such as Marglu Billabong, as well as the broader area of the flood plain within the Parry Lagoons Nature Reserve that are subject to periodic inundation. The area from the boundary near Adolphis Island to the Rocks is known as the Ord Estuary. The False Mouths of the Ord is an area of extensive intertidal creeks and flats in the north of the Ramsar site.

The Ord River Floodplain Ramsar site meets seven of the nine Nomination Criteria. The site represents the best example of wetlands associated with the floodplain, and estuary of a tropical river system in the Kimberly Region of Western Australia. Ord River contains extensive and diverse mangrove community containing 14 of the 18 species of mangrove known to occurs in Western Australia (Hale, 2008).

A number of threatened species including Freshwater Sawfish (*Pristis microdon*), the Green Sawfish (*Pristis zijsron*) and the Australian Painted Snipe (*Rostratula australis*), which are listed as vulnerable under the EPBC Act are supported in this area. The site also provides one of the two known habitats for the nationally endangered Northern River Shark (*Glypis* sp. C). The Ord River Floodplain Ramsar site provides an important nursery, breeding and feeding ground for at least 50 species of fish and a migratory route for 15 diadromous species.

There is sufficient evidence to suggest the sire regularly supports 20,000 birds in the site alone, although it should be acknowledged that there are difficulties associated with surveying the Ord River Floodplain. According to the 4th edition of Waterbird Population Estimates, the site regularly supports 1% of the population of Plumed Whistling Duck and Little Curlew (Hale, 2008). The Ramsar site is managed under the Ord River and Parry Lagoons Nature Reserves Management Plan (DEC, 2012c).

9.3 Wetlands of National Importance

9.3.1 Ashmore Reef

See the Ashmore Reef National Nature Reserve (Section 9.2.3) and Ashmore Reef Marine Park (Section 12.3.12).

9.3.2 Mermaid Reef

See the Mermaid Reef Marine Park (Section 12.3.9).

9.3.3 Vasse-Wonnerup Wetland System

See the Vasse-Wonnerup Wetland System (Section 9.2.6).

9.3.4 "The Dales", Christmas Island

See The Dales Ramsar site (Section 9.2.8).

9.3.5 Eighty Mile Beach System

See Eighty Mile Beach Ramsar site (Section 9.2.1).

9.3.6 Exmouth Gulf East

The Exmouth Gulf East wetlands are located in the eastern section of Exmouth Gulf from Giralia Bay to Urala Creek Locker Point. The wetland comprises of numerous tidal creeks, indentations and islands of dry land, mudflats, saline coastal flats and extensive mangroves (DAWE 2020a).

The site is one of the major population centres for dugongs in WA and its seagrass beds and extensive mangroves provide nursery and feeding areas for marine fishes and crustaceans in the Gulf. In addition, there are at least 29 species of birds which utilise the wetland, including 16 migratory shorebirds and several terns (DAWE 2020a).

9.3.7 Hosnies Spring, Christmas Island

See Hosnie's Spring Ramsar site (Section 9.2.7).

9.3.8 Hutt Lagoon System

The Hutt Lagoon System wetlands (3,000 ha) are located within the Geraldton Sandplains and comprises of Hutt Lagoon and the lakes and marshes immediately north-west and south-east of the lagoon, notably Utcha Swamp. The system is a coastal brine lake which runs parallel to the coast (DAWE 2020b).

Hutt Lagoon is a migratory stop-over for migratory waders, however numbers using the area vary greatly between years and are likely to be lower when northern and inland waterbodies are extensively flooded. Breeding shorebirds include the Australasian grebe (*Tachybaptus novaehollandiae*), grey teal (*Anas gibberifrons*) and eurasian coot (*Fulica atra*) at Utcha Swamp (DAWE 2020b).

9.3.9 Lake Macleod

The Lake Macleod wetland (150,000 ha) is located in the Carnarvon bioregion and includes distinct "inner wetlands" (sinkholes, channels, lakes, marshes) in the west and "floodout marshes" at river mouths in the north-east. The wetland also includes a lakebed that is infrequently inundated. The lake lies parallel to the Indian Ocean, north of the Gascoyne River and located 30 km away from Shark Bay East wetland (DAWE 2020c).

The Lake Macleod is a major migration stop-over and drought refuge area for shorebirds; it is one of the most important non-tidal stop-over sites in Australia. It also supports Australia's largest inland community of mangroves and associated fauna. Fifty-eight species have been identified within the wetland with 29 being shorebirds and eight gulls and terns, with seven species found breeding (DAWE 2020c).

9.3.10 Lake Thetis

The Lake Thetis wetland (7 ha) is located in the Swan bioregion and comprises of seasonal marshes that form in interdunal areas to the south of the lake. Lake Thetis is distinguished by the presence of both a variety of benthic microbial communities (mats) and stromatolites. No threatened species or migratory species have been observed to utilise this wetland (DAWE 2020d).

9.3.11 Learmonth Air Weapons Range – Saline Coastal Flats

The Learmonth Air Weapons Range – Saline Coastal Flats wetland (300 ha) represents typical saline coastal flats subject to inundation and ponding. The vegetation typically has a low species richness, but its floristic composition and structure is highly distinctive and supports habitat specific fauna (DAWE 2020e).

Species composition of the wetland has little information however it is likely to possess a relatively diverse community (DAWE 2020e).

9.3.12 Leslie (Port Hedland) Saltfields System

The Leslie (Port Hedland) Saltfields System (13,000 ha) comprises a large saltfield, fringing coastal flats, tidal creeks and mudflats between the saltfields and the Indian Ocean.

The wetland is likely a major migration stop-over area for shorebirds in the East Asia-Australasia Flyway. It is possibly the most important stop-over site in the Flyway for the broad-billed sandpiper (*Limicola falcinellus*) and an important site for oriental plover (*Charadrius veredus*). It is also likely to be the most important site in Australia for Asian dowitcher (*Limnodromus semipalmatus*) and red-necked phalarope (*Phalaropus lobatus*) (DAWE 2020f).

9.3.13 Prince Regent River System

The site comprises of the entire Prince Regent River system and large areas of mangrove on either side of the river mouth in Saint George Basin (14,300 ha). The site is a tropical estuary and river system incised in a plateau and is characterised by mangrove-fringed embayments (DAWE 2020g).

The site comprises of a diverse assemblage of flora and fauna, and includes mangroves, riverine vegetation, waterbirds, frogs, reptiles and fish. The site includes some of the most suitable and extensive breeding habitat for the saltwater crocodile in WA, well developed river banks with thick stands of reed and grasses (DAWE 2020g).

9.3.14 Roebuck Bay

See Roebuck Bay Ramsar site (Section 9.2.2).

9.3.15 Rottnest Island Lakes

The Rottnest Island Lakes wetland site comprises of a cluster of 18 lakes and swamps on the north-east part of Rottnest Island (180 ha). The site is a breeding area for Australian shelduck (*Tadorna tadornoides*) and major breeding area for Australian fairy tern (*Sterna nereis nereis*). The lakes are also a major migration stop-over area for shorebirds in south-western Australia and provide a significant drought refuge area for shorebirds, notably the banded stilt (*Cladorhynchus leucocephalus*) (DAWE 2020h).

9.3.16 Shark Bay East

The Shark Bay East wetland site extends along 250 km of coastline in the east arm of Shark Bay, from the mouth of the Gascoyne River (Carnarvon) south to latitude 26 S. The site comprises tidal wetlands and marine waters that are less than 6 m deep at low tide (up to approximately 10 km from shore). The wetland is a large, shallow marine embayment that support extensive seagrass beds and substantial areas of intertidal mud/sand-flats and mangrove swamp (DAWE 2020i).

The mangroves, algae and seagrasses present at the side are important for both dugongs and green turtles. A total of 69 species have been identified within the wetland including the threatened little tern (*Sterna albifrons*) and 33 shorebirds. A total of six species have been identified to be breeding within the wetland (Australian pelican, great egret, little egret, unidentified cormorants and striated herons). The site is also a stop-over for 24 species of migratory shorebirds (DAWE 2020i).

9.3.17 Cape Leeuwin System

The Cape Leeuwin System site is a small coastal valley, approximately 20 ha in size. Seepage from a series of freshwater springs feed an elongate swamp on the floor of the valley and moistens areas of the limestone and granite coastline to the west (DAWE 2020j). The site has been identified as the habitat for the largest known population of the rare aquatic gastropod mollusc; the Cape Leeuwin freshwater snail (*Austroassiminea letha* (Sr)) (DAWE 2020j).

9.3.18 Doggerup Creek System

The Doggerup Creek System site (2,500 ha) supports extensive flats subject to inundation in the north and east of its catchment. The site includes lakes (e.g. Doggerup, Samuel and Florence Lakes) and many small unnamed swamps. The site is an example of an `acid peat flat' with small permanent lakes and river (DAWE 2020k).

The wetland plant communities include 32 species at Doggerup Lake, 19 at Lake Samuel and 35 at Lake Florence. The site is a major habitat for two aestivating inland fishes, *Galaxiella nigrostriata* and

Lepidogalaxias salamandroides, that are endemic to the far south coast of WA. No threatened species have been identified within the site and it is not considered to be an important wetland for migratory shorebirds (DAWE 2020k).

9.3.19 Cape Range Subterranean Waterways

The Cape Range Subterranean Waterways wetland site comprises of the subterranean waterways, sinkholes, general groundwater and artificial wells of the coastal plain and foothills of Cape Range north of a line between Norwegian Bay, at the foot of the peninsula on the west coast, and the Bay of Rest in Exmouth Gulf (DAWE 2020l).

The site is one of the only examples of subterranean karst wetland system (apart from Barrow Island) in arid north-western Australia. Two threatened species have been identified within the wetland and include the blind cave eel and the blind gudgeon (DAWE 2020l).

9.3.20 Yalgorup System

See Peel-Yalgorup System Ramsar site (Section 9.2.5).

9.3.21 Adelaide River Floodplain System

Several swamps, lakes, lagoons and dams are included in the 134,800-hectare site. Four principal plant structural formations are present consisting of mangal low closed-forest (mangroves) mainly in the far north-west but extending along the river to south of the site, scattered chenopod low shrubland (samphire) in the far north, patches of melaleuca open-forest near the floodplain edges and missed closed grassland/sedgeland (seasonal floodplain) over most of the site (Jaensch, 1993).

The site is of particular significance as it contains one of the largest blocks of mangroves associated with the Top End floodplain as well as near-permanent marsh (Fogg Dam and Melacca Swamp), a rare wetland type in the Northern Territory. A rare species of the wetland plant Goodenia quadrigida also occurs within the floodplain. Surface inflow from the Adelaide-Margaret River System as well as numerous creeks (e.g. Hollands, Sunday and Buffalo Creeks) and Manton River provides a water supply for the area. The total volume of inflow is moderately high. The area provides a good example of the major floodplain-tidal wetland system typical of the Top End Region with substantial area of each component wetland type (Jaensch, 1993).

Adelaide River Floodplain system is a major breeding area for multiple species such as the Magpie Goose (*Anseranas semipalmata*), Saltwater Crocodile (*Crocodylus porosus*) and herons and allies. It is also a major dry season refuge area for waterbirds and a significant migration stop-over area for shorebirds (Jaensch, 1993).

9.3.22 Kakadu National Park

See Kakadu National Park Ramsar site (Section 9.2.10).

9.3.23 Mary Floodplain System

Included in the 127,600hectare site is the entire floodplain of the Mary River, from near Bark Hit Inn downstream to Van Diemen Gulf (including intertidal mudflats) and including Swim Creek Plain. Three principal plant formations occur within the site. These include melaleuca open-forest (paperbark swamp), scattered chenopod low shrubland (samphire) in the north and centre-north; and the remainder, mixed closed- grassland/sedgeland (seasonal floodplain). Mangroves occur in the far north fringing the coast and at estuary mouths. The site includes some of the largest areas of wooded swamp in the Northern Territory. 21 of the 36 described floodplain flora communities occur in the Mary Floodplain system (Jaensch, 1993).

Water supply mainly occurs from the surface inflow form the Mary-McKinlay River system as well as many creeks. Mudflats, estuaries, and saline coastal flats are tidal. Tidal areas of mudflats and estuaries are inundated twice daily compared to the large parts of coastal flats that may be only periodically inundated. The floodplain water supply is seasonal, with near-permanent water in deeper channels and billabongs, as well as Eleocharis swamp. The site is a good example of a major floodplain-tidal wetland system typical of the Top End Region and features a complex network of channels and billabongs (Jaensch, 1993).

Mary Floodplain System provides a major breeding area for the Magpie Goose (*Anseranas semipalmata*) as well as refuge during dry season for waterbirds (geese, ducks and herons) and Saltwater Crocodiles (*Crocodylus porosus*). At least 75 species recorded within the area, of those 33 species were listed under treaties and 11 species were found breeding. The mudflat and coastal flats support at least several thousand migrant shorebirds at a time (Jaensch, 1993).

9.3.24 Cobourg Peninsula System

See Cobourg Peninsula Ramsar site (Section 9.2.9).

9.3.25 Daly-Reynolds Floodplain-Estuary System

The Daly-Reynold Floodplain-Estuary System includes the entire floodplain of the Daly River, entire floodplain of the Reynolds River and the tidal mudflats of north-east Anson Bay and is in the Darwin Coastal and Daly Basin biographical regions. Six principal plant formations exist within the 159,300-hectare site. This includes mixed closed-grassland/sedgeland (seasonal floodplain) over most of the site; Melaleuca open-forest (paperbark swamp) in patches throughout, Coolibah/Gutta-percha low woodland over grassland in the far south-east; closed-forest (monsoon vine-thicket) around the Daly River in the far south-east; mangal low closed-forest (mangroves), discontinuously along the Daly River estuary (to 1 km wide); and scattered chenopod low shrubland (samphire) at/near the coast and river mouth. The site provides a good example of a major floodplain-tidal wetlands system as it contains substantial areas of all the principal features of such a system in the Top End Region. It is also one of the largest floodplains in the Northern Territory (Jaensch, 1993).

31 of the 36 described floodplain flora communities occur on the Daly-Reynolds Floodplain. The Daly-Reynolds Floodplain-Estuary System plays an important ecological role by providing a top three breeding ground for Magpie goose (*Anseranas semipalmata*), as well as herons, allies and Saltwater Crocodiles. Additionally the site is a major dry season refuge area for waterbirds and a significant migration stop-over area for shorebirds. The site also contains more than 80 fauna species, 30 of which are listed under treaties. Up to 2100 shorebirds are known to frequent this site as a migratory stop over (Jaensch, 1993).

9.3.26 Finniss Floodplain and Fog Bay Systems

The floodplain and bay systems provide a good example of a beach-fringed, curved bay with intertidal mudflats and intact floodplain with extensive paperback swamps. Plant structural formations within the area include mixed closed grassland/sedgeland and melaleuca open forests. Small areas of mangal and samphire occur near the estuaries and the south-west part of the bay. Surface inflow from the Finniss River, and several creeks supply the site with water (Jaensch, 1993).

At least 70 species of fauna are recorded in the area, 20 of which are listed under treaties. Finnis Floodplain and Fog Bay Systems are major breeding areas for Magpie goose and Saltwater Crocodile, a significant dry season refuge area for water birds and a major migration stop-over for over 25’000 shorebirds. 24 of the described floodplain flora communities along with the best floating mats in the Northern territory occur within this site (Jaensch, 1993).

9.3.27 Moyle Floodplain and Hyland Bay System

Plant structural formations of the area consist of closed grassland/sledgeland latiform arrangements, some fringing and scattered patches of melaleuca open-forests, and mangal low closed forest (mangroves) along the lower river. Surface inflow to floodplain areas from multiple creeks and Moyle River is the main source of water supply.

The Moyle Floodplain and Hyland Bay System is one of the least distributed examples of a Top End floodplain system associated with a small river a mudflat-fringed bay. The site is a major breeding area for magpie goose, a refuge for waterbirds (whistling duck) in the dry season, migration stop over area for shorebirds and a major breeding area for Saltwater Crocodiles. 27 of the described floodplain flora communities occur at this site. 47 fauna species are known to occur on the floodplain and adjacent coast, 26 of which are listed under treaties (Jaensch, 1993).

9.3.28 Murgenella-Cooper Floodplain System

Murgenella-Cooper Floodplain System includes the entire contiguous floodplains and saline coastal flats, estuaries, and tidal mudflats of Murgenella, Cooper and Salt-Water Creeks within 81,500 hectares. Surface flow from Cooper Creek and several unnamed creeks provide water supply for the area. Plant structural formations that are present include mixed closed grassland/sedgeland over most of the site, scattered chenopod low shrubland and narrow areas of mangal closed-forest (mangroves) along tidal channels and at the coast. The site provides a good example of floodplain-tidal wetland system of the Top End Region, with relatively low volume of freshwater inflow (Jaensch, 1993).

13 of the 36 described floodplain flora communities occur within the site. The site is a major breeding ground for Magpie Goose, cormorants, herons and allies, a major dry season refuge area for waterbirds and a major migration stop-over area for more than 10’000 shorebirds. At least 71 species of fauna are recorded in the area, 26 of which are on treaties (Jaensch, 1993).

9.3.29 Ord Estuary System

See Ord River Flood Plains Ramsar site (Section 9.2.11).

9.3.30 Port Darwin

The entire Port Darwin site covers 48,800 hectares. The whole site is tidal with mangal low closed-forest (mangroves) plant structural formations present. The site provides a good example of a shallow branching embayment of the Top End Region, supporting one of the largest discrete areas of mangrove swamp in the Northern Territory (Jaensch, 1993).

36 flora species, 23 of them trees and tall shrubs are present within the mangrove communities. Including Northern territory endemic *Avicennia integra*. The mangrove communities of this site are the most extensive and species rich of any Northern Territory embayment. The site is a major nursery for estuarine and offshore fish and crustaceans in the Beagle Gulf area. 48 fauna species, with 25 listed under treaties existing within this site. Rare species such as Red-necked Phalarope have also been recorded within the site. Furthermore, Woods Inlet is frequented by the uncommon dolphin *Orcaella brevirostris*. At least 72 fish species occur within the site as well as there being an unusual richness in sponges (220 species), soft and hard coral as well as invertebrates (Jaensch, 1993).

9.3.31 Shoal Bay - Micket Creek

Shoal bay is approximately 10km immediately north-east of the City of Darwin and the site includes King Creek and Noogoo swamp within 1,600 hectares. The site contains wetland marshes, mangrove woodlands, beaches, mudflats, creeks and estuaries and is a good example of a spring fed coastal wetland system. Micket Creek is a tidal estuary flowing into Shoal Bay while King Creek and water from Noogoo Swamp all flow into Shoal Bay. All areas contain remnants of monsoon forest interspersed with open woodland bounded by grassed backsoil plain (Hodgson, 1995).

Within the site there are some notable species. It has a bird habitat of over 200 species and provides a dry season refuge for waterfowl and birds of prey. Migratory birds regularly use the areas of mudflats with more than 15,000 wader species and 25 of them listed on international agreements with Japan and China. The Nationally endangered Littler Tern and two other uncommon species, the Eastern Grass Owl and Peregrin Falcon have been recorded within Shoal Bay – Micker Creek (Hodgson, 1995).

9.4 National Heritage Places

Natural, historic and indigenous places that are of outstanding heritage value to the Australian nation are recorded as National Heritage Places. Eleven National Heritage Places are found in waters from the South Australian border to the NT, with ten of these occurring within the combined EMBA. Kakadu National Park, Shark Bay and The Ningaloo Coast are listed as both World Heritage Areas and National Heritage Places, and are discussed in Section 9.1.

9.4.1 HMAS Sydney II and HSK Kormoran Shipwreck Sites

The naval battle fought in 1941 between the Australian warship HMAS Sydney II and the German commerce raider HSK Kormoran off the Western Australian coast during World War II was a defining event in Australia’s cultural history. The loss of HMAS Sydney II, along with its entire crew of 645 following the battle with HSK Kormoran, remains Australia’s worst naval disaster (DoE 2014d).

The shipwreck sites are comprised of two areas located approximately 290 km west-southwest of Carnarvon. The shipwrecks of the HMAS Sydney II and HSK Kormoran are located on the seabed approximately 22 km apart (DoE 2014d).

9.4.2 Batavia Shipwreck site and Survivor Camps Area 1629 - Houtman Abrolhos

The Batavia was included on the National Heritage List in 2006. This shipwreck is the oldest of the known Verenigde Oost-Indische Compagnie (VOC) wrecks on the WA coast and has a unique place in Australian shipwrecks. Because of its relatively undisturbed nature the archaeological investigation of the wreck itself has revealed a range of objects of considerable value to the artefact specialist and historian. The recovered sections of the hull of the Batavia that have been reconstructed in the Western Australian Maritime Museum and provides information on 17th century Dutch ship building techniques, while the remains of the cargo carried by the vessel have provided economic, and social evidence of the operation of the Dutch port at Batavia (now Jakarta) in the early 17th century (DoE 2014d).

9.4.3 The West Kimberley

The West Kimberley was included on the National Heritage List in 2011 and has numerous values which contribute to the significance of the property, including indigenous, historic, aesthetic, cultural and natural heritage values (DoE 2014d). Of these values, the most relevant to the marine environment is Roebuck Bay as a migratory hub for shorebirds. These values are discussed in Section 9.2.2. The area is characterised by a diversity of landscapes and biological richness found in its cliffs, headlands, sandy beaches, rivers, waterfalls and islands.

9.4.4 The Ningaloo Coast

See the Ningaloo Coast World Heritage Area (Section 9.1.2).

9.4.5 Shark Bay

See Shark Bay World Heritage Area (Section 9.1.1).

9.4.6 Dirk Hartog Landing Site 1616 - Cape Inscription Area

Cape Inscription is the site of the oldest known landings of Europeans on the Western Australian coastline (from Dirk Hartog of the Dutch East India Company's ship the Eendracht in October 1616), and is associated with a series of landings and surveys by notable explorers over a 250-year period (DoEE 2019b). The landing site forms part of the Dirk Hartog Island and is about 1,110 ha located 100 km south west of Carnarvon (DoEE 2019b).

9.4.7 Dampier Archipelago (including Burrup Peninsula)

The Dampier Archipelago (including the Burrup Peninsula) contains one of the densest concentrations of rock engravings in Australia, with some sites containing thousands or tens of thousands of images. At a national level it has an exceptionally diverse and dynamic range of schematised human figures and provides an unusual and outstanding visual record of the Aboriginal responses to the rise of sea levels at the end of the last Ice Age (DoEE 2019c).

The site is about 36,860 ha at Dampier and comprises of nine distinct areas of the Burrup Peninsula Areas and part of the following surrounding islands: West Intercourse Island, West Mid Intercourse Island, Enderby Island, Goodwin Island, West Lewis Island and East Lewis Island, Rosemary Island, Brigadier Island, Miller Rocks, Lady Nora Island and Elphick Nob, Malus Islands, Angel Island, Gidley Island, Cohen Island, Keast Island and Collier Rocks, Tozer Island, Dolphin Island, and Unnamed Island (DoEE 2019c).

9.4.8 Fitzgerald River National Park

The Fitzgerald River National Park contains an exceptional concentration of plant species richness and endemism. At an international level it is recognised as a biodiversity hotspot of south western Australia and at a national level it has an exceptional endemism and diversity for plant species. The diversity is considered high due to a wide range of landforms, geology and soil types that supports a diverse community of shrublands and heath, often dominated by eucalypt mallee species (DoEE 2019d).

The national park is approximately 297,244 ha located between Bremer Bay and Hopetoun in the south west of Western Australia. The park contains extensive marine plain sediments deeply incised by several rivers, creating valleys and tablelands. The park’s coastline is diverse, consisting of long beaches, quartzite cliffs, extensive sand drifts and inlets. Along the Hamersley and Fitzgerald River valleys are spongolite cliffs that were formed more than 36 million years ago (Eocene period) and consist of sea sponge fossils (DoEE 2019d)

9.4.9 Lesueur National Park

The Lesueur National Park contains an exceptional concentration of plant species richness and endemism. At an international level it is recognised as a biodiversity hotspot of south western Australia and at a national level it has an exceptional endemism and diversity for plant species. The diversity is considered high due to a wide range of landforms, geology and soil types that supports a diverse community of shrublands and heath (DoEE 2019e).

The national park is approximately 27,235 ha located near the towns of Green Head and Jurien Bay. Coastal areas consist of recent (Holocene) sand deposits and mobile dunes extending inland for approximately two kilometres. The dunes are bordered by a series of mainly saline lakes with some freshwater springs and swamps on the eastern margins. Further inland are older (Quaternary) dune systems that have been compacted in places to form limestone. The park supports approximately 122 birds, including a diverse range of honeyeaters, fairy wrens and thornbills (DoEE 2019e).

9.4.10 Kakadu National Park

See Kakadu National Park World Heritage Area (Section 9.1.3).

9.5 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. Ten Commonwealth Heritage Places are found in or adjacent to the combined EMBA. Three of these places (Ashmore Reef, Mermaid Reef and the Ningaloo Marine Area – Commonwealth Waters) are found in Marine Parks and are discussed further in Section 12. The HMAS Sydney II and HSK Kormoran Shipwreck Sites is listed under both National and Commonwealth Heritage Lists and discussed in Section 9.4.1.

9.5.1 Scott Reef and Surrounds – Commonwealth Area

Scott Reef is a large, emergent shelf atoll located on the edge of the broad continental shelf, about 300 km from mainland north-western Australia. The listing comprises the areas of Scott Reef that are within Commonwealth waters to the 50 m BSL 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 Western Australia 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).

9.5.2 Mermaid Reef – Rowley Shoals

See the Mermaid Reef Marine Park (Section 12.3.9).

9.5.3 Ningaloo Marine Area – Commonwealth Waters

See the Ningaloo Coast World Heritage Area (Section 9.1.2).

9.5.4 Ashmore Reef National Nature Reserve

See the Ashmore Reef Marine Park (Section 12.3.12).

9.5.5 Garden Island

Garden Island is located to the south of Perth, 5 km northwest of Rockingham. It was registered in 2004 based on various fauna, geological, European and Aboriginal heritage and vegetation values. It was the original first site occupied by Governors Stirling's Party in 1829, with prior use by Aborigines and the French (being called Ile de Buache by the French in 1801). The island is virtually free from widespread feral animal colonisation, providing important habitat for various species that have reduced on the mainland. The island provides breeding habitat for bridled tern (*Onychoprion anaethetus*), rainbow bee-eaters (*Merops ornatus*) and osprey (*Pandion haliaetus*), which nest on the rocks surrounding the island. Important feeding habitat for the Sanderling (*Calidris alba*) is provided by sandy beaches on the west coast of the island.

The island provides nesting habitat on beaches for the breeding migrant fairy tern (*Sterna nereis*), which requires undisturbed nesting periods. The mature relatively undisturbed heath, scrub and low forest communities unburnt since the 1920's in the northern section of the island are especially important as a reference site for natural history. The least disturbed examples of calcaronite reef structures dune and tamate landscapes in the metropolitan region are present on the western side of the island (DoEE 2016b).

9.5.6 Christmas Island Natural Areas

Christmas Island is located is approximately 1,500 km from Exmouth and is approximately 2,200 ha above Low Water and 3,600 ha below Low Water in the Indian Ocean. The island is an uplifted coral atoll with its characteristic steep series of rainforest-covered terraces and sheer limestone cliffs. It was registered in 2004 based on various fauna, vegetation, geological and cultural heritage values. The evolutionary significance of Christmas Island is demonstrated both by its high level of endemism and by its unique assemblage of plant and animal species. The island hosts seventeen endemic plant species and rich endemic fauna includes three mammal species, ten bird species, five reptile species, one crab species, two insects, three marine fish species and several marine sponge species (DoEE 2019f).

The rainforests of Christmas Island are biogeographically significant; species have evolved from being either shoreline forest or early rainforest succession species to those that fill a tall climax rainforest role. The Island contains unique plant communities of high conservation and scientific interest including a variety of elevated and relict cycad and back-mangrove communities of international significance (DoEE 2019f).

The island is also one of the world's most significant seabird islands, both for the variety and numbers of sea-birds, with over 100 species of bird having been recorded, including eight species that breed on the island. The island rainforest provides significant habitat for two endemics the nationally endangered Abbott's booby and the nationally vulnerable Christmas Island frigate bird (DoEE 2019f).

The fringing simple reefs and adjacent waters of Christmas Island support provides habitat for two nationally vulnerable species of turtle, the green and hawksbill which nest on two of the Island's beaches and two nationally vulnerable shark species (DoEE 2019f).

9.5.7 Yampi Defence Area

The Yampi Defence Area is located at the confluence of the Dampierland, Central and Northern Kimberley biogeographic regions and has a diverse range of ecosystems of landforms, soils and vegetation representative of the transition from the sandstone plateaux of the wetter north-west Kimberley, to the broad plains and pindan scrub of the drier south-west Kimberley (DoEE 2019g).

The diversity of landforms in the place and the resultant high concentration of small refugial habitats support a regionally rich vertebrate fauna. The bird fauna is significant as it represents a suite of species which are at or near the southern edge of their range in the semi-humid zone of the Kimberley. The place is also an important zone of overlap between many northern and southern species and sub-species. The vertebrate fauna shows its closest similarity to those recorded from the wetter areas of the west Kimberley that lie further to the north. The place supports several fauna and flora species that are listed as specially protected, threatened or having priority status in Western Australia in addition to four fauna species that are nationally vulnerable and one nationally endangered (DoEE 2019g).

9.5.8 Learmonth Air Weapons Range Facility

The Learmonth Air Weapons Range Facility is located 30 km south west of Learmonth within Cape Range and Adjacent Coastal Plain, which is listed on the Register of the National Estate. As the Learmonth Air Weapons Range Facility is located within Cape Range it is of considerable importance of showing he sea level and landform changes for the past 1.8 million years (DoEE 2019h).

The area is important to a number of cave fauna of Cape Range and is considered of exceptional biogeographical importance. It hosts a high number of endemic aquatic stygofauna with ecosystems found within this area are considered rare within Western Australia and are considered to be of considerable scientific interest. The area also supports several species of terrestrial fauna that are isolated populations, populations at the extent of their range and a number of fauna and flora species that are endemic to southern WA and restricted to sandy coastal habitats along the western coast (DoEE 2019h).

9.5.9 Lancelin Defence Training Area

The Lancelin Defence Training Area is located approximately 11 k north of Lancelin township situated on the Swan Coastal Plain and consists of three main land systems that include Quindalup and Spearwood Dune Systems (together making up the Coastal Belt), and the Bassendean Dunes (DoEE 2019i).

The area supports a high diversity of vegetation types, flora species, fauna habitat types and a high diversity of terrestrial fauna.

9.5.10 Bradshaw Defence Area

The Bradshaw Defence Area is located in the Northern Territory and is bounded by the Fitzmaurice and Victoria Rivers on the shores of the Joseph Bonaparte Gulf and the Bradshaw Defence field training area.

The complex topography of the Bradshaw area results in a broad range of highly distinct environments and habitats that include lowland woodlands, heaths, grasslands, sandstone escarpments, monsoon rainforest patches and wetlands. Compared to surrounding areas, the vegetation within the Bradshaw area is more diverse and incorporates more than one fifth of the vegetation types that occur in the Top End of the Northern Territory and includes grassland, woodland flora that are restricted on a national level (DAWE, 2002).

The topological complexity that results in a broad range of environments also contributes to the unusually rich vertebrate fauna. The species richness of frogs, reptiles and mammals is considered significant at a national level. Furthermore, it is also worth noting that the Bradshaw area supports many species that have declined elsewhere in Australia (DAWE, 2002).

9.6 Coastal Terrestrial Conservations Reserves – bound by marine waters

Conservation reserves are created under the Land Administration Act 1997, and once reserved and set aside for conservation purposes are regulated under the *Conservation and Land Management Act (CALM) 1984*. Most conservation reserves in WA are vested in (owned) by the WA Conservation and Parks Commission, an independent statutory body established by the CALM Act 1984, and most are managed by the Department of Biodiversity, Conservation and Attractions – Parks and Wildlife Service. Most conservation areas in the NT are managed under the *Territory Parks and Wildlife Conservation Act*.

In WA there are three main types of terrestrial conservation reserves with legislative protection:

+ Nature reserves – established for wildlife and landscape conservation; scientific study; and preservation of features of archaeological, historic or scientific interest;
+ National parks – as above but also to be used for enjoyment by the public. Have national or international significance; and
+ Conservation parks – as above but have local or regional significance.

Nature reserves can have an extra classification applied to them and become 'A class' reserves, which generally require an Act of Parliament to alter.

In NT there are a number of types of terrestrial conservation reserves with legislative protection, those present within the combined EMBA include coastal reserves, national parks and conservation parks.

There are numerous terrestrial conservation reserves located adjacent to the coast in the combined EMBA. The oceanward boundary of the reserves varies. In some cases, the reserves extend to the low water mark, i.e. including the inter-tidal zone (particularly applicable to older gazetted reserves and terrestrial reserves not surrounded by a marine reserve). While in other cases, the terrestrial reserves extend to the high-water mark e.g. Lowendal Islands Nature Reserve (particularly applicable to terrestrial reserves adjacent to more recently gazetted marine parks). In other cases, the seaward boundary of the reserves is not defined. Management plans also contain the caveat for further consideration of the most appropriate tenure for intertidal areas and management arrangements.

Further information on coastal terrestrial reserves is provided below in Section 9.6.1 (national parks) and Section 9.6.2 (nature reserves and conservations parks).

9.6.1 Coastal National Parks

Protected coastal national parks managed under the CALM Act 1984 in the combined EMBA are listed in Table 9-2. The table also includes: any applicable management plan; whether the park includes the inter-tidal area; and the name of any adjacent state marine reserve. All WA National Parks are WA Class A reserves and IUCN Class 2.

Table 9-2: Coastal National Parks – coastal boundary in relation to inter-tidal zone

<table>
<tr><th>National Park</th><th>IBRA bioregion[8]</th><th>Management plan</th><th>Includes inter-tidal zone</th><th>Adjacent Marine Management Park (see Section 11)</th></tr>
<tr><td colspan="5">Reserves of Northern WA (see Figure 9-6)</td></tr>
<tr><td>Lawley River</td><td rowspan="3">Northern Kimberley</td><td>-</td><td rowspan="3">No [9]</td><td rowspan="3">Kimberley Marine Park</td></tr>
<tr><td>Mitchell River</td><td>-</td></tr>
<tr><td>Prince Regent</td><td>-</td></tr>
<tr><td colspan="5">Reserves of North-West WA (see Figure 9-7)</td></tr>
<tr><td>Murujuga</td><td>Pilbara</td><td>Murujuga National Park management plan 78 (DEC 2013)</td><td>Yes [10]</td><td>-</td></tr>
<tr><td>Cape Range</td><td>Carnarvon</td><td>Cape Range National Park Management Plan (DEC 2010a)</td><td>No</td><td>Ningaloo Marine Park</td></tr>
<tr><td colspan="5">Reserves of Southern WA – (see Figure 9-8)</td></tr>
<tr><td>Francois Peron</td><td>Carnarvon</td><td rowspan="2">Shark Bay Terrestrial Reserves and Proposed Reserve Additions Management Plan (2012)</td><td>No</td><td rowspan="2">Shark Bay Marine Park and Hamelin Pool Marine Nature Reserve</td></tr>
<tr><td>Dirk Hartog</td><td>Yalgoo</td><td>Yes – intertidal zone on western side of Dirk Hartog is included (as no marine park on western side of island)</td></tr>
<tr><td>Houtman Abrolhos Islands</td><td>Geraldton Sandplains</td><td>-</td><td>No - extends to the high water mark only.</td><td>Abrolhos Commonwealth Marine Park</td></tr>
</table>

[8] IBRA classifies Australia's landscapes into large geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information (DoEE 2012).

National Park	IBRA bioregion[8]	Management plan	Includes inter-tidal zone	Adjacent Marine Management Park (see Section 11)
Kalbarri	Geraldton Sandplains	Kalbarri National Park Management Plan (DPAW 2015)	Yes [10]	-
Namburg	Geraldton Sandplains	Namburg National Park Management Plan (1998)	Yes	-
Yalgorup	Swan Coastal Plain	Yalgorup National Park Management Plan (CALM 1995)	Yes [10]	-
Leeuwin - Naturaliste	Warren	Leeuwin-Naturaliste Capes Area Parks and Reserves Management Plan (DPAW 2015)	No	Ngari Capes Marine Park
Torndirrup	Warren	Albany coast draft management plan 2016 (DPaW 2016b)	Yes[10]	
Walpole-Nornalup	Warren	Walpole Wilderness and Adjacent Parks and Reserves Management Plan (DEC 2008) Walpole and Nornalup Inlets Marine Park Management Plan No 62 (DEC 2009b)	Yes[10]	Walpole and Nornalup Inlets Marine Park
Waychinicup	Southern Jarrah Forest and Fitzgerald	Albany coast draft management plan 2016 (DPAW 2016)	Yes[10]	
West Cape Howe	Warren	Albany coast draft management plan 2016 (DPaW 2016)	Yes[10]	
D'Entrecasteaux	Warren	Shannon and D'Entrecasteaux National Parks Management Plan No. 71 (DEC 2012b)	Yes[10]	
Fitzgerald River	Fitzgerald	Fitzgerald River National Park Management Plan 1991 – 2001 No. 15 (CALM 1991)	Yes[10]	
Reserves of the Northern Territory (NT) – (see Figure 9-5)				
Djukbinj National Park	Darwin Coastal and Pine Creek	-	Yes[10]	-
Garig Gunak Barlu National Park	Tiwi Cobourg	Cobourg Marine Park Plan of Management (PAWCNT, 2011)	Yes[10]	Cobourg Marine Park

National Park	IBRA bioregion[8]	Management plan	Includes inter-tidal zone	Adjacent Marine Management Park (see Section 11)
Mary River National Park	Darwin Coastal	Mary River National Park Joint Management Plan March 2015 (PAWCNT, 2015)	Yes[10]	-
Keep River National Park	Victoria Bonaparte	-	Yes[10]	-
Charles Darwin National Park	Darwin Coastal	Charles Darwin National Park Plan of Management (NT government, nd)	Yes[10]	-

9.6.2 Coastal Nature Reserves and Conservation Parks

Protected coastal nature reserves and conservation parks managed under the CALM Act 1984 in the combined EMBA are listed in Table 9-3 and shown in Figure 9-6, Figure 9-7 and Figure 9-8 for the north, north-west and south of WA respectively. Protected lands in the NT are shown in Figure 9-5 as gazetted under the (NT) Crown Lands Act 1992. The table also includes reserve class; IUCN classification; any applicable management plan; whether the reserve includes the inter-tidal area; and the name of any adjacent state marine reserve (may also describe inter-tidal areas values).

The CALM Act does not require management plans to be in place for conservation reserves at all time, instead they are required to be made as is reasonably practicable regarding resources. This means some conservation reserves do not have a management plan, or do not have a recent management plan.

Table 9-3: Nature Reserves (NR) and Conservation Parks (CP) in EMBA

Reserve name and type	Reserve class	IUCN	Management Plan	Includes inter-tidal zone	Adjacent Marine Park (see Section 11)
Reserves of Northern WA (see Figure 9-6)					
Ord River NR	-	1a	-	No [9]	North Kimberley Marine Park
Pelican Island NR	-	1a			
Lesueur Island NR	A	1a			
Low Rocks NR	A	1a			
Browse Island NR	A	1a	-	Yes [10]	-
Scott Reef NR	-	1a	-	Yes [10]	-
Adele Island NR	A	1a	-	Yes [10]	-
Tanner Island NR	A	1a	-	Yes [10]	-
Lacepede Islands NR		1a	-	Yes [10]	-

[9] Inferred as adjacent marine park boundary is the high water mark and dual tenure cannot exist.

[10] Conservatively inferred as no adjacent Marine Park.

Reserve name and type	Reserve class	IUCN	Management Plan	Includes inter-tidal zone	Adjacent Marine Park (see Section 11)
Coulomb Point NR	A	1a	-	Yes [10]	-
Yawaru Birragun CP; Yawuru Northern Intertidal Area	- & A	2 & 6	Yawaru Birragun Conservation Park Management Plan (DPaW 2016). *Yawuru Intertidal Area management plan is not yet available*.	Yes	-
Jinmarnkur CP	C	-	Parks and reserves of the south-west Kimberley and north-west Pilbara Draft Management Plan (DPAW 2016). *Covers 80 Mile Beach coastal reserves*.	No	Eighty Mile Beach Marine Park
Jinmarnkur Kulja NR	A	-			
Kujungurru Warrarn NR	A	1a			
Kujungurru Warrarn CP	C	-			
Unnamed	A	-			
Jarrkunpungu NR	A				
Bedout Island NR	A	1a	-	Yes [10]	-
North Turtle Island NR	A	1a	-	Yes [10]	-
Reserves of North-West WA (see Figure 9-7)					
Unnamed (Dampier Archipelago) NR	A	1a	Dampier Achipelago Management Plan (CALM 1990). *Covers 25 of the islands*	Yes	-
Swan Island NR	A	1a	-	Yes[10]	Kimberly Marine Park
Unnamed NR		1a	-	Yes [10]	-
North Sandy Island NR	A	1a	-	Yes [10]	-
Montebello Islands CP	A	2	-	Partially [11]	Montebello Islands Marine Park
Lowendal Island NR		1a	-	No	Barrow Island Marine Management Area and Marine Park. Lowendal Island NR only partially bounded
Barrow Island NR	A	1a	Barrow Island Group Nature Reserves (DPAW 2015)	Yes	
Boodie, Double and Middle Islands NR	-	1a		Yes	
Great Sandy Island NR	B	1a	-	Yes	Barrow Island Marine Management Area
Weld Island NR	-	1a	-	Yes [10]	-
Little Rocky Island NR	A	1a	-	Yes [10]	-

[11] Reserve R42197 includes the inter-tidal zone and reserve R42196 does not.

Reserve name and type	Reserve class	IUCN	Management Plan	Includes inter-tidal zone	Adjacent Marine Park (see Section 11)
Airlie Island NR	-	1a	-	Yes [10]	-
Thevenard Island Nature	-	1a	-	Yes [10]	-
Bessieres Island NR	A	1a	-	Yes [10]	-
Serrurier Island NR	-	1a	-	Yes [10]	-
Round Island NR	-	1a	-	Yes [10]	-
Locker Island NR	A	1a	-	Yes [10]	-
Rocky Island NR	-	1a	-	Yes [10]	-
Gnandaroo Island NR	A	1a	-	Yes [10]	-
Victor Island NR	-	1a	-	Yes [10]	-
Y Island NR	-	1a	-	Yes [10]	-
Tent Island NR	-	1a	-	Yes [10]	-
Burnside and Simpson Island NR	-	1a	-	Yes [10]	-
Whalebone Island NR		1a	-	Yes [10]	-
Whitmore, Roberts, Doole Islands & Sandalwood Landing NR	-	1a	-	Yes [10]	-
Muiron Islands NR	-	1a	Jarabi and Bundegi Coastal Parks and Muiron Islands (CALM 1999)	No [9]	Muiron Islands Marine Management Area
OneTree Point NR	A	1a	-	Yes [10]	
Reserves of Southern WA – (see Figure 9-8)					
Koks Island NR	A	1a	Shark Bay Terrestrial Reserves and Proposed Reserve Additions Management Plan (DPAW 2012)	Yes [10]	-
Bernier and Dorre Islands NR	A	4			
Shell Beach CP	-	3		No	Shark Bay Marine Park
Freycinet, Double Islands etc NR	A	1a			Shark Bay Marine Park
Zuytdorp NR	-	1a		Yes [10]	-
Beekeepers NR	-	1a	-	Yes [10]	-
Beagle Islands NR	A	1a	Turquoise Coast Nature Reserve Management Plan (CALM 2004).	Yes	-
Lipfert, Milligan, etc Islands NR	A	1a			-
Fisherman Islands NR	A	1a			Jurien Bay Marine Park: extends from
Sandland Islands NR	A	1a			

Reserve name and type	Reserve class	IUCN	Management Plan	Includes inter-tidal zone	Adjacent Marine Park (see Section 11)
Boullanger, Whitlock, Favourite, Tern and Osprey Islands NR	A	1a	*Covers chain of approximately 40 protected islands lying between Lancelin and Dongara.*		Greenhead south to Wedge Island
Escape Island NR	A	1a			
Essex Rocks NR	A	1a			
Outer Rocks NR	A	1a			
Ronsard Rocks NR	A	1a			
Cervantes Islands NR	A	1a			
Buller, Whittell and Green Islands NR	A	1a			
Wedge Island NR	A	1a			
Lancelin and Edwards Islands NR	A	1a			-
Southern Beekeepers NR	-	1a	Namburg National Park Management Plan (CALM 1998)	No	-
Wanagarren NR	-	1a		Yes	
Nilgen NR	-	1a		Yes	
Unnamed CP (R 49994) west of Wilbinga	-	2	-	Yes [10]	-
Unnamed CR (R 42469) at Woodman Point	-	-	Woodman Park Regional Park Management Plan (DEC 2010b)	No	-
Unnamed CP at Woodman Point (R 49220)	-	2		No	-
Carnac Island NR	A	1a	Carnac Island Nature Reserve Management Plan (CALM 2003)	Yes	-
Penguin Island CP	A	3	Shoalwater Islands Management Plan (CALM 2002)	No	Shoalwater Islands Marine Park
Shoalwater Islands NR	A	1a		Yes	
Port Kennedy Scientific Park	A	1a	Rockingham Lakes Regional Park (DEC 2015)	No	-
Leschenault Peninsula CP	A	2	Leschenault Peninsula Management Plan (CALM 1998)	Yes	-
Sugar Loaf Rock NR	A	1a	Leeuwin-Naturaliste Capes Area Parks and Reserves Management Plan (DPAW 2015)	Yes	Ngari Capes Marine Park
Hamelin Island NR	A	1a		Yes	
Seal Island NR	A	1a		Yes	
St Alouarn Island NR	A	1a		Yes	
Flinders Bay NR	A	1a		Yes	
Quagering NR	A	1a	-	Yes[10]	-
Doubtful Islands NR	A	1a	-	Yes	Bremer Marine Park
Quarram NR	A	1a	-	Yes	

Reserve name and type	Reserve class	IUCN	Management Plan	Includes inter-tidal zone	Adjacent Marine Park (see Section 11)
Chatham Island NR	A	1a	-	Yes	South-west corner Marine Park
Two Peoples Bay NR	A	4	Albany coast draft management plan 2016 (DPAW 2016b)	Yes[10]	-
Breaksea Island NR	A	1a		Yes[10]	-
Bald Island NR	A	1a		Yes[10]	-
Eclipse Island NR	A	1a		Yes[10]	-
Michaelmas Island NR	A	1a		Yes[10]	-
Glasse Island NR	A	1a	-	Yes[10]	-
Arpenteur NR	-	1a	-	No	-
Figure 9-5					
Channel Point Coastal Reserve	-	5	-	Yes[10]	-
Casuarina Coastal Reserve	1 and 3	5	Casuarina Coastal Reserve Management Plan (PAWCNT, 2016)	Yes[10]	-
Shoal Bay Coastal Reserve	-	6	-	Yes[10]	-
Tree Point Conservation Area	-	5	-	Yes[10]	-

Further information is provided below in relation to Varanus Island and Airlie Island Nature Reserves. Santos' Varanus Island Processing Hub and Airlie Island (operations ceased) co-exist with the reserves.

Lowendal Islands Nature Reserve - Varanus Island

Varanus Island is part of the Lowendal Islands group, a Nature Reserve (Class C). The Lowendal Islands comprise more than 40 limestone islands, islets and rocky stacks. There is not currently a DBCA Management Plan covering the Lowendal Islands Nature Reserve. Varanus Island is the largest island in the Lowendal Islands and is approximately 2.5 km long and 600m wide at its widest point. Its highest point is approximately 30m above sea level.

Described ecological conservation values of marine relevance include: Wedge-tailed Shearwater nesting (see Section 8.1.6); Loggerhead and Hawksbill Turtle nesting (see Section 6.1.1 and Section 6.1.3), Flatback Turtle nesting (Section 6.1.4). The Lowendal Islands are described as particularly important for tern breeding (DEC 2002), further information on terns is provided in Section 8.2.1.

Airlie Island Nature Reserve

Airlie Island Nature Reserve is an ungazetted 'C' class nature (Reserve identifier: 40323, Crown Lease 1901/100) located on Airlie Island. Airlie Island is a small sand cay (26 Ha) located 35 km NNE of Onslow. It is part of the Pilbara Inshore Islands chain. A management plan for the nature reserves of the Pilbara Inshore Islands is currently under development (DBCA 2019) i.e. there is not currently a DBCA Management Plan covering Airlie Island Nature Reserve.

Described ecological conservation values of marine relevance include: a wedge-tailed shearwater nesting (see Section 8.1.6); silver gull nesting (see Section 8.1.6) and low levels of green turtle and hawksbill turtle nesting (see Section 6.1.2 and 6.1.3).

9.7 Threatened Ecological Communities

An ecological community is a naturally occurring group of plants, animals and other organisms interacting in a unique habitat. Ecological communities are listed under the EPBC Act as threatened if the community is at risk of extinction.

Similarly, ecological communities can be listed under the WA BC Act as threatened if facing a risk of becoming a collapsed ecological community. To date no ecological communities are listed as threatened under the WA Act, however several ecological communities are currently endorsed by the WA Minister of Environment as Threatened Ecological Communities (TECs) through the previous non-statutory process.

TECs of relevance (likely to exist in marine water inter-tidal areas) in the combined EMBA are listed in Table 9-1 and further described below.

Table 9-4: Relevant TEC in the marine EMBA

Species	Conservation Status		
	EPBC Act 1999 (Cwth)	BC Act 2016 (WA)	Otherwise endorsed by the WA Minister for Environment
Monsoon Vine Thicket on the Ridge on the Coastal Sand Dunes of Dampier	Endangered	-	Vulnerable
Roebuck Bay mudflats	-	-	Vulnerable
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	-	-

9.7.1 Monsoon Vine Thicket on the Ridge on the Coastal Sand Dunes of Dampier

Monsoon vine thicket occurs as semi - deciduous and evergreen vine thicket communities on and behind landward slopes of coastal sand dunes on the Dampier Peninsula in the Kimberley Region. This community is closely associated with coastal dunes elsewhere on the Dampier Peninsula and is listed as Endangered under the EPBC Act (Government of Western Australia 2010; DoEE 2016b). The community is also endorsed by the WA Minister for Environment as a threatened ecological community (non-statutory process).

9.7.2 Roebuck Bay Mudflats

Roebuck Bay mudflats (Kimberley region) have been endorsed by the WA Minister for Environment as a threatened ecological community (non-statutory process). The TEC is not listed under the EPBC Act.

Roebuck Bay mudflats (Kimberley region) are described as a 'species rich faunal community of the intertidal mudflats of Roebuck Bay' in the Kimberley region. Classed as Vulnerable (B). Roebuck Bay is a tropical marine embayment with extensive, biologically diverse, intertidal mudflats.

Roebuck Bay is protected as a designated Ramsar Wetland of International Importance (Section 9.2.2) and Marine Park (see Sections 11.1.17 and 12.3.10).

9.7.3 Subtropical and Temperate Coastal Saltmarsh

Subtropical and Temperate Coastal Saltmarsh occurs within the subtropical and temperate climatic zones and is present in coastal areas under regular or intermittent tidal influences and occurs over six State jurisdictions (Queensland, New South Wales, Victoria, Tasmania and WA). In WA it occurs from the south coast up to the southern part of Shark Bay. The community is made up of mainly salt tolerant vegetation which include halophytes as well as a number of non-vascular plant species. The community is listed as vulnerable under the EPBC Act (DoE 2014k).

9.7.4 Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)

The Lake Clifton thrombolite community is restricted to Lake Clifton, which occurs on the Swan Coastal Plain region of WA. Lake Clifton is situated within the Yalgorup National Park and is the northernmost lake in the Peel-Yalgorup Lakes System, which consists of several hypersaline and brackish lakes (Moore 1990). The Lake Clifton thrombolite community occurs on a relict foredune plain of Holocene age sands. The main known occurrence of the ecological community is a stretch, approximately 15 km long and up to 15 m wide, along the north-eastern shoreline of Lake Clifton. There are other small clusters of thrombolites within the Lake, also at the northern end. The thrombolites cover a total area of approximately four square kilometres (Moore 1990). This structure is the largest known example of a living, non-marine microbialite reef in the southern hemisphere.

The Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton) is listed as critically endangered under the EPBC Act because it has a very restricted distribution and recent investigations indicate that *Scytonema*, a key cyanobacterium for thrombolite formation has gone from being a dominant species to no longer being found in Lake Clifton thrombolites.

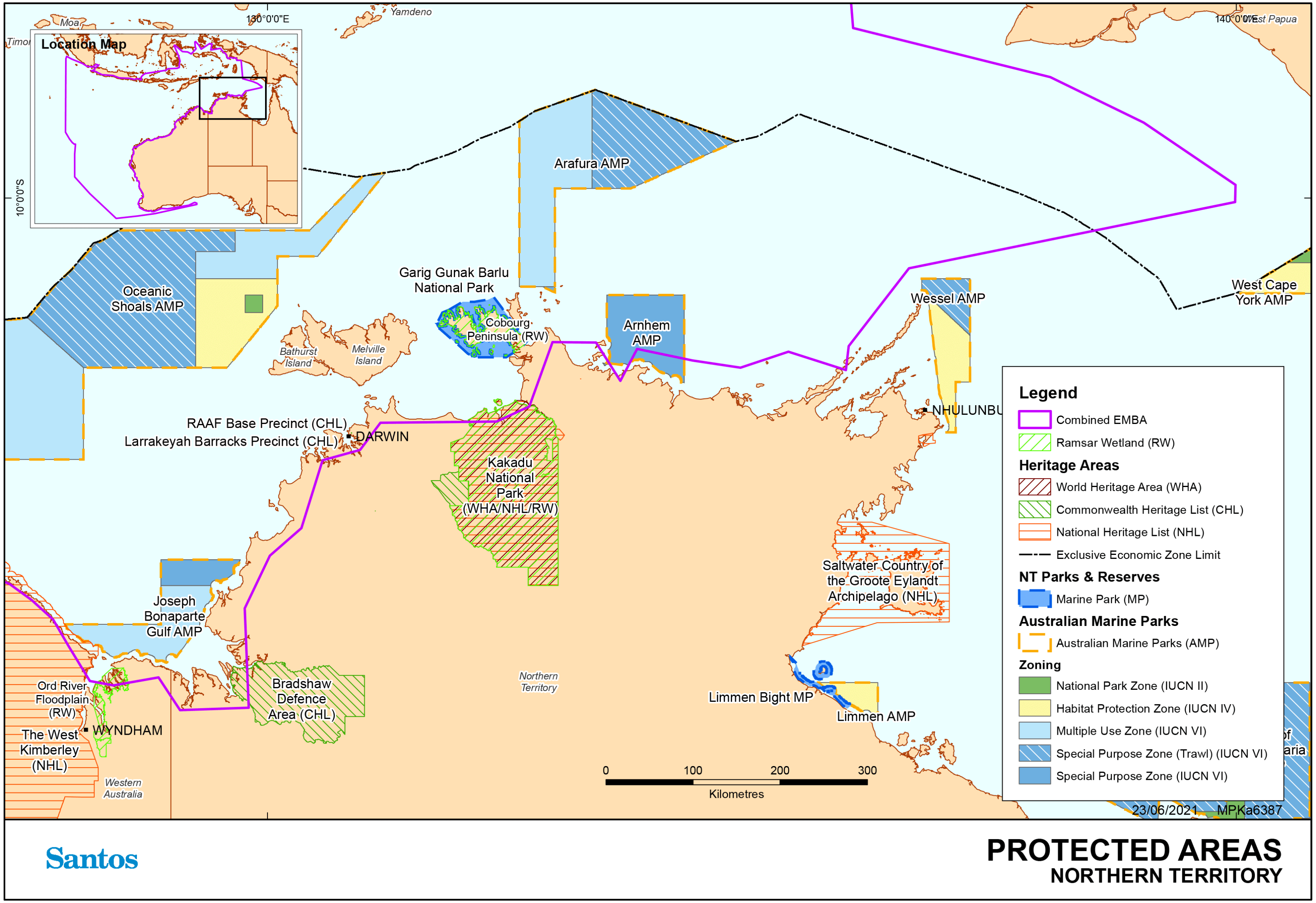


Figure 9-1: Protected areas in NT

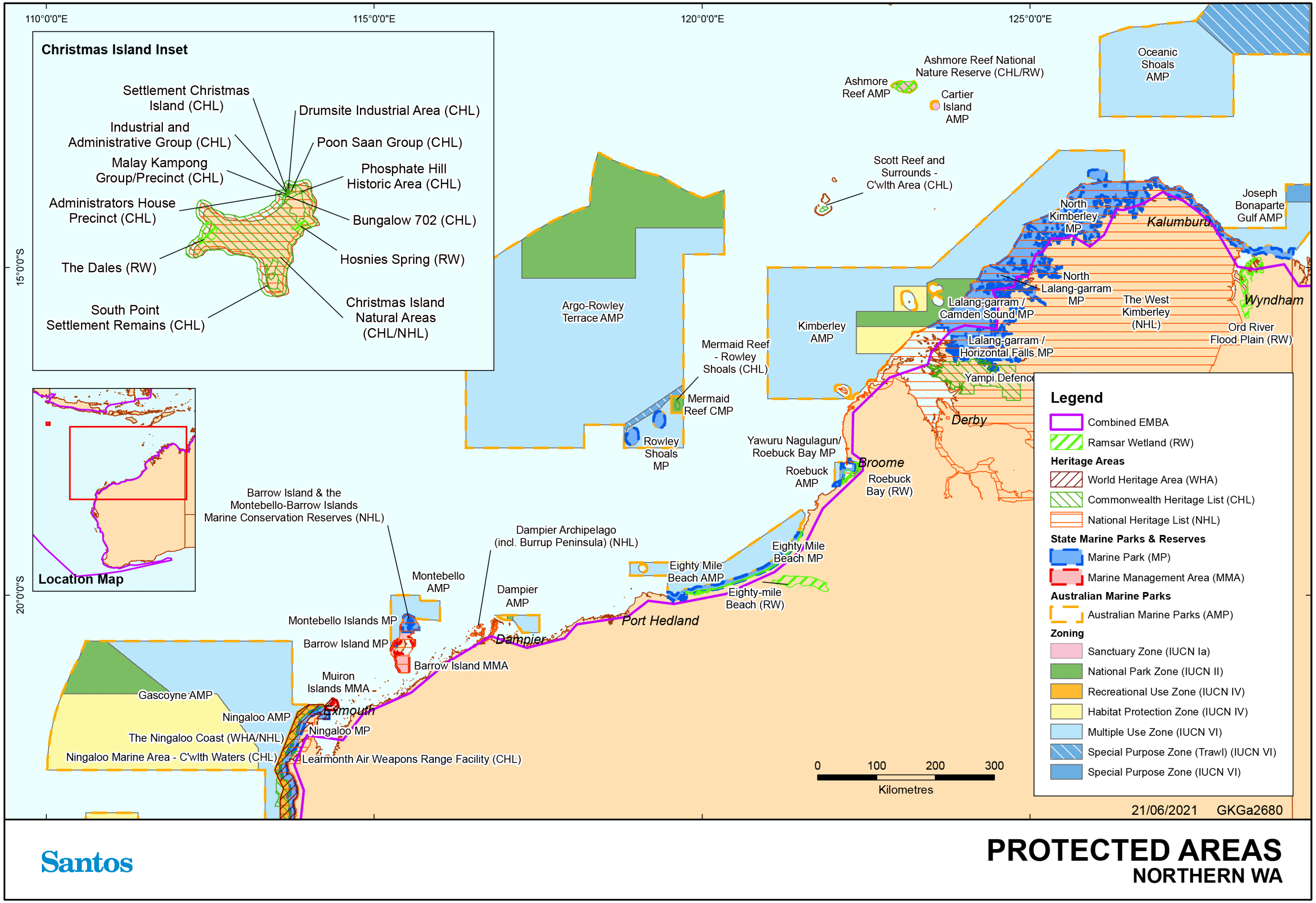


Figure 9-2: Protected areas in Northern WA

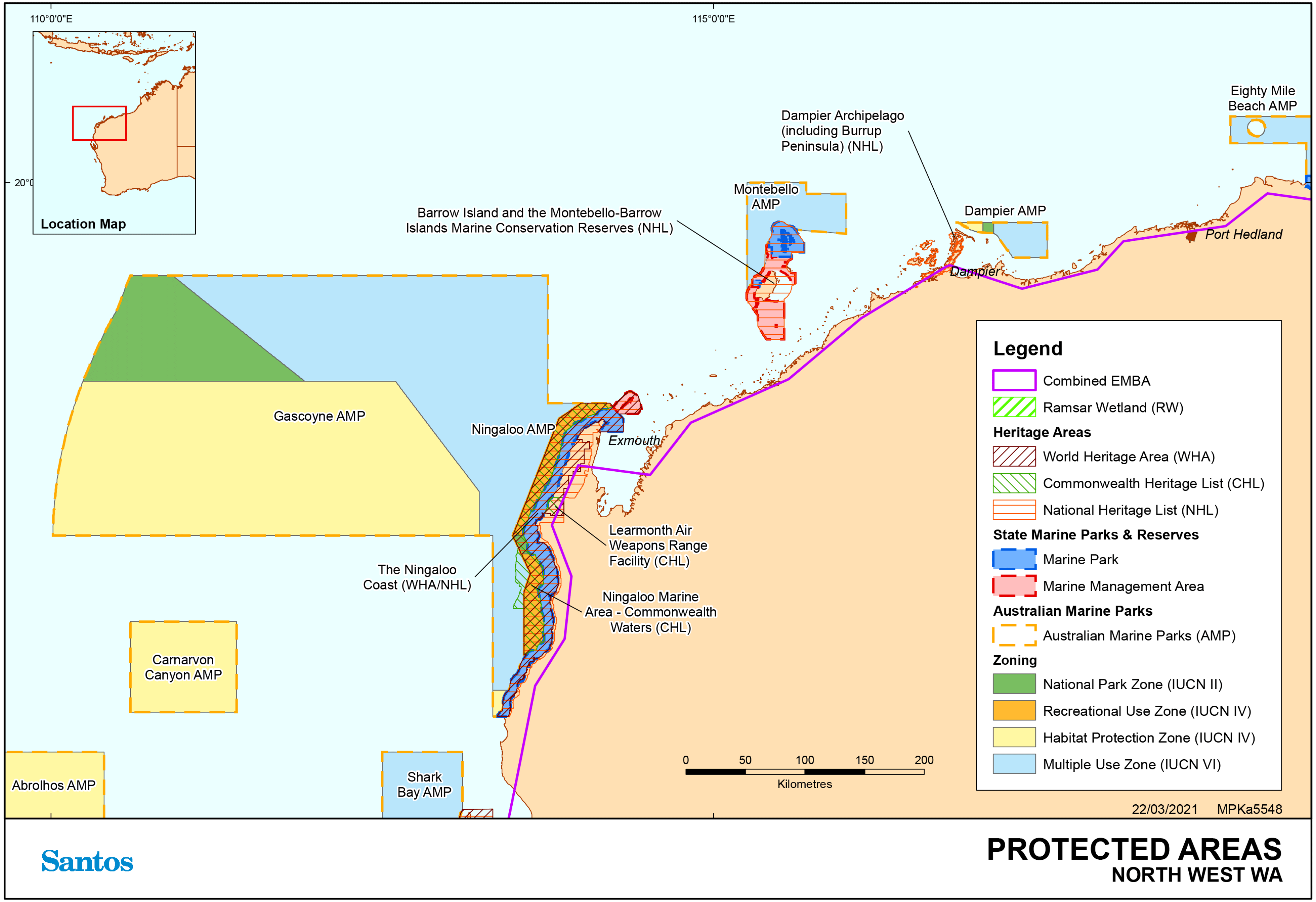


Figure 9-3: Protected areas in North West WA

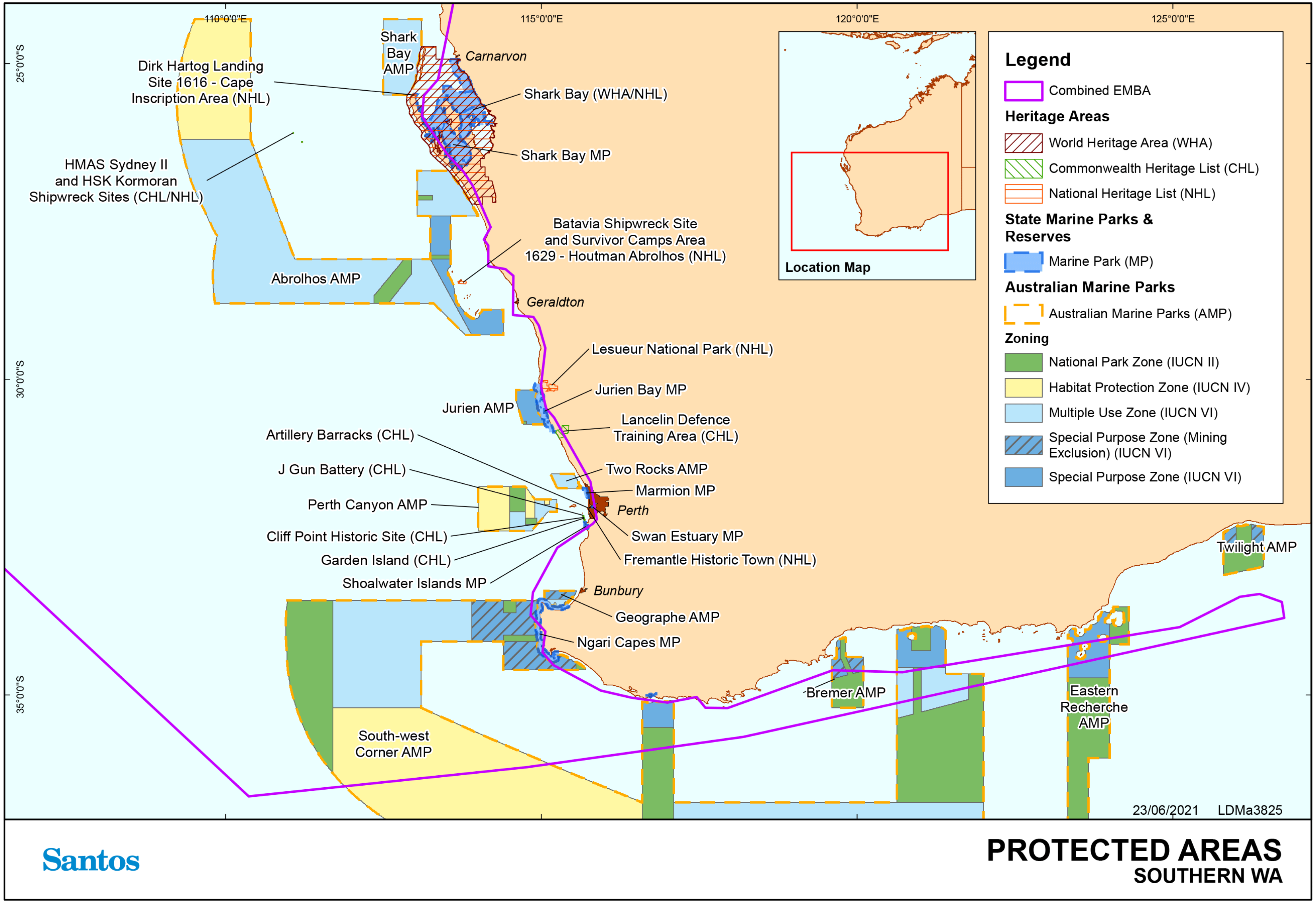


Figure 9-4: Protected areas in Southern WA

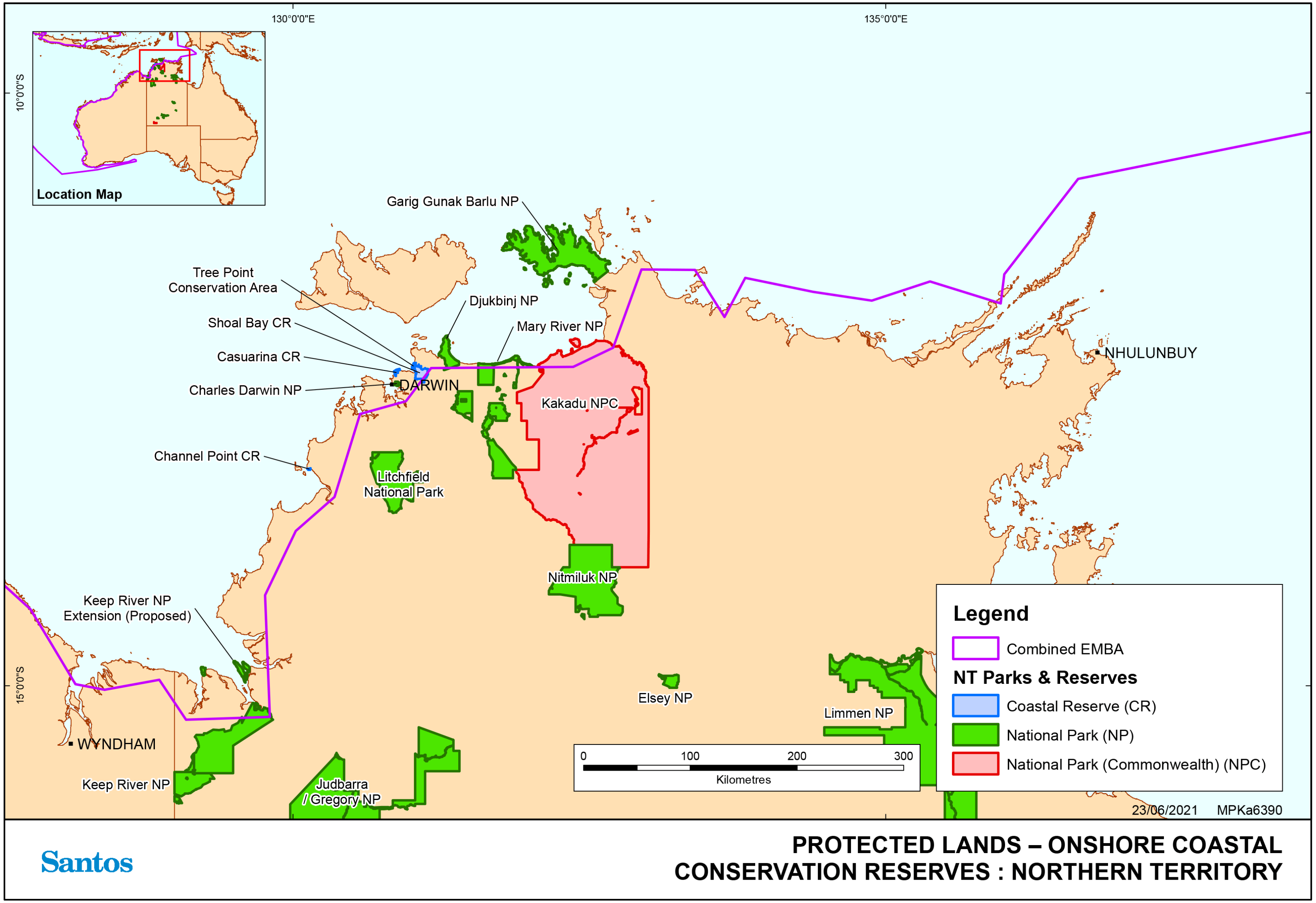


Figure 9-5: Protected Lands (CALM Act 1984) – terrestrial coastal reserves bounding marine waters in NT

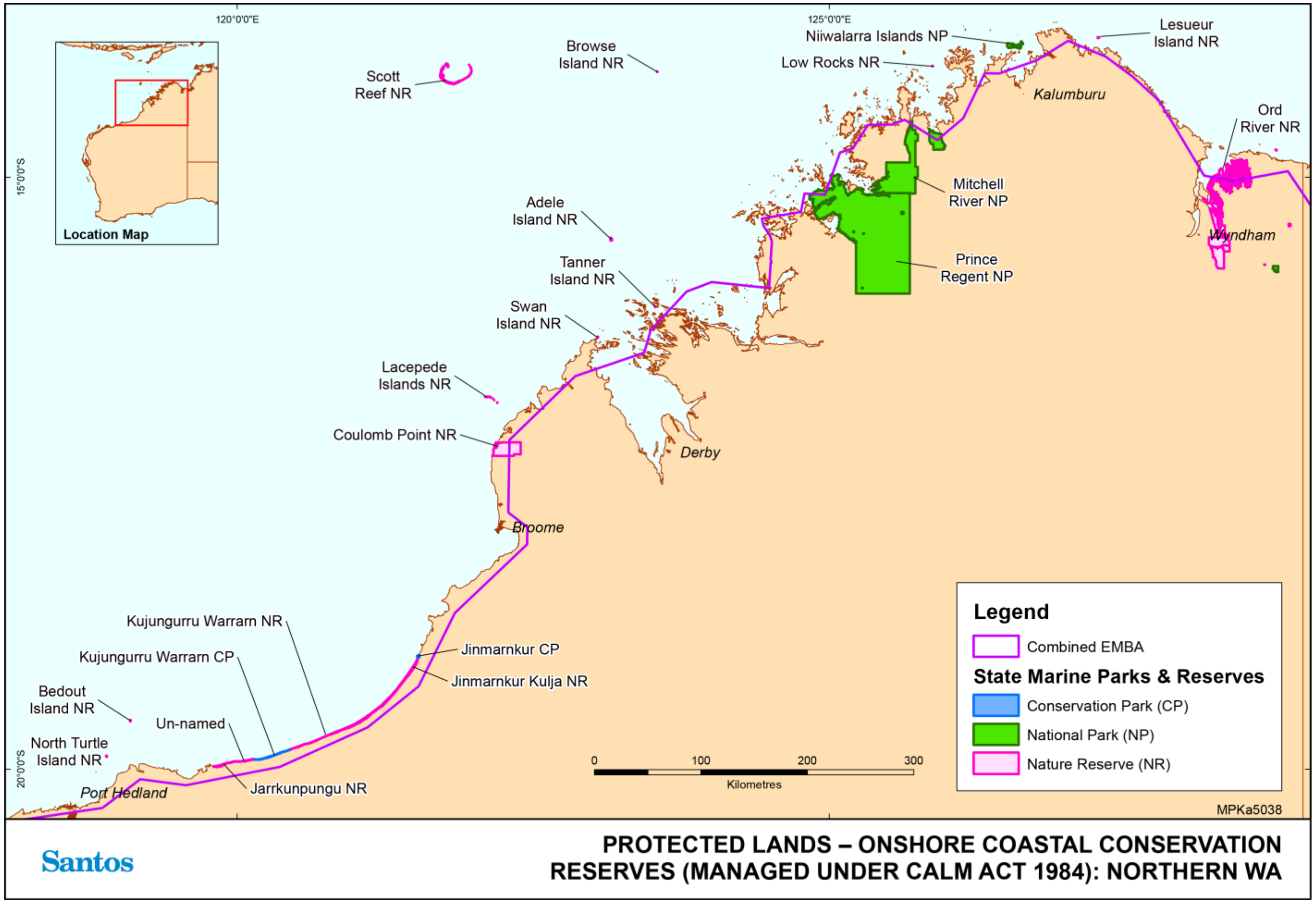


Figure 9-6: Protected Lands (CALM Act 1984) – terrestrial conservation reserves bounding marine waters in northern WA[12]

[12] Yawaru Minyirr Buru Conservation Reserve (adjacent to Roebuck Bay) not shown as exact spatial extent unavailable, however the adjacent inter-tidal waters are managed under adjacent Roebuck Bay Marine Park (described in Section 11.1.17).

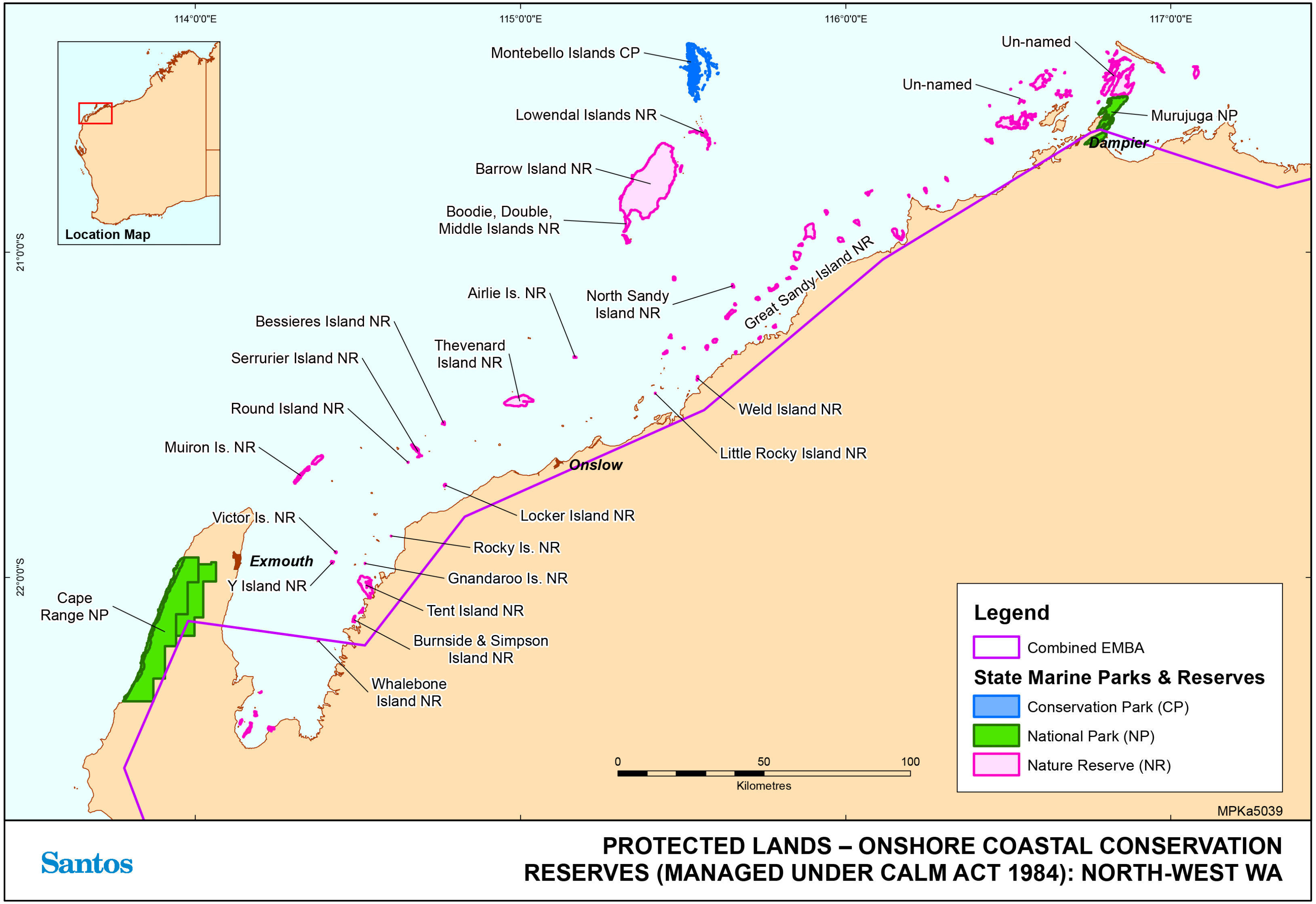
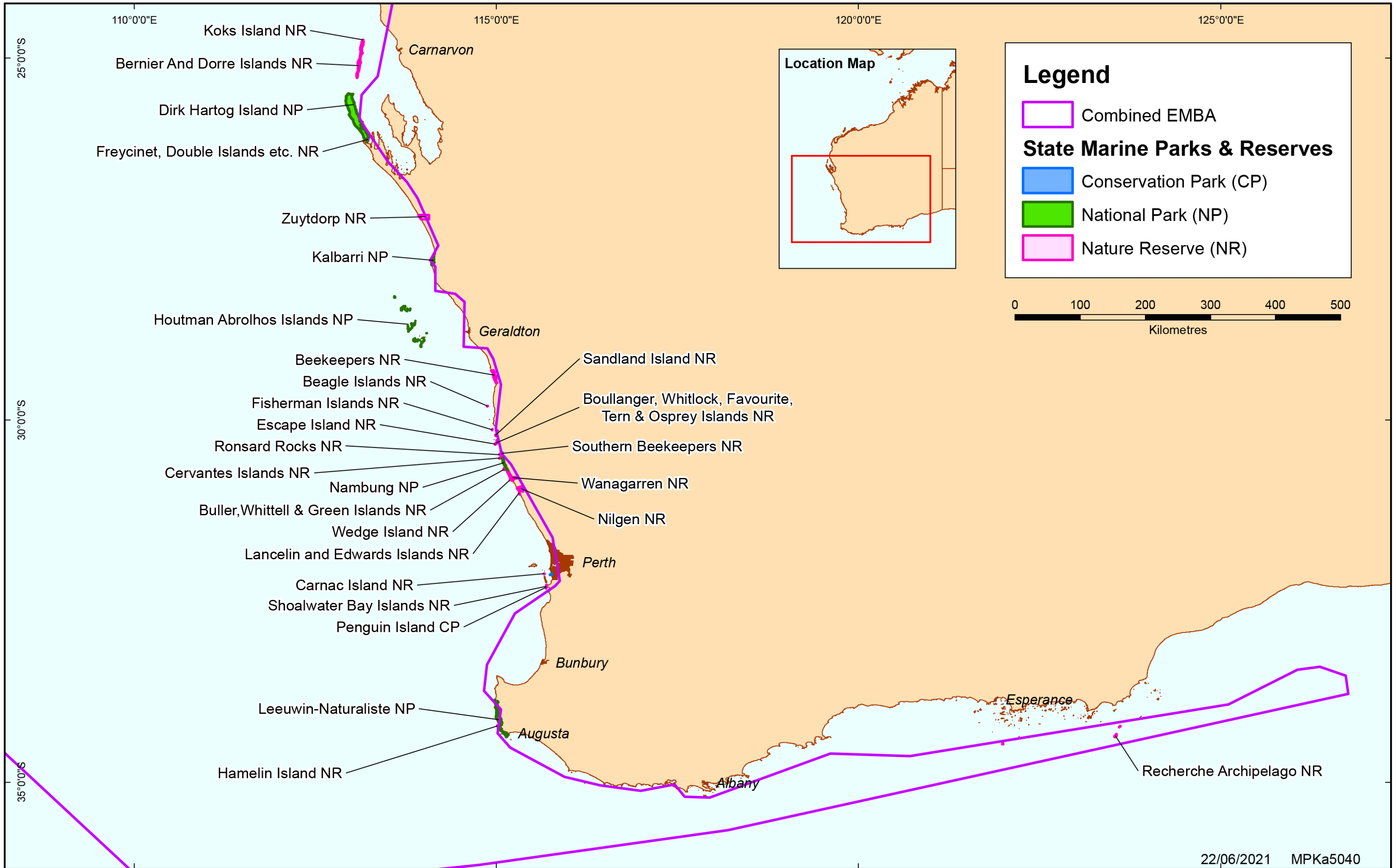


Figure 9-7: Protected Lands (CALM Act 1984) – terrestrial conservation reserves bounding marine waters in North-West WA

Santos



Santos

PROTECTED LANDS – ONSHORE COASTAL CONSERVATION RESERVES (MANAGED UNDER CALM ACT 1984): SOUTHERN WA

Figure 9-8: Protected Lands (CALM Act 1984) – terrestrial conservation reserves bounding marine waters in Southern WA[13]

9.8 International Protected Areas

There are 54 National Parks in Indonesia, six are World Heritage Sites, nine are part of the World Network of Biosphere Reserves and five are wetlands of international importance under the Ramsar convention. A total of nine parks are largely marine (ADB 2014). the combined EMBAA number of marine national parks, nature reserves and protected areas are overlapped by the combined EMBA. A summary of these is provided below. The waters and islands of these protected areas are frequented by tourists undertaking diving, snorkelling, sailing and other marine nature based tourism with many attractions such as shipwrecks and whale sharks as well as the extensive terrestrial ecosystems. Traditional fishing also occurs throughout the parks where allowed.

9.8.1 World Heritage and Protected Sites

9.8.1.1 Komodo

Komodo National park is located within the lesser Sunda Island between the provinces of East Nusa Tenggara and West Nusa Tenggara. Within the 1733km^2 site, three larger island (Komodo, Padar and Rincach) and 26 smaller ones are included. The marine fauna and flora are generally the same as that found throughout the Indo Pacific area, though species richness is very high, notable marine mammals include blue whale (*Balaenoptera musculus*) and sperm whale (*Physeter catodon*) as well as 10 species of dolphin, dugong (*Dugong dugon*) and five species of sea turtles (WHC, 2021). Fringing and patch coral reefs are extensive and most developed on the north-east side of Komodo (Indahnesia, 2011). The property is identified as a global conservation priority area, comprising unparalleled terrestrial and marine ecosystems (WHC, 2021).

The islands have an irregular coastline characterized by bays, beaches and inlets separated by headlands, often with sheer cliffs falling vertically into the surrounding seas.

9.8.1.2 Siberut

Siberut is located about 155km off the coast of West Sumatra across the Mentawaian strait and covers an area of 4050km^2. Sand beaches, lagoons, mangroves, and coral sea gardens create ecosystems within the site (Indahnesia, 2011).

9.8.1.3 Ujung Kulon

Ujung Kulon covers 1230km^2 of area. The coastline features various ecosystems such as sandy beaches, lagoons, rocky outcrops, as well as mangrove swamps. The water is an unusually warm 29 to 30 degrees Celsius and is home to multiple species of coral and fish (Indahnesia, 2011). The property includes the Ujung Kulon peninsula and several offshore islands that demonstrate on-going evolutionary processes (WHC, 2021).

9.8.2 Marine National Parks

9.8.2.1 Laut Sawu

The Laut Sawu Marine National Park located within the Lesser Sunda Ecoregion in the Savu Sea and covers a reported 35,211 km^2 (Protected Planet 2017). It was established in 2009 and has an IUCN Category II status (Protected Planet 2017). The marine park area is a known migration route for several cetacean species, including the blue whale and sperm whale. Other cetacean species such as pygmy killer whales, melon-head whale, short-finned 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 marine park area. Several species of marine turtle, including the green turtle, hawksbill turtle and leatherback turtle have also been recorded in the marine park area.

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; and
- 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).

9.8.2.2 Kepulauan Seribu

Kepulauan Seribu, also known as Thousand Islands National Park, consists of a string of 105 islands within a reported area of 1074.89km^2. It is designated with an IUCN category II status. The closest island lies in Jakarta Bay, only a few kilometres from off mainland Jakarta with islands stretching as far as 45km north into the Java Sea (Indahnesia, 2011). Some islands are uninhabited, others have resorts or are privately owned. The coastlines are dominated by sandy beaches with some of the islands declared as protected historical sites to protect the artifacts and ruins on the islands dating back to the 19th century. Extensive coral reefs surround the islands. A Hawksbill turtle preservation program is in places in the park to protect the species that are found in the waters and nest on sandy beaches there (UNDP Indonesia, 2017). Mangroves are also found in the park, including plantations to increase the mangrove coverage.

9.8.2.3 Teluk Cenderawasih

Teluk Cenderawasih National Park is the largest marine park in Indonesia, with the reported area being 14535 km^2. It is designated with an IUCN category II status. The National Park is in Cenderawasih Bay, south-east of Bird's Head Peninsula, and includes the Islands of Misowaar, Nusrowi, Roon, Rumberpon and Yoop. The Park protects a rich marine ecosystem where over 150 coral species have been recorded. It is therefore considered to be a potential World Heritage Site (Indahnesia, 2011).

3.8% of the site consists of island tropical forest ecosystems, where some 46 species of plant have been recorded on the islands. 0.9% of the site is specifically mangrove ecosystems. Although only 5.5% of the site consists of coral reef ecosystems, 150 species of coral have been recorded. This coral reef ecosystem forms part of the Coral Triangle region. Within the remaining area of the site, over 200 fish species, various species of molluscs, whale sharks, four species of turtle as well as mammals such as the dugong, blue whale and dolphins inhabit the 89.8% of marine water ecosystems.

9.8.2.4 Taka Bonerate

Taka Bonerate National Park includes the Takabonerate Atoll Islands within a 5307 km^2 area within the Flores Sea. Taka Bone Rate consists of separate table reefs, enclosing a lagoon filled with massive reefs and is a site of major ecological importance (Indahnesia, 2011). According to the Indonesian Department of Forestry, the site has 261 species of coral, 295 species of coral fish, 244 species of molluscs as well as many other species such as turtles including green turtles that are known to nest on sandy beaches within the park (UNDP Indonesia, 2017).

9.8.2.5 Bunaken

Bunaken National Park is located in the north of the Sulawesi Islands, located near the centre of the Coral Triangle, it is designated with an IUCN category II status. This site typifies Indonesian tropical water ecosystems, consisting of seagrass plains, coral reefs and coastal ecosystems. 97% of the site is classified as marine habitat with the remaining being terrestrial, including 5 islands (Indahnesia, 2011). 390 species of coral, 90 fish species as well as mollusc, reptile, marine and mammal species have all been recorded.

9.8.2.6 Kapulauan Wakatobi

Kapulauan Wakatobi is located south of Sulawesi Island of Indonesia within a 13900km^2 area. It is designated with an IUCN category II status. Types of vegetation found in the National Park include mangrove forests, coastal forests, lowland swamp forests, riverbank vegetation, lowland rainforests, mountain rainforests and coral reefs (Indahnesia, 2011). There are 25 groups of coral reefs, including fringing reefs, barrier reefs and atolls. 396 species of coral belonging to 68 genera and 15 families populate the coral reef. Turtles are found nesting on the beaches and in the waters of the marine park.

9.8.2.7 Meru Betiri

Meru Betiri National Park lies within the province of East Java and extends over 580km^2. Of that area, 8.45 km^2 is marine (Indahnesia, 2011). The beaches of the park provide nesting grounds for endangered turtle species such as leatherback turtles, hawksbill turtles, green turtles, and olive ridley turtles (ADB 2014). The coastal vegetation is mostly found around Sukamade Bay and Meru Bay. Mangrove vegetation is largely found at the eastern side of the Rajegwesi Bay. The dominant genera are *Rhizophora, Avicennia* and *Bruguiera*. At the outlet of the Sukamade River, there is *Nypa fruticans*.

9.8.2.8 Togian Islands

The Togian Islands National Park, otherwise known as Kepulauan Togean, is a largely marine national park and provides habitat and breeding areas for hawksbill and green turtles and dugongs (Indahnesia, 2011). Mangroves forests are found within the marine park and extensive coral reefs.

9.8.3 Marine Nature Reserves and Conservation Areas

9.8.3.1 Karimunjawa

Karimunjawa is a national marine park in the Karimumjawa archipelago, 80km north of Jepara in the Java sea. The national park was formally declared a marine protected area in 2001 and has an IUCN category Ia status.

Karimunja has five types of ecosystems; coral reef, seagrass and seaweed, mangrove forest, coastal forest and low land tropical rainforest. The coral reefs of Karimunja are composed of fringing and barrier reefs along with several patch reefs. More than 90 species of coral biota is known to make up these ecosystems that creates a habitat for over 242 species of ornamental fish. Protected coral biota such as black coral, hornet helmet, titron trumpet, green shell and organ pipe coral, can be found here.

The 300 hectares of mangrove forests contain 32 species of mangroves and habitat many endemic species such as the dewadaru tree (*Fragraea elliptica*), setgi (*Pemphis acidula*) and kalimsada (*Cordia Subcordata*). Around 40 species of bird habitat this area as well as other terrestrial animals. Several species of turtles are known to use this national park as a breeding ground. Marine species within the area are particularly diverse, and in more abundance than the terrestrial populations.

9.8.3.2 Savu Sea National Marine Conservation Area

Savu Sea National Marine Conservation Area is located between the islands Sumba and Timor encompassing Pulau Roti and Sawu. The park includes coral reefs, mangroves, seagrass and deepwater habitats such as seamounts and deepwater canyons. Savu Sea NMCA is located within the Lesser Sunda seascape which is regarded as a high priority seascape for marine biodiversity conservation (Huffard et al. 2012). The Lesser Sundas is the main corridor between the Indian and Pacific Oceans including for migrating whales and commercially-important pelagic fishes (Huffard et al. 2012). Savu Sea NMCA covers ranges of species diversities and habitats within its region which includes:

+ 532 corals species, 11 endemic and sub endemic species;
+ 350 reef fish species;
+ 15 mangrove species are recorded that represented nine families of mangrove;
+ 10 sea grass species in two families;
+ Deep-water habitats such as seamounts, deep-water canyons, straits (migratory corridors) and large persistent pelagic habitats were covered within Savu Sea NMP boundaries;
+ Main migratory corridors and habitats for 14 whales species, seven dolphins species and one dugong species; and
+ Habitats for five sea turtles species (green, leatherback, olive ridley, loggerhead, and flat back), as well as for large marine fauna such as sharks, napoleon, parrotfish and groupers (Savu Sea Management Plan 2014).

10. Key Ecological Features

10.1 Introduction

Key ecological features (KEFs) are elements of the Commonwealth marine environment that are considered to be of regional importance 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; or
  - Biodiversity and/or endemism
+ A unique seafloor feature with ecological properties of regional significance.

Twenty eight key ecological features of the Commonwealth waters in the combined EMBA (covering the NMR, the NWMR and the SWMR) have been identified in the protected matters search (Figure 10-2,Figure 10-3 and Figure 10-1) and are discussed in this section.

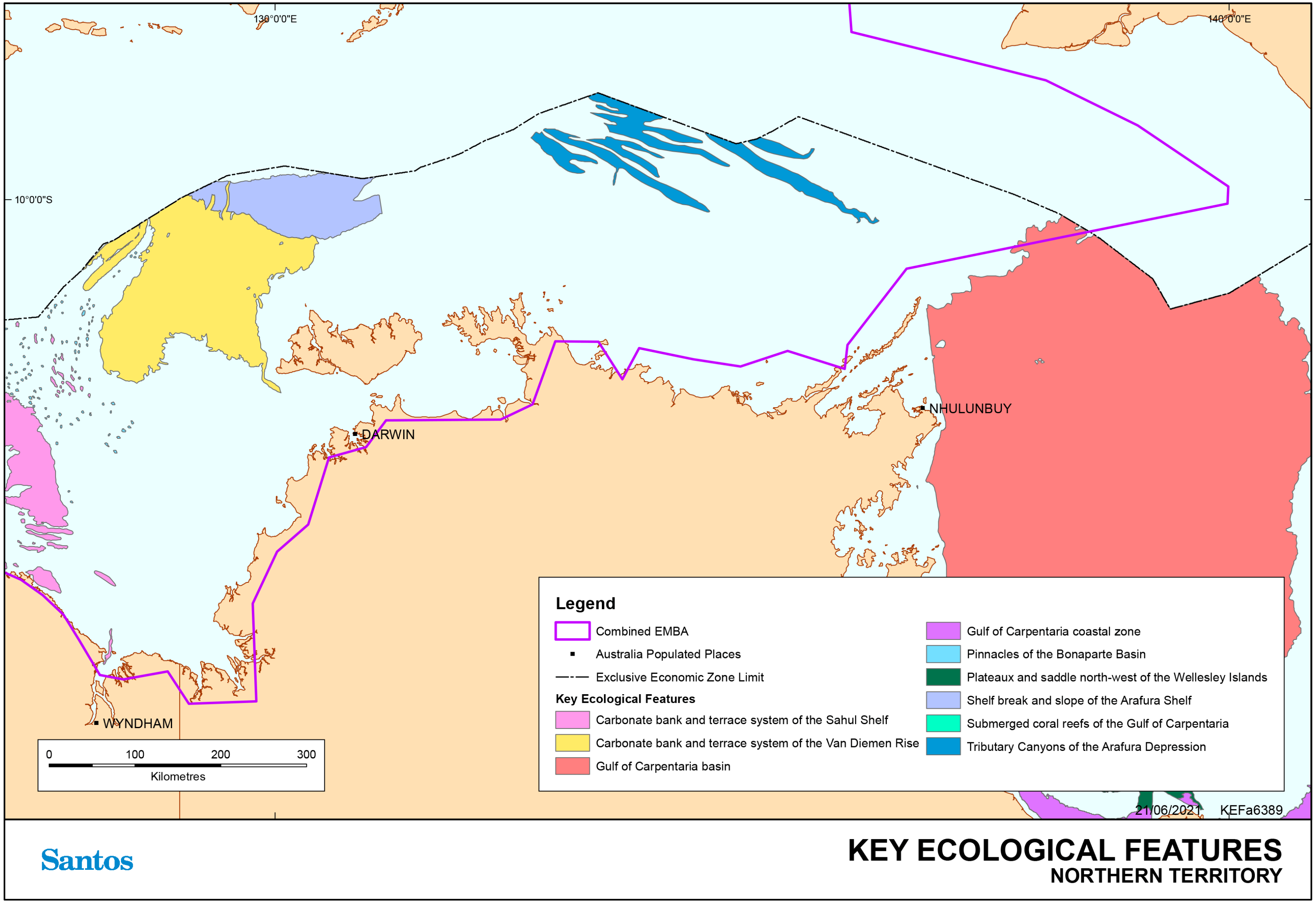


Figure 10-1: Key ecological features of NT

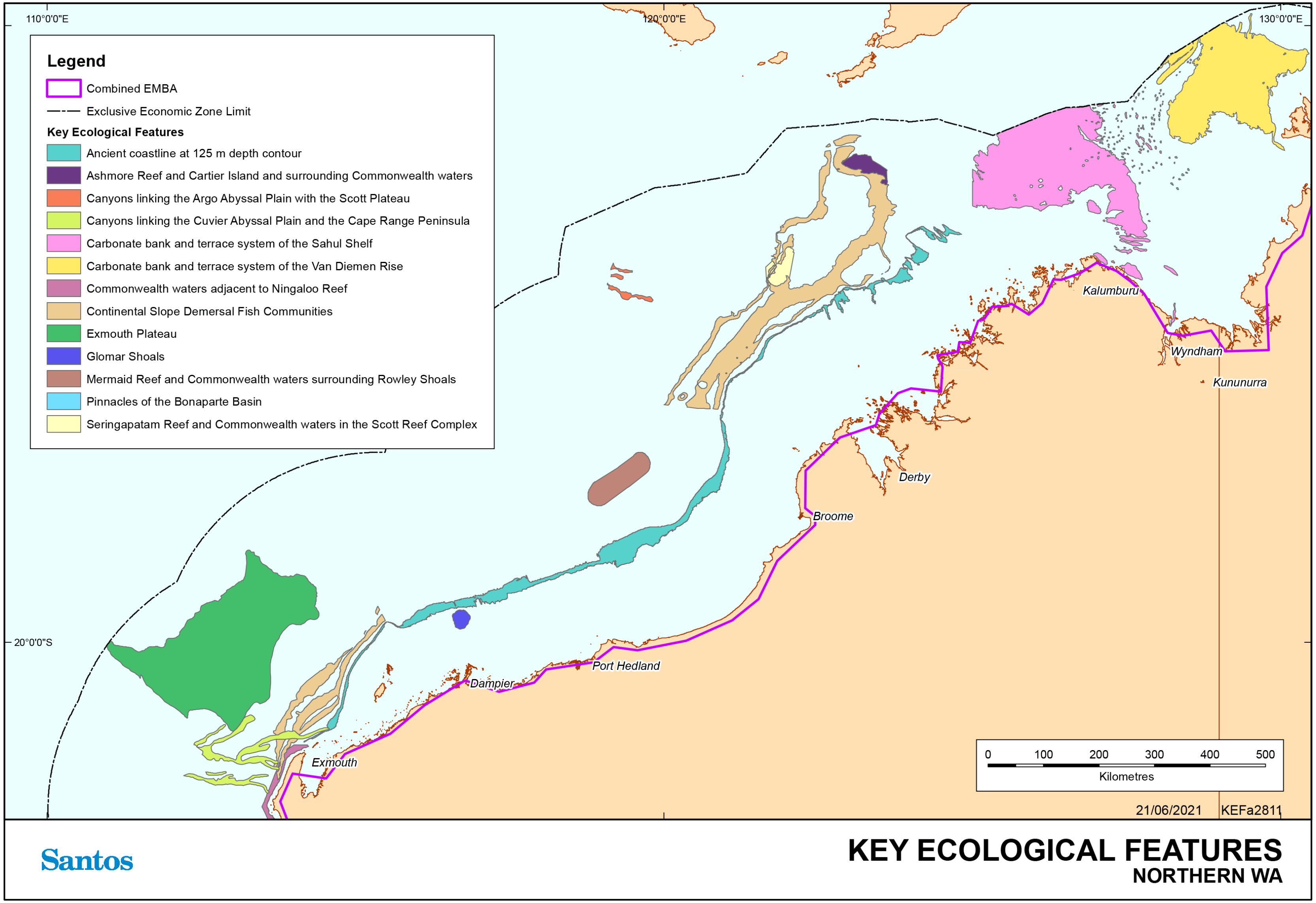


Figure 10-2: Key ecological features of Northern WA

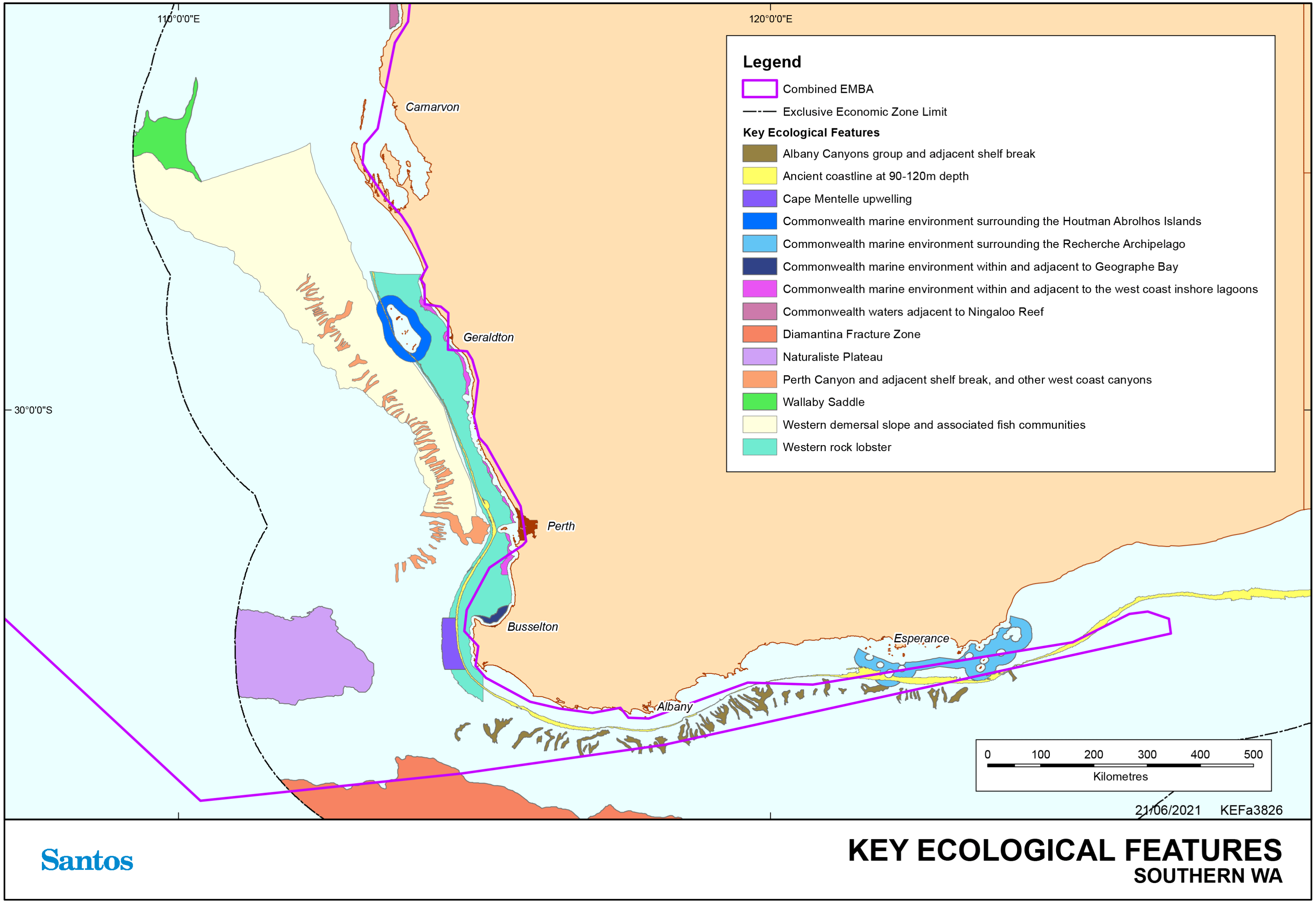


Figure 10-3: Key ecological features of Southern WA

10.1.1 Commonwealth Marine Environment Surrounding the Houtman Abrolhos Islands (and Adjacent Shelf Break)

The Commonwealth marine environment surrounding the Houtman Abrolhos Islands (and adjacent shelf break) is defined as a KEF for its high levels of biodiversity and endemism in benthic and pelagic habitats. The Houtman Abrolhos Islands and surrounding reefs support a unique mix of temperate and tropical species, resulting from the southward transport of species by the Leeuwin Current over thousands of years. The reefs are composed of 184 known species of corals that support about 400 known species of demersal fish, 492 known species of molluscs, 110 known species of sponges, 172 known species of echinoderms and 234 known species of benthic algae (DEWHA 2008b). The Houtman Abrolhos Islands are the largest seabird breeding station in the eastern Indian Ocean (DSEWPaC 2012a). They support more than one million pairs of breeding seabirds. The Houtman Abrolhos Islands and surround waters are also BIAs for Australian sea lions for foraging and breeding (DEWHA 2010b).

10.1.2 Commonwealth Marine environment surrounding the Recherche Archipelago

The Recherche Archipelago is a chain of approximately 105 islands and 1 500 islets extending over 470 km of coastline near Esperance, Western Australia. This area is defined as a KEF as it is a region of high biodiversity, The Recherche Archipelago is the most extensive area of reef in the South-west Marine Region. Its reef and seagrass habitat support a high species diversity of warm temperate species, including 263 known species of fish, 347 known species of molluscs, 300 known species of sponges, and 242 known species of macroalgae. The islands also provide haul-out (resting areas) and breeding sites for Australian sea lions and New Zealand fur seals (DSEWPaC 2012)

10.1.3 Perth Canyon and Adjacent Shelf Break, and other West-Coast Canyons

The Perth Canyon is defined as a KEF for its high biological productivity and aggregations of marine life and unique seafloor features with ecological properties of regional significance. The Perth Canyon is the largest known undersea canyon in Australian waters. In the Perth Canyon, interactions between the Leeuwin Current and the Canyon topography induce clockwise-rotating eddies that transport nutrients upwards in the water column from greater depths (DoEE 2019a). Due to the Canyon's depth and Leeuwin Current's barrier effect, this remains a subsurface upwelling which supports ecological complexity that is typically absent from canyon systems in other areas (Pattiaratchi 2007). This nutrient-rich cold-water habitat attracts feeding aggregations of deep-diving mammals, such as pygmy blue whales and large predatory fish that feed on aggregations of small fish, krill and squid (DSEWPaC 2012a). The Perth Canyon also marks the southern boundary for numerous tropical species groups on the shelf, including sponges, corals, decapods and xanthid crabs (DoEE 2017a).

10.1.4 Commonwealth Marine Environment within and adjacent to the West-Coast Inshore Lagoons

This key ecological feature is composed by a chain of inshore lagoons of limestone reef (as deep as 30 m) extending along the Western Australian coast from south of Mandurah to Kalbarri. The mix of sheltered and exposed seabeds form a complex mosaic of habitats. The lagoons are dominated by seagrass and epiphytic algae (Dambacher et al. 2009). Although macroalgae (principally Ecklonia spp.) and seagrass appear to be the primary source of production, scientists suggest that groundwater enrichment may supplement the supply of nutrients to the lagoons. The lagoons are associated with high biodiversity and endemism, containing a mix of tropical, subtropical and temperate flora and fauna.

The inshore lagoons are important areas for the recruitment of the commercially and recreationally important western rock lobster, dhufish, pink snapper, breaksea cod, baldchin and blue gropers, abalone and many other reef species. The area includes breeding and nursery aggregations for many temperate and tropical marine species (Goldberg & Collings 2006 in McClatchie et al. 2006). Extensive schools of migratory fish visit the area annually, including herring, garfish, tailor and Australian salmon.

10.1.5 Commonwealth Marine Environment within and Adjacent to Geographe Bay

The Commonwealth marine environment within and adjacent to Geographe Bay is defined as a KEF for its high productivity and aggregations of marine life and high levels of biodiversity and endemism. Geographe Bay is known for its extensive beds of tropical and temperate seagrass that account for about 80 % of benthic primary production in the area (DEH 2006). This habitat supports a diversity of species, many of them not found anywhere else (DSEWPaC 2012a). The bay provides important nursery habitat for many species, including juvenile dusky whaler sharks. It is also an important resting area for migrating for humpback whales (McCauley *et al.* 2000).

10.1.6 Cape Mentelle Upwelling

The Cape Mentelle upwelling is defined as a KEF for its high productivity and aggregation soft marine life. The Cape Mentelle upwelling draws relatively nutrient-rich water from the base of the Leeuwin Current, up the continental slope and onto the inner continental shelf, where it results in phytoplankton blooms at the surface. The phytoplankton blooms provide the basis for an extended food chain characterised by feeding aggregations of small pelagic fish, larger predatory fish, seabirds, dolphins and sharks (DSEWPaC 2012a). The Cape Mentelle upwelling has a disproportionate influence on the overall-nutrient poor nature of the region's water.

10.1.7 Naturaliste Plateau

The Naturaliste Plateau is defined as a KEF for its unique seafloor feature with ecological properties of regional significance. The Naturaliste Plateau is Australia's deepest temperate marginal plateau and occurs an area where numerous water bodies and currents converge. It is also the only seafloor feature in the region that interacts with the subtropical convergence front (DoEE 2019b). Although there is very little known about the marine life of the plateau, it is speculated that the combination of its structural complexity, mixed water dynamics and relative isolation indicate that it supports deep-water communities with high species diversity and endemism (DEWHA 2008b; DSEWPaC 2012a). The Plateau acts as an underwater 'biogeographical island' on the edge of the abyssal plain, providing habitat for fauna unique to these depths (Richardson et al. 2005). The Plateau is also within a deep eddy field that is thought to be associated with high productivity and aggregations of marine life (Pattiaratchi 2007). Proximity to the nearby subtropical convergence front is thought to have a significant influence on the biodiversity of the Plateau (DEWHA 2008b).

10.1.8 Western Demersal Slope and associated Fish Communities

The Western Demersal Slope and associated Fish Communities, also known as the Demersal Slope and associated Fish Communities of the Central Western Province, is defined as a key ecological community for its high levels of biodiversity and endemism. It is located on the edge of the shelf to the limit of the exclusive economic zone from Perth to the northern boundary of the SWMR. The western demersal slope provides important habitat for demersal fish communities, with a high level of diversity and endemism. A diverse assemblage of demersal fish species below a depth of 400 m is dominated by relatively small benthic species such as grenadiers, dogfish and cucumber fish. Unlike other slope fish communities in Australia, many of these species display unique physical adaptations to feed on the sea floor (such as a mouth position adapted to bottom feeding), and many do not appear to migrate vertically in their daily feeding habits (DSEWPaC 2012a, Williams *et al.* 2001). A total of 480 fish species have been described that inhabit the slope of this bioregion with 31 considered to be endemic to the bioregion (DoEE 2019a). Demersal fish communities within the area have recorded higher diversity when compared to other oceanic regions which have been more intensively sampled. The increased diversity within the area has been attributed to the overlap of ancient and extensive Indo-west Pacific and temperate Australasian fauna (Williams et al. 2001).

10.1.9 Western Rock Lobster

The Western Rock Lobster KEF is defined due to its presumed ecological role on the West Coast Continental Shelf. This species is the dominant large benthic invertebrate in the region. The lobster plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western rock lobsters are an important part of the food web on the inner shelf, particularly as juveniles as they are preyed upon by octopus, cuttlefish, baldchin groper, dhufish, pink snapper, wirrah cod and breaksea cod (DEWHA 2008b, DSEWPaC 2012a). The high biomass of western rock lobsters and their vulnerability to predation suggest that they are an important trophic pathway for a range of inshore species that prey upon juvenile lobsters (DEWHA 2008b).

10.1.10 Wallaby Saddle

The Wallaby Saddle is defined as a KEF for its high productivity and aggregations of marine life. The Wallaby Saddle is an abyssal geomorphic feature located on the upper continental slope at a depth of 4,000–4,700 m (DSEWPaC 2012a). The feature connects the north-west margin of the Wallaby Plateau with the margin of the Carnarvon Terrace (Falkner *et al*. 2009 in DSEWPaC 2012a). The Wallaby Saddle is situated within the Indian Ocean water mass and is thus differentiated from systems to the north that are dominated by transitional fronts or the Indonesian Throughflow (DSEWPaC 2012a). Little is known about the Wallaby Saddle; however, the area is considered one of enhanced productivity and low habitat diversity (Brewer *et al*. 2007). The Wallaby Saddle is associated with historical aggregations of sperm whales (DEWHA 2008c).

10.1.11 Commonwealth Waters Adjacent to Ningaloo Reef

The Commonwealth Waters adjacent to Ningaloo Reef KEF is defined for high productivity and aggregations of marine life. The Ningaloo Reef extends almost 300 km along the Cape Range Peninsula to the Red Bluff and is globally significant as the only extensive coral reef in the world that fringes the west coast of a continent. Commonwealth waters adjacent to the reef are thought to support the rich aggregations of marine species at Ningaloo Reef through upwellings associated with canyons on the adjacent continental slope and interactions between the Ningaloo and Leeuwin currents (Brewer *et al*. 2007, DEWHA 2008d, DSEWPaC 2012a). The narrow continental shelf (10 km at its narrowest) means that the nutrients channelled to the surface via canyons are immediately available to reef species. Terrestrial nutrient input is low, hence this deep-water source is a major source of nutrients for Ningaloo Reef and therefore very important in maintaining this system (DEWHA 2008c).

The reef is known to support an extremely abundant array of marine species including over 200 species of coral and more than 460 species of reef fish, as well as molluscs, crustaceans and other reef plants and animals (DEWHA 2008c). Marine turtles, dugongs and dolphins frequently visit the reef lagoon. The Commonwealth waters around Ningaloo include areas of potentially high and unique sponge biodiversity (DEWHA 2008c). Upwellings on the seaward side support aggregations such as whale sharks and manta rays (these waters are the main known aggregation area for whale sharks in Australian waters). Humpback whales are seasonal visitors to the outer reef edge and seasnakes, sharks, large predatory fish and seabirds also utilise the reef and surrounding waters.

The Ningaloo Marine Park includes this Key Ecological Feature and is discussed in Section 12.3.4.

10.1.12 Canyons Linking the Cuvier Abyssal Plain with the Cape Range Peninsula

The Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula are defined as a KEF as they are unique seafloor features with ecological properties of regional significance.

Cape Range Peninsula and the Cuvier Abyssal Plain are linked by canyons, the largest of which are the Cape Range Canyon and Cloates Canyon. These two canyons are located along the southerly edge of Exmouth Plateau adjacent to Ningaloo Reef and are unique due to their close proximity to the North West Cape (DSEWPaC 2012a). The Leeuwin Current interacts with the heads of the canyons to produce eddies resulting in delivery of higher nutrient, cool waters from the Antarctic intermediate water mass to the shelf (Brewer *et al*. 2007). Strong internal tides also create upwelling at the canyon heads (Brewer *et al*. 2007). Thus the canyons, the Exmouth Plateau and the Commonwealth waters adjacent to Ningaloo Reef interact to create the conditions for enhanced productivity seen in this region (Sleeman *et al*. 2007 in DSEWPaC 2012a). The canyons are also repositories for particulate matter deposited from the shelf and sides of the canyons and serve as conduits for organic matter between the surface, shelf and abyssal plains (DSEWPaC 2012a).

The soft bottom habitats within the canyons themselves are likely to support important assemblages of epibenthic species. Biological productivity at the head of Cape Range Canyon in particular, is known to support species aggregations, including whale sharks, manta rays, humpback whales, sea snakes, sharks, large predatory fish and seabirds. The canyons are thought to be significant contributors to the biodiversity of the adjacent Ningaloo Reef, as they channel deep water nutrients up to the reef, stimulating primary productivity (DEWHA 2008c).

10.1.13 Exmouth Plateau

The Exmouth Plateau is defined as a KEF as it is a unique seafloor feature with ecological properties of regional significance. The Exmouth Plateau covers an area of 49,310 km^2 and is located approximately 150 km northwest of Exmouth. The plateau ranges in water depths from 800 to 4,000 m (Heap & Harris 2008 in DSEWPaC 2012a). The plateau's surface is rough and undulating at 800–1,000 m depth. The northern margin is steep and intersected by large canyons (e.g. Montebello and Swan canyons) with relief greater than 50 m. The western margin is moderately steep and smooth and the southern margin is gently sloping and virtually free of canyons (Falkner *et al*. 2009 in DSEWPaC 2012a).

The Exmouth Plateau is a regionally and nationally unique tropical deep sea plateau. It that may serve an important ecological role by acting as a topographic obstacle that modifies the flow of deep waters that generate internal tides, causing upwelling of deeper water nutrients closer to the surface (Brewer *et al.* 2007). Sediments on the plateau suggest that biological communities include scavengers, benthic filter feeders and epifauna. Whaling records from the 19th century suggest that the Exmouth Plateau may have supported large populations of sperm whales (Bannister *et al*. 2007). Fauna in the pelagic waters above the plateau are likely to include small pelagic species and nekton (Brewer *et al.* 2007).

10.1.14 Mermaid Reef and Commonwealth Waters surrounding Rowley Shoals

Mermaid Reef and Commonwealth waters surrounding Rowley Shoals is defined as a KEF for its enhanced productivity and high species richness. The Rowley Shoals are a group of three atoll reefs—Clerke, Imperieuse and Mermaid reefs—located about 300 km north-west of Broome. Mermaid Reef lies 29 km north of Clerke and Imperieuse reefs and is totally submerged at high tide. Mermaid Reef and Commonwealth Waters surrounding Rowley Shoals are regionally important in supporting high species richness, higher productivity and aggregations of marine life associated with the adjoining reefs themselves (Done et al. 1994). Rowley shoals contain 214 coral species and approximately 530 species of fishes (Gilmour et al. 2007), 264 species of molluscs and 82 species of echinoderms (Done et al. 1994; Gilmour et al. 2007). Both coral communities and fish assemblages differ from similar habitats in eastern Australia (Done et al. 1994).

Mermaid Reef falls under Commonwealth jurisdiction and forms the Mermaid Reef Commonwealth Marine Park. Clerke and Imperieuse reefs constitute the Rowley Shoals Marine Park, which falls under Western Australian Government jurisdiction (EA 2000). The Rowley Shoals are discussed with the Commonwealth and State Marine Park (Sections 11.1.9 and 12.3.9).

10.1.15 Glomar Shoals

The Glomar Shoals are a submerged feature situated at a depth of 33–77 m, approximately 150 km north of Dampier on the Rowley Shelf (Falkner *et al*. 2009 in DSEWPaC 2012a). They consist of a high percentage of marine-derived sediments with high carbonate content and gravels of weathered coralline algae and shells (McLoughlin & Young 1985 in DSEWPaC 2012a). The area's higher concentrations of coarse material compared to surrounding areas are indicative of a high energy environment subject to strong seafloor currents (Falkner *et al*. 2009 in DSEWPaC 2012a).

Biological communities found at the Glomar Shoals have not been comprehensively studied, however the shoals are known to be an important area for a number of commercial and recreational fish species such as rankin cod, brown striped snapper, red emperor, crimson snapper, bream and yellow-spotted triggerfish. Catch rates at the Glomar Shoals are high, indicating that the area is a region of high productivity (Falkner *et al*. 2009, Fletcher & Santoro 2009 in DSEWPaC 2012a). It is unclear if the removal of non-target species due to the commercial fishing over the shoals is having an impact on its value (DSEWPaC 2012a).

The Glomar Shoals are regionally important for their potentially high biological diversity and localised productivity. Biological data specific to the Glomar Shoals is limited, however the fish of the shoals are probably a subset of reef-dependent species and anecdotal evidence suggests they are particularly abundant (DSEWPaC 2012a).

10.1.16 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 125m as an escarpment along the North West Shelf and Sahul Shelf (DSEWPaC 2012a). 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, 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 DEWHA 2008c), 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 (DEWHA 2008c).

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 (DoEE 2019a).

10.1.17 Ancient Coastline at 90-120 m Depth

This coastline is found in the South-west Marine Region and contains several terraces and steps reflecting a gradual increase in sea level across the shelf that occurred during the Holocene. Some of these features create escarpments of distinct elevation, creating topographic complexity through the exposure of rocky substrates. The most prominent of these occurs close to the middle of the continental shelf off the Great Australian Bight at a depth of 90-120 m, which provides a complex habitat for a number of species (DSEWPaC 2012c). The area has important conservation value due to its potential for high productivity, biodiversity and aggregations of marine life. Benthic biodiversity and productivity occur where the ancient coastline forms a prominent escarpment of exposed hard substrates, where it is dominated by sponge communities of significant biodiversity and structural complexity (DSEWPaC 2012c). These sponge communities have been recorded to contain sponges up to one metre across, which implies that some of the sponges in this region are likely to be many decades old (DSEWPC 2012c). It has been suggested that in certain places, the area may support some demersal fish species, travelling to the upper continental slope from across the continental shelf. The transportation of fine grained sediments off shelf occurs as a physical process down to depths of approximately 120 m, and influence the benthic invertebrate communities of the Great Australian Bight (DSEWPaC 2012c). Both species richness and biomass in the area, has been associated as declining with increasing depth and percentage of fines in sediment (Ward *et al.* 2006 cited in DSEWPaC 2012c).

10.1.18 Canyons Linking the Argo Abyssal Plain with Scott Plateau

The Scott Plateau connects with the Argo Abyssal Plain via a series of canyons, the largest of which are the Bowers and Oates canyons (DSEWPaC 2012a). The canyons are believed to be up to 50 million years old and excavated during the evolution of the region through sediment and water movements (DEWHA 2008d). The canyons cut deeply into the south-west margin of the Scott Plateau and act as conduits for transport of sediments from an approximate depth of 2,000–3,000 m to depths of more than 5,500 m (DSEWPaC 2012a). The water masses at these depths are deep Indian Ocean water on the Scott Plateau and Antarctic bottom water on the Argo Abyssal Plain. Both water masses are cold, dense and nutrient-rich (Lyne *et al*. 2006 in DSEWPaC 2012a). The high productivity of the region is believed to be led by topographically induced water movements through the canyons and the action of internal waves in these canyons as well as around islands and reefs. The canyons are therefore thought to be linked to small and periodic upwellings that enhance this biological productivity (DEWHA 2008d).

The Canyons linking the Argo Abyssal Plain and Scott Plateau are likely to be important features due to their historical association with sperm whale aggregations (DSEWPaC 2012a). Historical records of whaling in the Timor region indicate that the number of sperm whales was high in the region in the past. Though current numbers are unknown, it is possible that they congregate around the canyon heads adjacent to the Scott Plateau, encouraged by the high biological productivity, supporting stocks of their prey (DEWHA 2008d). There is anecdotal evidence that supports the idea that the Scott Plateau itself may be a breeding ground for sperm and beaked whales. It is also likely that important demersal communities occur in the canyons, as they do in the Scott Plateau supported by the localised upwelling, which in turn attract larger predatory fish, sharks and cetaceans (DEWHA 2008d).

10.1.19 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 2012).

The Continental Slope consists of two distinct community types, associated with the upper and mid slope, 225 – 500 m and 750 – 1000 m respectively. The Timor Province and Northwest Transition bioregions are the second-richest areas for demersal fish across the entire continental slope (DSEWPaC 2012). 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 of this system has been poorly researched, 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 (DoEE 2019a). The endemism of the region is not supported by large data sets and is scarce. It is consequently not well understood what interactions exist between the physical processes and trophic structures that lead to this high diversity of fish and the suggested presence of endemic species in the region (DoEE 2019a).

10.1.20 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 300–700 m contours on the north-west continental slope and lie 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 key ecological feature is approximately 2,418 km². As two of the few offshore reefs in the north-west, they provide an important biophysical environment in the region.

Scott and Seringapatam reefs and the waters surrounding them 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; Woodside 2009). 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, approximately 400 mollusc species, 118 crustacean species, 117 echinoderm species and around 720 fish species (Woodside 2009). 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 9.5.1.

10.1.21 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 Commonwealth Marine Reserve encloses an area of about 583 km² of seabed (EA 2002). Cartier Island lays about 350 km off Australia's Kimberley coast, 115 km south of the Indonesian island of Roti and 45 km south-east of Ashmore Reef Commonwealth Marine Reserve. Cartier Island Commonwealth Marine Reserve covers 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 Western Australia 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 (Brown & Skewes 2005; 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 supporting 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). Large colonies of sooty terns, crested terns, bridled terns and common noddies breed on the east and middle islands. Smaller breeding colonies of little egrets, eastern reef egrets, black noddies and possibly lesser noddies also occur. Migratory wading birds include eastern curlews, ruddy turnstones, whimbrels, bar-tailed godwits, common sandpipers, Mongolian plovers, red-necked stints and tattlers, during October–November and March–April as part of the migration between Australia and the Northern Hemisphere (Milton 2005).

10.1.22 Carbonate Bank and Terrace System of the Sahul Shelf

The Carbonate Banks and Terrace System of the Sahul Shelf are 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 km^2 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 2012).

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 2012). 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). Cetaceans, green and fresh sawfish are also likely to occur in the area, as well as possibly the Australian snubfin dolphin, a migratory species occurring mostly on the northern extent of the Sahul Shelf (DSEWPaC 2012).

According to DSEWPaC (2012) the carbonate banks and terrace system of the Sahul Shelf are regionally important because of their role in enhancing productivity relative to their surrounds. 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).

10.1.23 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 of 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 to be up to 50 m in height and range from 50 to 100 km long (Baker *et al.* 2008, Heyward *et al.* 1997).

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, Nichol *et al.* 2013). Foraging and general use has been recorded within the pinnacles by marine turtles 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 which has recorded greater diversity and communities than that of the surrounding seafloor (NERP MBH 2014).

According to DSEWPaC (2012) the Pinnacles of the Bonaparte Basin are regionally important because of its biodiversity values (unique sea-floor feature with ecological properties of regional significance), which apply to both the benthic and pelagic habitats. The hard substrate of the pinnacles are likely to support a high number of species, although a better understanding of the species richness and diversity associated with these structures is required.

10.1.24 Diamantina Fracture Zone

The Diamantina Fracture Zone is located south of the Naturaliste Plateau covering a range of more than 100,000 km^2 in water depths greater than 3,000 m. The ridge, troughs and seamounts that form the fracture zone have been recorded to have a relief up to 4,000 m which has resulted in highly variable environmental conditions (Stow 2006, Richardson *et al.* 2005). The Diamantina Fracture Zone encompasses the deepest known points in Australia's exclusive economic zone, reaching depths of more than 6,000 metres.

Limited information is available for the Diamantina Fracture Zone, however it is likely that due to the highly variable environmental conditions within the distinctive community structures and unique habitats have the potential to form. The presence of seamounts and ridges has the potential to increase local primary and secondary productivity, which may in turn promote phytoplankton growth. Increased phytoplankton has been recorded to increase the diversity and abundance of marine life (e.g. whales, dolphins, fish and benthic species) (Rowden *et al.* 2010). The area is expected to sustain similar habitats to that of and around the Tasmanian Seamounts due to similar depths in the South-east Marine Region (Richardson et al. 2005).

According to DSEWPaC (2012) the Diamantina Fracture Zone is regionally important because of to enhance productivity and assist with dispersal and migration of species across the region and wider abyssal plain (Wilson & Kaufman 1987, in Richardson *et al.* 2005). While research on the Diamantina Fracture Zone is limited, its size, physical complexity and isolation indicate that it is likely to support deepwater communities characterised by high species diversity and endemism.

10.1.25 Demersal Slope and Associated Fish Communities of the Central Western Province

The demersal slope and associated fish communities of the Central Western Province is located on the edge of the shelf to the limit of the exclusive economic zone from Perth to the northern boundary of the SWMR. The area supports a diverse demersal fish species assemblage of relatively small benthic species (e.g. grenadier, dogfish and cucumber fish) at depths greater than 400 m. Fish species within this area have adapted physically to feed on the seafloor and do not appear to migrate vertically to feed (Williams et al. 2001).

According to DSEWPaC (2012), the demersal slope and associated fish communities of the Central Western Province are recognised as a KEF for their high levels of biodiversity and endemism. A total of 480 fish species have been described that inhabit the slope of this bioregion with 31 considered to be endemic to the bioregion. Demersal fish communities within the area have recorded higher diversity when compared to other oceanic regions which have been more intensively sampled. The increased diversity within the area has been attributed to the overlap of ancient and extensive Indo-west Pacific and temperate Australasian fauna (Williams et al. 2001).

10.1.26 Albany Canyons Group and Adjacent Shelf Break

The Albany Canyons group and adjacent shelf break is located along a 700 km extent ranging from Cape Leeuwin to the east of Esperance and consists of 32 deep canyons which cut into the continental slope. Sonar surveys have indicated that individual canyons can extent up to 90 km long at water depths of 2,000 m. The canyons can start at the uppermost continental slope and reach the lowermost slope and extend onto the abyssal plain (Exon *et al.* 2005).

Due to close spacing of the numerous canyons, a wide range of depth dependent benthic habitats are connected increasing the habitat heterogeneity along the south western Australian continental margin. Offshore transport increases the sediment load and organic material is received from productive shelf waters. The closely spaced canyons have the potential to allow increased amounts of organic matter to reach the abyssal plain which may increase biodiversity in comparison to other areas within the south west Marine Region. (Richardson e*t al.* 2005).

According to DSEWPaC (2012), the Albany Canyons group and adjacent shelf break is regionally important and recognised as a key ecological feature for its high productivity, aggregations of marine life, and as a unique seafloor feature with ecological properties of regional significance (Pattiaratchi 2007). Both benthic and demersal habitats within the feature are of conservation value. The canyons are known to be a feeding area for the sperm whale (Bannister *et al.* 1996) and sites of orange roughy aggregations (Caton & McLoughlin 2004).

10.1.27 Carbonate Bank and Terrace System of the Van Diemen Rise

The bank and terrace system of the Van Diemen Rise covers approximately 31,278 km^2 and forms part of the larger system associated with the Sahul Banks to the north and Londonderry Rise to the east. 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 variability in water depth and substrate composition across the feature may 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 cannels and valleys, and 63% of the terrace found across the North Marine Region. The carbonate banks and shoals rise from depths of 100 m- 200 m to withing 10 m -40 m of the sea surface (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 hole/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 distinct gene pool of gold band snapper are found in the Van Diemen Rise.

10.1.28 Gulf of Carpentaria Basin

The Gulf of Carpentaria basin is defined as a key ecological feature for its regional importance for biodiversity, endemism and aggregations of marine life. These values apply to both the benthic and the pelagic habitats within the feature.

The Gulf of Carpentaria is believed to be one of the few remaining near-pristine marine environments in the world (Wightman et al. 2004). Primary productivity in the 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 (Smith et al. 2006). The Gulf is also an important migratory route for seabirds, shore birds and marine turtles.

10.1.29 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 strong influence (DEWHA, 2007).

The physical characteristics of the Shelf Break and Slope of the Arafura Shelf 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 (DEWHA, 2007). Records show approximately 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 (DEWHA, 2008a).

10.1.30 Tributary Canyons of the Arafura Depression

The Tributary Canyons of the Arafura Depression is an important ecological feature characterised by high nutrients from upwellings of deep ocean water, which enhance productivity of the area (DEWHA, 2008a). 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).

Surveys of the area identified around 245 macroscopic species including a variety of invertebrates and six small fish species (Wilson, 2005). The area also contains coral communities and attract aggregations of marine life (DEWHA, 2008a). Larger species found at this key ecological feature include predatory fish, whale sharks, sawfish and marine turtles (mostly olive ridley) (DEWHA, 2008a).

The national and/or regional importance of the Tributary Canyons of the Arafura Depression is associated with its high productivity, high levels of biodiversity and endemism.

11. State Marine Conservation Reserves

11.1 Introduction

Marine parks and reserves have been progressively established in Western Australia since 1987 and the Northern Territory since 1983. The Conservation and Parks Commission (CPC) is the vesting authority for marine parks and reserves under the provisions of the *Conservation and Land Management Act 1984*. Parks and Wildlife, within the Department of Biodiversity, Conservation and Attractions (DBCA), is responsible for day to day management of the parks.

There are three categories of state marine conservation reserves: marine parks; marine management areas; and marine nature reserves.

Marine parks are created to protect natural features and aesthetic values while allowing recreational and commercial uses that do not compromise conservation values. There are currently 25 marine parks within the combined EMBA (refer Figure 9-2, Figure 9-3 Figure 9-4 and Figure 9-4).

Marine parks are multiple-use reserves that cater for a wide range of activities. Within marine parks there may be four types of management zones: recreation zones: general use zones; no-take areas known as sanctuary zones; and special purpose zones.

Each marine park has a ‘management plan’ that contains strategies to protect the high value assets in the park, as well as permitted activities tables. These tables provide explicit regulatory management.

Sanctuary zones are ‘no-take' areas created primarily for conservation and scientific research and are designed to protect a particular significant ecosystem or habitat. Low-impact tourism may be permitted, but no recreational or commercial fishing, aquaculture, pearling, petroleum drilling or production is allowed.

Marine management areas provide an integrated management structure over areas that have high conservation value and intensive multiple-use. There are two marine management areas within the combined EMBA (described below).

There is currently only one state marine nature reserve: Hamelin Pool Nature Reserve part of the Shark Bay World Heritage Area (Section 9.1.1).

Within the NT component of the combined EMBA, there are no marine based conservation reserves. There were three coastal reserves (Channel Point Coastal Reserve, Casuarina Coastal Reserve and Shoal Bay Coastal Reserve), one conservation area (Tree Point Conservation Area) and two national parks (Djukbinj National Park Garig Gunak Barlu National Park) identified in the PMST report as being situated adjacent to the combined EMBA. Three more were identified as being present (Mary River National Park, Keep River National Park, Charles Darwin National Park) in the combined EMBA from mapping. However, these are all terrestrial based reserves and have not been discussed in further detail.

11.1.1 Ngari Capes Marine Park

The Ngari Capes Marine Park is gazetted as a Class A Marine Park. The park is located off the southwest coast of Western Australia, approximately 250 km south of Perth, covering approximately 123,790 ha. The seaward boundary of the marine park is congruent with the seaward limit of Western Australian waters (three nautical miles from the territorial baseline). The north-eastern boundary in Geographe Bay is located near the intersection of the Shire of Busselton boundary with the coastline. The Shire of Busselton–Shire of Capel boundary is approximately 30 m north-east of the marine park boundary, while the south-eastern boundary in Flinders Bay is located at 115°17’00” E. The marine park consists of four areas that are representative of the Leeuwin–Naturaliste marine bioregion: Geographe Bay; Cape Naturaliste to Cape Mentelle coast; the

Cape Mentelle to Cape Leeuwin coast; and Flinders Bay. These areas show distinct differences in geomorphology, oceanography, habitats and flora and fauna.

The Ngari Capes Marine Park was identified as one of the most diverse temperate marine environments in Australia. Warm, tropical waters of the Leeuwin Current mix with the cool waters of the Capes Current, resulting in high finfish diversity, including tropical and temperate species (see fish in Section 5.1.1) and internationally significant seagrass diversity with seagrasses occurring at depths greater than 40 m (see seagrasses in Section 3.2). The marine park also surrounds a number of islands that are important seabird nesting habitat and pinniped haul-outs (places where seals and sea lions leave the water and come onto land), including Hamelin Island, Sugarloaf Rock and the Saint Alouarn Islands which include Flinders Island, Seal Island and Square Rock (DEC 2013). These islands are vested with the Conservation Commission as nature reserve and are managed by DBCA for the purpose of conservation. The marine park is also adjacent to the Leeuwin Naturaliste National Park which extends to the high water mark (DEC 2013).

The Ngari Capes marine park was also created for its high social values. The unique geographical location of this region exposes it to large, uninterrupted ocean swells and results in the South West capes area being recognised as one of the world's premier surfing regions. Many activities occurring in the region are marine based, including commercial and recreational fishing, swimming, surfing, diving, snorkelling, boating, and marine nature-based tourism.

11.1.2 Jurien Bay Marine Park

The Jurien Bay Marine Park is a Class A marine park located on the central west coast of Western Australia about 200 km north of Perth and covers an area of 82,375 ha (CALM 2005b). Its western boundary is the seaward limit of Western Australian coastal waters. Its northern boundary is the northern point of Dynamite Bay at Green Head (30° 4' 7.9" South), and its southern boundary is located just south of Wedge (30° 50' 20" South) and is contiguous with the southern boundary of the Wanagarren Nature Reserve.

Jurien Bay Marine Park is considered to be broadly representative of the Central West Coast limestone reef system, which is a major marine ecosystem within this bioregion. The marine biota of the area consists of an unusual mix of tropical and temperate species as well as many endemic species (Larkum & Hartog, 1989). The Marine Park is dominated by five major marine habitat types: seagrass meadows; bare or sparsely vegetated mobile sand; shoreline and offshore intertidal reef platforms; subtidal limestone reefs; and reef pavement (CALM 2005b). Marine wildlife includes 14 species of cetaceans, a variety of sea and shorebirds which nest on the islands and the Australian sea lion (North Fisherman Island to the north of Jurien Bay is one of the main breeding sites for sea lions in the Central West Coast region and it is believed this breeding population is genetically distinct from the southern coast population – Gales et al. 1992). Commercial fishing for western rock lobster as well commercial wetlining, abalone, shark netting, beach seining for mullet and collecting of specimen shells and aquarium fish are carried out within the marine park.

11.1.3 Shark Bay Marine Park and Hamelin Pool Marine Nature Reserve

The Shark Bay Marine Reserves comprise the Shark Bay Marine Park and the Hamelin Pool Marine Nature Reserve. The Shark Bay Marine Park was gazetted on 30 November 1990 as A Class Marine Park Reserve No. 7 and vested in the National Park and Nature Conservation Authority (NPNCA) under the CALM Act. The marine park encompasses an area of 748,725 ha (CALM 1996).

The Bay is located near the northern limit of a transition region between temperate and tropical marine fauna. Of the 323 fish species recorded from Shark Bay, 83% are tropical species with 11% warm temperate and 6% cool temperate species. Similarly, of the 218 species of bivalves recorded in Shark Bay, 75% have a tropical range and 10% a southern Australian range, with 15% being endemic to the west coast (CALM 1996).

Key features of Shark Bay Marine Park include (CALM 1996, DSEWPaC 2013b):

- 12 species of seagrass making it one of the most diverse seagrass assemblages in the world;
- Seagrass that covers over 4,000 km^2 of the bay. The 1,030 km^2 Wooramel Seagrass Bank is the largest structure of its type in the world;
- An estimated population of about 11,000 dugongs, one of the largest populations in the world;
- Humpback and southern right whales use the bay as a migratory staging post;
- Bottlenose dolphins occur in the bay, and green turtle and loggerhead turtle nest on the beaches;
- Large numbers of sharks including whaler, tiger shark and hammerhead are present as well as an abundant population of rays, including the manta ray;
- Hamelin Pool in Shark Bay contains the most diverse and abundant examples of stromatolite forms in the world, representative of life-forms which lived some 3,500 million years ago; and
- Shark Bay Marine Park does not cover Bernier and Dorre Islands and only coastal waters inshore of Dirk Hartog Island (east of eastern shoreline).

Shark Bay was included on the World Heritage List in 1991 primarily on the basis of three natural features: vast seagrass beds; dugong population; and stromatolites (microbial colonies that form hard, dome-shaped deposits and are among the oldest forms of life on Earth) (DSEWPaC 2013b; see Section 9.1).

There is no zoning within the Hamelin Pool Marine Nature Reserve. This area is a 'look but don't take' area managed solely for the conservation of globally outstanding marine life. Hamelin Pool is one of only two known places in the world with living examples of marine stromatolites (DEC 2010). The shores of Hamelin Pool are also important for the formation of extensive marine algal mats formed by microbial algae. If damaged, the mats and stromatolites can take many hundreds of years to recover (DEC 2010).

11.1.4 Ningaloo Marine Park

The Ningaloo Marine Park was declared in May 1987 under the National Parks and Wildlife Conservation Act 1975 (Commonwealth). The Ningaloo Coast, incorporating both key marine and terrestrial values was later granted World Heritage Status in June 2011. In November 2012, the Ningaloo Marine Park (Commonwealth Waters) was renamed to be incorporated in the North-west Commonwealth Marine Reserves Network. The park covers an area of 263,343 km^2, including both State and Commonwealth waters, extending 25 km offshore.

The park protects a large portion of Ningaloo Reef, which stretches over 300 km from North West Cape south to Red Bluff. It is the largest fringing coral reef in Australia, forming a discontinuous barrier that encloses a lagoon that varies in width from 200 m to 7 km. Gaps that regularly intercept the main reef line provide channels for water exchange with deeper, cooler waters (CALM 2005). The Ningaloo Marine Park forms the backbone of the nature-based tourism industry, and recreational activities in the Exmouth region. Seasonal aggregations of whale sharks, manta rays, sea turtles and whales, as well as the annual mass spawning of coral attract large numbers of visitors to Ningaloo each year (CALM 2005).

The reef is composed of partially dissected basement platform of Pleistocene marine or Aeolian sediments or tertiary limestone, covered by a thin layer of living or dead coral or macroalgae. Key features that characterise the Ningaloo Reef include (CALM 2005):

- Over 217 species of coral (representing 54 genera);

- Over 600 species of mollusc (clams, oysters, octopus, cuttlefish, snails);
- Over 460 species of fish;
- Ninety-seven species of echinoderms (sea stars, sea urchins, sea cucumbers);
- Habitat for numerous threatened species, including whales, dugong, whale sharks and turtles; and
- Habitat for over 25 species of migratory wading birds listed in CAMBA and JAMBA.

11.1.5 Muiron Islands Marine Management Area

The Ningaloo Marine Park Management Plan (CALM 2005) created a MMA for the Muiron Islands, immediately adjacent to the northern end of the Park. This is managed as an integrated area together with the Ningaloo Marine Park, but its status as a MMA means that some activities, including oil and gas exploration, are still permitted under a strict environmental assessment process involving DMIRS.

The Muiron Islands, located 15 km northeast of the North West Cape, comprise the North and South Muiron Islands and cover an area of 1,400 ha (AHC 2006). They are low limestone islands (maximum height of 18 m above sea level (ASL)) with some areas of sandy beaches, macroalgae and seagrass beds in the shallow waters (particularly on the eastern sides) and coral reef up to depths of 5m, which surrounds both sides of South Muiron Island and the eastern side of North Muiron Island. The Muiron Islands MMA was WA's first MMA, gazetted in November 2004. It covers an area of 28,616 ha and occurs entirely within state waters (CALM 2005).

11.1.6 Barrow Island Marine Park

The Barrow Island Marine Park covers 4,169 ha, all of which is zoned as sanctuary zone (the Western Barrow Island Sanctuary Zone) (DEC 2007). It includes Biggada Reef, an ecologically significant fringing reef, and Turtle Bay, an important turtle aggregation and breeding area (DEC 2007). Representative areas of seagrass, macroalgal and deep water habitat are also represented within the marine park (DEC 2007). Passive recreational activities (such as snorkelling, diving and boating) are permitted but extractive activities such as fishing and hunting are not.

11.1.7 Barrow Island Marine Management Area

The Barrow Island Marine Management Area (MMA) is the largest reserve within the Montebello/ Barrow Islands marine conservation reserves, covering 114,693 ha (DEC 2007). The MMA includes most of the waters around Barrow Island, the Lowendal Islands and the Barrow Island Marine Park, with the exclusion of the port areas of Barrow Island and Varanus Island.

The MMA is not zoned apart from one specific management zone: the Bandicoot Bay Conservation Area. This conservation area is on the southern coast of Barrow Island and has been created to protect benthic fauna and seabirds. It includes the largest intertidal sand/mudflat community in the reserves, is known to be high in invertebrate diversity and is an important feeding area for migratory birds.

As for the other reserves in the Montebello/Barrow Islands marine conservation reserves, the Barrow Island MMA includes significant breeding and nesting areas for marine turtles and the waters support a diversity of tropical marine fauna, important coral reefs and unique mangrove communities (DEC 2007). Green, hawksbill and flatback turtles regularly use the island's beaches for breeding, and loggerhead turtles are also occasionally sighted.

11.1.8 Montebello Islands Marine Park

Montebello/ Barrow/ Lowendal Islands are part of a shallow submarine ridge, which extends north from the mainland near Onslow. The ridge contains extensive areas of intertidal and shallow subtidal limestone pavement surrounding the numerous, mostly small islands which are found in the region. The seabed is generally less than 5 m deep and consists of sand veneered limestone pavement with patches of fringing coral reef (DEC 2007).

The island chain lies entirely within WA State waters, with the State-Commonwealth boundary extending out to encompass the islands and waters 3 nm west of Barrow Island and north of the Montebello Islands. These islands are protected within as marine conservation reserves: Montebello Islands Marine Park, Barrow Islands Marine Park and Barrow Island Marine Management Area.

The Montebello Islands Marine Park (58,331 ha) consists of two sanctuary zones, two recreation zones, one special purpose zone for benthic protection, eleven special purpose zones for pearling and general use zones.

The Montebello Islands comprise over 100 islands, the majority of which are rocky outcrops; rocky shore accounts for 81% of shoreline habitat (DEC 2007a).

The ecological and conservation values of the Montebello and Barrow Islands Marine Conservation Reserve (MCR) include important habitats including corals reefs and bommies, mangroves, seagrass and macroalgae meadows, rocky shorelines and hard substrate, intertidal sand and mudflat communities. These habitats provide protection, food and habitat for a large diversity of species, including dugongs, turtles, whales, other protected cetaceans and birds as well as sea snakes and fish. The area is considered to have a high biodiversity. The islands also provide feeding and resting areas for migrating shorebirds and seabird nesting areas.

Socio-economic values of the Montebello and Barrow Islands MCR include hydrocarbon exploration and production, pearling, nature-based tourism, commercial and recreational fishing, water sports, European history and maritime heritage and scientific research (DEC 2007)

Special purpose zones for pearling are established for the existing leaseholder to allow pearling to be the priority use of these areas (DEC 2007a). Commercial fishing includes a trap fishery for reef fishes, mainly in water depths of 30–100 m, and wet lining for reef fish and mackerel. Fish trawling also occurs in the waters near to the Montebello Islands. A tourist houseboat operates out of Claret Bay, at the southern end of Hermite Island, during the winter months. The Montebello Islands are becoming more frequently used by recreational boaters for camping, fishing and diving activities.

11.1.9 Rowley Shoals Marine Park

The Rowley Shoals (including the Commonwealth-managed Mermaid Reef Marine National Nature Reserve) are located approximately 300 km west-northwest of Broome, lying between 17°07'S, 119°36'E and 17°35'S, 118°56'E and encompassing approximately 87,674 ha (DEC 2007b).

The Rowley Shoals is ecologically significant in that the reefs form part of a series of important ecological "stepping stones" for a range of reef biota originating in Indonesian/west Pacific waters. Their position off the north-west Australian coast, an area of few offshore reef systems, provides an important upstream source for recruitment to reefs further south (DEC 2007b). Marine wildlife includes 184 species of corals, primarily Indo-West Pacific species, indicating the strong affinity of the Rowley Shoals communities with Indonesia. In terms of other species, at least 264 species of molluscs, 82 species of echinoderms and 389 species of finfish were also identified (DEC 2007b). The faunal assemblages of the Rowley Shoals Marine Park are regionally significant as they contain large numbers of species not found in the more turbid coastal environments of tropical Western Australia (DEC 2007b). There is a relatively low level of recreational and commercial activity, mostly atribuated to the remoteness of the Shoals with access difficult from both Indonesia and mainland Australia (DEC 2007b).

11.1.10 Lalang-garram/Camden Sound Marine Parks

The Lalang-garram/Camden Sound Marine Park was created on 19 June 2012 under Section 13 of the Conservation and Land Management Act 1984 (CALM Act). It is a multiple zone marine park that includes; Sanctuary, Special Purpose, and General Use zones (DPaW 2013). The marine park falls within the west Kimberley, which was recently added to the Australian National Heritage List because of its natural, indigenous and historic values to the nation.

The marine park is located about 150 km north of Derby (or 300 km north of Broome) and lies within the traditional country of three Aboriginal native title groups. The Dambimangari people's determination overlies the majority of the marine park. A section of the Wunambal Gaambera people's Uunguu determination includes a small portion of St George Basin, while a small section of the Mayala people's claim (native title not determined at the time of writing of Management Plan) overlies the southwest corner of the marine park (DPaW 2013).

The marine park covers an area of approximately 705,000 ha. It recognises and provides special management arrangements for this area of the Kimberley, which is a principal calving habitat of the humpback whale (*Megaptera novaeangliae*) population that migrates annually along Western Australia's coast. The marine park also conserves a range of species listed as having special conservation status including marine turtles, snubfin and Indo-Pacific humpback dolphins, dugong, saltwater crocodiles, and several species of sawfish. The park also includes a wide range of marine habitats and associated marine life, such as coral reef communities, rocky shoals, and the extensive mangrove forests and marine life of the St George Basin and Prince Regent River (DPaW 2013).

11.1.11 Marmion Marine Park

Marmion Marine Park was Western Australia's first marine park, declared in 1987 and is a multi-use reserve (CALM 2002). Marmion Marine Park is located offshore from Perth's northern suburbs, between Trigg Island and Burns Beach.

Habitats in the area include intertidal reef platforms, coastal sand beaches, a high limestone reef about 1 km from shore, Little Island and the Three Mile Reef system. Of note are complex assemblages of sea floor communities, including seagrass meadows, algal limestone pavement communities and crevice animal associations (CALM 2002).

The marine park provides an important habitat for marine mammals, such as sea lions, dolphins and whales. The island nature reserves within Marmion Marine Park provide an important habitat for several species of seabirds and haul-out areas for Australian sea lions, especially at Little Island and Burns Rocks (CALM 2002).

11.1.12 Swan Estuary Marine Park

The Swan Estuary Marine Park (A Class marine reserve number 4) was gazetted on 25 May 1990. The Swan Estuary Marine Park and Adjacent Nature Reserves Management Plan 1999-2009 was gazetted 7 April 2000 (CALM 1999).

The Swan Estuary Marine Park encompasses Alfred Cove, 200 ha adjacent to the suburbs of Attadale and Applecross; Pelican Point, a 45 ha area in Crawley; and Milyu, 95 ha adjacent to the Como foreshore (CALM 1999). All three localities are within 20 minutes of the Perth CBD.

These areas encompass mudflats, seagrass beds and intertidal vegetation such as sedges and saltmarsh, which provide many different habitats for a host of animals. The most important of these, due to their international significance, are the migratory wading birds. They come from as far afield as Asia, Mongolia and Siberia. About 33 of these species are protected, including the red-necked stint (CALM 1999).

11.1.13 Shoalwater Islands Marine Park

The Shoalwater Islands Marine Park is located within the Perth metropolitan area, adjacent to the city of Rockingham and was gazetted in 1990 (DEC 2007). There are three sanctuary zones, two special purpose zones and a large general use zone in the park.

The Shoalwater Island region is dominated by beach and rocky shore shoreline habitats. The many jagged edged islands and rocky islets of the marine park provide important roosting and nesting areas for numerous bird species. The marine park has some of the healthiest seagrass meadows in the Perth metropolitan area, consisting of long lived species such as *Posidonia* spp. and *Amphibolis* spp. Seagrass meadows provide an important habitat and nursery area for a large number of marine species such as fish, rock lobsters, worms, shellfish, crustaceans, fish sharks and rays (DEC 2007).

The habitats of the marine park are important for the feeding, resting and breeding of little penguins and other sea and shore birds. Penguin Island which is found within the marine park has the largest breeding colony of little penguin on the west coast of Australia (DEC 2007). The bottlenose dolphin is the most common marine mammal, and Australian sea lions are commonly seen throughout the park.

11.1.14 Eighty Mile Beach Marine Park

The Eighty Mile Beach Marine Park, located between Port Hedland and Broome, was gazetted on 29 January 2013. It covers an area of approximately 200,000 ha stretching for some 220 km from Cape Missiessy to Cape Keraudren, and includes sanctuary, recreation, general use and special purpose zones. The park is managed under the Eighty Mile Beach Marine Park Management Plan 2014-20124 (DPaW, 2014).

The listed ecological values of the Eighty Mile Beach Marine Park include the high sediment and water quality, the juxtaposition of the beach, coastal topography and seabed and the diverse and ecologically important habitats and marine/coastal flora and fauna. The listed habitat values of the marine park are as follows:

+ The intertidal sand and mudflat communities supporting a high abundance and diversity of invertebrate life and providing a valuable food source for shorebirds (including migratory species) and other fauna;
+ The diverse subtidal filter-feeding communities;
+ Macroalgal and seagrass communities providing habitat and feeding opportunities for fish, invertebrates and dugongs;
+ High diversity intertidal and subtidal coral reef communities; and
+ Mangrove communities and adjacent saltmarshes provide nutrients to the surrounding waters and habitat for fish and invertebrates.

The listed marine and coastal fauna values are as follows:

+ A high diversity and abundance of nationally and internationally important shorebirds and waders (including migratory species) are found in the marine park;
+ Flatback turtles are endemic to northern Australia and nest at Eighty Mile Beach;

- Dugongs and several whale and dolphin species inhabit or migrate through the marine park;
- A highly diverse marine invertebrate fauna provides an important food source for a variety of animals, including birds, fish and turtles, along with recreational and commercial fishing opportunities;
- A diversity of fish species provides recreational and commercial fishing opportunities; and
- A diversity of sharks and rays, including several protected species, are found in the park.

In addition to these natural values, the marine park contains land and sea important to traditional Indigenous owners through identity and place, family networks, spiritual practice and resource gathering. The marine park also has a history of European activity including exploration, pastoralism and commercial fishing (e.g. the pearl oyster fishery). The park contains a historical WWII plane wreck (*Dornier Do-24 X-36*) and shipwrecks (two pearl luggers). The marine park provides tourism opportunity and recreational value through its remoteness, diversity and abundance of habitats and marine fauna and the pristine nature of the marine and coastal environment.

The marine park contains vast intertidal sand and mudflats that extend up to 4 km wide at low tide and provide a rich source of food for many species. Eighty Mile Beach Marine Park is one of the world's most important feeding grounds for small wading birds that migrate to the area each summer, travelling from countries thousands of kilometres away (DPaW 2014) (see Section 9.2.1).

11.1.15 Lalang-garram/ Horizontal Falls and North Lalang-garram Marine Parks

The Lalang-garram/ Horizontal Falls and North Lalang-garram Marine Parks were established in 2016 under the State Government's *Kimberley Science and Conservation Strategy* and are jointly managed by Dambimangari Traditional Owners and the Department of Parks and Wildlife (DPaW 2016). The marine parks fall within the west Kimberly region, included in the Australian National Heritage List for its nationally significant natural, indigenous and historic values (DoEE 2019c).

The Lalang-garram/ Horizontal Falls Marine Park extends from Talbot Bay (*Ganbadba*) in the west to Walcott Inlet (*Iledda*) and Glenelg River (*Molor Moloiyn*) in the east and covers approximately 353,000 ha (DPaW 2016). The marine park protects the internationally recognised Horizontal Falls and is important for the region's tourism. The North Lalang-garram Marine Park lies between the Lalang-garram / Camden Sound and North Kimberley Marine Parks and covers approximately 110,000 ha (DPaW 2016).

The area's large tidal range results in extensive intertidal areas with diverse ecosystems such as fringing coral reefs, mangroves and mudflat communities. Subtidal habitats and communities common to the marine parks include filter feeding communities of sponges and hard and soft corals. These intertidal and subtidal habitats provide critical foraging and nursery areas for dugong, marine turtles, estuarine crocodiles, snubfin and Indo-Pacific humpback dolphins, several species of sawfish and migratory seabirds. The marine parks are also a principal calving habitat for humpback whales (DPaW 2016).

11.1.16 North Kimberley Marine Park

The North Kimberley Marine Park was established in December 2016 as a Class A marine park under the CPC (DPaW 2016a). The marine park comprises four separate management areas including, Uunguu, Balanggarra, Miriuwung Gajerrong, and Wilinggin. It is a multiple zone marine park that includes: eight sanctuary zones, nine special purpose zones (recreation and conservation), two special use zone (cultural heritage), and general use areas (DPaW 2016a). The marine park is managed in accordance with the provisions of the CALM Act with joint management between the Department of Parks and Wildlife and Traditional Owners of the area.

The area within the marine park is recognised for its Aboriginal cultural and heritage values, natural values including coral reefs, marine turtle species, dugongs, seagrass and macroalgal communities, mangroves and saltmarshes, finfish, and water and sediment quality, as well as for its social values (i.e. recreation, tourism and community values) and commercial values and resource use (e.g. commercial fishing). The marine park lies within the Indian Ocean and Timor Sea of Western Australia's Kimberley region, covering an area of approximately 1,845,000 hectares (DPaW 2016a). The south-western boundary is approximately 270 km northeast of Derby.

11.1.17 Yawuru Nagulagun/ Roebuck Bay Marine Park

The Yawuru Nagulagun/Roebuck Bay Marine Park was approved by the State Minister for Environment in October 2016 and declared as a Class A reserve over the subtidal and intertidal areas of Roebuck Bay (excluding the Kimberley Ports Authority waters), (DBCA, 2017a). The Marine Park is managed with a joint management framework between Parks and Wildlife and Yawuru Registered Native Title Body Corporation (RNTBC). The intent is to manage the areas from the offshore waters around Roebuck and Broome, collectively referred to as the Yawuru conservation estate, as one ecological system (DPaW 2016b). The development of the joint management plan is in accordance with the Conservation and Land Management Act 1984 (Yawuru Organisation 2017) as well as contributes to the State Governments commitment under the Kimberly Science and Conservation Strategy, released in June 2011.

The Yawuru people have lived along the foreshores of Roebuck Bay for thousands of years, the Bay is part of the Yawuru traditional estate (DPaW 2016b). Roebuck Bay is an internationally significant Ramsar wetland, declared in 1990, and an important feeding ground for many species of migratory shorebirds. It hosts possibly the greatest diversity of shorebird species at any site across the globe (DBCA 2017b). The Bay has some of the most productive tropical intertidal flats in the world, and is consequently an important ground for Yawuru fishing, hunting and gathering of sea food. The Bay hosts communities of seagrass and macroalgae, providing food for protected species such as the dugong and flatback turtle. Marine mammals also pass through the waters of the Bay such as the Australian snubfin dolphin and the humpback dolphin, the humpback whale can also be found during annual migration (DPaW 2016b).

11.1.18 Bardi Jawa Gaarra Marine Park

As part of a network of marine protected areas in state waters, DBCA has established the Bardi Jawa Gaarra Marine Park Joint Management Plan 2022 (DBCA, 2022). This plan is intended to guide management of the park for ten years, or until a new plan is developed. The plan was jointly developed, and will be jointly implemented, by DBCA and the Bardi and Jawi traditional owners. The plan is expected to come into effect in 2024, with approximately 204,000 hectares of protected area. The park forms part of a network of marine protected areas in state waters along the Kimberley coast.

The Bardi Jawa Gaarra Marine Park contains important cultural values for the Bardi and Jawi traditional owners, including hunting and fishing, cultural activities and business. The Bardi Jawa Gaarra Marine Park Joint Management Plan 2022 (DBCA, 2022) recognises the importance of these values, and includes relevant key performance indicators:

- Relationship to country
- Looking after country
- Language and traditional knowledge
- Enjoyment of country and customary activities

These cultural values are dependent on the physical and biological characteristics of the park.

The physical setting for the Bardi Jawa Gaarra Marine Park is in coastal waters, where there is a large tidal range. The climate is tropical, with wet and dry seasons. Most rainfall occurs during the wet season. Water and sediment quality is expected to be high due to a lack of industrial activity within the park. Habitats within the park include (DBCA, 2022):

+ coral and reef communities
+ mangroves, creeks, and saltmarsh communities
+ seagrass and macroalgal communities
+ subtidal filter-feeding communities
+ intertidal sand and mud flat communities and freshwaters soaks

The Bardi Jawa Gaarra Marine Park hosts a range of biological values, including (DBCA, 2022):

+ marine turtles
+ fish, sharks and rays
+ dugongs
+ whales and dolphins
+ estuarine crocodiles
+ seabirds and shorebirds
+ invertebrates

Other activities that occur within the Bardi Jawa Gaarra Marine Park include research, recreational and commercial fishing, pearl aquaculture, and research.

11.1.19 Mayala Marine Park

The Mayala Marine Park is a component of the network of marine protected areas in state waters along the Kimberley coastline,and lies adjacent to the Bardi Jawa Gaarra Marine Park described above. The park is not yet gazetted, nor has a management plan been finalised. The Proposed Mayala Marine Park Indicative Joint Management Plan (DBCA, 2020) was published for public comment in 2020, and the park is expected to be gazetted by 2024. The park will be jointly managed by the Mayala traditional owners and DBCA.

The Mayala Marine Park contains important cultural values for the Mayala traditional owners, including hunting and fishing, cultural activities and sites of cultural and spiritual importance. The *Proposed Mayala Marine Park Indicative Joint Management Plan* (DBCA, 2020) recognises the importance of these values, and proposes the following strategic objectives:

+ Relationship to country
+ Looking after country
+ Language and traditional knowledge
+ Enjoyment of country and customary activities

The Mayala Marine Park contains a range of physical and biological environmental values. The *Proposed Mayala Marine Park Indicative Joint Management Plan* (DBCA, 2020) identifies the same physical and biological environmental values as described above for the Bardi Jawa Gaarra Marine Park (refer to Section 11.1.18).

11.1.20 Lalang-gaddam Marine Park

The Lalang-gaddam Marine Park is an amalgamation of the Lalang-garram / Camden Sound, Lalang-garram / Horizontal Fall and the North Lalang-garram Marine Park, and the proposed Maiyalam Marine Park. The *Lalang-gaddam amended Joint Management Plan for the Lalang-garram / Camden Sound, Lalang-garram / Horizontal Falls and North Lalang-garram Marine Parks and Indicative Joint Management Plan for the Proposed Maiyalam Marine Park* (DBCA, 2020) states the amalgamation is intended to:

- Provide clearer direction for joint management and governance outcomes
- Aid in communication and engagement with the Dambeemangardee Community and other park users

The amendment to the plan is expected to come into effect in 2024 and is intended to be in effect for 10 years. The strategic objective of the amendment is to protect and conserve the value of the land for the culture and heritage of Dambeemangardee people.

The *Lalang-gaddam amended Joint Management Plan for the Lalang-garram / Camden Sound, Lalang-garram / Horizontal Falls and North Lalang-garram Marine Parks and Indicative Joint Management Plan for the Proposed Maiyalam Marine Park* (DBCA, 2020) states the following key performance indicators:

- Cultural connection and cultural laws and protocols
- Looking after country
- Traditional knowledge and language
- Customary use

The Lalang-gaddam Marine Park has a range of physical and biological environmental values. The *Lalang-gaddam amended Joint Management Plan for the Lalang-garram / Camden Sound, Lalang-garram / Horizontal Falls and North Lalang-garram Marine Parks and Indicative Joint Management Plan for the Proposed Maiyalam Marine Park* (DBCA, 2020) identifies the same physical and biological environmental values as described above for the Lalang-gaddam Marine Park (refer to Section 11.1.18). The plan also recognises tourism, recreational fishing, commercial fishing and aquaculture as important values within the park, which are also identified as sources of risk that require management.

12. Australian Marine Parks

12.1 Introduction

In agreement with the States and NT governments, the Australian Commonwealth government was committed to establish Commonwealth marine parks as a component of the National Representative System of Marine Protected Areas (DoE 2014) (See Figure 9-2, Figure 9-3 and Figure 9-4). 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 (Director of National Parks 2012a). 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 South-east network 10-year Management Plan came into effect on 1 July 2013. The remaining networks 10-year Management Plans were approved and came into effect on 1 July 2018.

The new management plans establish the management and zoning of the designated marine parks. The marine park networks pertinent to the combined EMBA include:

+ The South-West Marine Parks Network;
+ The North-West Marine Parks Network; and
+ The North Marine Parks Network.

The South-West Marine Parks Network comprises 14 marine parks. Seven of these occur in West Australian waters in the combined EMBA, including:

+ Abrolhos Commonwealth Marine Park;
+ Jurien Marine Park;
+ Two Rocks Marine Park;
+ Perth Canyon Marine Park;
+ Geographe Marine Park;
+ South-west Corner Marine Park; and
+ Bremer Marine Park
+ Eastern Recherche Marine Park

The North-West Marine Parks Network comprises 13 marine parks which all occur in West Australian waters pertinent to the combined EMBA:

+ Carnarvon Canyon Marine Park;
+ Shark Bay Marine Park;
+ Gascoyne Marine Park;
+ Ningaloo Marine Park;
+ Montebello Marine Park;
+ Dampier Marine Park;
+ Eighty Mile Beach Marine Park;

- Argo-Rowley Terrace Marine Park;
- Mermaid Reef Marine Park;
- Roebuck Marine Park;
- Kimberley Marine Park;
- Ashmore Reef Marine Park; and
- Cartier Island Marine Park.

The Northern Marine Parks Network comprises eight marine parks. Four of these occur in Western Australian or Northern Territory waters within the combined EMBA:

- Oceanic Shoals Marine Park;
- Arafura Marine Park;
- Arnhem Marine Park; and
- Joseph Bonaparte Gulf Marine Park.

the combined EMBAThe sizes of these marine parks range from 300—152,000 km^2, and the water depths within the marine parks vary from approximately 15—1,500 m deep. The EPBC Act requires that each management plan assign an International Union for the Conservation of Nature (IUCN) category to each marine park. Additionally, the Act also allows for the management plan to divide a marine park into zones and to assign a category to each zone, which may differ from the overall category of the marine park. Zoning considers the purposes for which the marine parks were declared, the objectives of the relevant management plans, the values of the marine park and requirements of the EPBC Act and EPBC Regulations.

the combined EMBAThe North-West Marine Parks Network includes six different types of zoning:

- Sanctuary Zone (IUCN Category Ia);
- National Park Zone (IUCN Category II);
- Recreational Use Zone (IUCN Category IV);
- Habitat Protection Zone (IUCN Category IV);
- Multiple Use Zone (IUCN Category VI); and
- Special Purpose Zone (Trawl) (VI).

The South-west Marin Parks Network includes six different types of zoning:

- National Park Zone (IUCN Category II);
- Habitat Protection Zone (IUCN Category IV);
- Multiple Use Zone (IUCN Category VI);
- Special Purpose Zone (Mining Exclusion) (IUCN Category VI);
- Special Purpose Zone (IUCN Category VI); and
- Special Purpose Zone (Trawl) (IUCN Category VI).

Five types of zones are represented within the North Marine Parks Network:

- National Park Zone (IUCN Category II)

- Habitat protection zone (IUCN Category IV)
- Multiple use zone (IUCN Category VI)
- Special Purpose Zone (Trawl) (IUCN Category VI)
- Special Purpose Zone (IUCN Category VI)

A summary of the South-West, North-West and North Marine Parks Networks is provided in Table 12-1.

12.2 South-West Marine Parks Network

The South-West Commonwealth Marine Parks Network is aligned to the South-West Marine Region. The network covers 508,371 km^2 and includes 14 marine parks (Director of National Parks, 2018a). Broad values of the South-west Australian Marine Parks include:

- Natural values;
- Cultural values;
- Heritage values; and
- Socio-economic values.

Further detail on each of the relevant marine parks those that fall within the combined EMBA is provided below.

12.2.1 Abrolhos Marine Park

The Abrolhos Marine Park (including zones within the combined EMBA: Marine National Park Zone – IUCN Category II-2,548 km^2; Habitat Protection Zone – IUCN Category VI-23,239 km^2; Multiple Use Zone – IUCN Category VI-56,545 km^2; Special Purpose Zone – IUCN Category VI-5,729 km^2) covers an area of approximately 88,060 km^2 and protects the following conservation values (Director of National Parks, 2018a):

- Important foraging areas for the:
  - Threatened Australian lesser noddy;
  - Northernmost breeding colony of the threatened Australian sea lion;
  - Great white sharks; and
  - Migratory common noddy, wedge-tailed shearwater, bridled tern, Caspian tern and roseate tern.
- Important migration habitat for the protected humpback whale and pygmy blue whales;
- The second largest canyon on the west coast, the Houtman Canyon;
- Examples of the northernmost ecosystems of the Central Western Province and South-west Shelf Transition (including the Central West Coast meso-scale bioregion);
- Examples of the deeper ecosystems of the Abrolhos Islands meso-scale bioregion;
- Examples of the shallower, southernmost ecosystems of the Central Western Shelf Province provincial bioregion including the Zuytdorp meso-scale bioregion;
- Examples of the deeper ecosystems of the Central Western Transition provincial bioregion;

- Examples of diversity of seafloor features including: southern most banks and shoals of the North-west region; deep holes and valleys; slope habitats; terrace and shelf environments; and
- Seven KEFs.

The Abrolhos Marine Park is adjacent to the Shark Bay World Heritage Property. The marine park does not contain any Commonwealth or National Heritage listings (Director of National Parks 2018a). The marine park contains 11 known shipwrecks listed under the *Underwater Culture Heritage Act 2018*. Commercial tourism, fishing, recreation and mining are important supported socio-economic activities in the park.

12.2.2 Jurien Marine Park

The Jurien Marine Park (including zones within the combined EMBA): Marine National Park Zone -IUCN Category II – 31 km^2 Special Purpose Zone -IUCN Category VI – 1,820 km^2) covers an area of approximately 1,851 km^2 and protects the following conservation values (Director of National Parks 2018a):

- Important foraging areas for the:
  - Threatened soft-plumaged petrel;
  - Threatened Australian sea lion;
  - Threatened white shark; and
  - Migratory roseate tern, bridled tern, wedge-tailed shearwater, and common noddy.
- Important migration habitat for the protected humpback whale;
- Examples of the ecosystems of two provincial bioregions: the central part of the South-west Shelf Transition (which includes the Central West Coast meso-scale bioregion) and small parts of the Central Western Province;
- Three KEFs; and
- Heritage values represented by the SS Cambewarra and Oleander historic shipwreck.

The Jurien Marine Park does not contain any international, Commonwealth or National Heritage listings (Director of National Parks 2018a). Commercial tourism, fishing, recreation and mining are important supported socio-economic activities in the park.

12.2.3 Two Rocks Marine Park

The Two Rocks Marine Park (including zones within the combined EMBA): Multiple Use Zone - IUCN Category VI – 867 km^2; Marine National Park Zone - IUCN Category II – 15 km^2) covers an area of approximately 882 km^2 and protects the following conservation values (Director of National Parks 2018a):

- Important foraging areas for the:
  - Threatened soft-plumaged petrel;
  - Threatened Australian sea lion; and
  - Migratory roseate tern, bridled tern, Caspian tern, wedge-tailed shearwater, and common noddy.
- Important migratory areas for protected humpback whales and pygmy blue whales;
- Seasonal calving habitat for the threatened southern right whale;

- Examples of the ecosystem of the southernmost parts of the South-west Shelf Transition (including the Central West Coast meso-scale bioregion); and
- Three KEFs.

The Two Rocks Marine Park does not contain any international, Commonwealth or National Heritage listings (Director of National Parks 2018a). Commercial tourism, fishing, recreation and scientific research are important supported socio-economic activities in the park.

12.2.4 Perth Canyon Marine Park

Perth Canyon Marine Park (including zones within the combined EMBA): Marine National Park Zone – IUCN Category II – 1,241 km^2; Habitat Protection Zone – IUCN Category IV –4,352 km^2; Multiple Use Zone – IUCN Category VI – 1,816 km^2) covers an area of approximately 7,409 km^2 and protects the following conservation values (Director of National Parks 2018a):

- Globally important seasonal feeding aggregation for the threatened blue whale;
- Important foraging areas for the:
  - Threatened soft-plumaged petrel;
  - Migratory sperm whale; and
  - Migratory wedge-tailed shearwater.
- Important migratory areas for protected humpback whales and blue whales;
- Seasonal calving habitat for the threatened southern right whale;
- Examples of the ecosystems of the southernmost parts of the Central Western Province and South-west Shelf Transition (including the Central West Coast meso-scale bioregion), and the northernmost parts of the South-west Transition and Southwest Shelf Province (including the Leeuwin-Naturaliste meso-scale bioregion); and
- Four KEFs.

The Perth Canyon Marine Park does not contain any international, Commonwealth or National Heritage listings (Director of National Parks 2018a). Commercial tourism, fishing, shipping, recreation and defence training are important supported socio-economic activities in the park.

12.2.5 Geographe Marine Park

Geographe Marine Park (including zones within the combined EMBA): Marine National Park Zone - IUCN Category II – 15 km^2; Special Purpose Zone - IUCN VI – 650 km^2; Multiple Use Zone - IUCN Category VI – 291 km^2; Habitat Protection Zone (IV) 21 km^2) covers an area of approximately 977 km^2 and protects the following conservation values (Director of National Parks 2018a):

- Important foraging areas for the:
  - Threatened soft-plumaged petrel; and
  - Migratory wedge-tailed shearwater.
- Important pre-migration aggregation area for the migratory flesh-footed shearwater;
- Important migratory habitat for the protected humpback whale and blue whale;
- Seasonal calving habitat for the threatened southern right whale.

- Seasonal calving habitat for the threatened southern right whale.
- Representation of the South-west Shelf Province on the continental shelf as well as the Leeuwin-Naturaliste meso-scale bioregion;
- Two KEFs; and
- Representation of the seagrass habitats of the Geographe Bay key ecological feature, which in this location extend the furthest into Commonwealth waters.

The Geographe Marine Park does not contain any international, Commonwealth or National Heritage listings (Director of National Parks 2018a). The marine park contains eight known shipwrecks listed under the *Underwater Culture Heritage Act 2018.* Commercial tourism, fishing and recreation are important supported socio-economic activities in the park.

12.2.6 South-west Corner Marine Park

The South-west Corner Marine Park (including zones within the combined EMBA: Marine National Park Zone - IUCN II – 54,841 km^2; Multiple Use Zone - IUCN VI –106,602 km^2; Special Purpose Zone (Mining exclusion) - IUCN VI – 9,550 km^2, Special Purpose Zone – IUCN VI – 5753 km^2; Habitat Protection Zone - IUCN IV – 95,088 km2) covers an area of approximately 271,833 km2 within the combined EMBA and protects the following conservation values (Director of National Parks 2018a):

- Important migratory area for protected humpback whales and blue whales;
- Important foraging areas for the:
  - Threatened white shark;
  - Threatened Australian sea lion;
  - Threatened Indian yellow-nosed albatross and soft-plumaged petrel;
  - Sperm whale;
  - Migratory flesh-footed shearwater, short-tailed shearwater and Caspian tern; and
  - Seasonal calving habitat for the threatened southern right whale.
- Representation of three provincial bioregions (the South-west Transition and Southern Province in the off-shelf area, and the South-west Shelf Province on the continental shelf) and two meso-scale bioregions (southern end of the Leeuwin-Naturaliste meso-scale bioregion and western and central parts of the Western Australia South Coast meso-scale bioregion);
- Representation of the Donnelly Banks, east of Augusta, characterised by higher productivity and including nursery habitats; and
- Six KEFs.

The South-west Corner Marine Park does not contain any international, Commonwealth or National Heritage listings (Director of National Parks 2018a). The marine park contains ten known shipwrecks listed under the *Underwater Culture Heritage Act 2018*. Commercial tourism, fishing, shipping and recreation are important supported socio-economic activities in the park.

12.2.7 Bremer Marine Park

The Bremer Marine Park: National Park Zone – IUCN II – 3,172 km^2; Special Purpose Zone (Mining exclusion) - IUCN VI – 1,300 km^2, which covers an area of approximately 4,472 km^2 and protects the following conservation values (Director of National Parks 2018a):

- Contains habitats, species and ecological communities associated with two bioregions: Southern Province and South-west Shelf Province;
- Two key ecological features (Albany Canyon group and adjacent shelf break and ancient coastline between 90 m and 120 m depth);
- Important foraging areas for:
- Threatened white shark;
- Threatened Australian sea lion;
- Threatened Indian yellow-nosed albatross, Australian fairy tern and soft-plumaged petrel; and
- Migratory flesh-footed shearwater, short-tailed shearwater, bridled tern and Caspian tern.
- Important migratory pathway for humpback whales;
- Significant calving habitat for the threatened southern right whale; and
- Important aggregation area for killer whales

The marine park does not contain any international, Commonwealth or National Heritage listings (Director of National Parks 2018a). Commercial tourism, fishing, shipping and recreation are important supported socio-economic activities in the park.

12.2.8 Eastern Recherche Marine Park

The Eastern Recherche Marine Park (Special Use Zone – IUCN Category V) is part of the South-West Marine Park Network. It lies adjacent to the Recherche Archipelago about 135km east of Esperance and includesimportant foraging areas for:

- Threatened white shark;
- Threatened Australian sea lion
- Pygmy blue whales are distributed across the marine park
- Southern right whales migrate through the region to important nursery areas in coastal waters.

The marine park does not contain any international, Commonwealth or National heritage listings (Director of National Parks 2018a) but it is adjacent to the Recherche Archipelago which is home to the only breeding population of great-winged petrels in Australia.

12.3 North-West Marine Park 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 (Director of National Parks, 2018b). Broad values of the North-west Commonwealth Marine Reserves Network include:

- Natural values;
- Cultural values;

- Heritage values; and
- Socio-economic values.

Further detail on each of the relevant marine parks within the combined EMBA is provided below.

12.3.1 Carnarvon Canyon Marine Park

The Carnarvon Canyon Marine Park (Habitat Protection Zone – IUCN Category IV) covers an area of approximately 6,177 km^2 and protects the following conservation values (Director of National Parks 2018b):

- The Carnarvon Canyon a single channel canyon with seabed features that include slope, continental rise and deep holes and valleys;
- The Carnarvon Canyon ranges in depth from 1500 m to over 5,000 m, thereby providing habitat diversity for benthic and demersal species; and
- Central Western Transition provincial bioregion ecosystem examples are found here, which are characteristic of the biogeographic faunal transition between tropical and temperate species.

There is limited information about species' use of this Marine Park (Director of National Parks 2018b). The marine park does not contain any international, Commonwealth or National Heritage listings (Director of National Parks 2018b). Commercial fishing, tourism, shipping and mining are important supported socio-economic activities in the marine park.

12.3.2 Shark Bay Marine Park

The Shark Bay Marine Park (Multiple Use Zone – IUCN Category VI) covers an area of approximately 7,443 km^2 and protects the following conservation values (Director of National Parks 2018b):

- Foraging areas adjacent to important breeding areas for several species of migratory seabirds;
- Part of the migratory pathway of protected humpback whales;
- Internesting habitat for marine turtles;
- Waters that are adjacent to the largest nesting area for loggerhead turtles in Australia;
- Marine park and adjacent coastal areas important for shallow-water snapper;
- Protection to shelf and slope habitats as well as a terrace feature;
- Examples of the shallower ecosystems of the Central Western Shelf Province and Central Western Transition provincial bioregions including the Zuytdorp meso-scale bioregion; and
- Connectivity between the inshore waters of the Shark Bay World Heritage Area and the deeper waters of the area.

Whilst no listed international, Commonwealth or National Heritage places are within the marine park, the park is adjacent to Shark Bay World Heritage Area (Director of National Parks 2018b). Commercial tourism, fishing, mining and recreation are important socio-economic values of the park.

12.3.3 Gascoyne Marine Park

The Gascoyne Marine Park (Multiple Use Zone – IUCN Category VI-33,652 km^2; Habitat Protection Zone – IUCN Category IV-38,982 km^2; Marine National Park Zone – IUCN Category II-9,132 km^2) covers an area of approximately 81,766 km^2 and protects the following conservation values (Director of National Parks 2018a):

+ Important foraging areas for: migratory seabirds threatened and migratory hawksbills and flatback turtles; and vulnerable and migratory whale shark;
+ A continuous connectivity corridor from shallow depths around 15 m out to deep offshore waters on the abyssal plain at over 5,000 m in depth;
+ Seafloor features including canyon, terrace, ridge, knolls, deep hole/valley and continental rise. It also provides protection for sponge gardens in the south of the reserve adjacent to Western Australian coastal waters;
+ Ecosystems examples from the Central Western Shelf Transition, the Central Western Transition and the Northwest province provincial bioregions as well as the Ningaloo meso-scale bioregion;
+ Four KEFs for the region:
  - Canyons on the slope between the Cuvier Abyssal Plain and the Cape Range Peninsula (enhanced productivity, aggregations of marine life and unique sea-floor feature);
  - Exmouth Plateau (unique sea-floor feature associated with internal wave generation);
  - Continental slope demersal fish communities (high species diversity and endemism – the most diverse slope bioregion in Australia with over 500 species found with over 64 of those species occurring nowhere else); and
  - Commonwealth waters adjacent to Ningaloo Reef.
+ The canyons in this reserve are believed to be associated with the movement of nutrients from deep water over the Cuvier Abyssal Plain onto the slope where mixing with overlying water layers occurs at the canyon heads. These canyon heads, including that of Cloates Canyon, are sites of species aggregation and are thought to play a significant role in maintaining the ecosystems and biodiversity associated with the adjacent Ningaloo Reef; and
+ The reserve therefore provides connectivity between the inshore waters of the existing Ningaloo Commonwealth marine park and the deeper waters of the area.

The park is also adjacent to World Heritage listings associated with the Ningaloo Coast. Commercial tourism, commercial fishing, mining and recreation are important socio-economic values of the park (Director of National Parks 2018b).

12.3.4 Ningaloo Marine Park

Ningaloo Marine Park stretches approximately 300 km along the west coast of the Cape Range Peninsula and is adjacent to the Western Australian Ningaloo Marine Park and Gascoyne Marine Park (Director of National Parks, 2018b). Ningaloo Reef is the longest fringing barrier reef in Australia forming a discontinuous barrier that encloses a lagoon that varies in width from 200 m to 7 km. Gaps that regularly intercept the main reef line provide channels for water exchange with deeper, cooler waters (CALM 2005). It is the only example in the world of extensive fringing coral reef on the west coast of a continent.

The Ningaloo Marine Park (Recreational Use Zone – IUCN Category II) covers an area of approximately 2,435 km^2 and protects the following conservation values (Director of National Parks 2018a):

+ Important habitat (foraging areas) for vulnerable and migratory whale sharks;
+ Areas used for foraging by marine turtles adjacent to important internesting sites;
+ Part of the migratory pathway of the protected humpback whale;

- Foraging and migratory pathway for pygmy blue whales;
- Breeding, calving, foraging and nursing habitat for dugong;
- Shallow shelf environments which provides protection for shelf and slope habitats, as well as pinnacle and terrace seafloor features;
- Seafloor habitats and communities of the Central Western Shelf Transition;
- Three KEFs; and
- The Ningaloo Coast World Heritage Property, the Ningaloo Coast National Heritage listing and Ningaloo Marine Area Commonwealth Heritage Listing.

Commercial tourism and recreation are important socio-economic values of the marine park (Director of National Parks 2018b).

12.3.5 Montebello Marine Park

The Montebello Marine Park is located offshore of Barrow Island and 80 km west of Dampier extending from the Western Australian state water boundary and is adjacent to the Western Australian Barrow Island and Montebello Islands Marine Parks. The Montebello Marine Park (Multiple Use Zone – IUCN Category VI) covers an area of approximately 3,413 km^2 and protects the following conservation values (Director of National Parks 2018b):

- Foraging areas for migratory seabirds that are adjacent to important breeding areas;
- Areas used by vulnerable and migratory whale sharks for foraging;
- Foraging areas marine turtles which are adjacent to important nesting sites;
- Section of the north and south bound migratory pathway of the humpback whale;
- Shallow shelf environments with depths ranging from 15–150 m which provides protection for shelf and slope habitats, as well as pinnacle and terrace seafloor features;
- Seafloor habitats and communities of the Northwest Shelf Province provincial bioregions as well as the Pilbara (offshore) meso-scale bioregion; and
- One KEF for the region is the ancient Coastline (a unique seafloor feature that provides areas of enhanced biological productivity).

Commercial tourism, commercial fishing, mining and recreation are important socio-economic values for the park.

12.3.6 Dampier Marine Park

The Dampier Marine Park (Marine National Park Zone – IUCN Category I-73 km^2; Habitat Protection Zone – IUCN Category IV-104 km^2; Multiple Purpose Zone – IUCN Category VI-1,074 km^2) covers an area of approximately 1,252 km^2 and protects the following conservation values (Director of National Parks 2018b):

- Foraging areas for migratory seabirds that are adjacent to important breeding grounds;
- Important foraging areas for marine turtles adjacent to significant nesting sites;
- Part of the migratory pathway of the protected humpback whale;
- Protection for offshore shelf habitats and shallow shelf habitats adjacent to the Dampier Archipelago; and

- Communities and seafloor habitats of the Northwest Shelf Province provincial bioregion as well as the Pilbara (nearshore) and Pilbara (offshore) meso-scale bioregions are included.

Port activities, commercial fishing and recreation are important activities in the marine park (Director of National Parks 2018b). No heritage listings apply to the marine park.

12.3.7 Eighty Mile Beach Marine Park

The Eighty Mile Beach Marine Park (Multiple Use Zone – IUCN Category VI) is adjacent to the Western Australia Eighty Mile Beach Marine Park, 74 km north-east of Port Hedland and covers an area of approximately 10,785 km^2 and protects the following conservation values (Director of National Parks 2018b):

- Breeding, foraging and resting habitat for seabirds (one of the world's most important feeding grounds for migratory shorebirds and waders and is listed under the Ramsar Convention);
- Internesting and nesting habitat for marine turtles (it supports a significant nesting population of flatback turtles, which are endemic to northern Australia);
- Foraging, nursing and pupping habitat for sawfish;
- Migratory pathway for humpback whales;
- Coastal waters provide critical habitat for several shark and ray species at varying life stages;
- The Nyangumarta, Karajarri and Ngarla people's sea country extends into Eighty Mile Beach Marine Park. Access to sea country by families is important for cultural traditions, livelihoods and future socio-economic development opportunities; and
- Three known shipwrecks listed under the *Underwater Cultural Heritage Act 2018*: Lorna Doone (wrecked in 1923), Nellie (wrecked in 1908), and Tifera (wrecked in 1923).

Tourism, commercial fishing, pearling and recreation are important activities in the Marine Park (Director of National Parks 2018b).

12.3.8 Argo-Rowley Terrace Marine Park

The Argo-Rowley Marine Park is located approximately 270 km north-west of Broome, Western Australia, and extends to the limit of Australia's exclusive economic zone. The Marine Park (Multiple Use Zone – IUCN Category VI-108,812 km^2; Marine National Park Zone – IUCN Category II-36,050 km^2; Special Purpose Zone – IUCN Category VI-1,141 km^2) covers an area of approximately 146,003 km^2 and protects the following conservation values (Director of National Parks 2018b):

- Foraging areas that are important for migratory seabirds as well as the endangered loggerhead turtle;
- Important habitat and foraging for sharks;
- Migratory pathway for pygmy blue whales (Director of National Parks 2018b);
- Protection for communities and habitats of the deeper offshore waters (220 m to over 5,000 m) of the region;
- Seafloor features including aprons and fans, canyons, continental rise, knolls/abyssal hills and the terrace and continental slope;
- Communities and seafloor habitats of the Northwest Transition and Timor Province provincial bioregions;

- Connectivity between the existing Mermaid Reef Marine National Nature Reserve and reefs of the Western Australian Rowley Shoals Marine Park and the deeper waters of the region;
- Two KEFs in the reserve include:
  - The canyons linking the Argo Abyssal Plain with the Scott Plateau (unique seafloor feature with enhanced productivity and feeding aggregations of species); and
  - Mermaid Reef and the Commonwealth waters surrounding Rowley Shoals (an area of high biodiversity with enhanced productivity and feeding and breeding aggregations).

No heritage listings apply to this marine park (Director of National Parks 2018b). Commercial fishing, mining and recreation are important socio-economic values for the park.

12.3.9 Mermaid Reef Marine Park

The Mermaid Reef Marine Park (Multiple Use Zone – IUCN Category VI) lays approximately 280 km north-west of Broome, Western Australia, adjacent to the Argo–Rowley Terrace Marine Park and approximately 13 km from the Western Australian Rowley Shoals Marine Park. It covers an area of 540 km² and protects the following conservation values (Director of National Parks 2018b):

- Mermaid Reef and Commonwealth waters surrounding Rowley Shoals are valued for its high productivity, aggregations of marine life and high species richness;
- Mermaid Reef, Clerke Reef and Imperieuse Reef are biodiversity hotspot and key topographic feature of the Argo Abyssal Plain;
- Rowley Shoals present some of the best geological examples of shelf atolls in Australian waters, and are ecologically significant in that they are considered ecological steppingstones for reef species originating in Indonesian/Western Pacific waters, are one of a few offshore reef systems on the north-west shelf, and may also provide an upstream source for recruitment to reefs further south;
- Breeding habitat for seabirds;
- Migratory pathway for the pygmy blue whale; and
- One known shipwreck listed under the *Underwater Cultural Heritage Act 2018*: Lively (wrecked in 1810).

Tourism, recreation, and scientific research are important activities in the Marine Park (Director of National Parks 2018b).

12.3.10 Roebuck Marine Park

The Roebuck Marine Park (Multiple Use Zone – IUCN Category VI) covers an area of approximately 304 km^2 and protects the following conservation values (Director of National Parks 2018b):

- Foraging habitat area for migratory seabirds adjacent to important breeding areas;
- Foraging area adjacent to important nesting sites for flatback turtles;
- Parts of the migratory pathway of the protected humpback whale;
- Habitat adjacent to important foraging, nursing and pupping areas for freshwater, green and dwarf sawfish;
- Foraging and calving areas for Australian snubfin, Indo-Pacific humpback and Indo-Pacific bottlenose dolphins;

+ Foraging habitat for dugong;
+ Protection for shallow shelf habitats ranging in depth from 15–70 m;
+ Ecosystems example of the Northwest Shelf Province provincial bioregion and the Canning meso-scale bioregion; and
+ Sea country valued for indigenous cultural identity, health and well-being for the Yawuru people (Director of National Parks 2018b).

No heritage listings apply to the marine park. Commercial tourism, fishing, pearling and recreation are important socio-economic values of the marine park (Director of National Parks 2018b).

12.3.11 Kimberley Marine Park

The Kimberley Marine Park (Multiple Use Zone – IUCN Category VI) is located approximately 100 km north of Broome, Western Australia, and extends from the Western Australian state water boundary north from the Lacepede Islands to the Holothuria Banks offshore from Cape Bougainville. It is adjacent to the Western Australian Lalanggarram / Camden Sound Marine Park and the North Kimberley Marine Park. It covers an area of 74,469 km², and protects the following conservation values (Director of National Parks 2018b):

+ Northwest Shelf Province;
  - Diverse benthic and pelagic fish communities
  - Ancient coastline thought to be an important seafloor feature
  - Migratory pathway for humpback whales
+ Northwest Shelf Transition;
  - High levels of species diversity
  - Endemism occur among demersal fish communities on the continental slope
+ Timor Province;
  - Reefs and islands of the bioregion are regarded as biodiversity hotspots
  - Endemism in demersal fish communities of the continental slope is high (two distinct communities have been identified on the upper and mid slopes)
  - Ancient coastline at the 125 m depth contour where rocky escarpments are thought to provide biologically important habitats in areas otherwise dominated by soft sediments;
  - Continental slope demersal fish communities characterised by high diversity of demersal fish assemblages;
  - breeding and foraging habitat for seabirds;
  - Internesting and nesting habitat for marine turtles;
  - Breeding, calving and foraging habitat for inshore dolphins;
  - Calving, migratory pathway and nursing habitat for humpback whales;
  - Migratory pathway for pygmy blue whales;
  - Foraging habitat for dugong and whale sharks;

- The Wunambal Gaambera, Dambimangari, Mayala, Bardi Jawi and the Nyul Nyul people's sea country extends into the Kimberley Marine Park. Access to sea country by families is important for cultural traditions, livelihoods and future socio-economic development opportunities; and
- More than 40 known shipwrecks listed under the *Underwater Cultural Heritage Act 2018*.

Tourism, commercial fishing, mining, recreation, including fishing, and traditional use are important activities in the Marine Park (Director of National Parks 2018b).

12.3.12 Ashmore Reef Marine Park

The Ashmore Reef Marine Park (Sanctuary Zone – IUCN Category Ia; Recreational Use Zone – IUCN Category II) covers an area of approximately 583 km^2 (Director of National Parks 2018b). It forms part of the North-west 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 2012). 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 2012).

Ashmore Reef Marine Park is located on Australia's North West Shelf in the Indian Ocean, about 450 nautical miles (840 km) west of Darwin and 330 nautical miles (610 km) north of Broome. The reserve covers 583 km^2 and 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 (DoE, 2002).

Ashmore was designated a Ramsar Wetland of International Importance in 2003 due to the importance of its islands providing a resting place for migratory shorebirds and supporting large seabird breeding colonies.

The proclaimed marine park will protect the following conservation values (DoE 2014):

+ Ecosystems, habitats and communities associated with; the North West Shelf; Timor Province; and emergent oceanic reefs;
+ The island and reef habitats:
  - Contains 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 occur around the reefs (it is estimated that approximately 11,000 marine turtles feed in the area throughout the year);
  - Supports 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;
  - Migratory pathway for pygmy blue whales (Director of National Parks 2018b);
  - Support 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;
  - Is an important staging points/feeding areas for many migratory seabirds; and
  - Is internationally significant for its abundance and diversity of sea snakes.

- Two KEFs:
- Ashmore Reef and Cartier Island and surrounding Commonwealth waters; and
- Continental slope demersal fish communities (Director of National Parks 2018b);
- Cultural and heritage sites, including;
- Ashmore lagoon as a rest/staging area for traditional Indonesian fishers
- Indonesian artefacts; and
- Grave sites.
- Commonwealth heritage listing – Ashmore Reef

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.* 2012; 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.* 2012). Benthic organisms that depend on photosynthesis such as seagrasses, macroalgae and zooxanthellate corals are typically restricted to shallower waters around the reefs, although in the clear tropical waters may be found at considerable depths. Given the shallowest sampling location is greater than 60 m, and that most sampling locations are greater than 100 m deep, diverse benthic communities driven by primary producers such as seagrasses, algae and zooxanthellate corals are not expected to occur at the sampling locations. Data collected in the vicinity of 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 (Smith *et al.* 1997).

Commercial tourism, recreation and scientific research are important socio-economic values of the marine park (Director of National Parks 2018b).

12.3.13 Cartier Island Marine Park

The Cartier Island Marine Park (Sanctuary Zone – IUCN Category Ia) is located approximately 45 km south-east of Ashmore Reef Marine Park and 610 km north of Broome, Western Australia. Both 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 (Director of National Parks 2018b):

- 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;
- Internesting, 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*: the Ann Millicent (wrecked in 1888).

Scientific research is an important activity in the Marine Park (Director of National Parks 2018b).

12.4 North Marine Park Network

The North Marine Parks Network is aligned to the North Marine Region. The network covers 157,480 km^2 (Director of National Parks 2018c). Broad values of the North Network include:

- Natural values;
- Cultural values;
- Heritage values; and
- Socio-economic values.

Further detail on the applicable Oceanic Shoals Marine Park is provided below.

12.4.1 Oceanic Shoals Marine Park

The Oceanic Shoals Marine Park (zones within EMBA: Multiple Use Zone - IUCN Category VI- 32,488 km^2; Special Purpose Zone – IUCN VI-24,443 km^2) and is wholly contained within the combined EMBA.

The marine park protects the following conservation values (DoE 2014):

- 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 (Director of National Parks 2018c):
  - Carbonate bank and terrace system of the Van Diemen Rise (unique sea-floor feature);
  - Carbonate banks and terrace system of the Sahul Shelf (unique sea-floor feature);
  - Pinnacles of the Bonaparte Basin (enhanced productivity, unique sea-floor feature); and
  - Shelf break and slope of the Arafura Shelf (unique sea-floor feature).

No heritage listings apply to the marine park. Commercial fishing and mining are important socio-economic values for the park (Director of National Parks 2018c).

A spatial predictive benthic habitat model of the Oceanic Shoals Marine Park has been developed by AIMS, as part of the Australian National Environmental Science Programme, to determine the spatial heterogeneity of the benthic environment and key classes of organisms within the reserve. The benthic habitat model maps the 10 broad classes of benthic organisms; alcyons, gorgonians, soft corals, hard corals, halimeda, macroalgae, seagrass, filterers (e.g. sponges), burrowers (e.g. sea urchins) and no biota detected (Radford and Puotinen 2016).

12.4.2 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 wholly contained within the combined EMBA. It is located approximately 256 km from Darwin and extends to the outer edge of the Exclusive Economic Zone and the water depth ranges from 15 m to 500 m (Director of National Parks 2018c).

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*" (Director of National Parks, 2018c)

The Arafura Marine Park has both cultural and natural values.

The marine park protects the following natural values (Director of National Parks, 2018c):

- Ecosystems representative of the Northern Shelf Province
- Ecosystems representative of the Timor Transition
- BIAs for Marine Turtles
- BIAs for Seabirds
- Tributary canyons of the Arafura Depression key ecological features.

The sea country of the marine park is part of the responsibility of the Yuwurrumu members of the Mandilarri-Ilduji, 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 the sea country within the Arafura Marine Park for tens of thousands of years (Director of National Parks, 2018c).

12.4.3 Arnhem Marine Park

The Arnhem Marine Park covers an area of 7125 km^2 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 majorityof the marine park is contained within the combined EMBA. It is located approximately 100 km south-east of Croker Island and 60 km south-east of the Arafura Marine Park. It extends from Northern Territory waters surrounding the Goulburn Islands, to the waters north of Maningrida (Director of National Parks 2018c).

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*" (Director of National Parks 2018c).

The Arnhem Marine Park has both cultural and natural values.

The marine park protects the following natural values (Director of National Parks, 2018c):

- Ecosystems representative of the Northern Shelf Province

- Nutrient-rich coastal water contributing to high biological biodiversity
- BIAs for Marine Turtles
- BIAs for Seabirds

The sea country of the marine park is part of the responsibility of the coastal Aboriginal people of West Arnhem land. Sea country is valued for Indigenous cultural identity and Indigenous people have been sustainably using and managing their sea country, including the sea country within the Arnhem Marine Park for tens of thousands of years (Director of National Parks, 2018c).

No heritage listings apply to the marine park. Commercial fishing, tourism and recreation are important socio-economic values for the park (Director of National Parks 2018c).

12.4.4 Joseph Bonaparte Marine Park

The Joseph Bonaparte Gulf Marine Park is located approximately 15 km west of Wadeye, Northern Territory, and approximately 90 km north of Wyndham, Western Australia, 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, and is wholly contained within the combined EMBA. The marine park is comprised of two zones; Special Purpose Zone (VI) and Multiple Use Zone (VI) (Director of National Parks, 2018c).

The Joseph Bonaparte Marine Park has been deemed significant because "*it contains habitats, species and ecological communities associated with the Northwest Shelf Transition bioregion. It includes one key ecological feature: the carbonate bank and terrace system of the Sahul Shelf (valued as a unique seafloor feature with ecological properties of regional significance). 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 systems 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*" (Director of National Parks, 2018c).

The Joseph Bonaparte Marine Park has both cultural and natural values.

The marine park protects the following natural values (Director of National Parks, 2018c):

- Ecosystems representative of the Northwest Shelf Transition
- BIAs for Marine Turtles
- BIA for the Australian Snubfin Dolphin
- KEFs represented in the park are:
  - Carbonate bank and terrace system of the Sahul Shelf (unique sea-floor feature)

The sea country of the marine park is part of the responsibility of the Miriuwung, Gajerrong, Doolboong, Wardenybeng and Gija and Balangarra people. Sea country is valued for Indigenous cultural identify and Indigenous people have been sustainably using and managing their sea country, including the sea country within the Arnhem Marine Park for tens of thousands of years (Director of National Parks, 2018c).

No heritage listings apply to the marine park, however the marine park is adjacent to the West Kimberly National Heritage Place. Tourism, commercial fishing, mining and recreation are important socio-economic values for the park (Director of National Parks 2018c).

Table 12-1 Summary of marine network values, pressures, management programs and actions applicable to the combined EMBA

Marine network	Values	Pressures	Management programs and actions
SOUTH WEST	+ Nine bioregions + Key ecological features + EPBC listed species + Biologically important areas + Sea country indigenous values + Historic shipwrecks + Adjacent to Shark Bay World Heritage Area + Shipping and port activities + Commercial fishing + Marine tourism	+ Climate change + Hydrological changes from coastal development and agriculture (increase sediment loads and pollutants) + Illegal/unregulated/unreported fishing + Bycatch of non-target species + Habitat modification from mining + Human presence + Invasive species + Marine pollution	+ Communication, education and awareness programs + Promote suitable tourism experience + Facilitate partnerships between tourism operators and Indigenous operators + Indigenous engagement program + Marine monitoring programs + Park management via assessments / authorisation program for marine park activities + Marine park management and development of suitable infrastructure + Compliance planning and surveillance

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Marine network	Values	Pressures	Management programs and actions
NORTH WEST	+ Eight bioregions + Key ecological features + EPBC listed species + Biologically important areas + Sea country indigenous values + Native title determinations + Traditional Indonesian fishers + World Heritage Properties (Ningaloo Coast, Shark Bay) + Ashmore Reef Marine Park and Eighty-Mile Beach Ramsar sites + Shipping and port activities + Commercial fishing, pearling, aquaculture + Marine tourism + Scientific research	+ Climate change + Hydrological changes from coastal development and agriculture (increase sediment loads and pollutants) + Illegal/unregulated/unreported fishing + Bycatch of non-target species + Habitat modification from mining + Human presence + Invasive species + Marine pollution	+ Communication, education and awareness programs + Promote suitable tourism experience + Facilitate partnerships between tourism operators and Indigenous operators + Indigenous engagement program + Marine monitoring programs + Park management via assessments / authorisation program for marine park activities + Marine park management and development of suitable infrastructure + Compliance planning and surveillance
NORTH	+ One bioregion + Key ecological features + EPBC listed species + Biologically important areas + Historic shipwrecks	+ Climate change + Hydrological changes reliance upon the large number of estuaries and waterways that feed into the Gulf of Carpentaria and the waters adjacent to the Northern Territory coastline + Illegal/unregulated/unreported fishing + Bycatch of non-target species + Physical Habitat modification + Marine pollution	+ Communication, education and awareness programs + Promote suitable tourism experience + Facilitate partnerships between tourism operators and Indigenous operators + Indigenous engagement program + Marine monitoring programs + Park management via assessments / authorisation program for marine park activities + Marine park management and development of suitable infrastructure + Compliance planning and surveillance

13. Conservation Management Plans

In order to protect, maintain and enhance recovery of certain threatened species and ecological communities the DAWE may prepare conservation management plans in the form of Conservation Advice or Recovery Plans.

13.1 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.

13.2 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 Commonwealth 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.

Table 13-1: Summary of EPBC Act recovery plans applicable to the combined EMBA

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
Bird	Australian lesser noddy	Approved Conservation Advice for *Anous tenuirostris melanops* (Australian lesser noddy) (2015)	Habitat modification by pied cormorants (Houtman Abrolhos)
			Catastrophic destruction of habitat by cyclones
	Migratory species within the combined EMBA: + Asian dowitcher; + Bar-tailed godwit; + Black-tailed godwit; + Broad-billed sandpiper; + Common greenshank; + Common redshank; + Common sandpiper; + Curlew Sandpiper; + Double-banded plover; + Eastern Curlew; + Fork-tailed swift; + Grey plover; + Grey-tailed tattler; + Long-toed stint; + Little greenshank + Oriental plover; + Oriental pratincole; + Pacific golden plover; + Pectoral sandpiper; + Red-necked phalarope; + Red-necked stint; + Red knot; + Ruddy turnstone; + Ruff (reeve);	Wildlife Conservation Plan for Migratory Shorebirds (2015)	Habitat loss and degradation
			Pollution and Contaminants
			Invasive species
			Anthropogenic disturbance
			Climate change and variability
			Overharvesting of shorebird prey
			Fisheries bycatch
			Direct mortality (hunting)

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
	+ Sanderling; + Sharp-tailed sandpiper; + Streaked shearwater; + Terek sandpiper; + Whimbrel; and + Wood sandpiper.		
	Migratory and/or marine species within the combined EMBA + Red-tailed Tropicbird; + White-tailed Tropicbird; + Broad-billed Prion; + Fairy Prion; + Wedge-tailed Shearwater; + Flesh-footed Shearwater; + Sooty Shearwater; + Short-tailed Shearwater; + Streaked Shearwater; + Lesser Frigatebird; + Great Frigatebird; + Masked Booby; + Red-footed Booby; + Brown Booby; + Common Noddy; + Bridled Tern; + Little Tern; + Caspian Tern; + Roseate Tern and; + Osprey.	Wildlife Conservation Plan for Migratory Seabirds (2020)	Habitat loss and modification Climate variability and change Geological processes (volcanism, earthquake, tsunami and landslips) Invasive species Native wildlife Fisheries interactions and by-catch Prey depletion Resource extraction Renewable energy (collision/limited foraging) Anthropogenic disturbance Direct mortality (hunting) Transport Drones Pollution and contaminants Aquaculture Disease
	Christmas Island frigatebird		Introduction of a new disease

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
		Conservation Advice for the Christmas Island frigatebird *Fregata andrewsi* (2020a) Recovery Plan for the Christmas Island Frigatebird (*Fregeta andrewsi*) (2004)	Disturbance of habitat
			Fisheries – prey depletion
			Illegal killing and hunting in south-east Asia
			Invasive weeds
			Fisheries - bycatch
			Drowning in artificial water bodies
			Heavy metal contamination
			Marine debris - plastics
	Australasian bittern	Conservation Advice for *Botaurus poiciloptilus* (Australasian Bittern) (2019)	habitat loss through water reductions and transition from ponded rice to other farming systems
			habitat degradation through increased salinity, siltation and pollution; grazing by livestock and feral animalsan d changes in abundance of plant species
			Climate change through changes in water availability; changes in fire regimes and salinisation of coastal wetlands
			Infrastructure through urban development
			Predation by introduced vertebrate pests such as foxes and cats
	Red knot	Approved Conservation Advice for *Calidris canutus* (Red knot) (2016) Wildlife Conservation Plan for Migratory Shorebirds (2015)	Habitat loss and habitat degradation
			Over-exploitation of shellfish
			Pollution/contamination impacts
			Disturbance
			Direct mortality (hunting)
			Diseases
			Extreme weather events
			Climate change impacts

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
	Curlew sandpiper	Approved Conservation Advice for *Calidris ferruginea* (Curlew Sandpiper) (2015)	Ongoing human disturbance
			Habitat loss and degradation from pollution
			Changes to the water regime
			Invasive plants
	Great knot	Approved Conservation Advice for *Calidris tenuirostriss* (Great knot) (2016) Wildlife Conservation Plan for Migratory Shorebirds (2015).	Habitat loss and habitat degradation
			Pollution/contaminants
			Disturbance
			Diseases
			Direct mortality (hunting)
			Climate change impacts
	Greater sand plover	Approved Conservation Advice for *Charadrius leschenaultii* (Greater sand plover) (2016) Wildlife Conservation Plan for Migratory Shorebirds (2015)	Habitat loss and habitat degradation
			Pollution/contamination impacts
			Disturbance
			Direct mortality (hunting)
			Diseases
			Climate change impacts
	Lesser sand plover	Approved Conservation Advice for *Charadrius mongolus* (Lesser sand plover) (2016) Wildlife Conservation Plan for Migratory Shorebirds (2015)	Habitat loss and habitat degradation
			Pollution/contamination impacts
			Disturbance
			Direct mortality (hunting)
			Diseases
			Climate change impacts
	Antipodean albatross		Incidental catch resulting from fishing operations

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
		National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Competition with fisheries for marine resources
			Dependence on discards
			Marine pollution
			Climate change
			Intentional shooting/killing
			Feral pest species
			Human disturbance at the nest
			Parasites and diseases
			Loss of nesting habitat
			Competition for nest space
	Amsterdam albatross	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Incidental catch resulting from fishing operations
			Competition with fisheries for marine resources
			Dependence on discards
			Marine pollution
			Climate change
			Intentional shooting/killing
			Feral pest species
			Human disturbance at the nest
			Parasites and diseases
			Loss of nesting habitat
			Competition for nest space
	Tristan albatross		Incidental catch resulting from fishing operations
			Competition with fisheries for marine resources

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
		National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Dependence on discards
			Marine pollution
			Climate change
			Intentional shooting/killing
			Feral pest species
			Human disturbance at the nest
			Parasites and diseases
			Loss of nesting habitat
			Competition for nest space
	Southern royal albatross	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Incidental catch resulting from fishing operations
			Competition with fisheries for marine resources
			Dependence on discards
			Marine pollution
			Climate change
			Intentional shooting/killing
			Feral pest species
			Human disturbance at the nest
			Parasites and diseases
			Loss of nesting habitat
			Competition for nest space
	Wandering albatross	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Incidental catch resulting from fishing operations
			Competition with fisheries for marine resources
			Dependence on discards

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
			Marine pollution
			Climate change
			Intentional shooting/killing
			Feral pest species
			Human disturbance at the nest
			Parasites and diseases
			Loss of nesting habitat
			Competition for nest space
	Northern royal albatross	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Incidental catch resulting from fishing operations
			Competition with fisheries for marine resources
			Dependence on discards
			Marine pollution
			Climate change
			Intentional shooting/killing
			Feral pest species
			Human disturbance at the nest
			Parasites and diseases
			Loss of nesting habitat
			Competition for nest space
	Blue petrel	Approved Conservation Advice for *Halobaena caerulea* (blue petrel) (2015)	Habitat loss, disturbance and modification
			Predation
	Western Alaskan bar-tailed godwit	Wildlife Conservation Plan for Migratory Shorebirds (2015)	Habitat loss and habitat degradation
			Over-exploitation of shellfish

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
		Approved Conservation Advice for *Limosa lapponica baueri* (Bar-tailed godwit (western Alaskan)) (2016)	Pollution/contamination impacts
			Disturbance
			Direct mortality (hunting)
			Diseases
			Extreme weather events
			Climate change impacts
	Northern Siberian bar-tailed godwit	Approved Conservation Advice for *Limosa lapponica menzbieri* (Bar-tailed godwit (northern Siberian)) (2016)	Habitat loss and habitat degradation
			Over-exploitation of shellfish
			Pollution/contamination impacts
			Disturbance
			Direct mortality (hunting)
			Diseases
			Extreme weather events
			Climate change impacts
	Southern giant petrel	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Incidental catch resulting from fishing operations
			Competition with fisheries for marine resources
			Dependence on discards
			Marine pollution
			Climate change
			Intentional shooting/killing
			Feral pest species
			Human disturbance at the nest
			Parasites and diseases

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
			Loss of nesting habitat
			Competition for nest space
	Northern giant petrel	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Incidental catch resulting from fishing operations
			Competition with fisheries for marine resources
			Dependence on discards
			Marine pollution
			Climate change
			Intentional shooting/killing
			Feral pest species
			Human disturbance at the nest
			Parasites and diseases
			Loss of nesting habitat
			Competition for nest space
	Eastern curlew	Approved Conservation Advice *for Numenius madagascariensis* (eastern curlew) (2015)	Ongoing human disturbance
			Habitat loss and degradation from pollution
			Changes to the water regime
			Invasive plants
	Fairy prion (southern)	Approved Conservation Advice for *Pachyptila turtur subantarctica* (fairy prion (southern)) (2015)	Competition with blue petrels
			Soil erosion
			Fire
	Abbott's booby	Conservation Advice for the Abbott's booby *Papasula abbotti* (2020b)	Vegetation clearing – edge effects from previous clearing and new vegetation clearing
			Climate change – severe storm events and prey depletion
			Introduction of a new disease

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
			Invasive weeds
			Yellow crazy ants – habitat modification
			Fisheries – prey depletion
			Marine debris - plastics
	Christmas Island white-tailed tropicbird	Conservation Advice for *Phaethon lepturus fulvus* white-tailed tropicbird (Christmas Island) (2014)	Introduced predators on Christmas Island
			Crazy ants
	Sooty albatross	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Incidental catch resulting from fishing operations
			Competition with fisheries for marine resources
			Dependence on discards
			Marine pollution
			Climate change
			Intentional shooting/killing
			Feral pest species
			Human disturbance at the nest
			Parasites and diseases
			Loss of nesting habitat
			Competition for nest space
	Soft-plumaged petrel	Approved Conservation Advice for *Pterodroma mollis* (soft-plumaged petrel) (2015)	Accidental introduction of predators (relevant only to Maatsuyker Island, located offshore of Tasmania)
	Australian painted snipe	Commonwealth Conservation Advice on *Rostratula australis* (Australian painted snipe) (2013)	Loss and degradation of wetlands, through drainage and the diversion of water for agriculture and reservoirs
			Grazing and associated trampling of wetland vegetation/nests, nutrient enrichment and disturbance to substrate by livestock

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
			Climate change
			Predation by feral animals
			Introduction of weeds
	Australian fairy tern	Commonwealth Conservation Advice on *Sternula nereis nereis* (fairy tern) (2011)	Predation by introduced mammals and native birds
			Disturbance by humans, dogs and vehicles
			Increasing salinity in waters adjacent to Fairy Tern colonies
			Irregular water management
			Weed encroachment
			Oil spills, particularly in Victoria (potential threat)
	Indian yellow-nosed albatross	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Incidental catch resulting from fishing operations
			Competition with fisheries for marine resources
			Dependence on discards
			Marine pollution
			Climate change
			Intentional shooting/killing
			Feral pest species
			Human disturbance at the nest
			Parasites and diseases
			Loss of nesting habitat
			Competition for nest space
	Shy albatross	Conservation Advice *Thalassarche cauta* Shy Albatross (2020c)	Fisheries bycatch
			Disease
			Competition for nesting habitat

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
		National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Marine plastics
			Human disturbance
			Previous harvesting for feathers and eggs
			Climate change
	White-capped albatross	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Incidental catch resulting from fishing operations
			Competition with fisheries for marine resources
			Dependence on discards
			Marine pollution
			Climate change
			Intentional shooting/killing
			Feral pest species
			Human disturbance at the nest
			Parasites and diseases
			Loss of nesting habitat
			Competition for nest space
	Campbell albatross	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Incidental catch resulting from fishing operations
			Competition with fisheries for marine resources
			Dependence on discards
			Marine pollution
			Climate change
			Intentional shooting/killing
			Feral pest species
			Human disturbance at the nest

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
			Parasites and diseases
			Loss of nesting habitat
			Competition for nest space
	Black-browed albatross	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (2011)	Incidental catch resulting from fishing operations
			Competition with fisheries for marine resources
			Dependence on discards
			Marine pollution
			Climate change
			Intentional shooting/killing
			Feral pest species
			Human disturbance at the nest
			Parasites and diseases
			Loss of nesting habitat
			Competition for nest space
	Round Island Petrel	Conservation Advice *Pterodroma arminjoniana* Round Island Petrel (2015)	Introduced pests and predators
			Cyclones
Mammals	Sei whale	Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (2015)	Climate and oceanographic variability and change
			Anthropogenic noise and acoustic disturbance
			Habitat degradation including pollution (increasing port expansion and coastal development)
			Pollution (persistent toxic pollutants)
			Vessel strike

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
			Prey depletion due to fisheries (potential threat)
			Resumption of commercial whaling (potential threat)
	Blue whale	Blue Whale Conservation Management Plan 2015 - 2025 (2015)	Whaling
			Climate Variability and Change
			Noise Interference
			Habitat Modification
			Vessel Disturbance
			Overharvesting of prey
	Fin whale	Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (2015)	Climate and oceanographic variability and change
			Anthropogenic noise and acoustic disturbance
			Habitat degradation including coastal development, port expansion and aquaculture
			Pollution (persistent toxic pollutants)
			Fisheries catch, entanglement and bycatch
			Vessel strike
			Resource depletion due to fisheries (potential threat)
			Resumption of commercial whaling (potential threat)
	Southern right whale	Conservation Management Plan for the Southern Right Whale 2011 – 2021 (2012)	Entanglement
			Vessel disturbance
			Whaling
			Climate variability and change
			Noise interference
			Habitat modification
			Overharvesting of prey

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
	Australian sea-lion	Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) (2013)	Fishery bycatch (primary threat)
			Entanglement in marine debris (primary threat)
			Marine aquaculture
			Habitat degradation
			Human disturbance
			Direct killing (primary threat)
			Disease
			Pollution and oil spills
			Noise
			Competition and prey depletion
			Climate change
Reptiles	Short-nosed seasnake	Approved Conservation Advice on *Aipysurus apraefrontalis* (Short-nosed seasnake) (2011)	Degradation of reef habitat, primarily as a result of coral bleaching (primary threat)
			Oil and gas exploration
			Incidental catch and death in commercial prawn trawling fisheries
	Leaf-scaled seasnake	Approved Conservation Advice on *Aipysurus foliosquama* (Leaf-scaled seasnake) (2011)	Degradation of reef habitat, primarily as a result of coral bleaching (primary threat)
			Oil and gas exploration
			Incidental catch and death in commercial prawn trawling fisheries (north-west marine area)
			Unsustainable and illegal fishing practices (currently the most significant threat in the Ashmore region)
	Loggerhead turtle	Recovery plan for marine turtles in Australia 2017 – 2027 (2017) Loggerhead turtle – WA genetic stock	Fisheries bycatch – international (moderate), domestic (high)
			Indigenous take (moderate)
			Terrestrial predation (moderate)

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
			Habitat modification – infrastructure/coastal development (moderate), dredging/trawling (moderate)
			Chemical and terrestrial discharge – acute (high), chronic (low)
			Marine debris – entanglement and ingestion (moderate; unknown)
			Climate change and variability (high)
			International take – outside Australia's jurisdiction (moderate), within Australia's jurisdiction (low)
			Light pollution (moderate)
			Vessel disturbance (moderate)
			Noise interference – acute (moderate), chronic (moderate; unknown)
			Recreational activities (low)
			Diseases and pathogens (low; unknown)
			Fisheries bycatch – international (moderate), domestic (high)
			Cumulative impacts of threats
	Green turtle	Recovery plan for marine turtles in Australia 2017 – 2027 (2017) Green turtle – NWS genetic stock (NWS), Scott-Browse genetic stock (ScBr), Ashmore genetic stock (AR)	Fisheries bycatch – international (moderate), domestic (moderate)
			Indigenous take (moderate)
			Terrestrial predation NWS – moderate, AR –high; unknown, ScBr – moderate; unknown)
			Habitat modification – infrastructure/coastal development (NWS – moderate, AR – low, ScBr – high), dredging/trawling (NWS – moderate, AR – low, ScBr – low)
			Chemical and terrestrial discharge – acute (NWS, AR, ScBr –high), chronic (NWS – moderate, AR – high, ScBr – high)
			Marine debris – entanglement (NWS – moderate, AR – very high, ScBr – moderate; unknown) and ingestion (NWS – low; unknown, AR – moderate, ScBr – moderate)
			Climate change and variability (NWS – moderate, AR – very high, ScBr – high)

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
			International take – outside Australia's jurisdiction (moderate; unknown for NWS and ScBr), within Australia's jurisdiction (moderate; unknown for NWS and ScBr)
			Light pollution (NWS – high, AR – moderate, ScBr – moderate)
			Vessel disturbance (moderate)
			Noise interference – acute (NWS – moderate; unknown, AR – low, ScBr – moderate), chronic (NWS – moderate; unknown, AR – low, ScBr – moderate; unknown)
			Recreational activities
			Diseases and pathogens (low; unknown for AR and ScBr)
			Cumulative impacts of threats
	Leatherback turtle	Approved Conservation Advice on *Dermochelys coriacea* (2008)	Incidental capture in commercial fisheries
			Harvest of eggs and meat
			Ingestion of marine debris
			Boat strike
			Predation on eggs by wild dogs, pigs and monitor lizards
			Degradation of foraging areas
			Changes to breeding sites
		Recovery plan for marine turtles in Australia 2017 – 2027 (2017)	Fisheries bycatch – international (high), domestic (high)
			Indigenous take (low)
			Terrestrial predation (moderate; unknown)
			Habitat modification – infrastructure/coastal development (moderate), dredging/trawling (low)
			Chemical and terrestrial discharge – acute (low), chronic (low; unknown)
			Marine debris – entanglement (moderate) and ingestion (high)
			Climate change and variability (high)

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
			International take – outside Australia's jurisdiction (high), within Australia's jurisdiction (low)
			Light pollution (low)
			Vessel disturbance (moderate)
			Noise interference – acute (low; unknown), chronic (low; unknown)
			Recreational activities (low)
			Diseases and pathogens (low; unknown)
			Fisheries bycatch – international (high), domestic (high)
			Cumulative impacts of threats
	Hawksbill turtle	Recovery plan for marine turtles in Australia 2017 – 2027 (2017) Hawksbill turtle – WA genetic stock	Fisheries bycatch – international (moderate), domestic (moderate)
			Indigenous take (moderate)
			Terrestrial predation (moderate)
			Habitat modification – infrastructure/coastal development (moderate), dredging/trawling (moderate)
			Chemical and terrestrial discharge – acute (moderate), chronic (moderate)
			Marine debris – entanglement (moderate) and ingestion (low; unknown)
			Climate change and variability (high)
			International take – outside Australia's jurisdiction (very high), within Australia's jurisdiction (moderate)
			Light pollution (high)
			Vessel disturbance (moderate)
			Noise interference – acute (moderate), chronic (moderate; unknown)
			Recreational activities (low)
			Diseases and pathogens (low; unknown)

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
			Cumulative impacts of threats
	Olive ridley turtle	Recovery plan for marine turtles in Australia 2017 – 2027 (2017) Olive ridley turtle – Northern Territory genetic stock	Fisheries bycatch – international (moderate), domestic (high)
			Indigenous take (moderate)
			Terrestrial predation (moderate; unknown)
			Habitat modification – infrastructure/coastal development (low), dredging/trawling (low)
			Chemical and terrestrial discharge – acute (high), chronic (moderate)
			Marine debris – entanglement (very high) and ingestion (moderate; unknown)
			Climate change and variability (very high)
			International take – outside Australia's jurisdiction (moderate), within Australia's jurisdiction (moderate)
			Light pollution (moderate)
			Vessel disturbance (moderate)
			Noise interference – acute (low), chronic (low; unknown)
			Recreational activities (low)
			Diseases and pathogens (low; unknown)
			Cumulative impacts of threats
	Flatback turtle	Recovery plan for marine turtles in Australia 2017 – 2027 (2017) Flatback turtle – Pilbara coast genetic stock (Pil), South-west Kimberley coast genetic stock (swKim) and Cape Domett (CD)	Fisheries bycatch – international (low), domestic (moderate)
			Indigenous take (moderate)
			Terrestrial predation (moderate)
			Habitat modification – infrastructure/coastal development (Pil – high, swKim – moderate), dredging/trawling (moderate)
			Chemical and terrestrial discharge – acute (high), chronic (moderate)
			Marine debris – entanglement (moderate) and ingestion (low)

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
			Climate change and variability (Pil – high, swKim – moderate)
			International take – outside Australia's jurisdiction (low), within Australia's jurisdiction (low)
			Light pollution (Pil – high, swKim – moderate)
			Vessel disturbance (moderate)
			Noise interference – acute (moderate), chronic (moderate; unknown)
			Recreational activities (Pil – low, swKim – moderate)
			Diseases and pathogens (low; unknown)
			Cumulative impacts of threats
Sharks and fish	Grey nurse shark	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (2014)	Mortality due to incidental capture by commercial and recreational fisheries
			Mortality die to shark control programs
			Ecotourism
			Public aquarium trade
			Pollution and disease
			Ecosystem effects - habitat modification and climate change
	Great white shark	Recovery plan for the White Shark (*Carcharodon carcharias*) (2013)	Mortality related to being caught accidentally (bycatch) or illegally (targeted) by commercial and recreational fisheries, including issues of post release mortality
			Mortality related to shark control activities such as beach meshing or drumlining (east coast population)
			Illegal trade in white shark products
			Ecosystem effects as a result of habitat modification and climate change
			Ecotourism
	Northern river shark	Approved Conservation Advice for *Glyphis garricki* (northern river shark) (2014)	Commercial fishing activities
			Recreational fishing

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
			Indigenous fishing
			Illegal, unreported and unregulated fishing
			Habitat degradation and modification
			Marine debris
			Collection of animals for display in public aquaria (no known occurrences to date)
		Sawfish and River Sharks Multispecies Recovery Plan (2015)	Fishing activities including: being caught as by-catch in the commercial and recreational sectors; through indigenous fishing; and illegal, unreported and unregulated fishing
			Habitat degradation and modification
	Dwarf sawfish	Approved Conservation Advice on *Pristis clavata* (dwarf sawfish) (2009)	Being caught as bycatch in commercial and recreational net fishing
			Illegal, unreported and unregulated fishing
			Habitat degradation due to increasing human development
		Sawfish and River Sharks Multispecies Recovery Plan (2015)	Fishing activities including: being caught as by-catch in the commercial and recreational sectors; through indigenous fishing; and illegal, unreported and unregulated fishing
			Habitat degradation and modification
	Freshwater sawfish	Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (2014)	Commercial fishing activities
			Recreational fishing
			Indigenous fishing
			Illegal, unreported and unregulated fishing
			Habitat degradation and modification
			Marine debris
			Collection of animals for display in public aquaria
		Sawfish and River Sharks Multispecies Recovery Plan (2015)	Fishing activities including: being caught as by-catch in the commercial and recreational sectors; through indigenous fishing; and illegal, unreported and unregulated fishing
			Habitat degradation and modification

Taxa	Common name	Recovery Plan / Conservation Advice	Threats
	Green sawfish	Approved Conservation Advice for *Pristis zijsron* (green sawfish) (2008)	Capture as bycatch and byproduct in gillnet and trawl fisheries
			Illegal capture for fins and rostra
			Habitat degradation through coastal development
		Sawfish and River Sharks Multispecies Recovery Plan (2015)	Fishing activities including: being caught as by-catch in the commercial and recreational sectors; through indigenous fishing; and illegal, unreported and unregulated fishing
			Habitat degradation and modification
	Whale shark	Approved Conservation Advice for *Rhincodon typus* (whale shark) (2015)	Intentional and unintentional mortality from fishing outside of Australian waters
			Boat strike from large vessels
			Habitat disruption from mineral exploration, production and transportation
			Disturbance from domestic tourism operations
			Marine debris
			Climate change
	Blind gudgeon	Approved Conservation Advice for *Milyeringa veritas* (blind gudgeon) (2008)	Habitat degradation and modification associated with sedimentation from mining/construction, canal development, water abstraction, point source pollution from sewage, landfill, dumping and mining; and diffuse pollution from urban development/ petroleum infrastructure
	Blind cave eel	Approved Conservation Advice for *Ophisternon candidum* (blind cave eel) (2008)	Habitat degradation and modification associated with sedimentation from mining/construction, canal development, water abstraction, point source pollution from sewage, landfill, dumping and mining; and diffuse pollution from urban development
	Balston's pygmy perch	Approved Conservation Advice for *Nannatherina balstoni* (Balston's pygmy perch) (2008)	Habitat degradation and modification associated with flow and increased salinisation, siltation and eutrophication that occur through changes to flow regimes (regulation and abstraction), road maintenance, mineral sand exploration and mining, ground water extraction and agricultural and forestry practices in the uppermost catchment
	Black-stripe minnow	Approved Conservation Advice for *Galaxiella nigrostriatal* (Black-striped minnow) (2018)	Climate change – increased air and water temperatures, decreased rainfall, increased evaporation, lowering groundwater table.
			Invasive species (*Gambusia holbrooki*), aggressive interactions and competition

14. Social, Economic and Cultural Features

14.1 Industry

In 2018/19, Western Australia's petroleum industry was worth $38.4 billion per annum. The petroleum sector accounted for 26% of the total value of WA's mineral and petroleum sales in 2018/19, with 20 per cent of all mineral and petroleum sales coming from Liquefied Natural Gas (LNG). Currently Western Australia has four operating LNG projects; the North West Shelf, Gorgon, Pluto and Wheatstone. There are also a number of Floating Production and Storage Offtake (FPSO) facilities in the Timor Sea and North West Shelf, as denoted on Figure 14-1, Figure 14-2 and Figure 14-3. Offshore development is focussed in the Carnarvon Basin, Browse Basin and on the North West Shelf (DMP 2014). There are also domestic gas plants on Varanus Island in the North West Shelf, Devil Creek Onshore Gas Plant and Macedon Gas Plant in the Pilbara region and an oil facility near Dongara called Cliff Head. There are several exploration and production permits and leases throughout WA and Commonwealth waters in the combined EMBA. Existing petroleum infrastructure, permits and licences are shown in Figure 14-1, Figure 14-2 and Figure 14-3.

14.2 Other Infrastructure

The Jasuraus submarine communication cable links Australia with Indonesia. The cable was installed as a link from Australia to provide telephone services connection to the world in 1995-1996. Travelling north out of Port Hedland for approximately 210 km the cable then heads north-west toward Jakarta, Indonesia. The cable runs up through Permit Areas WA-435-P and WA437-P. Its capacity and major role was overtaken in 2000 by other subsea cables out of Australia. However, Telstra continues to manage the cable as it remains an emergency backup link out of Australia. The cable includes two submerged repeaters in the wider region.

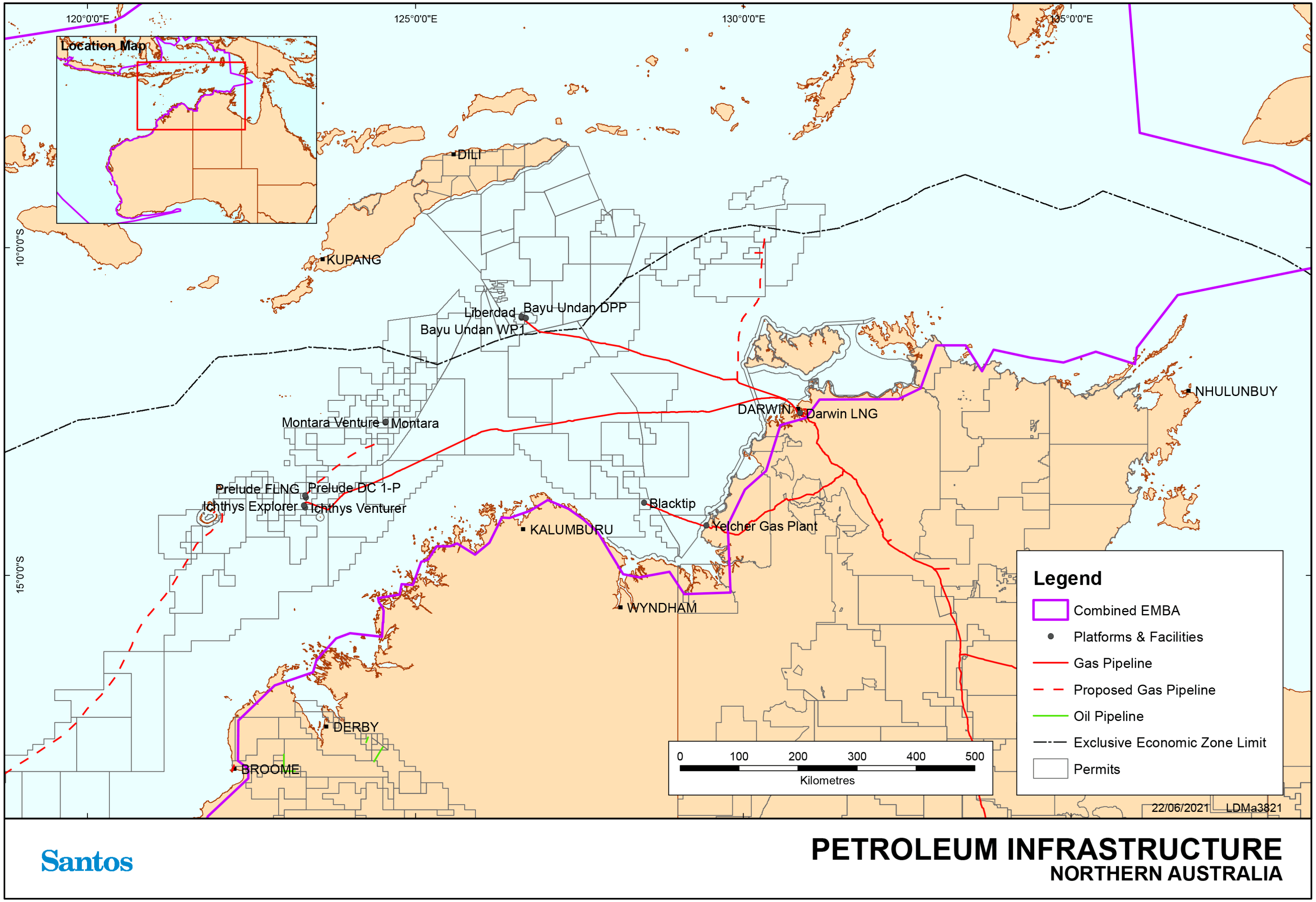

Figure 14-1: Existing petroleum infrastructure, permits and licences – Northern WA

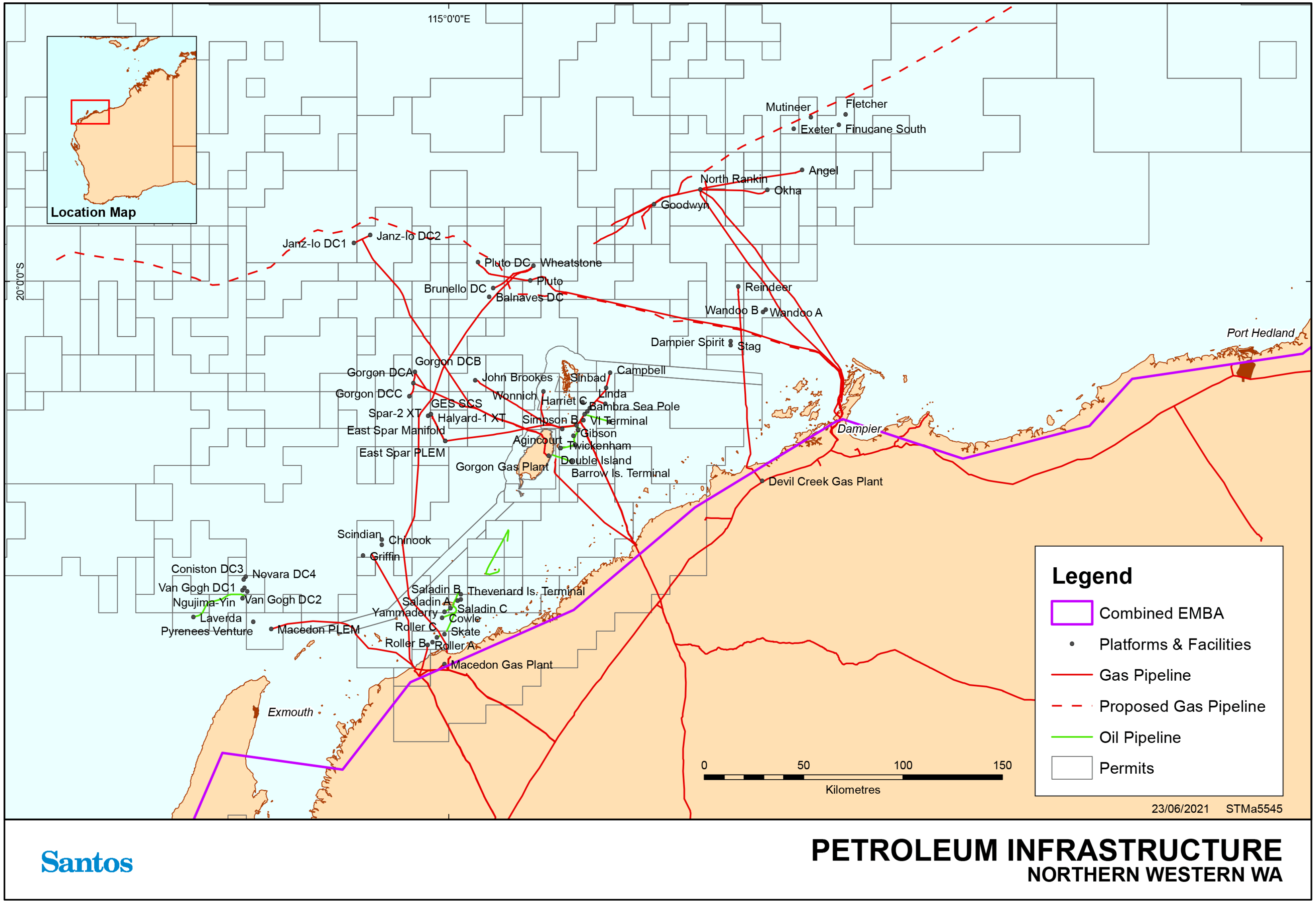

Figure 14-2: Existing petroleum infrastructure, permits and licences – Northern Western WA

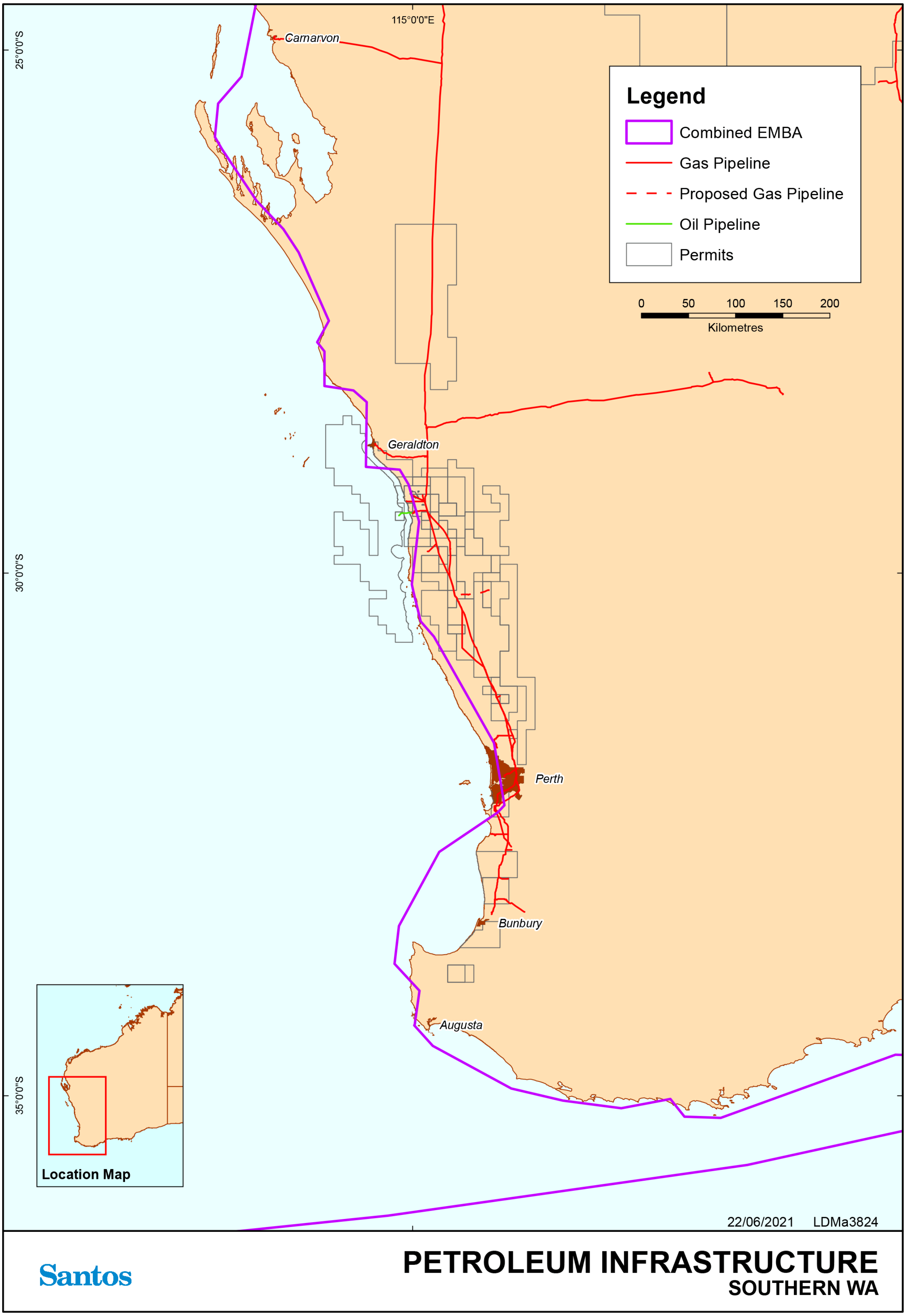

Figure 14-3: Existing petroleum infrastructure, permits and licences –Southern WA

14.3 Shipping

The Western Australian coastline supports twelve ports including the major ports of Dampier, Port Hedland and Broome which are operated by their respective port authorities. Large cargo vessels move through the region to and from Fremantle, transiting along coastline. Commercial shipping also moves to and from marine terminals associated with the oil and gas industry (see Section 14.1). Other large ports include Geraldton, Busselton, Albany and Esperance. Closer proximity shipping also includes construction vessels/barges/dredges, domestic support vessels, and offshore survey vessels.

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 *Commonwealth Navigation Act 2012*, 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 in waters in the combined EMBA through the AUSREP system in 2021 are shown in Figure 14-4.

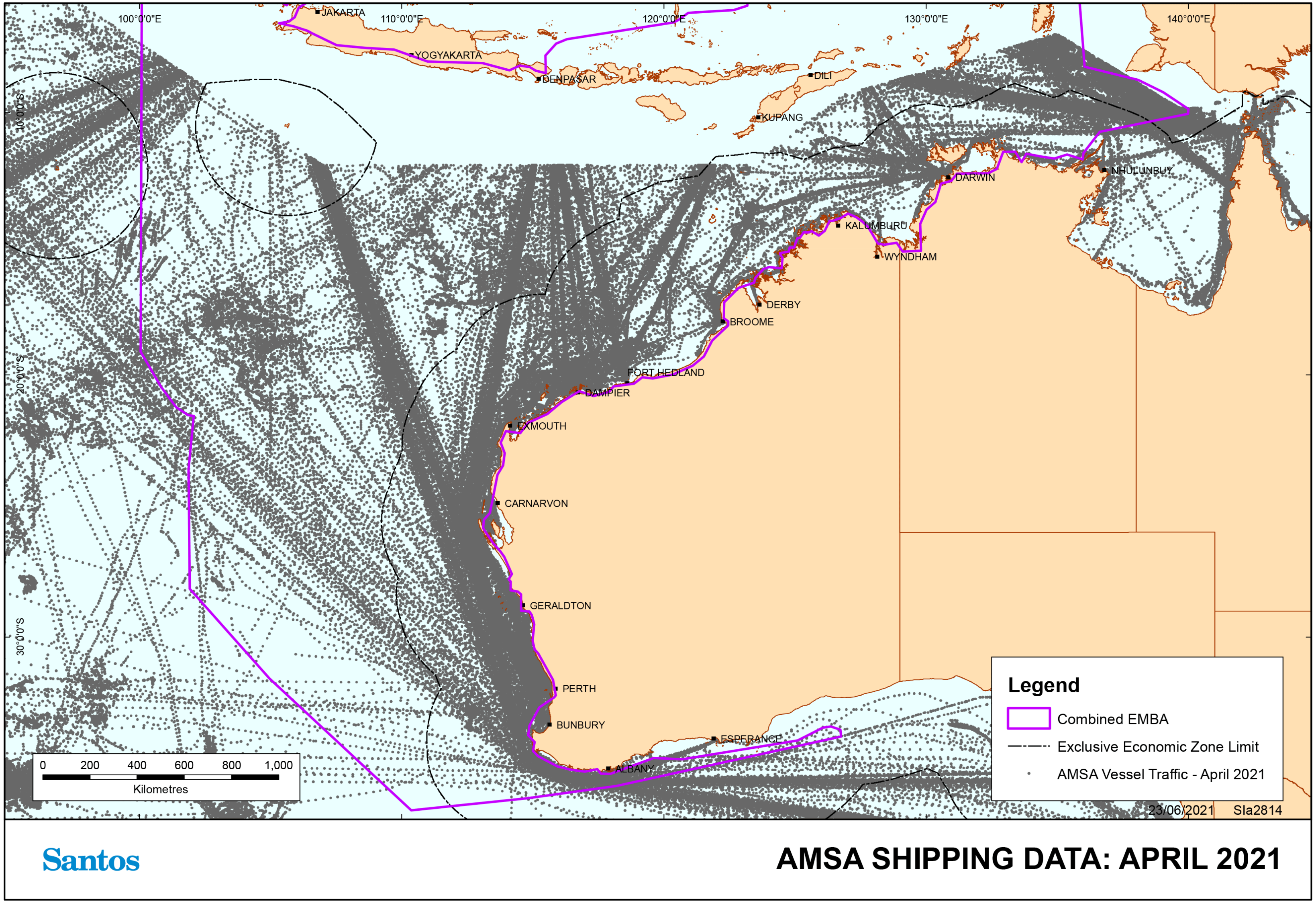

Figure 14-4: AMSA ship locations and shipping routes

14.4 Defence Activities

Key defence bases and facilities are illustrated in Figure 14-5.

The Naval Communication Station Harold E. Holt is located on the northwest coast of Australia, 6 km north of Exmouth. The town of Exmouth was built at the same time as the communications station to provide support to the base and to house dependent families of US Navy personnel (Shire of Exmouth 2018, DoE 2014).

The station provides very low frequency radio transmission to US Navy and Royal Australian Navy ships and submarines in the western Pacific Ocean and eastern Indian Ocean. With a transmission power of 1 megawatt, it is the most powerful transmission station in the southern hemisphere (Shire of Exmouth 2018, DoE 2014).

Two Royal Australian Airforce (RAAF) bases are located in the northwest of WA; Learmonth RAAF Base, near Exmouth and Curtin RAAF Base near Derby (RAAF 2014).

Designated military exercise areas occur over waters and airspace of the north west of WA and may be activated following the required notifications.

Additional defence activities that occur within the combined EMBA include:

+ Broome training depot;
+ Exmouth admin and high frequency transmitting;
+ Exmouth Very Low Frequency transmitting station;
+ Geraldton training depot “A” Company 16th Battalion;
+ HMAS Stirling-Rockingham;
+ HMAS Stirling-Garden Island;
+ Karratha training depot;
+ Learmonth – air weapons range;
+ Learmonth radar site – Vlaming Head Exmouth; and
+ Yampi Sound training area.
+ Bradshaw Defence field training area
+ Artillery Barracks – Fremantle
+ Camble Barracks- Swanborne
+ Irwin Barracks – Karrakatta
+ Lancelin Training Area
+ Leeuwin Barracks- East Fremantle
+ Preston Point Training Depot
+ Rockingham – Navy CPSO
+ Swanbourne Rifle Range

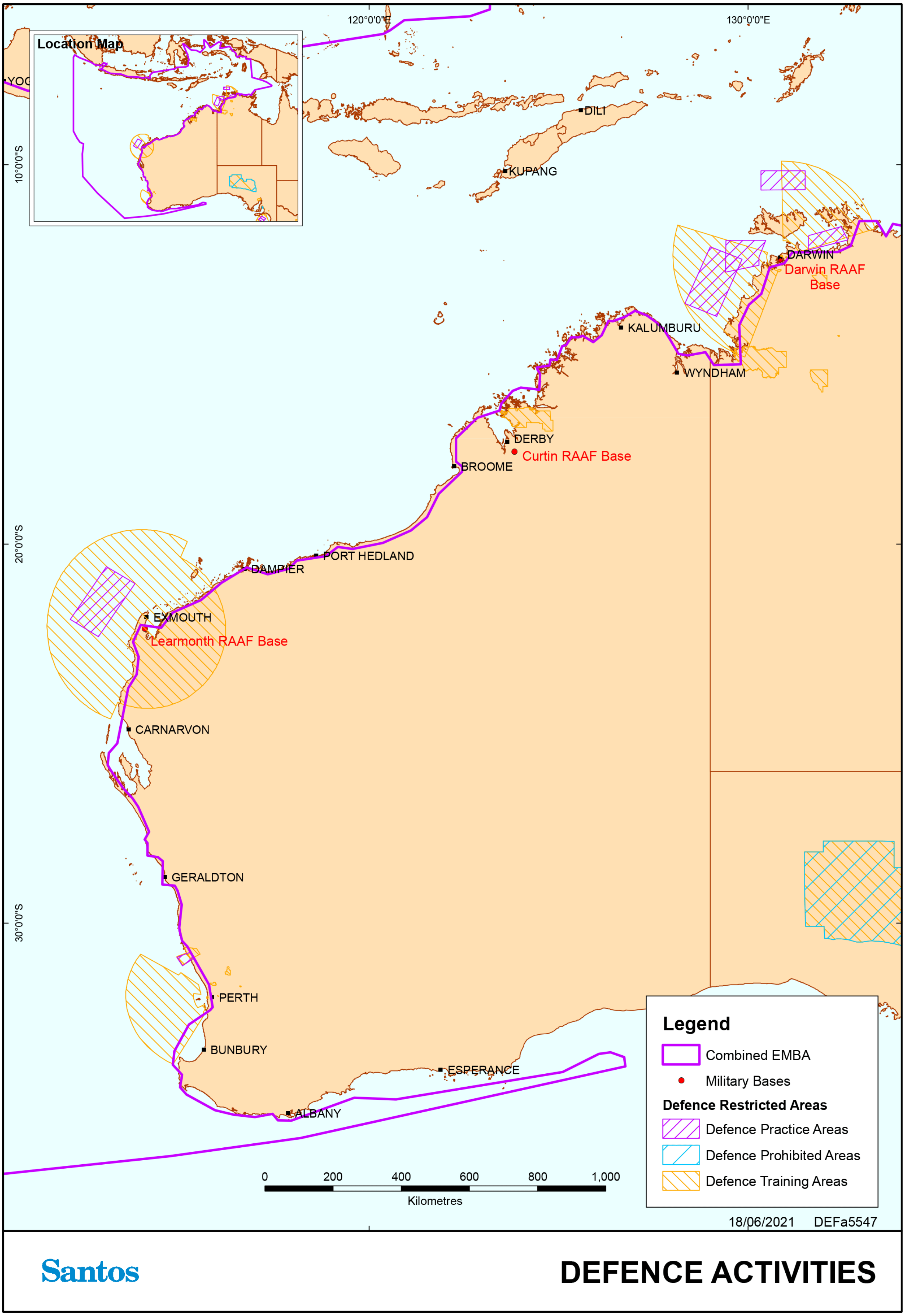

Figure 14-5: Defence activities

14.5 Tourism

The Kimberley, Pilbara and Gascoyne regions are popular visitor destination for Australian and international tourists. Tourism is concentrated in the vicinity of population centres including Broome, Dampier, Exmouth, Coral Bay and Shark Bay.

Marine and coastal use is also clustered around major population centres along the WA coastline including Perth, Bunbury, Geraldton, Margaret River, Jurien Bay, August and Albany.

Marine tourism to offshore Islands includes various Pilbara nearshore Islands (Muiron, Serrurier, Sholl and Montebello) and the Abrolhos Islands near Geraldton. Currently visitation to the Abrolhos is low because the park is only accessible via recreational boat, charter flight or commercial tour (either on a boat or aircraft); however, there is an increasing number of visitors, with visitations peaking between February and May (DBCA, 2022). The Montebello Islands are ranked among the world's most bio-diverse marine environments (DBCA) and are attracting a growing number of nature-based tourism operators, with people participating in activities such as fishing, diving, wildlife viewing, island exploration and surfing (DEC, 2007).

Tourism contributes to local economies in terms of both income and employment and tourists include local, interstate and international visitors. Popular water-based activities include fishing, swimming, snorkelling/ diving, surfing/windsurfing/kiting and boating, while popular land based activities include bushwalking, camping, bird watching and four-wheel driving.

Seasonal nature-based tourism such as humpback whale watching, whale shark encounters and tours of turtle hatching mainly occurring around Ningaloo Reef, Cape Range National Park, Broome and Perth (Tourism Western Australia 2014). Seasonal aggregations of whale sharks, manta rays, sea turtles and whales, as well as the annual mass spawning of coral attract large numbers of visitors to Ningaloo each year (CALM 2005).

14.6 Cultural Heritage

Four places of cultural significance are protected as National Heritage Places in the waters from Busselton to the NT. The Dampier Archipelago (including Burrup Peninsula), Batavia Shipwreck Site and Survivor Camps Area 1629 – Houtman Abrolhos, Dirk Hartog Landing Site 1616 – Cape Inscription area and the HMAS Sydney II and HSK Kormoran Shipwreck Site are discussed in Section 9. Additional Commonwealth Heritage Places denoted for their historic value in the combined EMBA are listed in Appendix A.

14.6.1 Indigenous Heritage

Indigenous people have a strong ongoing association with the area that extends from the beginning of human settlement in Australia some 50,000 years ago. The close, long standing relationship between Aboriginal peoples and the coastal and marine environments of the area is evident in indigenous culture today, in addition to archaeological sites such as the Burrup Peninsula. The Indigenous peoples of the northwest continue to rely on coastal and marine environments and resources for their cultural identity, health and wellbeing, as well as their domestic and commercial economies (DEWHA 2008a). Within the combined EMBA, Barrow Island, Montebello Islands, Exmouth, Ningaloo Reef, Kimberly Coast, Eighty Mile Beach, Roebuck Bay, Dampier Peninsula and the South West and the adjacent foreshores have a long history of occupancy by Indigenous communities. Areas that are covered by registered native title claims are likely to practice indigenous fishing techniques at various sections of the WA coastline, most notably in the Kimberley coastal region and islands.

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. However, while direct use by Aboriginal people deeper offshore waters is limited, many groups continue to have a direct cultural interest in decisions affecting the management of these waters. The cultural connections Aboriginal people maintain with the sea may be affected, for example, by offshore fisheries and industries. In addition, some Indigenous people are involved in commercial activities such as fishing and marine tourism, so have an interest in how these industries are managed in offshore waters with respect to their cultural heritage and commercial interests (DEWHA 2008a).

In the Northern Territory there are a number of sacred and significant sites located on the Tiwi Islands. There are currently four registered sacred sites on the Tiwi Islands (Aboriginal Areas Protection Authority, 2016). Another 56 sites of significance to Tiwi Islanders have been recorded, including two sites on the NT mainland (Tiwi Land Council, 2003). The Tiwi Islands sites hold importance as they have high spiritual and cultural history value (Tiwi Land Council 2003).

14.6.2 Maritime Heritage

Details of recorded shipwreck sites are available on the Australian National Shipwreck Database are managed by the DAWE although precise locations of the wrecks are sometimes unknown. the combined EMBA. Key shipwrecks in the North West Marine Region are shown in Figure 14-10 to Figure 14-6, in addition to the Ann Millicent (DEWHA 2008a). Under the Commonwealth *Underwater Culture Heritage Act 2018* all shipwrecks older than 75 years are protected, while those dated pre-1900 are protected by WA law under the *Maritime Archaeology Act 1973*. Within the combined EMBA, there are 1033 shipwrecks known to be in excess of 75 years old.

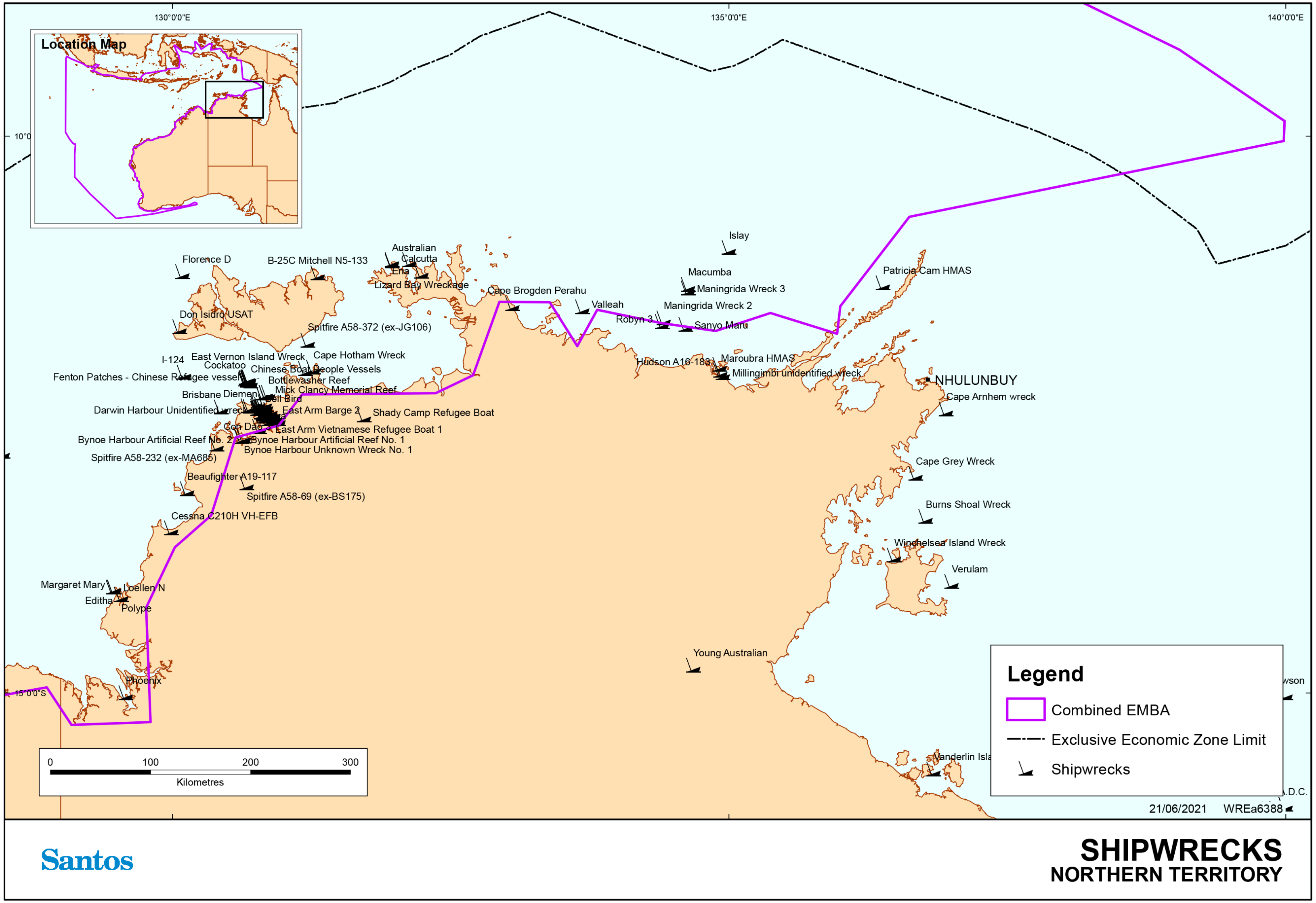

Figure 14-6: Shipwrecks –NT

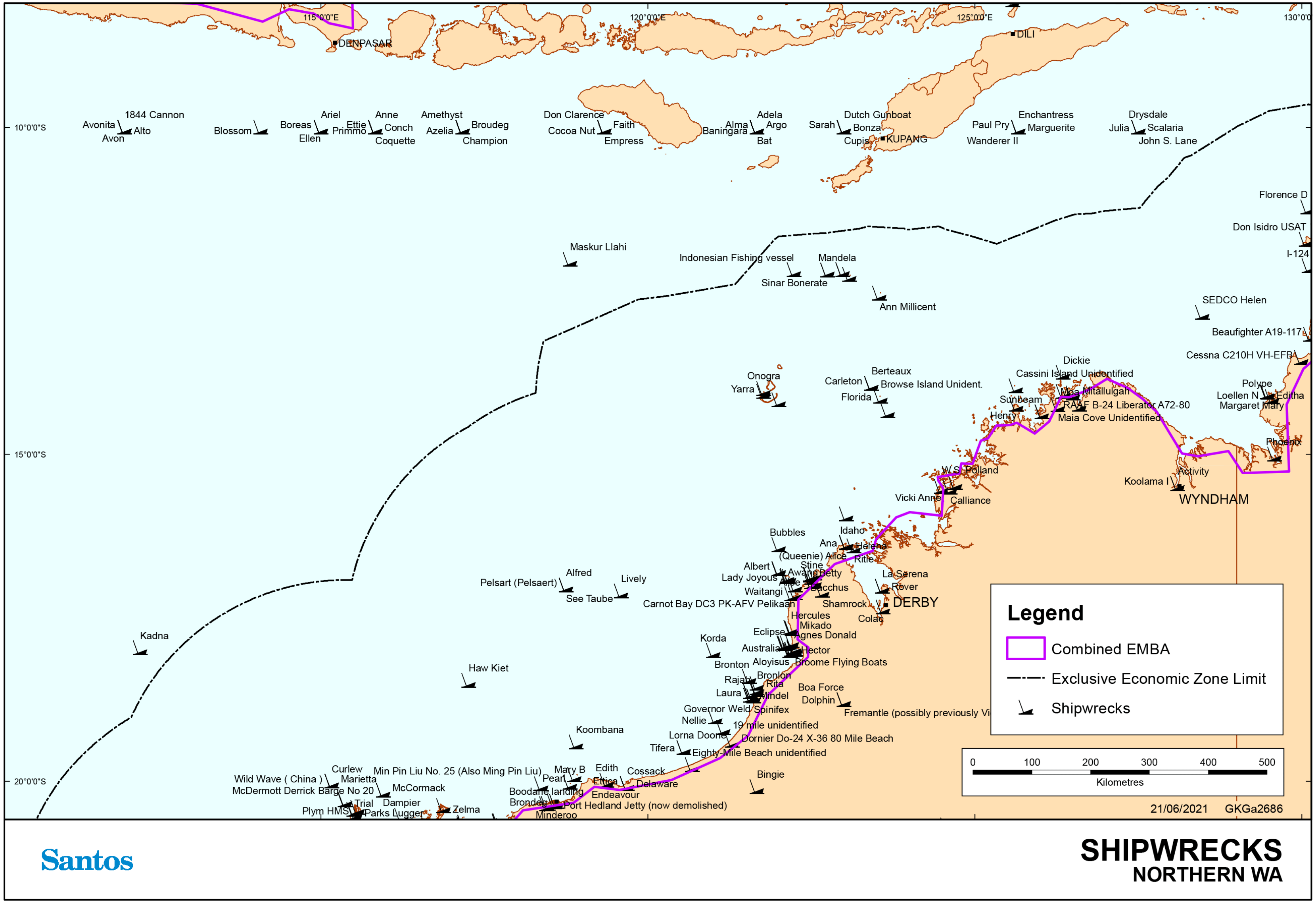

Figure 14-7: Shipwrecks – Northern WA

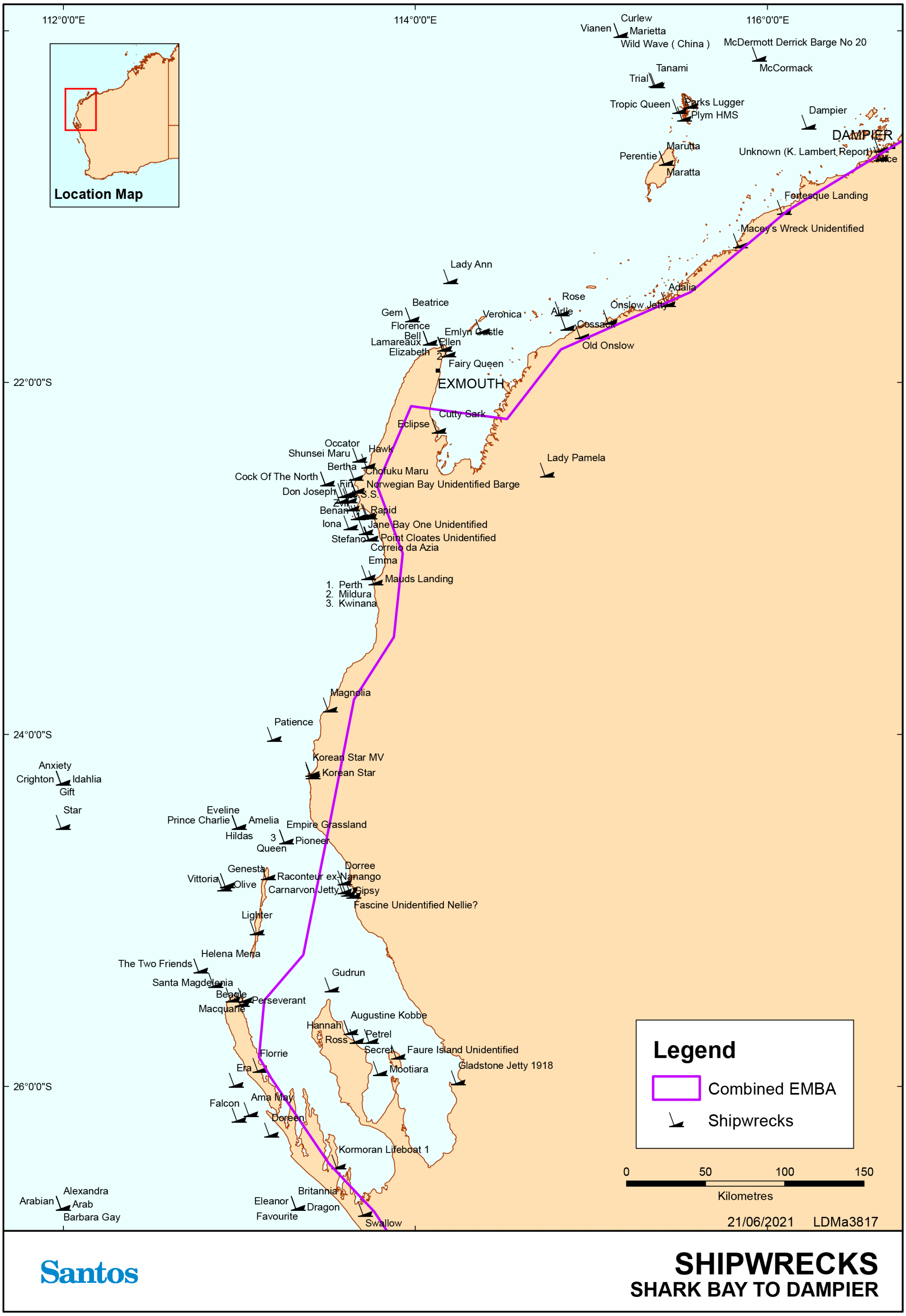

Figure 14-8: Shipwrecks – Shark Bay – Dampier

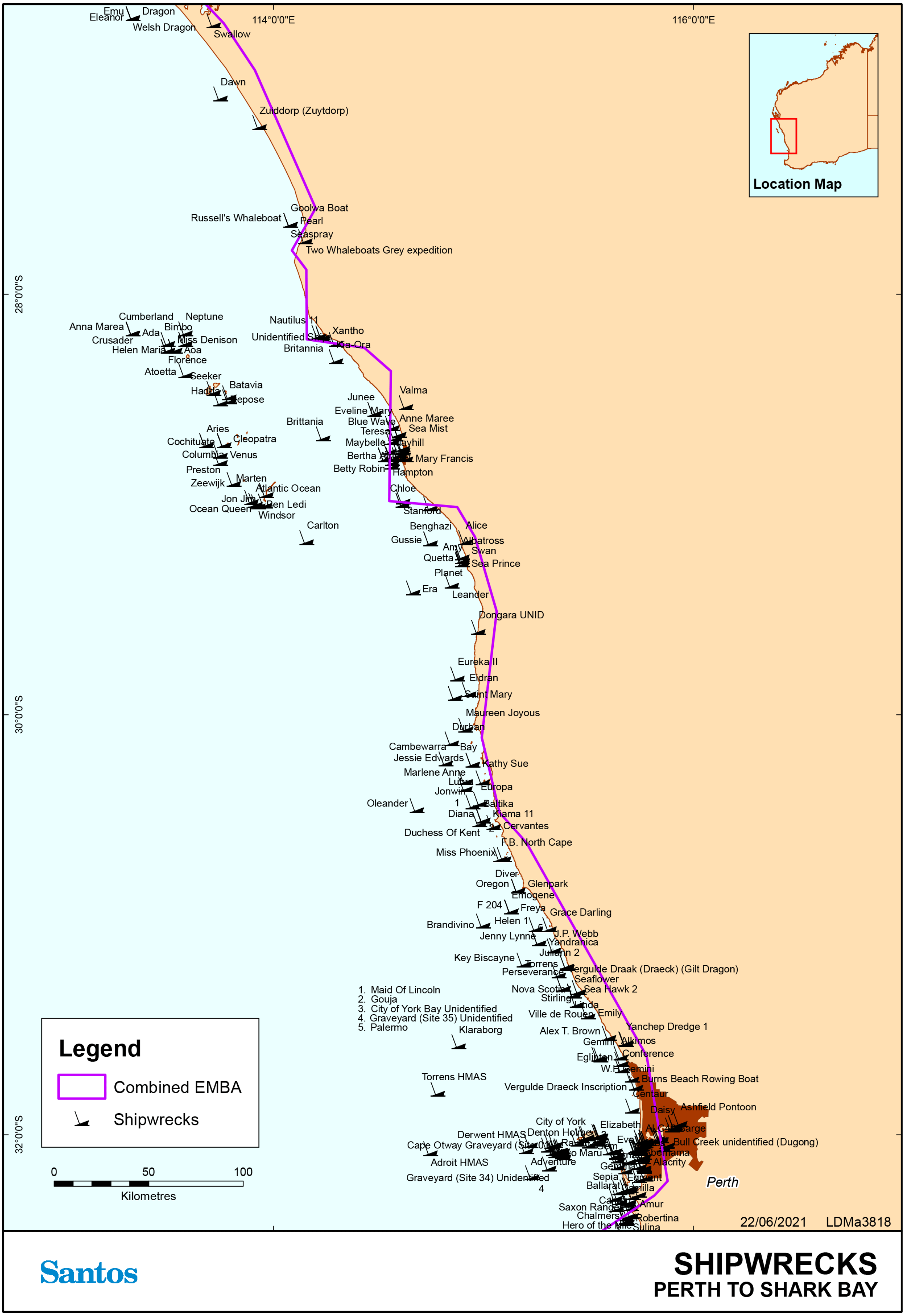

Figure 14-9: Shipwrecks – Perth – Shark Bay

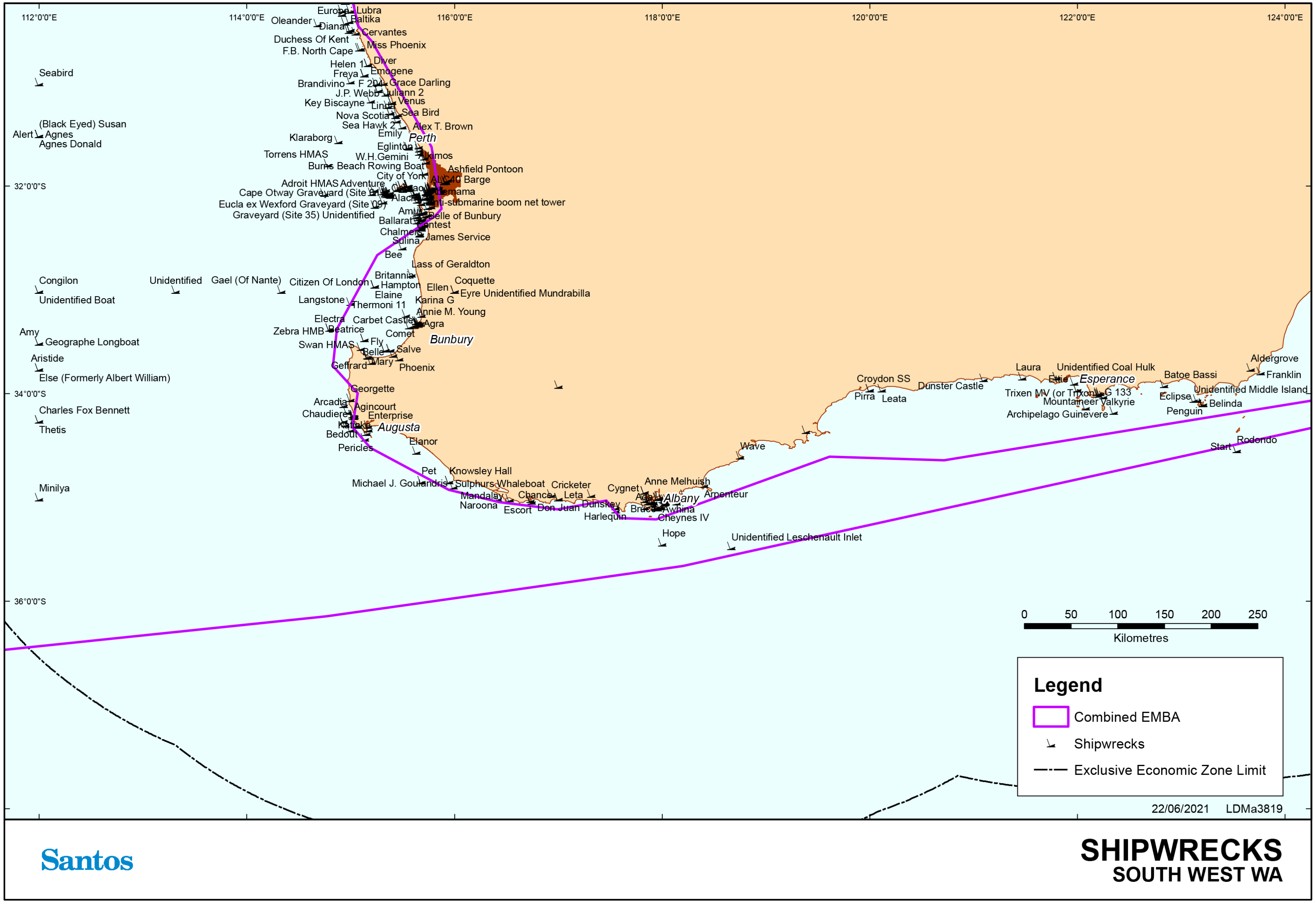

Figure 14-10: Shipwrecks – South West WA

14.7 Commercial Fisheries

A valuable and diverse commercial fishing industry is supported by both the offshore and coastal waters in the North Coast, Gascoyne, West Coast and South Coast Bioregions between the WA and NT and South Australian borders. The major fisheries in this area target tropical finfish, large pelagic fish species, crustaceans (prawns and scampi), Western Rock Lobster and pearl oysters (Fletcher and Santoro 2013). A number of smaller fisheries also exist in this area including the octopus and beche-de-mer fisheries.

14.7.1 State Fisheries

State fisheries are managed by the WA Department of Primary Industries and Regional Development (DPIRD) (formerly Department of Fisheries (DoF)) with specific management plans, regulations and a variety of subsidiary regulatory instruments under the *Fish Resources Management Act 1994* (WA). The information on State managed fisheries has been derived from '*The State of the Fisheries'* Report 2018/2019 (Gaughan *et al.* 2020) and direct consultation with DPIRD. Santos consults regularly with State fisheries relevant to activity operational areas, mainly by distribution of an Annual Consultation Update by post.

State commercial fisheries that exist between Kalbarri (WA) and the NT border are shown in Figure 14-12. Fisheries in the Northern Territory are shown in Figure 14-11. A summary of all commercial fisheries in the area is also provided in Table 14-1. These are:

North Coast Bioregion

+ Onslow Prawn Managed Fishery (OPMF);
+ Nickol Bay Prawn Managed Fishery (NBPMF) – referred to as Nickol Bay Prawn Limited Entry Fishery in Figure 14-12;
+ Broome Prawn Managed Fishery (BPMF);
+ Kimberley Prawn Managed Fishery (KPMF);
+ Kimberley Gillnet & Barramundi Managed Fishery (KGBF);
+ Kimberley Developing Mud Crab Fishery[14];
+ Northern Demersal Scalefish Managed Fishery (NDSF);
+ North Coast Traditional Trochus Fishery[14];
+ Pilbara Demersal Scalefish Fisheries[14];
+ Pilbara Developing Crab Fishery[14];
+ Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF);
+ Pilbara Trap Managed Fishery (PTMF);
+ Pilbara Line Fishery;
+ Western Australian Sea Cucumber Fishery;
+ Mackerel Managed Fishery (Area 1 – Kimberley and Area 2 – Pilbara);

[14] Not shown in Figure 14-12

- Western Australian Pearl Oyster Fishery – referred to as Pearl Oyster Managed Fishery in Figure 14-12;
- Northern Shark Fisheries (closed[14]) including:
- Western Australian North Coast Shark Fishery[14]; and
- Joint Authority Northern Shark Fishery[14]
- North Coast Trochus Fishery[14]; and
- Pilbara Developing Crab Fishery[14].

Northern Territory

- Coastal Line Fishery;
- Aquarium Fishery;
- Trepang Fishery;
- Development Small Pelagic Fishery;
- Coastal Net Fishery;
- Spanish Mackerel Fishery;
- Offshore Net and Line Fishery;
- Timor Reef Fishery;
- Demersal Fishery; and
- Barramundi Fishery.

Gascoyne Bioregion

- Exmouth Gulf Prawn Managed Fishery;
- Gascoyne Demersal Scalefish Managed Fishery;
- Shark Bay Scallop Managed Fishery – referred to as Shark Bay Scallop Limited Entry Fishery on Figure 14-12;
- Shark Bay Prawn Managed Fishery – referred to as Shark Bay Prawn Limited Entry Fishery on Figure 14-12;
- Shark Bay Beach Seine and Mesh Net Managed Fishery[14];
- Shark Bay Crab Interim Managed Fishery; and
- Mackerel Fishery (Area 3 – Gascoyne/West Coast).

West Coast Bioregion

- Roe's Abalone[14];
- Abrolhos Islands and Mid-West Trawl Managed Fishery (AIMWRMF) (Closed) – referred to as Abrolhos Islands and Mid-West Trawl Limited Entry Fishery in Figure 14-12;
- West Coast Demersal Scalefish Interim Managed Fishery (WCDSIMF);

- South West Trawl Managed Fishery – referred to as South West Trawl Limited Entry Fishery in Figure 14-12;
- Mandurah to Bunbury Developing Crab Fishery[14];
- Cockburn Sound Crab Managed Fishery[14];
- Cockburn Sound Line and Pot Managed Fishery[14];
- Cockburn Sound Mussel Managed Fishery[14];
- Warnbro Sound Crab Managed Fishery (closed) [14];
- West Coast Nearshore and Estuarine Finfish Fisheries, including:
- Cockburn Sound Fish Net Managed Fishery[14];
- West Coast Beach Baited Managed Fishery[14];
- South West Beach Seine Fishery[14]; and
- West Coast Estuarine Managed Fishery[14];
- Temperate Demersal Gillnet and Demersal Longline Fisheries, including:
- West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery (West Coast Bioregion) [14];
- West Coast Deep Sea Crab (Interim) Managed Fishery – referred to as West Coast Deep Sea Crustacean Managed Fishery in Figure 14-12;
- West Coast Nearshore Net Managed Fishery [14];
- Octopus Interim Managed Fishery [14];
- West Coast Rock Lobster Managed Fishery; and
- West Coast Purse Seine Fishery [14].

South Coast Bioregion

- Greenlip/Brownlip Abalone Fishery [14];
- South Coast Crustacean Managed Fishery [14];
- South Coast Deep-Sea Crab Fishery [14];
- South Coast Estuarine Managed Fishery[14];
- South Coast Open Access Netting Fishery [14]; and
- South West Coast Beach Net [14].
- South Coast Salmon Managed Fishery;
- South Coast Trawl Fishery;
- South West Coast Salmon Managed Fishery [14];
- Temperate Demersal Gillnet and Demersal Longline Fisheries including:

- Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery (South Coast Bioregion)
- South West Trawl Managed Fishery (SWTMF) – referred to as South Coast Trawl Limited Entry Fishery in Figure 14-12; and
- Windy Harbour/Augusta Rock Lobster Managed Fishery [14].

Whole of State Fisheries

- Marine Aquarium Fish Managed Fishery (MAFMF);
- Specimen Shell Managed Fishery; and
- Hermit Crab Fishery (HCF) [14].

Some of the fisheries listed above will be more susceptible to impacts than others, particularly fisheries without the ability to escape impacts. For example, above average water temperatures over the last three years will have had an impact on prawn fisheries in Exmouth and scallops and blue swimmer crabs in Shark Bay which have been significantly affected by the initial heat wave event of 2010/11 (Caputi *et al*. 2014).

14.7.2 Commonwealth Fisheries

Commonwealth fisheries are those within the 200 nautical mile Australian Fishing Zone (AFZ) managed by Australian Fisheries Management Authority (AFMA) and are, on the high seas, and, in some cases, by agreement with the States and Territory, to the low water mark. Information on Commonwealth managed fisheries has been derived from '*Fishery Status'* Report 2019 (Department of Agriculture 2019)

Commonwealth fisheries who have permits to operate in the combined EMBA include as shown in Figure 14-13:

- North West Slope Trawl (NWST);
- Northern Prawn Fishery (NPF);
- Southern Bluefin Tuna Fishery (SBFTF);
- Western Tuna and Billfish Fishery (WTBF) (including Southern Tuna and Billfish Fishery);
- Small Pelagic Fishery (SPF);
- Southern and Eastern Scalefish and Shark Fishery (SESSF) – not shown in Figure 14-13;
- Skipjack Tuna Fishery (STF) (referred to as Western Skipjack Tuna Fishery in Figure 14-13); and
- Western Deepwater Trawl (WDTF) (referred to as Western Deepwater Trawl Fishery in Figure 14-13).

Commonwealth commercial fisheries between Kalbarri (WA) and the NT Border are shown Figure 14-13 and summarised in Table 14-1.

14.7.3 Indonesian Commercial and Subsistence Fishing

Within the northern and north-western extent of the combined EMBA is a defined area where a Memorandum of Understanding (MoU) exists between the Australian and Indonesian Governments. The Agreement between the Government of Australia and the Government of the Republic of Indonesia Relating to Cooperation in Fisheries (1992 Fisheries Cooperation Agreement) 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.

Cooperation under the Agreement today takes place 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 Box (shown on Figure 14-13) is an area of Australian water in the Timor Sea where Indonesian traditional fishers, using traditional fishing methods only, are permitted to operate. Officially it is known as the Australia-Indonesia Memorandum of Understanding regarding the Operations of Indonesian Traditional Fishermen in Areas of the Australian Fishing Zone and Continental Shelf – 1974.

As part of negotiations to delineate seabed boundaries, Australia and Indonesia entered into the MoU which recognises the rights of access for traditional Indonesian fishers in shared waters to the north of Australia. This access was granted in recognition of the long history of traditional Indonesian fishing in the area. The MoU provides Australia with a tool to manage access to its waters while for Indonesia, it enables Indonesian traditional fishers to continue their customary practices and target species such as trepang, trochus, abalone and sponges. Guidelines under the MoU were agreed in 1989 in order to clarify access boundaries for traditional fishers and take into account the declaration of the 200 nautical mile fishing zones. Because of its approximate shape the MoU area became known as the MoU Box.

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 boundary (ERM 2008, 2009). 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 (approximately 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 Aidil 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).

14.8 Aquaculture

14.8.1 South West Bioregion

The predominant aquaculture activity undertaken in this region is the production of mussels and oysters from Oyster Harbour at Albany. This activity is restricted to this area where there are sufficient nutrient levels related to terrestrial run-off to provide the planktonic food necessary to promote growth of filter-feeding bivalves fishing (Fletcher and Santoro 2015). The high-energy environment and limited protected deep waters limits other forms of aquaculture such as sea cage farming.

Further invertebrate aquaculture operations are expected within Albany following recent funding and declaration of the Albany Aquaculture Development Zone by DPIRD. Two zones have already been declared with the Oyster Harbour area declared in August 2020 and the Princess Royal Harbour and King George Sound areas declared in December 2021. Once fully established, the Albany Aquaculture Development Zone will be the largest single zone dedicated to marine shellfish farming in Australia (DPIRD, 2020).

Further aquaculture in the region includes the Rare Foods Australia (formerly Ocean Grown Abalone) Project in Flinders Bay in the South West region of Western Australia. The project is the world's first commercial abalone ranch using concrete artificial reef structures, known as ABITATs. The ABITATs are lowered into two lease areas where the ranches are self-sustaining and the abalone nurture and feed from the ocean until they are ready for harvest (information available from . https://rarefoodsaustralia.com.au/a-world-first-ocean-ranching/)

14.8.2 West Coast Bioregion

The principal aquaculture development activities in this region are the production of blue mussels (*Mytilus galloprovincialis*) and marine algae (*Dunaliella salina*) and the emerging black pearl industry based on the production of *Pinctada margaritifera* at the Abrolhos Islands. The main mussel farming area is in southern Cockburn Sound, where conditions are sheltered and the nutrient and planktonic food levels are sufficient to promote good growth rates fishing (Fletcher and Santoro 2015).

Further aquaculture operations are expected following the establishment of the Mid-West Aquaculture Development Zone by DPIRD, which aims to provide a platform to stimulate aquaculture investment and development in the bioregion (Gaughan and Santoro 2020).

14.8.3 Gascoyne Coast Bioregion

Hatchery production of oysters is the core of the pearling industry in the Gascoyne region. Hatcheries in Carnarvon and Exmouth supply spat to pearl farms in the north-west and several hatcheries supply juveniles to the black-lip pearl oyster to developing black pearl farms in the region. Pearl production is carried out on a small scale in Shark Bay and Exmouth Gulf. The local aquiculture sector is also focussing on the production of aquarium species.

14.8.4 North Coast Bioregion

Aquaculture development in this region is dominated by the production of pearls from the species *Pinctada maxima.* Each year, approximately 500,000 wild individuals are harvested, with the majority being from Eighty Mile Bean in Broome, Western Australia (sourced from Fisheries Research and Development Cooperation in Thomas and Miller 2022). A large number of pearl oysters for seeding is obtained from wild stocks and supplemented by hatchery-produced oysters with major hatcheries operating at Broome and the Dampier Peninsular. Pearl farm sites are located mainly along the Kimberley coast, particularly in the Buccaneer Archipelago, in Roebuck Bay and at the Montebello Islands. Developing marine aquaculture initiatives in this region include growing trochus and barramundi.

The Pearl Oyster Fishery of Western Australia operates in shallow coastal waters (DoF 2006). All the leases are within the 35m diving depth, with commercial diving predominantly occurring in nearshore habitats of 8-15 m depths (Thomas and Miller, 2022). Through consultation the Pearl Producer's Association (PPA) have raised concern that spawning stock is found to the 100 m depth contour. However, this is not supported in the study by Condie *et al* (2006) who modelled oyster larva transport in the Eighty Mile Beach region and found that while some larvae travelled more than 60 km, most were transported less than 30 km. The model results suggest that spawning in the Eighty Mile Beach region is concentrated around the 8 to 15m depth range, with potential smaller contributions from the northeast. These spawning events are likely to lead to successful recruitment locally and alongshore to the southwest.

They also feed larvae into neighbouring shallow coastal environments (through tidal oscillations) and deeper waters to the west (>20 m). However, spat abundances seem to be low in these areas, suggesting that recruitment is strongly limited by habitat availability and possibly high mortality rates in shallow water. High local abundances of broodstock and spat observed occasionally in deeper water (<30 m) seem to be supported by intermittent larval transport from inshore populations. Spawning in this area seems to contribute little to recruitment in the inshore populations.

Further aquaculture in this region mainly focuses on barramundi farming within Cone Bay, with two aquaculture licences granted in this area located about 200 km north-east of Broome (Gaughan and Santoro 2020).

Further aquaculture operations have expanded in the region with the establishment of the Kimberley Aquaculture Development zone, which encompasses almost 2,000 ha of coastal waters within Cone Bay supporting the production of up to 20,000 t of finfish annually (Gaughan and Santoro 2020).

14.8.5 Northern Territory

The Northern Territory boasts a diverse and vibrant aquaculture industry. An extensive range of commercial activity includes barramundi farming, trepang (sea cucumber), pearling and the collection of marine fish and coral for the tropical aquarium market. A pond-based barramundi farm on the Adelaide River produces more than 1,000 tonnes of Barramundi a year (Northern Territory Government, 2016). Giant clams are also farmed with trials on Groote Eylandt and Goulburn Island growing sea clams in sea-based cages. The silver-lipped pearl oyster is farmed in four main areas of the NT: Bynoe Harbour, Beagle Gulf, Cobourg Peninsula and Croker Island around the islands north west of Nhulunbuy.

14.8.6 Indonesian Aquaculture

An analysis by WorldFish has indicated that aquaculture will overtake capture fisheries as the major source of fish in Indonesia before 2030 (Phillips *et al.* 2015). By volume, Indonesian aquatic production is dominated by seaweeds, but by value, domestically consumed species such tilapia and milkfish, together with export-orientated commodities such as shrimp and tuna, are of greater importance (Phillips *et al*. 2015).

Carrageenan seaweed farming based primarily on the cultivation of *Kappaphycus* and *Eucheuma* species has grown significantly in Indonesia. Due to the simple farming techniques required, low requirements of capital and material inputs, and short production cycles it has become a favourable livelihood for smallholder farmers and fishers (Valderrama *et al*. 2013). Indonesia's coastline provides ideal conditions for fish farming in "brackish waters". Aquaculture in Indonesia is predominantly used for seaweed production, whilst offshore fish cultivation remains relatively undeveloped (Global Business Guide 2014).

14.9 Recreational Fisheries

14.9.1 South West Bioregion

The South West Bioregion includes the water from Augusta to Eucla on the Western Australia/South Australia border. The continental shelf waters of this region are generally temperate but low in nutrients due to the seasonal presence of the tail of the tropical Leeuwin current and limited terrestrial run-off. As much of the south coast is remote or difficult to access, recreational beach and boat fishing tends to be concentrated around the main population and holiday centres. The major target species for beach and rock anglers are salmon, herring, whiting and trevally, while boat anglers target pink snapper, queen snapper, Bight redfish, a number of shark species, salmon fish and King George whiting. Another component of the recreational fishery is dinghy and shoreline fishing off estuaries and rivers where the main angling targets are black bream and whiting. Recreational netting primarily targeting mullet also occurs in these estuaries (WAFIC 2016).

14.9.2 West Coast Bioregion

The marine environment of the West Coast Bioregion which lies between Kalbarri and Augusta is predominantly a temperate oceanic zone, but it is heavily influenced by the Leeuwin current, which transports warm tropical water southward along the edge of the continental shelf. This region contains the state's major population centres and is the most heavily used bioregion for recreational fishing (Fletcher and Santoro 2015). The range of recreational fishing opportunities includes estuarine fishing, beach fishing and boat fishing either in embayments or offshore for demersal and pelagic game species often around the islands and out to the continental shelf (WAFIC 2016).

14.9.3 Gascoyne Coast Bioregion

The Gascoyne Coast Bioregion extends from just north of Kalbarri to the Ashburton River, south of Onslow. The marine environment of this region represents a transition between the fully tropical waters of the north-west shelf of the north coast region and the temperate waters of the west coast region. This region has been identified as one of the 18 world 'hotspots' in terms of tropical reef endemism and the second most divers marine environment in the world in terms of tropical reef species. This region is a focal point for winter recreational fishing and is a key component of many tourist visits. Angling activities include beach and cliff fishing (e.g. Steep Point and Quobba), embayment and shallow-water boat angling (e.g. Shark Bay, Exmouth Gulf and Ningaloo lagoons), and offshore boat angling for demersal and larger pelagic species (e.g. off Ningaloo). The predominant target species include the tropical species such as emperors, tropical snappers, groupers, mackerels, trevallies and other game fish. Temperate species at the northern end of their ranges such as pink snapper, tailor and whiting also provide significant catches, particularly in Shark Bay (WAFIC 2016).

14.9.4 North Coast Bioregion

The North Coast Bioregion (Pilbara/Kimberley) runs from the Ashburton River to the Western Australia/Northern Territory border (WAFIC 2016). The oceanography of this region includes waters of Pacific Ocean origin that enter through the Indonesian archipelago bringing warm, low salinity waters polewards via the Indonesian throughflow and Holloway currents which flow seasonally and interact with Indian ocean waters. Recreational fishing is experiencing a significant growth in this region, with a distinct seasonal peak in winter when the local population increases by significant numbers of metropolitan and inter-state tourists. This has been added to by the increased recreational fishing by those involved in the construction or operation of major developments in this region. Owing to the high tidal range, much of the angling activity is boat-based with beach fishing limited to periods of flood tides and high water. Numerous creek systems, mangroves, rivers and ocean beaches provide shore and small boat fishing for a variety of species including barramundi, tropical emperors, mangrove jack, trevallies, sooty grunter, threadfin, mud crabs and cods. Offshore islands, coral reef systems and continental shelf waters provide species of major recreational interest including saddletail snapper and red emperor, cods, coral and coronation trout, sharks, trevally, tuskfish, mackerels and billfish (WAFIC 2016).

14.9.5 Northern Territory

The most recent available data on recreational fishing in the Greater Darwin area indicates that line fishing (using bait, lures or flies) was the most common fishing method used, accounting for 72% of the total effort, followed by Mud Crab potting (23%). The use of cast nets and other fishing methods was far less common. Approximately 70% of all recreational fishing effort occurred in estuarine waters (Matthews et al, 2019). The Darwin Harbour region and its associated arms and creeks supported 40% of the total fishing effort, followed by Bynoe Harbour (14%) and Shoal Bay (6%). The offshore regions seaward of Bynoe Harbour and Dundee were the most popular sites for those fishers venturing beyond estuarine waters. Most of the catch (84%) comprised of fish species (i.e. bony fish and sharks/rays) with the bulk of the remaining catch consisting of crabs and prawns.

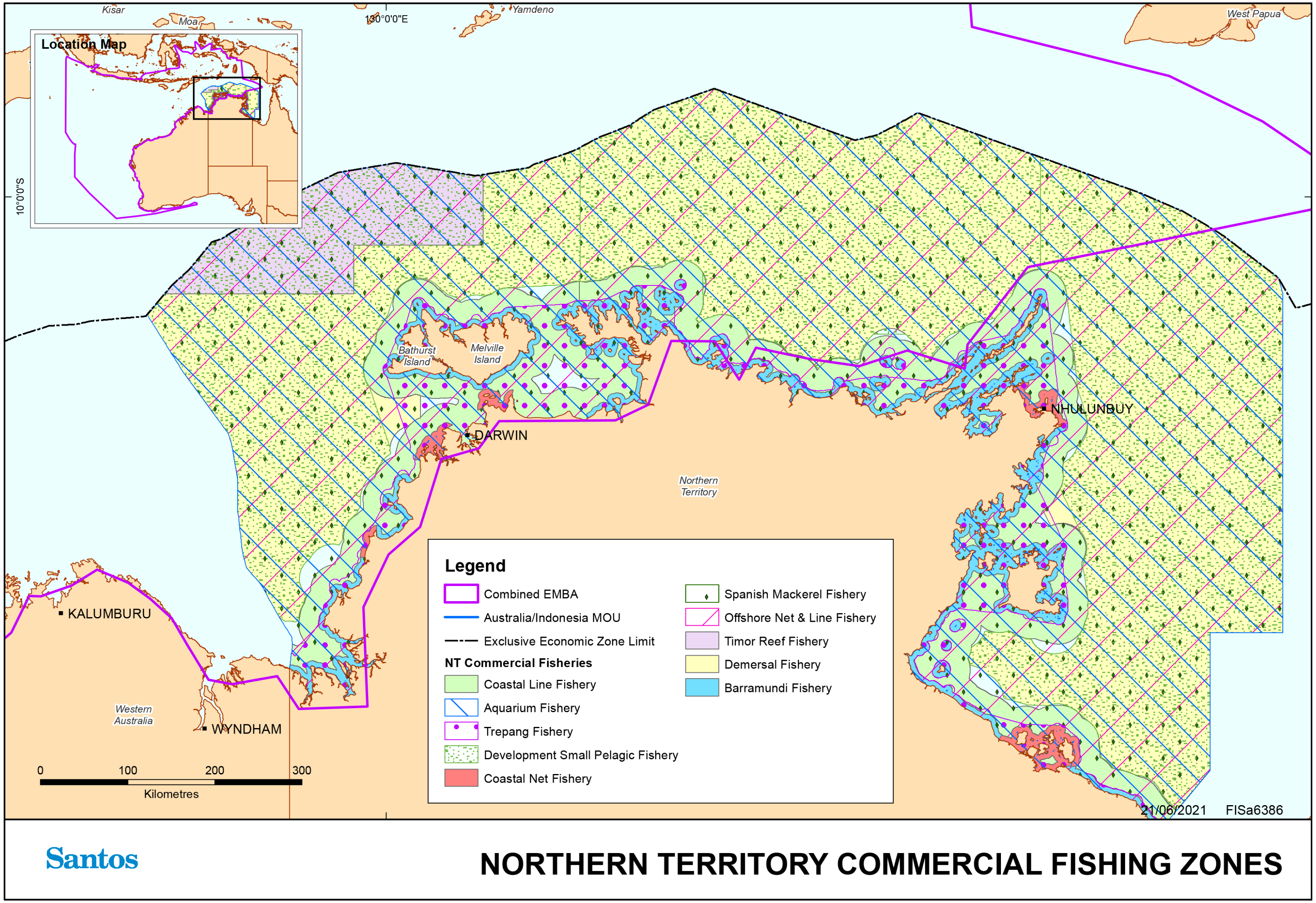

Figure 14-11: NT state commercial fishing zones

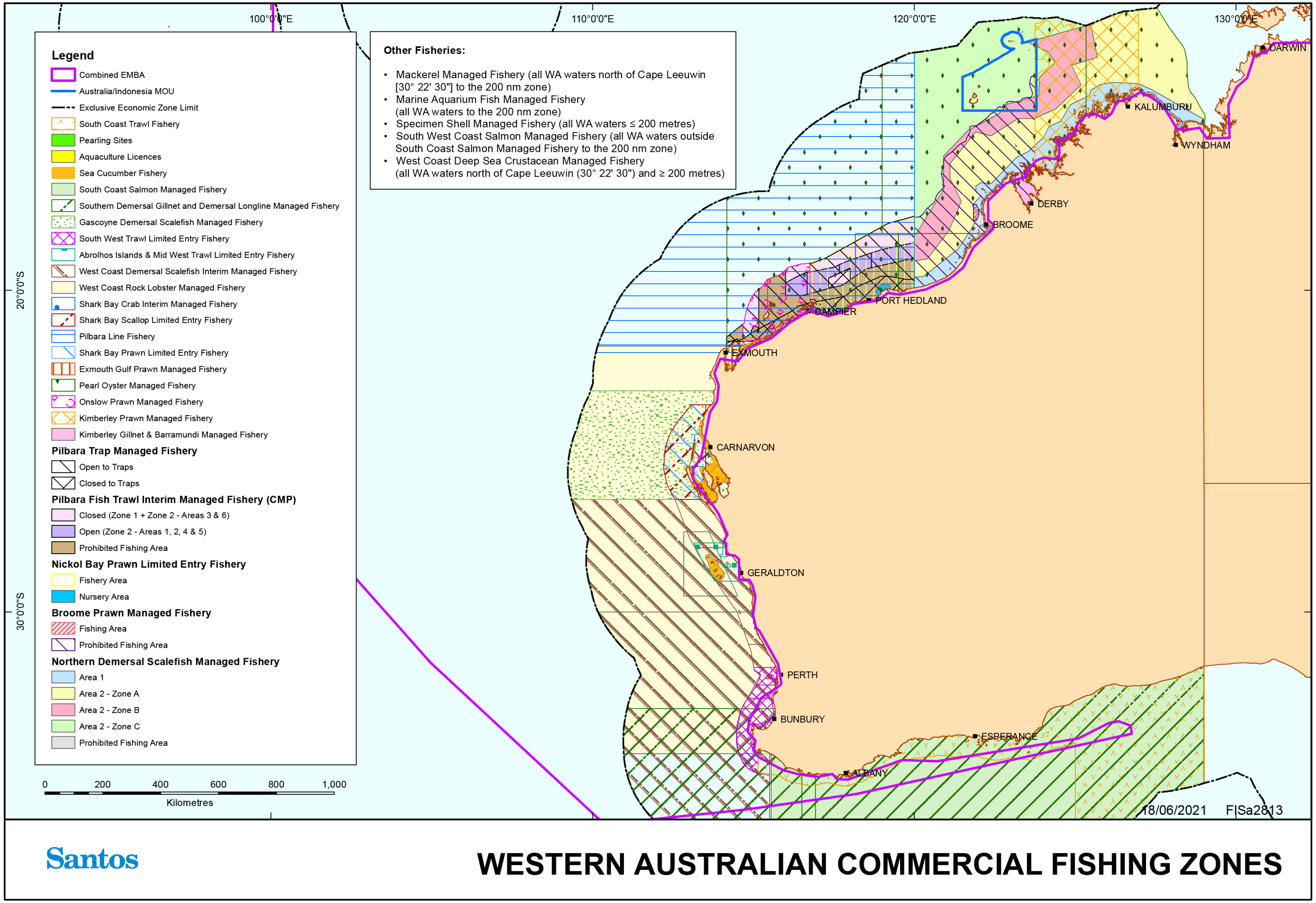

Figure 14-12: WA state commercial fishing zones

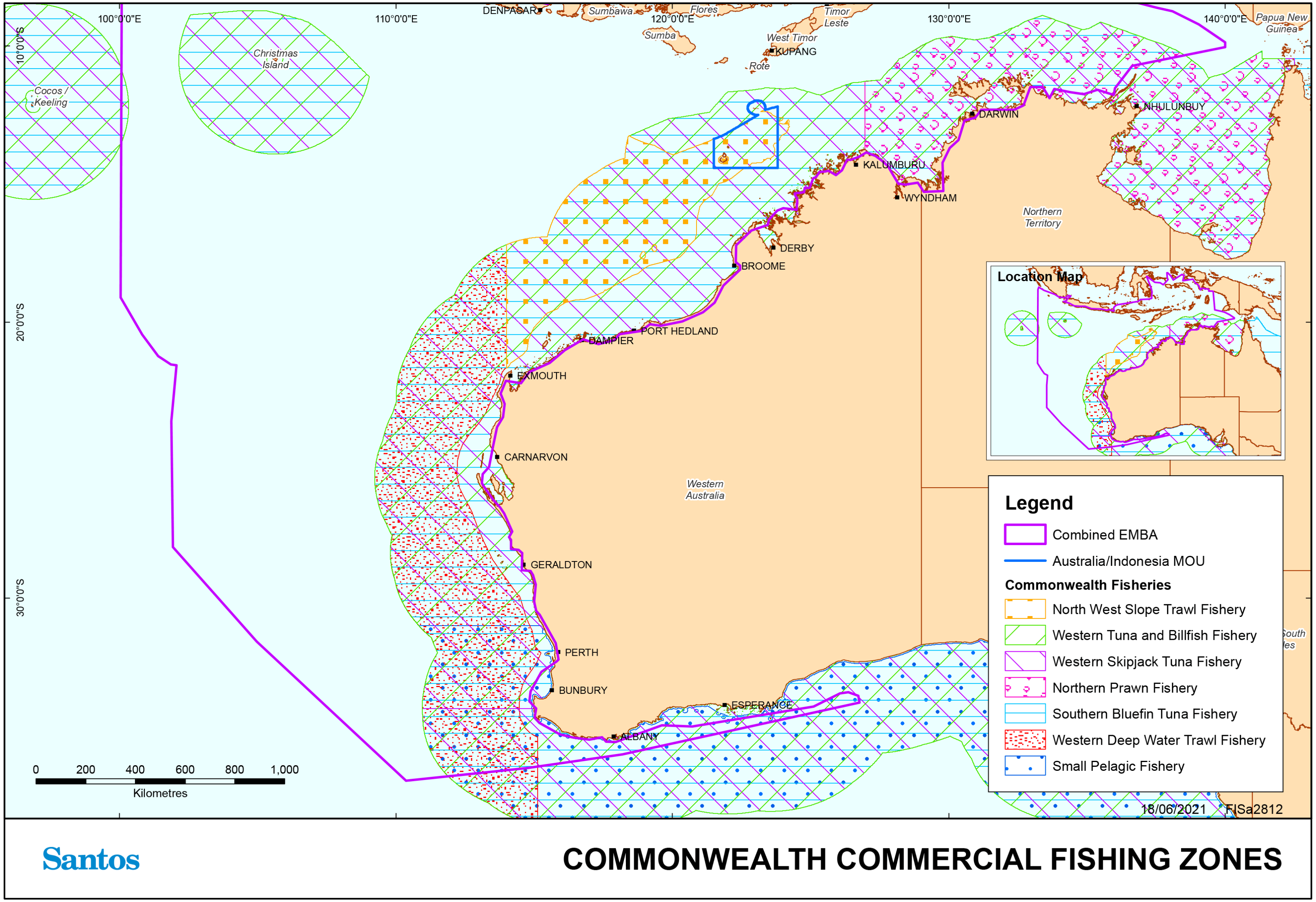

Figure 14-13: Commonwealth commercial fishing zones

Table 14-1: Commercial fisheries with permits to operate within the combined EMBA

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
State Managed Fisheries				
Abrolhos Islands and Mid-West Trawl Managed Fishery (AIMWTMF)	Saucer scallops (*Ylistrum balloti*), with a small component targeting the western king prawn (*Penaeus latisulcatus*)	2017/2018: 651 tonnes	Operates using low opening otter trawl systems.	All the waters of the Indian Ocean adjacent to Western Australia between 27°51´ south latitude and 29°03´ south latitude on the landward side of the 200 m isobath'.
Aquarium Fishery	Multi-species catch including; invertebtrates (hermit crabs, various snails, whelks and hard and soft corals) and finfish (rainbowfish, catfishes and scats).	Unknown	Dive-based method of collection, using barrier, cast, scoop, drag and skimmer nets, hand pumps, freshwater pumps and handheld instruments.	The Aquarium fishery is a small-scale, multi-species fishery that prospects freshwater, estuarine and marine habitats to the outer boundary of the AFZ. Most of the harvest occurs within 100km of Darwin, though one license holder does collect from two offshore locations; Evans Shoal and Lynedoch Bank. Fishing activities may occur year round.
Barramundi Fishery	Barramundi King threadfin	The fishery is restricted to 14 licences all of which are currently allocated to fishers.	Gill nets	The annual commercial barramundi fishing season in the NT is from 1 February to 30 September. Fishing is allowed from the high water mark to three nautical miles seaward of the low water mark. The area is restricted to waters seaward from the coast, river mouths and legislated closed lines
Broome Prawn Managed Fishery (BPMF)	Western king prawns (*Penaeus latisulcatus*) and coral prawns (a combined category of small penaeid species).	Extremely low fishing effort occurred as only a single boat undertook trial fishing to investigate whether catch rates were sufficient for commercial fishing. This resulted in negligible landings of western king prawns with no byproduct recorded.	Otter trawl	The BPMF operates in a designated trawl zone off Broome. The boundaries of the BPMF are 'all Western Australian waters of the Indian Ocean lying east of 120° east longitude and west of 123°45' east longitude on the landward side of the 200 m isobath'. The actual trawl area is contained within a delineated small area north west of Broome.

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
Coastal Line Fishery	Black jewfish Golden snapper	Fishery is restricted to 52 licenses, with approximately one third of these being active in 2015.	Lines, nets and traps	Fishing occurs along the NT coast between high water marks and 15 nm from low water mark. Majority of activity is concentrated around rocky reefs along the coastline within 100km from Darwin. Fishing activities occur year-round.
Coastal Net Fishery	Mullet	This fishery is restricted to five licences, all of which are allocated.	Nets	The fishery extends from the high water mark to three nautical miles out from the low water mark. The fishery is divided into regions including: • Darwin – from Cape Hotham to Native Point and Cape Ford to Cape Dooley • Gove – between Cape Arnhem and Cape Wilberforce • Borroloola – from Bing Bong Creek and Pelican Spit.
Cockburn Sound Mussel Managed Fishery	Blue mussels (*Mytilus edulis*)	2015: Unspecified	Agriculture	Main mussel farming occurs in southern Cockburn Sound.
Cockburn Sound Crab Managed Fishery	Blue Swimmer (*Portunus armatus)* Blue swimmer crab (*Portunus armartus)*	2017/2018: 5: closed to commercial and recreational fishing since April 2014	Drop nets, scoop nets, diving	Encompasses the inner waters of Cockburn Sound, from South Mole at Fremantle to Stragglers Rocks, through Mewstone to Carnac Island and Garden Island, along the eastern shore of Garden Island and back to John Point on the mainland.
Cockburn Sound Line and Pot Managed Fishery	Southern garfish (*Hyporhamphus melanochir*), Australian herring (*Arripis geogianus*)	2017/2018: 257 tonnes	Line (fish) Shelter and trigger pots (octopus)	Encompasses the inner waters of Cockburn Sound, from South Mole at Fremantle to Stragglers Rocks, through Mewstone to Carnac Island and Garden Island, along the eastern shore of Garden Island and back to John Point on the mainland.

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
Demersal Fishery	Red snappers Goldband snappers	There are currently 19 licenses issued for the fishery, with around 9 active.	Handline Dropline Fish traps Although, essentially trap-based since 2002	This fishery extends from waters 15nm from the coastal waters mark to the outer limit of the AFZ, excluding the area of the Timor Reef Fishery.
Exmouth Gulf Prawn Managed Fishery	Western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*), endeavour prawns (*Metapenaeus* spp.) and banana prawns (*Penaeus merguiensis*).	2017/2018: 713 tonnes	Low opening otter trawls.	Sheltered waters of Exmouth Gulf Essentially the western half of the Exmouth Gulf (eastern part is a nursery ground). The Muiron Islands and Point Murat provide the western boundary; Serrurier Island provides the northern limit
Gascoyne Demersal Scalefish Managed Fishery (GDSMF)	Targets pink snapper (*Pagrus auratus*) and goldband snapper (*Pristipomoides multidens*). Other demersal species caught include the rosy snapper (*P. filamentosus*), ruby snapper (*Etelis carbunculus*), red emperor (*Lutjanus sebae*), emperors (Lethrinidae, including spangled emperor, *Lethrinus nebulosus*, and redthroat emperor, *L. miniatus*), cods (Epinephelidae, including Rankin cod, *Epinephelus multinotatus* and goldspotted rockcod, *E. coioides*), pearl perch (*Glaucosoma burgeri*), mulloway (*Argyrosomus japonicas*), amberjack (*Seriola dumerili*) and trevallies (Carangidae).	2017/2018: Snapper: 133 tonnes Other demersals: 144 tonnes	Mechanised handlines	The GDSF operates in the waters of the Indian Ocean and Shark Bay between latitudes 23°07'30"S and 26°30'S. Vessels are not permitted to fish in inner Shark Bay.
Abalone Managed Fishery	Greenlip abalone (*Haliotis laevigata*) Brownlip abalone (*H. conicopora)*	2017/2018: 98 tonnes	Dive fishery The principal harvest method is a diver working off 'hookah' (surface supplied breathing apparatus) or SCUBA using an abalone 'iron' to prise the	Shallow coastal waters off the south-west and south coasts of Western Australia Covers all Western Australian coastal waters, which are divided into eight management areas. Commercial fishing for greenlip/brownlip abalone is managed in three separate areas.

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
			shellfish off rocks – both commercial and recreational divers employ this method.	
Hermit Crab Fishery (HCF)	Australian land hermit crab (*Coenobita variabilis*)	2017/2018: 58,643 (lowest reported in the last 10 years (2008-2017; catch range 58,643-118,203).	Land based hand collection typically using four-wheel drives to access remote beaches	Operates in Western Australian waters north of the Exmouth Gulf (22°30'S)
Kimberley Developing Mud Crab Managed Fishery	Mud crab (*Scylla serrata*)	2017/2018: 60 tonnes (also includes catch data from Pilbara Developmental crab fishery)	Mud Crab traps	This fishery operates between Broome and Cambridge Gulf. Three commercial operators are permitted to fish from King Sound to the Northern Territory border, with closed areas around communities and fishing camps. One Aboriginal Corporation is permitted to fish in King Sound, with the other Aboriginal Corporation permitted to fish in a small area on the western side of the Dampier peninsula, north of Broome. Notices issued under the *Fish Resources Management Act 1994* prohibit all commercial fishing for mud crabs in Roebuck Bay and an area of King Sound near Derby.
Kimberley Gillnet and Barramundi Managed Fishery (KGBF)	Barramundi *(Lates calcarifer),* King threadfin *(Polydactylus macrochir),* Blue threadfin *(Eleutheronema tetradactylum)*	2017/2018: 79.9 tonnes	Gill net in inshore waters	Nearshore and estuarine zones of the North Coast Bioregion from the WA/NT border (129ºE) to the top end of Eighty Mile Beach, south of Broome (19ºS). The waters of the KGBF are defined as 'all Western Australian waters north of 19° south latitude and west of 129° east longitude and within three nautical miles of the high water mark of the mainland of Western Australia and the waters of King Sound south of 16°21.47′ south latitude.

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
Kimberley Prawn Managed Fishery (KPMF)	Banana prawns (*Penaeus merguiensis*) Tiger prawns (*Penaeus esculentus*) Endeavour prawns (*Metapenaeus endeavouri*) Western king prawns (*Penaeus latisulcatus*)	2017/2018: 269 tonnes	Otter trawl	The KPMF operates off the north of the state between Koolan Island and Cape Londonderry. The boundaries of the KPMF are 'all Western Australian waters of the Indian Ocean lying east of 123°45´ east longitude and west of 126°58´ east longitude'. It abuts the western boundary of the Commonwealth Northern Prawn Fishery (NPF).
Mandurah to Bunbury Developing Crab Fishery	Blue swimmer crab (*Portunus armartus)*	2017/2018: 5.2 tonnes	Drop nets, scoop nets, diving	Fishery extends from south of the Shoalwater Islands Marine Park (32°22'40''S) to Point McKenna near Bunbury (33°16'S) and offshore to 115°30'E. The fishery is divided into two zones with crab fishing historically being permitted within Area 1, Comet Bay between 32°22''40''S and 32°30'S, and Area 2, Cape Bouvard to the southern boundary of the fishery. In 2015 crab fishing within Area 2 ceased.
Marine Aquarium Fish Managed Fishery (MAFMF)	Over 250 target species of finfish. (228 species caught in 2012). Fishermen can also take coral, live rock, algae, seagrass and invertebrates. The main fish species landed in 2012 were scribbled angelfish (*Chaetodontoplus duboulayi*) and green chromis (*Chromis cinerascens*) The main coral species landed in 2012 were the coral like anemones of the Corallimorpharia.	2017/2018: Total catch of 150,544 fishes, 21.9 t of coral, live rock & living sand and 322 L of marine plants.	Hand harvest while diving or wading. Hand held nets	Dive based fishery operating all year throughout WA waters, but restricted by diving depths. The MAFMF is able to operate in all State waters (between the Northern Territory border and South Australian border). The fishery is typically more active in waters south of Broome with higher levels of effort around the Capes region, Perth, Geraldton, Exmouth and Dampier. Operators in the MAFMF are also permitted to take coral, live rock, algae, seagrass and invertebrates under the Prohibition on Fishing (Coral, 'Live Rock' and Algae) Order 2007 and by way of Ministerial Exemption (Gaughan & Santoro, 2018).

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
Nickol Bay Prawn Managed Fishery (NBPMF)	Primarily targets banana prawns (*Penaeus merguiensis*)	2017/2018: 227 tonnes	Otter trawl	Operates along the western part of the North-West Shelf in coastal shallow waters The boundaries of the NBPMF are 'all the waters of the Indian Ocean and Nickol Bay between 116°45' east longitude and 120° east longitude on the landward side of the 200 m isobath'. The NBPMF incorporates the Nickol Bay, Extended Nickol Bay, Depuch and De Grey size managed fish grounds (State of the Fisheries 2014-15).
North Coast Trochus Fishery	Trochus (*Tectus niloticus*)	2017/2018: Unspecified	Harvested by with handheld levers or chisels	Indigenous fishery operating within King Sound
Northern Demersal Scalefish Managed Fishery (NDSF)	Red emperor (*Lutjanus sebae*) Goldband snapper (*Pristipomoides multidens*)	2017/2018:1317 tonnes (total) Goldband snapper (not including other jobfish): 473 tonnes Red emperor: 34 – 47 tonnes	The permitted means of operation within the fishery include handline, dropline and fish traps, but since 2002 it has essentially been a trap-based fishery which uses gear time access and spatial zones as the primary management measures (State of the Fisheries 2014-15).	The Northern Demersal Scalefish Managed Fishery (NDSF) operates off the northwest coast of Western Australia in the waters east of 120° E longitude. These waters extend out to the edge of the Australian Fishing Zone (200 nautical miles). The Fishery consists of three zones; Zone A is an inshore area, Zone B comprises the area with most historical fishing activity and Zone C is an offshore deep slope developmental area. The fishery is further divided into two fishing areas; an inshore sector and an offshore sector. The inshore waters in the vicinity of Broome are closed to commercial fishing.
WA North Coast Shark Fisheries	Sandbar (*Carcharhinus plumbeus*), hammer head (*Sphyrnidae*), blacktip (*Carcharhinus melanopterus*) and lemmon sharks (*Negaprion brevirostris*).	2017/2018: closed since 2008/2009	Gill net, longline	Comprised of the State-managed WA North Coast Shark Fishery in the Pilbara and western Kimberley, and the Joint Authority Northern Shark Fishery in the eastern Kimberley.
Octopus Interim Managed Fishery	*Octopus cf. tetricus*, with occasional bycatch of *O. ornatus* and *O. cyanea* in the northern parts of the fishery, and	2017/2018: Commercial: 257 tonnes	Line and pots Trawl and trap (land Octopus as byproduct)	Fishery in development phase. Four main categories in WA waters. Octopus are primarily caught in the Developing Octopus Interim

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
	O.maorum in the southern and deeper sectors.	Recreational: 1 tonne		Managed Fishery (largest fishery) are limited to the boundaries of the developmental fishery, which is an area bounded by the Kalbarri Cliffs (26°30'S) in the north and Esperance in the south. Passive and by-product harvests of octopus occur in both the Cockburn Sound (Line and Pot) Managed Fishery and the West Coast Rock Lobster Managed Fishery.
Offshore Net and Line Fishery	Blacktip sharks Grey mackerel,	The number of licences for the fishery is restricted to 17 and only 10 boats operated in 2015. Limited effort was undertaken in the outer offshore area of the fishery during 2012.	Lines and nets	The fishery covers an area of over 522,000 km2 and extends from the NT high water mark to the boundary of the AFZ. Majority of the fishing effort is in the coastal zone (within 12 nm of the coast) and immediately offshore in the Gulf of Carpentaria.
Onslow Prawn Managed Fishery (OPMF)	Western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*), endeavour prawns (*Metapenaeus* spp.)	2017/2018: Negligible (Minimal fishing occurred in 2017)	Otter trawl	Operates along the western part of the North-West Shelf with most prawning activities concentrated in the shallower water off the mainland. The boundaries of the OPMF are 'all the Western Australian waters between the Exmouth Prawn Fishery and the Nickol Bay prawn fishery east of 114º39.9' on the landward side of the 200 m depth isobath'.
Pilbara Developmental Crab Fishery	Blue Swimmer (*Portunus armatus)* Mud Crab (*Scylla* spp)	2017/2018: 60 tonnes (total number includes Kimberley Developing Mud Crab Fishery)	Variety of gear but mostly commercial crab pots (Hourglass traps used in inshore waters from Onslow through to Port Hedland with most commercial and activity occurring in and around Nickol Bay)	The majority of the commercially and recreationally-fished stocks are concentrated in the coastal embayments and estuaries between Geographe Bay in the south west and Nickol Bay in the north. Crabbing activity along the Pilbara coast is centred largely on the inshore waters from Onslow through to Port Hedland, with most commercial and recreational activity occurring in and around Nickol Bay.

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
			Recreational fishers use drop nets or scoop nets, with diving for crabs becoming increasingly popular	
Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF)	Variety of demersal scalefish including goldband snapper (*Pristipomoides multidens*), red emperor (*Lutjanus sebae*), bluespotted emperor (*Lethrinus punctulatus*), crimson snapper (*Lutjanus erythropterus*), saddletail snapper (*Lutjanus malabaricus*), Rankin cod (*Epinephelus multinotatus*), brownstripe snapper (*Lutjanus vitta*), rosy threadfin bream (*Nemipterus furcosus*), spangled emperor (*Lethrinus nebulosus*) and frypan Moses' snapper (*Argyrops Lutjanusspinifer russelli*).	2017/2018: 1,780 tonnes	Demersal trawl	The Pilbara Fish Trawl (Interim) Managed Fishery is situated in the Pilbara region in the north west of Australia. It occupies the waters north of latitude 21°35'S and between longitudes 114°9'36"E and 120°E. The Fishery is seaward of the 50 m isobath and landward of the 200 m isobath. The Fishery consists of two zones; Zone 1 in the south west of the Fishery (which is closed to trawling) and Zone 2 in the North, which consists of six management areas.
Pilbara Trap Managed Fishery (PTMF)	Blue-spot emperor (*Lethrinus hutchinsi*), Red snapper (*Lutjanus erythropterus*), Goldband snapper (*Pristipomoides multidens*), Scarlet perch (*Lutjanus malabaricus*), Red emperor (*Lutjanus sebae*), Spangled emperor (*Lethrinus nebulosus*), Rankin cod (*Epinephelus multinotatus*)	2017/2018: 400–600 tonnes	Use of rectangular traps with single opening and 50 mm x 70 mm rectangular mesh panels. Trap fishing normally targets areas around rocky outcrops and reefs	Permitted to operate within waters bounded by a line commencing at the intersection of 21°56´ S latitude and the high water mark on the western side of the North West Cape.
Pilbara Line Managed Fishery	Variety of demersal scalefish including goldband snapper (*Pristipomoides multidens*), red emperor (*Lutjanus sebae*), bluespotted emperor (*Lethrinus punctulatus*), crimson snapper (*Lutjanus erythropterus*), saddletail snapper (*Lutjanus malabaricus*), Rankin cod	2017/2018: 50–115 tonnes	Line	The Pilbara Trap Managed Fishery lies north of latitude 21°44´ S and between longitudes 114°9´36´´ E and 120° E on the landward side of a boundary approximating the 200 m isobath and seaward of a line generally following the 30 m isobath.

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
	(*Epinephelus multinotatus*), brownstripe snapper (*Lutjanus vitta*), rosy threadfin bream (*Nemipterus furcosus*), spangled emperor (*Lethrinus nebulosus*) and frypan snapper (*Argyrops spinifer*), Ruby snapper (*Etelis carbunculus*) and eightbar grouper (*Hyporthodus octofasciatus)*			
Roe's Abalone	Western Australian Roe's abalone (*Haliotis roei*)	2017/2018: Commercial: 49 tonnes Recreational: 23 tonnes	Dive and wade fishery. The commercial fishery harvest method is a single diver working off a 'hookah' (surface-supplied breathing apparatus) using an abalone 'iron' to prise the shellfish off rocks. Abalone divers operate from small fishery vessels (generally less than 9 metres in length).	Operating in shallow coastal waters along WA's western and southern coasts from Shark Bay to the SA border. Divided into 8 management areas. Commercial fishing for Roe's abalone is managed in 6 separate regions from the South Australian border to Busselton Jetty – Areas 1, 2, 5, 6, 7 and 8. Area 8 of the fishery was not fished in 2013.
Shark Bay Crab Interim Managed Fishery	Blue swimmer crab (*Portunus armatus*)	2017/2018: 443 tonnes total Crab: 153 tonnes	Trawl and trap	Waters of Shark Bay north of Cape Inscription, to Bernier and Dorre Islands and Quobba Point. In addition, two fishers with long-standing histories of trapping crabs in Shark Bay are permitted to fish in the waters of Shark Bay south of Cape Inscription.
Shark Bay Prawn Managed Fishery	Western king prawn (*Penaeus latisulcatus*), brown tiger prawn (*Penaeus esculentus*), Variety of smaller prawn species including endeavour prawns (*Metapenaeus* spp.) and coral prawns (various species).	2017/2018: 1,608 tonnes	Low opening otter trawls	The boundaries of the Shark Bay Prawn Managed Fishery are located in and near the waters of Shark Bay

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
Shark Bay Scallop Managed Fishery	Saucer Scallop (*Ylistrum balloti*)	2017/2018: 1,632 tonnes	Low opening otter trawls	The boundaries of the Shark Bay Scallop Managed Fishery are located in and near the waters of Shark Bay
South Coast Open Access Netting Fishery	Insufficient information	Insufficient information	Insufficient information	Bunbury to the South Australian Border
Specimen Shell Managed Fishery (SSF)	Shells (cowries, cones) The Specimen Shell Managed Fishery (SSF) is based on the collection of individual shells for the purposes of display, collection, cataloguing, classification and sale. Just under 200 (196) different Specimen Shell species were collected in 2012, using a variety of methods.	2017/2018: 7,806 shells	Hand harvest while diving or wading along coastal beaches below the high water mark An exemption method being employed by the fishery is using a remote controlled underwater vehicle at depths between 60 and 300 m.	Dive based fishery operating all year throughout WA waters, but restricted by diving depths. The fishing area includes all Western Australian waters between the high water mark and the 200 m isobath. While the fishery covers the entire WA coastline, there is some concentration of effort in areas adjacent to population centres such as Broome, Karratha, Exmouth, Shark Bay, metropolitan Perth, Mandurah, the Capes area and Albany.
South Coast Salmon Managed Fishery	WA salmon (*Arripis truttaceus*)	2017: 50 tonnes	Beach seine net, rod and line	Licensees operate from 18 designated beaches within the South Coast Bioregion, many of which have huts that are referred to as salmon camps.
South West Coast Salmon Managed Fishery	WA salmon (*Arripis truttaceus*)	Insufficient information	Insufficient information	Insufficient information
South West Coast Beach Net	Insufficient information	Insufficient information	Insufficient information	Insufficient information
South West Trawl Managed Fishery (SWTMF)	Saucer scallops (*Ylistrum balloti*)	2017/2018: 460 t meat weight (2,301 t whole weight)	Otter trawls	Waters between 31°34’27’’S and 115°8’8’’E where it intersects with the high water mark at Cape Leeuwin and on the landward side of the 200 m isobath.
Spanish Mackerel Fishery	Narrow-barred spanish Mackerel	In 2012, there were 16 fishery licences of which 12 were actively operating (DPIF 2014).	Near-surface trolling gear from vessels or handline.	The fishery extends from the NT waters seaward off the coast and river mouths to the outer limit of the AFZ. The majority of the fishing effort occurs

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
		The 2012 fishing effort was 719 boat-days; a decrease from 813 boat-days in 2011 but an increase from the 672 boat-days in 2010.		coastal areas around reefs, shoals and headlands. The majority of the catch is taken in the Kimberley Area and north of Port Hedland.
Temperate Demersal Gillnet and Demersal Longline Fisheries (TDGDLF)	Gummy shark (*Mustelus antarcticus*), dusky shark (*Carcharhinus obscurus*), whiskery shark (*Furgaleus macki*) and sandbar shark (*Carcharhinus plumbeus*).	2017/2018: 2016-17Sharks and rays: 936 tonnes Scalefish: 133 tonnes	Demersal gillnets and power-hauled reels (to target sharks) Demersal longline	The Temperate Demersal Gillnet and Demersal Longline fisheries consists of Zone 1 of the Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery and the West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery. The Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery (JASDGDLF) spans the waters from 33° S latitude to the WA/SA border and comprises three management zones Zone 1 extends southwards from 33° S to 116° 30' E longitude off the south coast. Zone 2 extends from 116°30' E to the WA/SA border (129° E). A small number of Zone 3 units permit fishing throughout Zone 1 and eastwards to 116° 55'40" E. The West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery (WCDGDLF) technically extends northwards from 33° S latitude to 26° S longitude. However, the use of shark fishing gear has been prohibited north of 26° 30' S (Steep Point) since 1993. Demersal gillnet and longline fishing inside the 250 metre depth contour has been prohibited off the Metropolitan coast (between latitudes 31° S and 33° S) since November 2007.

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
Trepang Fishery	Sea cucumber (sandfish species)	The fishery is restricted to six licences, all of which are currently allocated.	Trepang are harvested by hand, either on foot or by diving.	Commercial fishing for sea cucumber is allowed from the high water mark to three nautical miles seaward from the territorial sea baseline. Most sea cucumbers are collected along the Arnhem Land coast, mainly around the Cobourg Peninsula and Groote Eylandt
Timor Reef Fishery	Goldband snapper	Consultation undertaken in 2016 confirmed there are only two active fishers currently operating in the fishery	Drop lines primarily in the 100 m–200 m depth range	Operates in remote offshore waters in the Timor Sea in a defined area approximately 370 km north-west of Darwin.
Warnbro Sound Crab Managed Fishery	Blue Swimmer (*Portunus armatus)* Blue swimmer crab (*Portunus armartus)*	2017/2018: closed to commercial and recreational fishing	Drop nets, scoop nets, diving	Includes Warnbro sound and adjacent water, extending from Becher Point to John Point.
West Coast Deep Sea Crustacean (Interim) Managed Fishery	Crystal (Snow) crabs (*Chaceon albus*), Giant (King) crabs (*Pseudocarcinus gigas*) and Champagne (Spiny) crabs (*Hypothalassia acerba*).	2017/2018: 164.4 tonnes	Baited pots operated in a longline formation in the shelf edge waters (>150 m)	North of latitude 34° 24' S (Cape Leeuwin) and west of the Northern Territory border on the seaward side of the 150 m isobath out to the extent of the AFZ, mostly in 500 to 800 m of water.
West Coast Demersal Scalefish (Interim) Managed Fishery	West Coast Inshore Demersals: West Australian Dhufish (*Glaucosoma hebraicum*), Pink snapper (*Pagrus auratus*) with other species captured including Redthroat Emperor (*Lethrinus miniatus*), Bight Redfish (*Centroberyx gerrardi*) and Baldchin Groper (*Choerodon rubescens*). West Coast Offshore Demersals: Eightbar Grouper *Hyporthodus octofasciatus*, Hapuku *Polyprion oxygeneios*, Blue-eye Trevalla *Hyperoglyphe antarctica* and Ruby Snapper *Etelis carbunculus*.	2017/2018: 248 tonnes	Handline and drop line	The WCDSIMF encompasses the waters of the Indian Ocean just south of Shark Bay (at 26°30'S) to just east of Augusta (at 115°30'E) and extends seaward to the 200 nm boundary of the Australian Fishing Zone (AFZ). The commercial fishery is divided into five management areas comprising four inshore areas and one offshore area. The inshore areas, i.e. Kalbarri, Mid-West, Metropolitan and South-West, extend outwards to the 250 m depth contour, while the Offshore Area extends the entire length of the fishery from the 250 m depth contour to the boundary of the AFZ.

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
West Coast Estuarine Managed Fishery	Blue swimmer crab (*Portunus armartus)*	2017/2018: 353 tonnes (blue swimmer crab) commercial and 58-77 tonnes recreational	Drop nets, scoop nets, diving (crabs)	Includes the waters of the Swan and Canning Rivers (Area 1), the waters of the Peel Inlet and Harvey Estuary, together with the Murray Serpentine, Harvey and Dandalup Rivers (Area 2) and waters of the Hardy Inlet (Area 3). Of these areas only Areas 1-2 are permitted for crab fishing.
West Coast Nearshore and Estuarine Finfish Fisheries	<u>Nearshore:</u> whitebait (*Hyperlophus vittatus*), western Australian salmon (*Arripis truttaceus*), Australian herring (*Arripis georgianus*), southern school whiting (*Sillago bassensis*), yellowfin whiting (*Sillago schomburgkii*), yelloweye mullet (*Aldrichetta forsteri*), tailor (*Pomatomus saltarix*), southern garfish (*Hyporhamphus melanochir*), silver trevally (*Pseudocaranx georgianus*) and King George whtiting (*Sillaginodes punctate*). <u>Estuarine</u>*:* sea mullet (*Mugil cephalus*), estuary cobbler (*Cnidoglanis macrocephalus*) and black bream (*Acanthopagrus butcheri*).	2017/2018: 353 tonnes	Haul, beach seine and gill netting (commercial). Line fishing (recreational)	Five commercial fisheries target nearshore and/or estuarine finfish in the West Coast Bioregion. <u>Nearshore:</u> Cockburn Sound Fish Net Managed Fishery operating within in Cockburn sound, South West Coast Salmon Managed Fishery operating on various beaches south of the Perth Metropolitan area, West Coast Beach Bait Managed Fishery operating on beaches spanning from Moore River to Tim's Thicket and the South West Beach Seine Fishery operating on various beaches from Tim's Thicket southwards to Port Geographe Bay Marina. <u>Estuarine</u>*:* West Coast Estuarine Managed Fishery operating in the Swan/Canning and Peel Harvey estuaries, and in the Hardy Inlet
West Coast Nearshore Net Managed Fishery	Southern garfish (Hyporhamphus melanochir), Australian herring (Arripis georgianus),	Insufficient information	Insufficient information	Insufficient information
West Coast Purse Seine Fishery	Scaly mackerel (*Sardinella lemuru*), pilchard (*S. sagax*), Australian anchovy (*Engraulis australis*), yellowtail scad (*Trachurus novaezelandiae*) and maray (*Etrumeus teres*).	2017/2018: 1,095 tonnes	Purse seine gear	Waters between Ningaloo and Cape Leeuwin including three separate zones: Northern Development (22°00'S to 31°00'S), Perth Metropolitan (31°00'S to 33°00'S) and Southern Development Zone (33°00'S to Cape Leeuwin).

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
West Coast Rock Lobster Managed Fishery (WCRLMF)	Western rock lobster (*Panulirus cygnus*)	2016: 272 – 400 tonnes (346-481 tonnes based on updated average weight)	Baited traps (pots). Pots and diving (recreational catch)	The fishery is situated along the west coast of Australia between Latitudes 21°44´ to 34°24´ S. The fishery is managed in three zones: Zone A – Abrolhos Islands, north of latitude 30° S excluding the Abrolhos Islands (Zone B) and south of latitude 30° S (Zone C).
West Coast Demersal Gillnet and Demersal Longline (WCDGDLF)*	Gummy shark (*Mustelus antarcticus*), dusky shark (*Carcharhinus obscurus*), whiskery shark (*Furgaleus macki*) and sandbar shark (*C. plumbeus*)	2016/2018: 936 tonnes of sharks and rays	Demersal gillnets and demersal longline (not widely used)	Operates between 26° and 33° S.
Mackerel Fishery	Spanish mackerel *(Scomberomorus commerson)*, grey mackerel *(S.semifasciatus)*, with other species from the genera *Scomberomorus*, *Grammatorcynus* and *Acanthocybium* also contributing to commercial catches.	2016: Commercial: The commercial catch of spanish mackerel was 276 tonnes in 2016 (Gaughan & Santoro, 2018)	Trolling or handline Near-surface trolling gear from vessels in coastal areas around reefs, shoals and headlands. Jig fishing is also used to capture grey mackerel *(S.semifasciatus)*	The Fishery extends from the West Coast Bioregion to the WA/NT border, to the 200 nautical mile AFZ with most effort and catches recorded north of Geraldton, especially from the Kimberley and Pilbara coasts of the Northern Bioregion. Restricted to coastal and shallower waters. Catches are reported separately for three Areas: Area 1 - Kimberley (121º E to WA/NT border); Area 2 -Pilbara (114º E to 121º E); Area 3 - Gascoyne (27º S to 114º E) and West Coast (Cape Leeuwin to 27º S).
Western Australian Pearl Oyster Managed Fishery	Indo- Pacific silver-lipped pearl oyster (*Pinctada maxima*).	2018: 468,573 shells	Drift diving restricted to shallow diveable depths. The collection of pearl oysters for the Pearl Oyster Managed Fishery is restricted to shallow diving depths below 35 m. Divers are attached to large outrigger booms on a vessel and towed slowly over the pearl oyster beds, harvesting	The fishery is separated into four zones: Pearl Oyster Zone 1: NW Cape (including Exmouth Gulf) to longitude 119°30'E. There are five licensees in this zone. No fishing in this zone since 2008 Pearl Oyster Zone 2: East of Cape Thouin (118°20´ E) and south of latitude 18°14´ S. The 9 licensees in this zone also have full access to Zone 3. This zone is the mainstay of the fishery.

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
			legalised oysters by hand as they are seen.	Pearl Oyster Zone 3: West of longitude 125°20´ E and north of latitude 18°14´ S. The 2 licensees in this zone also have partial access to Zone 2. Pearl Oyster Zone 4: East of longitude 125°20´ E to the Western Australia/Northern Territory border. Although all licensees have access to this zone, exploratory fishing has shown that stocks in this area are not economically viable. However, pearl farming does occur.
Western Australian Sea Cucumber Fishery (formerly known as Beche-de-mer)	Sandfish (*Holothuria scabra*) and deepwater redfish (*Actinopyga echinites*).	2016: 93 tonnes	Hand-harvest fishery, with animals caught principally by diving, and a smaller amount by wading.	The Western Australian Sea Cucumber Fishery is permitted to operate throughout WA waters with the exception of a number of specific closures around the Dampier Archipelago, Cape Keraudren, Cape Preston and Cape Lambert, the Rowley Shoals and the Abrolhos Islands. The fishery is primarily based in the northern half of the State, from Exmouth Gulf to the Northern Territory border.
Commonwealth Managed Fisheries				
North West Slope Trawl	Scampi (crayfish): velvet scampi (*Metanephrops velutinus*) and boschmai scampi (*Metanephrops boschmai*). Deepwater prawns (penaeid and carid): pink prawn (*Parapenaeus longirostris*), red prawn (*Aristaeomorpha foliacea*), striped prawn (*Aristeus virilis*), giant scarlet prawn (*Aristaeopsis edwardsiana*), red carid prawn (*Heterocarpus woodmasoni*) and white carid prawn (*Heterocarpus sibogae*). Snapper.	2017-18: 79.7 total tonnes.	Demersal crustacean trawl seaward of the 200 m isobath.	Extends from 114° E to approximately 125° E off the WA coast between the 200 m isobath and the outer limit of the Australian Fishing Zone (AFZ).

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
Western Skipjack Tuna Fishery	Skipjack tuna (*Katsuwonus pelamis*)	2017-18: None in either zones	Purse seine	The Skipjack Tuna Fishery is split into two sectors; east and west. The Western Skipjack Tuna Fishery is located in all Australia waters west of 142° 30' 00°E, out to 200 nm from the coast. There has been no fishing effort in the Skipjack Tuna Fishery since the 2008-09 season, and in that season activity concentrated off South Australia (Department of Agriculture 2019).
Small Pelagic Fishery	Australian sardine (*Sardinops sagax*), blue mackerel (*Scomber australasicus*), jack mackerel (*Trachurus declivis*) and redbait (*Emmelichthys nitidus*).	2018-19: 9,424 tonnes	Purse-seine and midwater trawling	Extends from Queensland to southern Western Australia.
Southern Bluefin Tuna Fishery	Southern bluefin tuna (*Thunnus maccoyii*).	2017-18: 6,159 tonnes	Purse seine vessels primarily in Great Australian Bight all year round and longline off southern NSW in winter. Around 98% of Australia's SBT quota is taken by 5–10 purse seine vessels fishing for 13–25 kg southern bluefin tuna.	Fishery includes all waters of Australia, out to 200 nm from the coast. No current effort on the North West Shelf, fishing activity is concentrated in the Great Australian Bight and off South-east Australia (Department of Agriculture 2019).
Western Deepwater Trawl Fishery	A diverse range of species are caught, ranging from tropical and ruby snappers on the shelf edge to orange roughy (*Hoplostethus atlanticus*), oreo dories and bugs (*Ibacus* spp.) in the deeper temperate waters.	2017-18: 101.9 tonnes	Demersal fish trawl seaward of the 200 m isobath.	Its northernmost point is from the boundary of the AFZ to longitude 114° E, and its southernmost point is from the boundary of the AFZ to longitude 115°08' E. Deep water off WA, from the 200 m isobath to the edge of the AFZ.
Western Tuna and Billfish Fishery	Broadbill swordfish (*Xiphias gladius*), albacore tuna (*Thunnus alalunga*), striped marlin (*Kajikia audax*), bigeye tuna (*T. obesus*) and yellowfin tuna (*T. albacares*).	2018: 278 tonnes	Pelagic, longline, minor line and purse seine.	Extends westward from Cape York Peninsula (142°30' E) off Queensland to 34° S off the WA west coast. It also extends eastward from 34° S off the west coast of WA across the Great Australian Bight to 141° E at the South Australian–Victorian border. In recent years,

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
				fishing effort has concentrated off south-west Western Australia and South Australia with no current effort on the North West Shelf (Department of Agriculture 2019).

Source: Apache (2008); Australian Fisheries Management Authority (2011); Department of Fisheries (2013), Stakeholder consultation.

[1]Sources for catch data: Department of Agriculture 2019; Gaughan *et al*, 2019; DPIRD 2018.

15. Document review

This document is to be reviewed annually at a minimum. The review and revision will consider any changes to the spatial scope of the document, i.e. the Environment that May be Affected (EMBA), as well as any changes to EPBC Act Matters of National Environmental Significance (MNES) from one review year to the next, regardless of any changes to the spatial extent of the combined EMBA. A review of changes to MNES shall consider at a minimum any changes to EPBC Act species lists, species management/recovery plans and MNES spatial layers. Changes are to be recorded within the MNES review register (Appendix B).

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Appendix A: EPBC Act Protected Matters Reports

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Appendix B: EPBC Act Protected Matters Reports

Due to restrictions on spatial file size and features that can be uploaded to the PMST (DAWE, 2021 available at:https://haveyoursay.agriculture.gov.au/upgrading-the-protected-matters-search-tool/widgets/360422/documents) the EMBA shapefile was separated into smaller sections to produce separate reports, which were then combined to produce the final report.

As described in Caveat 3 of the PMST report, 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.).

This may cause some species to show up in the PMST report solely due to the polygon capture techniques utilised by the tool, which affect the resolution of the report (for example, near coastal boundaries). Hence any terrestrial species that are not expected to occur in significant numbers in the marine and coastal environments in the combined EMBA were not described further in Section 6, 7 and 8.

Appendix C: MNES Review Register

Table B 1: Review Register

Taxon	2022 Rev 10	Reason for Change	Sections Updated within this Document
Threatened Species			
Table 5-1	Various species updated as per BC Act update (Gazette 144 of 2022)	Legislation update	Table 5-1
Table 7-1	Various species updated as per BC Act update (Gazette 144 of 2022)	Legislation update	Table 7-1
Table 8-1	Various species updated as per BC Act update (Gazette 144 of 2022)	Legislation update	Table 8-1
Abbott’s booby	*Papasula abbotti*	Incorrect spelling of scientific name	Table 8-6
Abbott’s booby	Changed BIA from ‘Yes’ to ‘No’ – as BIA is no longer listed	Legislative update	Table 8-1
Abbott’s booby	Removed from BIA table as the BIA is no longer listed	Legislative update	Table 8-6
Australian fairy tern	Terminology added (Foraging)	Legislative update	Table 8-1
Sea Birds	*Anous tenuirostris melanops*	Incorrect spelling	Table 8-6
Black-browed albatross	Terminology added (Migratory)	EP Act Legislative update	Table 8-1
Christmas Island frigatebird	Changed BIA from ‘Yes’ to ‘No’ – as BIA is no longer listed	Legislative update	Table 8-1
Christmas Island frigatebird	Removed from BIA table as the BIA is no longer listed	Legislative update	Table 8-6
Humpback whale	Updated EPBC status and outlined that despite removal from threatened species list, that they are still protected under EPBC Act Division 3	Legislative update	Section 7.1.5
Humpback whale	Terminology deleted (Vulnerable)	Ep Act Legislative update	Table 7-1
Humpback whale	Removed Conservation Advice for Megaptera novaeangliae (humpback whale) (2015) as it is no longer approved/current	Removed Conservation Advice for Megaptera novaeangliae (humpback whale) (2015) as it is no longer approved/current	Table 13-1
Mammals	EPBC terminology altered from Vulnerable to Endangered	EP Act Legislative update	Table 7-1
Red Knot	Population numbers added	Not included in current revision	Table 8-5
Hawksbill Turtle	Added new tagging research identifying that turtles migrating from WA remain on the continental shelf during certain phases.	Literature update – information in current revision was outdated	Section 6.1.3
Hawksbill Turtle	Added NWSS and Fossette *et al* findings on BIA overlaps	Literature update as per Santos comments on Rev9A	Section 6.1.3

Flatback Turtle	Added information on homing instinct, growth rates / population assessment implications (Turner Tomaszewicz et al, 2022)	Literature update as per Santos comments on Rev9A	Section 6.1.4
Olive Ridley Turtle	Updated information based on recent tagging study showing deeper diving capabilities.	Literature update	Section 6.1.6
Sei Whale	Provided reference on migration description	Missing reference in document	Section 7.1.1
Blue Whale	Provided additional paragraph describing existing acoustic populations (including 2 recent discoveries).	Literature update	Section 7.1.2
Blue Whale	Updated info on feeding grounds	Existing information was lacking and out of date.	Section 7.1.2
Blue Whale	Provided reference for migration pattern	Missing reference in document	Section 7.1.2
Humpback Whale	Added information on WA having the largest known population	Literature update	Section 7.1.5
Sperm Whale	Updated depth range from 200 to 400m based on two more recent references	Outdated figure	Section 7.1.6
Whale Shark	Added additional information on high proportion of surface swimming and recent tracking study demonstrating risk to vessel collisions.	Literature update	Section 5.3.4
Whale Shark	Updated info from various references on sexual maturity/surface feeding and associated vulnerabilities	Literature update as per Santos comments on Rev9A	Section 5.3.4
Migratory Species			
None			
Provinces			
Southwest Shelf Province	Added information on Bremer Canyon	Santos Rev 9A comment	Section 2.1.4
Coral Reefs	Added the 2011 Ningaloo reef bleaching event, as well as the 2016 bleaching event at Scott reef.	Referenced bleach event in current revision outdated	Section 3.1
Northwest Transition	Added reference to the 2009 Mermaid reef coral survey and that it is comparable to the original 1993 survey referenced.	Outdated survey findings.	Section 3.1.6
Northwest Transition	Added paragraph outlining that recent genetic studies on offshore reefs within the region have shown high genetic diversity and potential vulnerability to impacts due to isolation and reliance on local recruitment.	Literature update	Section 3.1.6
Timor Province	Added number of Scleractinian coral taxa found at Scott reef as of 2013.	No description of coral taxa numbers provided	Section 3.1.9
Protected Areas			

State Marine Conservation Reserves	Added recently proposed marine reserves: + Bardi Jawa Gaarra Marine Park + Mayala Marine Park + Laland-gaddam Marine Park	Newly proposed marine protected areas in Kimberley coastal (i.e., state) waters. Expected to be gazetted in 2024.	New sections 11.1.18,11.1.19 and 11.1.20
Social, Economic and Cultural Features			
Recreational Fisheries: Southwest Bioregion	Updated info on the Albany Aquaculture Development Zone and included information on the Rare Foods Australia (Ocean Grown Abalone) Project	As per Santos Comment on Rev 9A	Section 14.9.1
Tourism			
Tourism	Added additional information on the Abrolhos and Montebello Islands where information specific to tourism growth was available	As per Santos Comment on Rev 9A	Section 14.1.4
Other edits			
General grammar/minor terminology	Minor edits on grammar, terminology (e.g. Santos WA removed) etc have been updated as per Santos' Review of Rev9A	As per Santos Comment on Rev 9A	Throughout
Appendix A (PMST)	Included additional information on how the PMST search was conducted and how the tool has been updated (as per caveat 3 referenced in all PMST reports)	As per Santos Comment on Rev 9A	Appendix A
Coral Reefs	Added the 2011 Ningaloo reef bleaching event, as well as the 2016 bleaching event at Scott reef.	Referenced bleach event in current revision outdated	Section 3.1
Northwest Transition	Added reference to the 2009 Mermaid reef coral survey and that it is comparable to the original 1993 survey referenced.	Outdated survey findings.	Section 3.1.6
Northwest Transition	Added paragraph outlining that recent genetic studies on offshore reefs within the region have shown high genetic diversity and potential vulnerability to impacts due to isolation and reliance on local recruitment.	Literature update	Section 3.1.6
Timor Province	Added number of Scleractinian coral taxa found at Scott reef as of 2013.	No description of coral taxa numbers provided	Section 3.1.9
Asian Dowitcher	Population numbers added	Environment.gov.au update	Table 8-5
Grey-tailed Tattler	Population numbers added	Not included in current revision	Table 8-5
Oriental Plover	Population numbers updated	Environment.gov.au update	Table 8-5
Pacific Golden Plover	Internationally important location removed	No longer on the government.gov.au site	Table 8-5
Sharp-tailed Sandpiper	Added internationally important sites	Not included in current revision	Table 8-5

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Whimbrel	Added internationally important sites	Not included in current revision	Table 8-5
Seabirds	Added species listed under the Wildlife Conservation Plan for Seabirds (2020) to table + Red-tailed Tropicbird; + White-tailed Tropicbird; + Broad-billed Prion; + Fairy Prion; + Wedge-tailed Shearwater; + Flesh-footed Shearwater; + Sooty Shearwater; + Short-tailed Shearwater; + Streaked Shearwater; + Lesser Frigatebird; + Great Frigatebird; + Masked Booby; + Red-footed Booby; + Brown Booby; + Common Noddy; + Bridled Tern; + Little Tern; + Caspian Tern; + Roseate Tern and; + Osprey;	New Conservation plan (effective June 2022)	Table 13-1

Appendix D Protected Matters Search Tool Reports

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: 18-May-2023

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:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	21
Listed Migratory Species:	34

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:	55
Whales and Other Cetaceans:	26
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	1

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:	7
Key Ecological Features (Marine):	1
Biologically Important Areas:	5
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
EEZ and Territorial Sea

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 canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	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
Phaethon lepturus fulvus		
Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis		
Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
FISH		

Scientific Name	Threatened Category	Presence Text
Thunnus maccoyii		
Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to 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
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	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 known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
SHARK		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	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
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	Foraging, feeding or related behaviour known to 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
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
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	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

Scientific Name	Threatened Category	Presence Text
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 likely to 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	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 known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known 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
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	Foraging, feeding or related behaviour known to 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

Scientific Name	Threatened Category	Presence Text
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Endangered	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
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
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	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
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		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 latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		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 grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		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 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 trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		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
Reptile		
Aipysurus laevis Olive Seasnake [1120]		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	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Leioselasma czeblukovi as Hydrophis czeblukovi Fine-spined Seasnake, Geometrical Seasnake [87374]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area

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 as Kogia simus 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 known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		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
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 may occur within area

Current Scientific Name	Status	Type of Presence
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

Habitat Critical to the Survival of Marine Turtles

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus		
Flatback Turtle [59257]	Nesting	Known to occur

Extra Information

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatston	2008/4469	Controlled Action	Post-Approval
Gorgon Gas Development	2003/1294	Controlled Action	Post-Approval
Gorgon Gas Development 4th Train Proposal	2011/5942	Controlled Action	Post-Approval
Not controlled action			
Development of Halyard Field off the west coast of WA	2010/5611	Not Controlled Action	Completed
Not controlled action (particular manner)			
CGGVERITAS 2010 2D Seismic Survey	2010/5714	Not Controlled Action (Particular Manner)	Post-Approval
John Ross & Rosella Off Bottom Cable Seismic Exploration Program	2008/3966	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
West Anchor 3D Marine Seismic Survey	2008/4507	Not Controlled Action (Particular Manner)	Post-Approval

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

Biologically Important Areas

Scientific Name	Behaviour	Presence
Marine Turtles		
Natator depressus		
Flatback Turtle [59257]	Internesting buffer	Known to occur
Seabirds		
Ardenna pacifica		
Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Sharks		
Rhincodon typus		
Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda		
Pygmy Blue Whale [81317]	Distribution	Known to occur
Megaptera novaeangliae		
Humpback Whale [38]	Migration (north and south)	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 are 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

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

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

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
- 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: 01-Feb-2023

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:	3
National Heritage Places:	6
Wetlands of International Importance (Ramsar	3
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	3
Listed Threatened Ecological Communities:	8
Listed Threatened Species:	121
Listed Migratory Species:	93

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:	289
Commonwealth Heritage Places:	9
Listed Marine Species:	148
Whales and Other Cetaceans:	41
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	28
Habitat Critical to the Survival of Marine Turtles:	1

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	66
Regional Forest Agreements:	1
Nationally Important Wetlands:	11
EPBC Act Referrals:	168
Key Ecological Features (Marine):	9
Biologically Important Areas:	46
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Legal Status
Australian Convict Sites (Fremantle Prison)	WA	Declared property
Shark Bay, Western Australia	WA	Declared property
The Ningaloo Coast	WA	Declared property

National Heritage Places [Resource Information]

Name	State	Legal Status
Historic		
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place
Batavia Shipwreck Site and Survivor Camps Area 1629 - Houtman Abrolhos	WA	Listed place
Dirk Hartog Landing Site 1616 - Cape Inscription Area	WA	Listed place
Fremantle Prison (former)	WA	Listed place
Natural		
Shark Bay, Western Australia	WA	Listed place
The Ningaloo Coast	WA	Listed place

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity
Becher point wetlands	Within 10km of Ramsar site
Forrestdale and thomsons lakes	Within Ramsar site
Peel-yalgorup system	30 - 40km upstream from 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
EEZ and Territorial Sea

Feature Name
Extended Continental Shelf
Extended Continental Shelf

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, 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.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text
Aquatic Root Mat Community 1 in Caves of the Leeuwin Naturaliste Ridge	Endangered	Community known to occur within area
Aquatic Root Mat Community in Caves of the Swan Coastal Plain	Endangered	Community known to occur within area
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Scott River Ironstone Association	Endangered	Community likely to occur within area
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	Endangered	Community known to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Thrombolite (microbial) community of coastal freshwater lakes of the Swan Coastal Plain (Lake Richmond)	Endangered	Community known to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

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
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Endangered	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]	Critically Endangered	Roosting known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat 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
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Malurus leucopterus leucopterus White-winged Fairy-wren (Dirk Hartog Island), Dirk Hartog Black-and-White Fairy-wren [26004]	Vulnerable	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
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
Turnix varius scintillans Painted Button-quail (Houtman Abrolhos) [82451]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Zanda baudinii listed as Calyptorhynchus baudinii		
Baudin's Black-Cockatoo, Long-billed Black-cockatoo [87736]	Endangered	Breeding known to occur within area
Zanda latirostris listed as Calyptorhynchus latirostris		
Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Breeding known to occur within area
CRUSTACEAN		
Engaewa pseudoreducta		
Margaret River Burrowing Crayfish [82674]	Critically Endangered	Species or species habitat may occur within area
FISH		
Galaxiella nigrostriata		
Blackstriped Dwarf Galaxias, Black-stripe Minnow [88677]	Endangered	Species or species habitat known to occur within area
Hoplostethus atlanticus		
Orange Roughy, Deep-sea Perch, Red Roughy [68455]	Conservation Dependent	Species or species habitat likely to occur within area
Nannatherina balstoni		
Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat known to occur within area
Thunnus maccoyii		
Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat likely to occur within area
INSECT		
Hesperocolletes douglasi		
Douglas' Broad-headed Bee, Rottnest Bee [66734]	Critically Endangered	Species or species habitat may occur within area
MAMMAL		
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Bettongia lesueur lesueur Burrowing Bettong (Shark Bay), Boodie [66659]	Vulnerable	Species or species habitat known to occur within area
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat known to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Lagorchestes hirsutus bernieri Rufous Hare-wallaby (Bernier Island) [66662]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus dorreae Rufous Hare-wallaby (Dorre Island) [66663]	Vulnerable	Species or species habitat known to occur within area
Lagostrophus fasciatus fasciatus Banded Hare-wallaby, Merrnine, Marnine, Munning [66664]	Vulnerable	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Breeding known to occur within area
Parantechinus apicalis Dibbler [313]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Perameles bougainville listed as Perameles bougainville bougainville		
Shark Bay Bandicoot [278]	Endangered	Species or species habitat known to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Pseudomys fieldi		
Shark Bay Mouse, Djoongari, Alice Springs Mouse [113]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat may occur within area
Setonix brachyurus		
Quokka [229]	Vulnerable	Species or species habitat known to occur within area
OTHER		
Westralunio carteri		
Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
PLANT		
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Androcalva bivillosa		
Straggling Androcalva [87807]	Critically Endangered	Species or species habitat may occur within area
Anigozanthos viridis subsp. terraspectans		
Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat may occur within area
Banksia mimica		
Summer Honeypot [82765]	Endangered	Species or species habitat may occur within area
Banksia nivea subsp. uliginosa		
Swamp Honeypot [82766]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
Boronia exilis Scott River Boronia [64844]	Endangered	Species or species habitat known to occur within area
Caladenia barbarella Small Dragon Orchid, Common Dragon Orchid [68686]	Endangered	Species or species habitat may occur within area
Caladenia bryceana subsp. cracens Northern Dwarf Spider-orchid [64556]	Vulnerable	Species or species habitat may occur within area
Caladenia elegans Elegant Spider-orchid [56775]	Endangered	Species or species habitat likely to occur within area
Caladenia hoffmanii Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat likely to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Caladenia lodgeana Lodge's Spider-orchid [68664]	Critically Endangered	Species or species habitat known to occur within area
Caleana dixonii listed as Paracaleana dixonii Sandplain Duck Orchid [87944]	Endangered	Species or species habitat may occur within area
Calectasia cyanea Blue Tinsel Lily [7669]	Critically Endangered	Species or species habitat may occur within area
Chorizema varium Limestone Pea [16981]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Darwinia ferricola Scott River Darwinia [56706]	Endangered	Species or species habitat known to occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Drummondita ericoides Morseby Range Drummondita [9193]	Endangered	Species or species habitat known to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus argutifolia Yanchep Mallee, Wabling Hill Mallee [24263]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus cuprea Mallee Box [56773]	Endangered	Species or species habitat may occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Grevillea brachystylis subsp. australis [55525]	Vulnerable	Species or species habitat likely to occur within area
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat may occur within area
Kennedia lateritia Augusta Kennedia [45985]	Endangered	Species or species habitat likely to occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Lambertia orbifolia Roundleaf Honeysuckle [15725]	Endangered	Species or species habitat known to occur within area
Leptomeria dielsiana Diels' Currant Bush [5146]	Vulnerable	Species or species habitat known to occur within area
Leucopogon marginatus Thick-margined Leucopogon [12527]	Endangered	Species or species habitat likely to occur within area
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat may occur within area
Marianthus paralius [83925]	Endangered	Species or species habitat known to occur within area
Melaleuca sp. Wanneroo (G.J. Keighery 16705) [89456]	Endangered	Species or species habitat known to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Verticordia plumosa var. ananeotes Tufted Plumed Featherflower [23871]	Endangered	Species or species habitat may occur within area
Verticordia plumosa var. vassensis Vasse Featherflower [55804]	Endangered	Species or species habitat likely to occur within area
Wurmbea tubulosa Long-flowered Nancy [12739]	Endangered	Species or species habitat known to occur within area
REPTILE		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Ctenotus lancelini Lancelin Island Skink [1482]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
SHARK		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Centrophorus zeehaani		
Southern Dogfish, Endeavour Dogfish, Little Gulper Shark [82679]	Conservation Dependent	Species or species habitat likely to occur within area
Galeorhinus galeus		
School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453]	Conservation Dependent	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
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area
SPIDER		
Idiosoma nigrum		
Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	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 likely to occur within area

Scientific Name	Threatened Category	Presence Text
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Breeding known to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely 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	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
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
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	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
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Foraging, feeding or related behaviour known 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 known to occur within area

Scientific Name	Threatened Category	Presence Text
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known 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
Physeter macrocephalus Sperm Whale [59]		Foraging, feeding or related behaviour 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
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		

Scientific Name	Threatened Category	Presence Text
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Species or species habitat known 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
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		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]		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 likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Phalaropus lobatus Red-necked Phalarope [838]		Roosting known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		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]		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]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

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
Defence	
Defence - ARTILLERY BARRACKS - FREMANTLE [50155]	WA
Defence - CAMPBELL BARRACKS - SWANBOURNE [50184]	WA
Defence - CAMPBELL BARRACKS - SWANBOURNE [50185]	WA
Defence - CAMPBELL BARRACKS - SWANBOURNE [50186]	WA
Defence - CAMPBELL BARRACKS - SWANBOURNE [50187]	WA
Defence - CAMPBELL BARRACKS - SWANBOURNE [50181]	WA
Defence - CAMPBELL BARRACKS - SWANBOURNE [50182]	WA
Defence - CAMPBELL BARRACKS - SWANBOURNE [50183]	WA
Defence - GERALDTON TRAINING DEPOT "A" Company 16th Battalion [50196]	WA
Defence - GERALDTON TRAINING DEPOT "A" Company 16th Battalion [50195]	WA
Defence - GERALDTON TRAINING DEPOT "A" Company 16th Battalion [50197]	WA
Defence - GREENOUGH RIFLE RANGE [50234]	WA
Defence - HMAS STIRLING-ROCKINGHAM ;HMAS STIRLING - GARDEN ISLAND [50132]	WA
Defence - HMAS STIRLING-ROCKINGHAM ;HMAS STIRLING - GARDEN ISLAND [50131]	WA
Defence - HMAS STIRLING-ROCKINGHAM ;HMAS STIRLING - GARDEN ISLAND [50134]	WA
Defence - HMAS STIRLING-ROCKINGHAM ;HMAS STIRLING - GARDEN ISLAND [50133]	WA
Defence - HMAS STIRLING-ROCKINGHAM ;HMAS STIRLING - GARDEN ISLAND [50117]	WA
Defence - LANCELIN TRAINING AREA [50120]	WA
Defence - LANCELIN TRAINING AREA [50121]	WA

Commonwealth Land Name	State
Defence - ROCKINGHAM - NAVY CPSO [50135]	WA
Defence - SWANBOURNE RIFLE RANGE [50191]	WA
Defence - SWANBOURNE RIFLE RANGE [50188]	WA
Unknown	
Commonwealth Land - [50478]	WA
Commonwealth Land - [50544]	WA
Commonwealth Land - [50552]	WA
Commonwealth Land - [50553]	WA
Commonwealth Land - [50543]	WA
Commonwealth Land - [51115]	WA
Commonwealth Land - [51113]	WA
Commonwealth Land - [51119]	WA
Commonwealth Land - [51118]	WA
Commonwealth Land - [51116]	WA
Commonwealth Land - [50745]	WA
Commonwealth Land - [50573]	WA
Commonwealth Land - [50467]	WA
Commonwealth Land - [50740]	WA
Commonwealth Land - [50474]	WA
Commonwealth Land - [50464]	WA
Commonwealth Land - [50511]	WA
Commonwealth Land - [50460]	WA
Commonwealth Land - [50510]	WA
Commonwealth Land - [50736]	WA
Commonwealth Land - [50737]	WA
Commonwealth Land - [51890]	WA
Commonwealth Land - [52199]	WA

Commonwealth Land Name	State
Commonwealth Land - [50498]	WA
Commonwealth Land - [50420]	WA
Commonwealth Land - [50421]	WA
Commonwealth Land - [50640]	WA
Commonwealth Land - [50641]	WA
Commonwealth Land - [50731]	WA
Commonwealth Land - [50494]	WA
Commonwealth Land - [50497]	WA
Commonwealth Land - [50492]	WA
Commonwealth Land - [50495]	WA
Commonwealth Land - [50499]	WA
Commonwealth Land - [50549]	WA
Commonwealth Land - [50490]	WA
Commonwealth Land - [50493]	WA
Commonwealth Land - [50548]	WA
Commonwealth Land - [50597]	WA
Commonwealth Land - [50630]	WA
Commonwealth Land - [51437]	WA
Commonwealth Land - [51436]	WA
Commonwealth Land - [50734]	WA
Commonwealth Land - [51432]	WA
Commonwealth Land - [50470]	WA
Commonwealth Land - [50545]	WA
Commonwealth Land - [50416]	WA
Commonwealth Land - [50415]	WA
Commonwealth Land - [50417]	WA
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Commonwealth Land Name	State
Commonwealth Land - [50590]	WA

Commonwealth Heritage Places

[Resource Information]

Name	State	Status
Historic		
Artillery Barracks	WA	Listed place
Cape Leeuwin Lighthouse	WA	Listed place
Cliff Point Historic Site	WA	Listed place
Geraldton Drill Hall Complex	WA	Listed place
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place
J Gun Battery	WA	Listed place
Natural		
Garden Island	WA	Listed place
Lancelin Defence Training Area	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place

Listed Marine Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna carneipes as Puffinus carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Ardenna grisea as Puffinus griseus Sooty Shearwater [82651]		Species or species habitat may occur within area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Arenaria interpres Ruddy Turnstone [872]		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]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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]		Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting 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 bicinctus Double-banded Plover [895]		Roosting known to occur within area overfly marine area
Charadrius dubius Little Ringed Plover [896]		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 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]		Species or species habitat may occur within area overfly marine area
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely 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]		Species or species habitat known to occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may 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 may occur within area overfly marine area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		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]		Roosting known to occur within area overfly marine area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within 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 may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Motacilla flava Yellow Wagtail [644]		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
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely 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
Onychoprion fuscatus as Sterna fuscata Sooty Tern [90682]		Breeding known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding likely to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Roosting known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Species or species habitat known to occur within area overfly marine area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area overfly marine area
Pterodroma macroptera Great-winged Petrel [1035]		Foraging, feeding or related behaviour known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Puffinus assimilis Little Shearwater [59363]		Breeding known to occur within area
Puffinus huttoni Hutton's Shearwater [1025]		Foraging, feeding or related behaviour known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting 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 known to occur within area overfly marine area
Stercorarius skua as Catharacta skua		
Great Skua [823]		Species or species habitat may occur within area
Sterna dougallii		
Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons as Sterna albifrons		
Little Tern [82849]		Species or species habitat may occur within area
Sternula nereis as Sterna nereis		
Fairy Tern [82949]		Breeding known to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta		
Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
Thalasseus bengalensis as Sterna bengalensis		
Lesser Crested Tern [66546]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Thalasseus bergii as Sterna bergii Greater Crested Tern [83000]		Breeding known to occur within area
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat known to occur within area overfly marine area
Tringa brevipes as Heteroscelus brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area overfly marine area
Tringa nebularia Common Greenshank, Greenshank [832]		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
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area overfly marine area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area overfly marine area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		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
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		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 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
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		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 breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		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
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		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

Scientific Name	Threatened Category	Presence Text
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammal		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Breeding known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Breeding known to occur within area
Reptile		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
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
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans [Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely 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	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		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
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to 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

Current Scientific Name	Status	Type of Presence
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Hyperoodon planifrons Southern Bottlenose Whale [71]		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 as Kogia simus 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
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Foraging, feeding or related behaviour known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
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
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcaella heinsohni as Orcaella brevirostris 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]		Foraging, feeding or related behaviour known to occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat likely 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 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
Abrolhos	Habitat Protection Zone (IUCN IV)
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Gascoyne	Habitat Protection Zone (IUCN IV)
Perth Canyon	Habitat Protection Zone (IUCN IV)
Perth Canyon	Habitat Protection Zone (IUCN IV)
Abrolhos	Multiple Use Zone (IUCN VI)

Park Name	Zone & IUCN Categories
Abrolhos	Multiple Use Zone (IUCN VI)
Abrolhos	Multiple Use Zone (IUCN VI)
Gascoyne	Multiple Use Zone (IUCN VI)
Perth Canyon	Multiple Use Zone (IUCN VI)
Perth Canyon	Multiple Use Zone (IUCN VI)
Shark Bay	Multiple Use Zone (IUCN VI)
Two Rocks	Multiple Use Zone (IUCN VI)
Abrolhos	National Park Zone (IUCN II)
Abrolhos	National Park Zone (IUCN II)
Abrolhos	National Park Zone (IUCN II)
Perth Canyon	National Park Zone (IUCN II)
Perth Canyon	National Park Zone (IUCN II)
South-west Corner	National Park Zone (IUCN II)
South-west Corner	National Park Zone (IUCN II)
South-west Corner	National Park Zone (IUCN II)
Two Rocks	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Abrolhos	Special Purpose Zone (IUCN VI)
Abrolhos	Special Purpose Zone (IUCN VI)
Jurien	Special Purpose Zone (IUCN VI)
South-west Corner	Special Purpose Zone (Mining Exclusion) (IUCN VI)
South-west Corner	Special Purpose Zone (Mining Exclusion) (IUCN VI)

Habitat Critical to the Survival of Marine Turtles

Scientific Name	Behaviour	Presence
Nov-Feb		

Scientific Name	Behaviour	Presence
Caretta caretta Loggerhead Turtle [1763]	Nesting	Known to occur

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Abrolhos Islands	Fish Habitat Protection Area	WA
Bernier And Dorre Islands	Nature Reserve	WA
Bold Park	Botanic Gardens	WA
Buller, Whittell And Green Islands	Nature Reserve	WA
Carnac Island	Nature Reserve	WA
Cervantes Islands	Nature Reserve	WA
Cottesloe Reef	Fish Habitat Protection Area	WA
D'Entrecasteaux	National Park	WA
Dirk Hartog Island	National Park	WA
Flinders Bay	Nature Reserve	WA
Freycinet, Double Islands etc	Nature Reserve	WA
Gingilup Swamps	Nature Reserve	WA
Hamelin Island	Nature Reserve	WA
Harry Waring Marsupial Reserve	Nature Reserve	WA
Houtman Abrolhos Islands	National Park	WA
Jurien Bay	Marine Park	WA
Koks Island	Nature Reserve	WA
Lancelin And Edwards Islands	Nature Reserve	WA
Lancelin Island Lagoon	Fish Habitat Protection Area	WA

Protected Area Name	Reserve Type	State
Leeuwin-Naturaliste	National Park	WA
Marmion	Marine Park	WA
Nambung	National Park	WA
Neerabup	Nature Reserve	WA
Neerabup	National Park	WA
Ngari Capes	Marine Park	WA
Nilgen	Nature Reserve	WA
Ningaloo	Marine Park	WA
NTWA Bushland covenant (0013)	Conservation Covenant	WA
Outer Rocks	Nature Reserve	WA
Penguin Island	Conservation Park	WA
Point Quobba	Fish Habitat Protection Area	WA
Ronsard Rocks	Nature Reserve	WA
Rottnest Island	State Reserve	WA
Scott	National Park	WA
Seal Island (WA25645)	Nature Reserve	WA
Shark Bay	Marine Park	WA
Shoalwater Bay Islands	Nature Reserve	WA
Shoalwater Islands	Marine Park	WA
Southern Beekeepers	Nature Reserve	WA
St Alouarn Island	Nature Reserve	WA
Stockdill Road	Nature Reserve	WA
Swan River	Management Area	WA
Thomsons Lake	Nature Reserve	WA
Unnamed WA15185	Nature Reserve	WA
Unnamed WA26400	5(1)(h) Reserve	WA

Protected Area Name	Reserve Type	State
Unnamed WA33799	Nature Reserve	WA
Unnamed WA37338	5(1)(h) Reserve	WA
Unnamed WA37383	5(1)(h) Reserve	WA
Unnamed WA39584	Conservation Park	WA
Unnamed WA39752	Conservation Park	WA
Unnamed WA42469	Nature Reserve	WA
Unnamed WA42942	Nature Reserve	WA
Unnamed WA43903	Nature Reserve	WA
Unnamed WA44676	5(1)(h) Reserve	WA
Unnamed WA44688	5(1)(h) Reserve	WA
Unnamed WA44705	5(1)(g) Reserve	WA
Unnamed WA48291	Conservation Park	WA
Unnamed WA48858	Nature Reserve	WA
Unnamed WA48968	5(1)(h) Reserve	WA
Unnamed WA49220	Conservation Park	WA
Unnamed WA49994	Conservation Park	WA
Unnamed WA53313	Conservation Park	WA
Unnamed WA53632	Conservation Park	WA
Wanagarren	Nature Reserve	WA
Wedge Island	Nature Reserve	WA
Yanchep	National Park	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

RFA Name	State
South West WA RFA	Western Australia

Nationally Important Wetlands [Resource Information]

Wetland Name	State
Blackwood River (Lower Reaches) and Tributaries System	WA

Wetland Name	State
Cape Leeuwin System	WA
Gingilup-Jasper Wetland System	WA
Hutt Lagoon System	WA
Lake Thetis	WA
Loch McNess System	WA
Rottnest Island Lakes	WA
Shark Bay East	WA
Spectacles Swamp	WA
Swan-Canning Estuary	WA
Thomsons Lake	WA

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Beale Park Redevelopment	2022/09297		Referral Decision
Fremantle District Police Complex Project	2022/09345		Completed
Midwest Offshore Wind Farm	2022/09264		Assessment
Residential Development, Wattleup Road, Hammond Park, WA	2021/8933		Post-Approval
Samphire Offshore Wind Farm	2022/09306		Assessment
Controlled action			
Airborne sonar trials	2001/540	Controlled Action	Completed
Alcoa Bauxite Residue Storage Area Extension	2011/5878	Controlled Action	Further Information Request
Alkimos city centre and central development, WA	2015/7561	Controlled Action	Post-Approval
Alkimos Coastal Node	2020/8861	Controlled Action	Further Information Request

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Alkimos Seawater Desalination	2019/8453	Controlled Action	Assessment Approach
Butler North District Open Space playing fields development, Wanneroo, WA	2017/8053	Controlled Action	Post-Approval
Catalina Residential Development	2010/5785	Controlled Action	Post-Approval
Clearing of Lots 2 and 10 Rowley Road, Mandogalup WA	2018/8182	Controlled Action	Assessment Approach
Coburn Mineral Sand Project	2003/1221	Controlled Action	Post-Approval
Construction of a Deepwater, General Container Port	2009/5178	Controlled Action	Proposed Decision
Development of Kwinana Quay port facility	2008/4387	Controlled Action	Completed
development of land based tourist facilities on Long Island	2006/2792	Controlled Action	Post-Approval
Develop three sites into residential housing and mixed use developments, Western Australia	2013/6916	Controlled Action	Post-Approval
Eglinton/South Yanchep Residential Development	2011/6021	Controlled Action	Post-Approval
Eglinton Estates - Clearing of native vegetation from Lot 1007 & part Lot 1008	2010/5777	Controlled Action	Post-Approval
Excavate sand and limestone resources	2010/5621	Controlled Action	Completed
Extension of Beeliar Drive between the junction of Mayor and Fawcett Roads an...	2003/1029	Controlled Action	Completed
Flat Rock boating facility	2008/4506	Controlled Action	Post-Approval
Hematite (iron ore) Mine and Beneficiation Plant	2001/542	Controlled Action	Completed
Industry Zone	2010/5337	Controlled Action	Post-Approval
Jindee Residential Development	2012/6631	Controlled Action	Post-Approval
Karara Magnetite Project	2006/3017	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Latitude 32-industrial development of various lots, Ashley and Sayer Roads, Hope Valley, WA	2016/7695	Controlled Action	Post-Approval
Leeuwin Offshore Wind Farm	2022/9160	Controlled Action	Assessment Approach
Lot 2 Corner Durrant Avenue and Sicklemore Road - Residential Development	2011/5882	Controlled Action	Completed
Mangles Bay Marina Based Tourist Precinct	2010/5659	Controlled Action	Post-Approval
Milyeannup Wind Farm	2009/4911	Controlled Action	Post-Approval
Mitchell Freeway Extension and Wanneroo Road Upgrade, WA	2018/8367	Controlled Action	Post-Approval
Mitchell Freeway Extension between Burns Beach Rd and Hester Av, Neerabup, WA	2013/7091	Controlled Action	Post-Approval
Natural Gas Pipeline Expansion	2006/2813	Controlled Action	Post-Approval
Nava-1 Cable System	2001/510	Controlled Action	Completed
Neerabup Industrial Estate, Lot 701 Flynn Drive Neerabup WA	2012/6424	Controlled Action	Post-Approval
Ocean Reef Marina Development	2009/4937	Controlled Action	Completed
open cut mine & assoc infrastructure	2005/2381	Controlled Action	Post-Approval
Port Enhancement Project	2001/266	Controlled Action	Post-Approval
Proposed Urban Development of Lots 1005 & 1006	2008/4638	Controlled Action	Post-Approval
Residential development,Lot 609, Yanchep Beach Road, Yanchep, WA	2014/7146	Controlled Action	Post-Approval
Residential development Lot 1004 Alkimos WA	2011/5902	Controlled Action	Post-Approval
Roe Highway extension, Kwinana Freeway to Stock Road, WA	2009/5031	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Shark Hazard Mitigation Drum Line Program, WA	2014/7174	Controlled Action	Completed
Shenton Park Subdivision	2004/1479	Controlled Action	Completed
Tourism Facility and Associated Infrastructure	2005/2038	Controlled Action	Post-Approval
Urban and Residential Development at Lot 9 Brighton	2011/6137	Controlled Action	Post-Approval
Urban development in accordance with the Local Structure Plan	2008/4601	Controlled Action	Post-Approval
Urban Residential Development at Lot 9049 Marmoin Avenue	2009/5155	Controlled Action	Post-Approval
Vegetation Clearing, Wannaroo Rd and Nowergup Rd	2011/5955	Controlled Action	Completed
Warders Hotel, Block 1 Warders Cottages, Fremantle, WA	2018/8144	Controlled Action	Post-Approval
Yanchep Rail Extension, WA	2018/8262	Controlled Action	Post-Approval
Yogi Magnetite Project, 225km east, northeast of Geraldton, WA	2017/8124	Controlled Action	Assessment Approach
Not controlled action			
'Looping 10' gas transmission pipeline from Kwinana to Hopelands	2005/2212	Not Controlled Action	Completed
Accommodation Units Sunday Island Bay, Dirk Hartog Island, WA	2015/7540	Not Controlled Action	Completed
Alkimos seawater desalination plant, offshore investigations, WA	2018/8224	Not Controlled Action	Completed
Amberton West urban development - Part lot 9005 Eglington WA	2013/7068	Not Controlled Action	Completed
APX-West Fibre-optic telecommunications cable system, WA to Singapore	2013/7102	Not Controlled Action	Completed
archaeological surveys & excavation at historic sites, Cape Inscription	2006/3027	Not Controlled Action	Completed
Bibra Lake Aboriginal Cultural Centre Development	2020/8642	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Busselton to Flinders Bay Rails to Trails Project, WA	2013/6835	Not Controlled Action	Completed
Butler Railway Extension Project - Nowergup Depot Eastern Alignment	2011/5989	Not Controlled Action	Completed
Clearing and development of 220 and 234 Wattleup Rd, Wattleup, WA	2016/7738	Not Controlled Action	Completed
Construction and operation of an 8 turbine wind farm at Rous Head Harbour, Frema	2003/933	Not Controlled Action	Completed
Construction of several passing lanes between Lancelin and Jurien Bay, WA	2015/7509	Not Controlled Action	Completed
Container Deposit Scheme Project	2019/8517	Not Controlled Action	Completed
CTBT - Cape Leeuwin Hydroacoustic Station Proposal	2000/27	Not Controlled Action	Completed
Development of Lots 100-101 Sayer Road, Hope Valley, WA	2019/8399	Not Controlled Action	Completed
Development of new Alkimos Wastwater Treatment Plant	2007/3259	Not Controlled Action	Completed
Disposal of residential properties, Fremantle, WA	2019/8593	Not Controlled Action	Completed
Drilling between Kalbarri and Cliff Head	2005/2185	Not Controlled Action	Completed
Eradication of the European House Borer, Perth metropolitan area, WA	2009/5027	Not Controlled Action	Completed
Expansion of berthing facilities at Kwinana Bulk Terminal	2006/2509	Not Controlled Action	Completed
Expansion of existing Ammonium Nitrate Production Facility	2005/1941	Not Controlled Action	Completed
Expedition 369-Australian Cretaceous Climate and Tectonics, Australian EEZ waters	2017/7891	Not Controlled Action	Completed
Extension of 7.5km of the Joondalup Line electrified passenger railway from Cla	2010/5632	Not Controlled Action	Completed
Extention to the existing Blind Strait Black Lip Pearl Oyster Farm	2004/1342	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Fremantle Ports Inner Harbour Capital Dredging Proposal	2005/2477	Not Controlled Action	Completed
Gas-fired Power Station	2005/2213	Not Controlled Action	Completed
Geo-science Investigations	2005/2069	Not Controlled Action	Completed
Hadda 1,Flying Foam 1,Magnat 1 exploration drill	2004/1697	Not Controlled Action	Completed
Hammond West Urban Development, Hammond Park, WA	2017/7917	Not Controlled Action	Completed
Hope Valley-Wattleup Redevelopment Project	2020/8644	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
Indian Ocean Drive Passing Lane and Widening 52-258 SLK	2017/7884	Not Controlled Action	Completed
Indian Ocean Drive Widening, Gingin Shire, WA	2018/8346	Not Controlled Action	Completed
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed
INDIGO West Submarine Telecommunications Cable, WA	2017/8126	Not Controlled Action	Completed
Industrial development 105 Sayer Road, Hope Valley, WA	2014/7261	Not Controlled Action	Completed
Industrial Development Lot 64 Ashley Road, Hope Valley, WA	2014/7238	Not Controlled Action	Completed
Kennedy Park Estate Residential Development	2003/1044	Not Controlled Action	Completed
Kwinana Depot Upgrade	2011/6035	Not Controlled Action	Completed
Kwinana Gas-Fired Power Station	2005/2101	Not Controlled Action	Completed
Lancelin Caravan Park Project, Hopkins Dve & Casserley Way, Lancelin	2015/7546	Not Controlled Action	Completed
Latitude 32 industrial development 6A, Cockburn, WA	2018/8193	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Lot 170 Hope Valley Road, Hope Valley	2020/8830	Not Controlled Action	Completed
Maintenance Dredging in the Geraldton Port Outer Channel	2010/5488	Not Controlled Action	Completed
Nowergup Strawberry Farm McLennan Drive, Nowergup, WA	2017/8042	Not Controlled Action	Completed
Ocean Reef Marina Development, City of Joondalup, WA	2014/7237	Not Controlled Action	Completed
Oman Australia Cable Installation, WA	2021/8922	Not Controlled Action	Completed
Oman Australia Cable - Marine Route Survey	2020/8731	Not Controlled Action	Completed
Palm Beach Caravan Park Redevelopment, Rockingham, WA	2013/6853	Not Controlled Action	Completed
Perth Desalination Plant 2	2019/8454	Not Controlled Action	Completed
Perth Seawater Desalination Project: Thomsons Lake to Kogolup Pipeline	2005/1971	Not Controlled Action	Completed
Quinns Main sewer extension, Clarkson - Neerabup, WA	2018/8215	Not Controlled Action	Completed
Redevelopment of Purvis Street school site, Hamilton Hill, WA	2018/8255	Not Controlled Action	Completed
Residential development, Lot 74 Wattleup Road, Hammond Park, WA	2018/8273	Not Controlled Action	Completed
Residential development, Lots 9010 and 9031, Yanchep Beach Rd, Yanchep	2016/7642	Not Controlled Action	Completed
Residential Development Eglinton West, Lot 5000 & part Lot 5001, Pipidinny Road, Eglinton	2014/7137	Not Controlled Action	Completed
Residential Development of Lots 76 and 107 Wattleup Road, Hamond Park	2020/8865	Not Controlled Action	Completed
Residential development on part of Lot 2 Fanstone Avenue, Beeliar, WA	2016/7726	Not Controlled Action	Completed
Residential-Rural Subdivision, Lot 1 Kudardup Rd, Kudardup, WA	2012/6471	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
residential subdivision	2005/1965	Not Controlled Action	Completed
Roe Highway - Karel Avenue to Hope Road Bridge Project	2005/2061	Not Controlled Action	Completed
Rottnest Lodge Redevelopment	2019/8565	Not Controlled Action	Completed
Scientific Sonar Trial	2002/680	Not Controlled Action	Completed
Seismic Survey, Bremer Basin, Mentelle Basin and Zeewyck Sub-basin	2004/1700	Not Controlled Action	Completed
Sepia Depression Ocean Outlet Landline Duplication	2012/6248	Not Controlled Action	Completed
Urban development, Lot 109 Wattleup Road, Hammond Park, WA	2015/7425	Not Controlled Action	Completed
Urban development of Lot 107 Wattleup Road, Hammond Park, WA	2017/7890	Not Controlled Action	Completed
Vegetation clearing for sand extraction, Lot 268 Leeuwin Road, Augusta	2013/6860	Not Controlled Action	Completed
WA-286-P Exploration Drilling Programme	2007/3863	Not Controlled Action	Completed
Warders' Cottages Block 2 'W2'	2022/9148	Not Controlled Action	Completed
Warders' Cottages W2 minor works, Fremantle, WA	2018/8185	Not Controlled Action	Completed
Yellowfin Tuna Aquaculture Trial	2003/1115	Not Controlled Action	Completed
Yngling-1 exploration well for WA-368-P	2007/3523	Not Controlled Action	Completed
Not controlled action (particular manner)			
2D Marine Seismic Survey in Permit Area WA-337-P	2003/1158	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey	2008/4493	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
3D Marine Seismic Survey	2007/3800	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey Within WA-382-P	2007/3799	Not Controlled Action (Particular Manner)	Post-Approval
Acheron Non-Exclusive 2D Seismic Survey	2009/4968	Not Controlled Action (Particular Manner)	Post-Approval
Acheron Non-Exclusive 2D Seismic Survey	2008/4565	Not Controlled Action (Particular Manner)	Post-Approval
Australian Square Kilometre Array Pathfinder telescope & infrastructure	2009/4891	Not Controlled Action (Particular Manner)	Post-Approval
Australia to Singapore Fibre Optic Submarine Cable System	2011/6127	Not Controlled Action (Particular Manner)	Post-Approval
CETO 6 Garden Island Project, offshore WA	2016/7635	Not Controlled Action (Particular Manner)	Post-Approval
CETO 6 Geophysical and Geotechnical Surveys	2014/7408	Not Controlled Action (Particular Manner)	Post-Approval
City of Cockburn Sporting Facilties	2005/2139	Not Controlled Action (Particular Manner)	Post-Approval
Coverack Marine Seismic Survey	2001/399	Not Controlled Action (Particular Manner)	Post-Approval
Extension of Spearwood Ave, from Barrington Rd to Miguel Rd	2009/5140	Not Controlled Action (Particular Manner)	Post-Approval
Grand Southern Margin 2D Marine Seismic Survey	2008/4599	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
Lake Richmond Boardwalk installation, Rockingham, WA	2013/6977	Not Controlled Action (Particular Manner)	Post-Approval
Laying a submarine optical fibre telecommunications cable, Perth to Singapore and Jakarta	2014/7332	Not Controlled Action (Particular Manner)	Post-Approval
Marine Environmental Survey	2012/6275	Not Controlled Action (Particular Manner)	Post-Approval
Marine reconnaissance survey	2008/4466	Not Controlled Action (Particular Manner)	Post-Approval
Marine Seismic Survey for oil and gas in Commonwealth waters off the WA coast.	2004/1802	Not Controlled Action (Particular Manner)	Post-Approval
Marine Seismic Survey in Permit WA-481P	2012/6626	Not Controlled Action (Particular Manner)	Post-Approval
Multipurpose development stage 1 within 340ha	2004/1913	Not Controlled Action (Particular Manner)	Post-Approval
Nexus Energy Seismic survey WA	2006/2569	Not Controlled Action (Particular Manner)	Post-Approval
North Perth Marine Survey	2011/6067	Not Controlled Action (Particular Manner)	Post-Approval
Quiberon 2D Seismic Survey, permit area WA-385P, offshore of Carnarvon	2009/5077	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
search for HMAS Sydney	2006/3071	Not Controlled Action (Particular Manner)	Post-Approval
South West Metropolitan Railway Project	2003/1175	Not Controlled Action (Particular Manner)	Post-Approval
Study of behavioural responses of Austn Humpback Whales to seismic surveys, offshore Dongara, WA	2013/6927	Not Controlled Action (Particular Manner)	Post-Approval
Tortilla 2D Seismic Survey, WA	2011/6110	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			
3D Marine Seismic survey	2007/3725	Referral Decision	Completed
3D Marine Seismic survey	2007/3729	Referral Decision	Completed
3D Seismic Survey	2012/6245	Referral Decision	Completed
CO2 3D Seismic Survey Vlaming Sub-Basin	2012/6343	Referral Decision	Completed
Exploration Drilling 2014/2015 WA-481-P	2013/7043	Referral Decision	Completed
Grand Southern Margin 2D Marine Seismic Survey	2008/4573	Referral Decision	Completed
Narelle 3D Marine Seismic Survey	2008/4575	Referral Decision	Completed
Proposed exploration drilling activities, Abrolhos Commonwealth Marine Reserve	2013/6949	Referral Decision	Completed
Residential Subdivision of 60ha, Swan Location 2424	2004/1928	Referral Decision	Completed
Rezoning of Crown Reserve 39181 to facilitate future residential development	2005/2096	Referral Decision	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Referral decision			
Sonar Trials and Acoustic Trials	2001/538	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 90-120m depth	South-west
Cape Mentelle upwelling	South-west
Commonwealth marine environment surrounding the Houtman Abrolhos Islands	South-west
Commonwealth marine environment within and adjacent to the west coast inshore lagoons	South-west
Commonwealth waters adjacent to Ningaloo Reef	North-west
Perth Canyon and adjacent shelf break, and other west coast canyons	South-west
Wallaby Saddle	North-west
Western demersal slope and associated fish communities	South-west
Western rock lobster	South-west

Biologically Important Areas

Scientific Name	Behaviour	Presence
Dugong		
Dugong dugon Dugong [28]	Breeding	Known to occur
Dugong dugon Dugong [28]	Foraging	Known to occur
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Internesting	Known to occur
Caretta caretta Loggerhead Turtle [1763]	Internesting buffer	Known to occur

Scientific Name	Behaviour	Presence
Caretta caretta Loggerhead Turtle [1763]	Nesting	Known to occur
Seabirds		
Anous stolidus Common Noddy [825]	Foraging	Known to occur
Anous stolidus Common Noddy [825]	Foraging (provisioning young)	Known to occur
Anous tenuirorstris melanops Australian Lesser Noddy [26000]	Foraging (provisioning young)	Known to occur
Ardenna carneipes Flesh-footed Shearwater [82404]	Aggregation	Known to occur
Ardenna carneipes Flesh-footed Shearwater [82404]	Foraging (in high numbers)	Known to occur
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Ardenna pacifica Wedge-tailed Shearwater [84292]	Foraging (in high numbers)	Known to occur
Eudyptula minor Little Penguin [1085]	Foraging (provisioning young)	Known to occur
Hydroprogne caspia Caspian Tern [808]	Foraging (provisioning young)	Known to occur
Larus pacificus Pacific Gull [811]	Foraging (in high numbers)	Known to occur
Larus pacificus Pacific Gull [811]	Foraging (in high numbers)	Former Range

Scientific Name	Behaviour	Presence
Onychoprion anaethetus Bridled Tern [82845]	Foraging (in high numbers)	Known to occur
Onychoprion fuscata Sooty Tern [82847]	Foraging	Known to occur
Pelagodroma marina White-faced Storm petrel [1016]	Foraging (in high numbers)	Known to occur
Pterodroma macroptera macroptera Great-winged Petrel (macroptera race) [1035]	Foraging (provisioning young)	Known to occur
Pterodroma mollis Soft-plumaged Petrel [1036]	Foraging (in high numbers)	Known to occur
Puffinus assimilis tunneyi Little Shearwater [59363]	Foraging (in high numbers)	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Foraging	Known to occur
Sterna dougallii Roseate Tern [817]	Foraging (provisioning young)	Known to occur
Sternula nereis Fairy Tern [82949]	Breeding	Known to occur
Sternula nereis Fairy Tern [82949]	Foraging (in high numbers)	Known to occur
Thalassarche chlororhynchos bassi Indian Yellow-nosed Albatross [85249]	Foraging (in high numbers)	Known to occur

Scientific Name	Behaviour	Presence
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Seals		
Neophoca cinerea Australian Sea Lion [22]	Foraging (male)	Likely to occur
Neophoca cinerea Australian Sea Lion [22]	Foraging (male and female)	Known to occur
Sharks		
Carcharodon carcharias White Shark [64470]	Foraging	Known to occur
Whales		
Balaenoptera musculus Blue and Pygmy Blue Whale [36]	Foraging (abundant food source)	Known to occur
Balaenoptera musculus Blue and Pygmy Blue Whale [36]	Foraging (high density)	Known to occur
Balaenoptera musculus Blue and Pygmy Blue Whale [36]	Foraging (on migration)	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging Area (annual high use area)	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Known Foraging Area	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur
Eubalaena australis Southern Right Whale [40]	Calving buffer	Known to occur
Eubalaena australis Southern Right Whale [40]	Seasonal calving	Known to occur

Scientific Name	Behaviour	Presence
	habitat	
Megaptera novaeangliae Humpback Whale [38]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north)	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Resting	Known to occur
Physeter macrocephalus Sperm Whale [59]	Foraging (abundant food source)	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 are 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

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

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

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
- 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: 01-Feb-2023

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	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	31
Listed Migratory Species:	36

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:	85
Commonwealth Heritage Places:	11
Listed Marine Species:	58
Whales and Other Cetaceans:	25
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	1
Australian Marine Parks:	2
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:	2
EPBC Act Referrals:	67
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
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
Hosnies spring	Within Ramsar site
The dales	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
EEZ and Territorial Sea
Extended Continental Shelf

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		
Accipiter hiogaster natalis		
Christmas Island Goshawk [82408]	Endangered	Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Chalcophaps indica natalis		
Christmas Island Emerald Dove, Emerald Dove (Christmas Island) [67030]	Endangered	Species or species habitat known to occur within area
Fregata andrewsi		
Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Ninox natalis Christmas Island Hawk-Owl, Christmas Boobook [66671]	Vulnerable	Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat known to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat known to occur within area
Turdus poliocephalus erythropleurus Christmas Island Thrush [67122]	Endangered	Species or species habitat likely to occur within area
FISH		
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to 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
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Crocidura trichura Christmas Island Shrew [86568]	Critically Endangered	Species or species habitat likely to occur within area
Pteropus natalis Christmas Island Flying-fox, Christmas Island Fruit-bat [87611]	Critically Endangered	Species or species habitat known to occur within area
PLANT		
Asplenium listeri Christmas Island Spleenwort [65865]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Pneumatopteris truncata fern [68812]	Critically Endangered	Species or species habitat known to occur within area
Tectaria devexa [14767]	Endangered	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 likely to occur within area
Cryptoblepharus egeriae Christmas Island Blue-tailed Skink, Blue-tailed Snake-eyed Skink [1526]	Critically Endangered	Species or species habitat likely to occur within area
Cyrtodactylus sadleiri Christmas Island Giant Gecko [86865]	Endangered	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
Lepidodactylus listeri Christmas Island Gecko, Lister's Gecko [1711]	Critically Endangered	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Ramphotyphlops exocoeti		
Christmas Island Blind Snake, Christmas Island Pink Blind Snake [1262]	Vulnerable	Species or species habitat likely to occur within area
SHARK		
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may 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 likely to occur within area
Fregata andrewsi		
Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Breeding known 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]		Breeding known to occur within area
Phaethon lepturus		
White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda		
Red-tailed Tropicbird [994]		Breeding known to occur within area
Sula leucogaster		
Brown Booby [1022]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Migratory Marine Species		
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	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 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 likely to occur within area

Scientific Name	Threatened Category	Presence Text
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	Species or species habitat likely to occur within area
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 known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely 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
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
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		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	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

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
Environment and Heritage	
Commonwealth Land - Christmas Island National Park [94102]	CI
Commonwealth Land - Christmas Island National Park [94101]	CI
Commonwealth Land - Christmas Island National Park [94104]	CI
Commonwealth Land - Christmas Island National Park [94105]	CI

Commonwealth Land Name	State
Commonwealth Land - Christmas Island National Park [94103]	CI
Unknown	
Commonwealth Land - [94217]	CI
Commonwealth Land - [94214]	CI
Commonwealth Land - [94218]	CI
Commonwealth Land - [94240]	CI
Commonwealth Land - [94203]	CI
Commonwealth Land - [94267]	CI
Commonwealth Land - [94266]	CI
Commonwealth Land - [94229]	CI
Commonwealth Land - [94237]	CI
Commonwealth Land - [94259]	CI
Commonwealth Land - [94236]	CI
Commonwealth Land - [94208]	CI
Commonwealth Land - [94248]	CI
Commonwealth Land - [94219]	CI
Commonwealth Land - [94209]	CI
Commonwealth Land - [94216]	CI
Commonwealth Land - [94212]	CI
Commonwealth Land - [94213]	CI
Commonwealth Land - [94202]	CI
Commonwealth Land - [94249]	CI
Commonwealth Land - [94211]	CI
Commonwealth Land - [94234]	CI
Commonwealth Land - [94230]	CI
Commonwealth Land - [94233]	CI
Commonwealth Land - [94232]	CI

Commonwealth Land Name	State
Commonwealth Land - [94206]	CI
Commonwealth Land - [94204]	CI
Commonwealth Land - [94210]	CI
Commonwealth Land - [94280]	CI
Commonwealth Land - [94201]	CI
Commonwealth Land - [94242]	CI
Commonwealth Land - [94220]	CI
Commonwealth Land - [94226]	CI
Commonwealth Land - [94260]	CI
Commonwealth Land - [94221]	CI
Commonwealth Land - [94223]	CI
Commonwealth Land - [94222]	CI
Commonwealth Land - [94225]	CI
Commonwealth Land - [94224]	CI
Commonwealth Land - [94227]	CI
Commonwealth Land - [94235]	CI
Commonwealth Land - [94246]	CI
Commonwealth Land - [94245]	CI
Commonwealth Land - [94244]	CI
Commonwealth Land - [94278]	CI
Commonwealth Land - [94238]	CI
Commonwealth Land - [94243]	CI
Commonwealth Land - [94241]	CI
Commonwealth Land - [94247]	CI
Commonwealth Land - [94239]	CI
Commonwealth Land - [94215]	CI
Commonwealth Land - [94273]	CI

Commonwealth Land Name	State
Commonwealth Land - [94276]	CI
Commonwealth Land - [94275]	CI
Commonwealth Land - [94279]	CI
Commonwealth Land - [94272]	CI
Commonwealth Land - [94258]	CI
Commonwealth Land - [94277]	CI
Commonwealth Land - [94274]	CI
Commonwealth Land - [94205]	CI
Commonwealth Land - [94269]	CI
Commonwealth Land - [94207]	CI
Commonwealth Land - [94261]	CI
Commonwealth Land - [94263]	CI
Commonwealth Land - [94262]	CI
Commonwealth Land - [94265]	CI
Commonwealth Land - [94264]	CI
Commonwealth Land - [94270]	CI
Commonwealth Land - [94271]	CI
Commonwealth Land - [94268]	CI
Commonwealth Land - [94253]	CI
Commonwealth Land - [94252]	CI
Commonwealth Land - [94255]	CI
Commonwealth Land - [94254]	CI
Commonwealth Land - [94231]	CI
Commonwealth Land - [94228]	CI
Commonwealth Land - [94251]	CI
Commonwealth Land - [94250]	CI
Commonwealth Land - [94256]	CI

Commonwealth Land Name	State
Commonwealth Land - [94257]	CI

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Administrators House Precinct	EXT	Listed place
Bungalow 702	EXT	Listed place
Drumsite Industrial Area	EXT	Listed place
Industrial and Administrative Group	EXT	Listed place
Malay Kampong Group	EXT	Listed place
Malay Kampong Precinct	EXT	Listed place
Phosphate Hill Historic Area	EXT	Listed place
Poon Saan Group	EXT	Listed place
Settlement Christmas Island	EXT	Listed place
South Point Settlement Remains	EXT	Listed place
Natural		
Christmas Island Natural Areas	EXT	Listed place

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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 known to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Cecropis daurica as Hirundo daurica Red-rumped Swallow [80610]		Species or species habitat known to occur within area overfly marine area
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Breeding known 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]		Breeding known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to 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
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		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
Fish		
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys sculptus Sculptured Pipefish [66197]		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
Cosmocampus maxweberi Maxweber's Pipefish [66209]		Species or species habitat may occur within area
Doryrhamphus baldwini Redstripe Pipefish [66718]		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
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		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 macrorhynchus Whiskered Pipefish, Ornate Pipefish [66222]		Species or species habitat may occur within area
Halicampus mataafae Samoan Pipefish [66223]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		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
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippichthys spicifer Belly-barred Pipefish, Banded Freshwater Pipefish [66232]		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 spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus brevirostris thorntail Pipefish, Thorn-tailed Pipefish [66254]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		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		
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 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 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 likely to 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	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
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 as Kogia simus 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 may 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
[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

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

Commonwealth Reserves Terrestrial [Resource Information]

Name	State	Type
Christmas Island	EXT	National Park (Commonwealth)

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Christmas Island	Habitat Protection Zone (IUCN IV)
Christmas Island	National Park Zone (IUCN II)

Extra Information

Nationally Important Wetlands [Resource Information]

Wetland Name	State
"The Dales", Christmas Island	EXT
Hosine's Spring, Christmas Island	EXT

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Christmas Island Airport Expansion	2001/434	Controlled Action	Post-Approval
Christmas Island Port Facility	2001/435	Controlled Action	Post-Approval
Construction of mobile phone tower	2002/694	Controlled Action	Completed
Cultural Appearance Upgrade of the Chinese Literary Association Building	2007/3568	Controlled Action	Completed
East Christmas Island Phosphate Mines (9 sites)	2001/487	Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Exploration for Mineable Phosphate, Christmas Island	2000/43	Controlled Action	Completed
Lily Beach Recreational Facilities	2001/395	Controlled Action	Post-Approval
Lily Beach Rock Pool Development	2001/400	Controlled Action	Completed
Nava-1 Cable System	2001/510	Controlled Action	Completed
Phosphate Mining in South Point Christmas Island	2012/6653	Controlled Action	Post-Approval
Proposed exploration drilling programme for Christmas Island	2016/7779	Controlled Action	Completed
Road Upgrade/Construction between Lily Beach Road and Port Faci	2001/436	Controlled Action	Post-Approval
Salvage, transport and processing of phosphate resource with extended airport si	2003/1217	Controlled Action	Post-Approval
Yellow Crazy Ant Biological Control	2013/6836	Controlled Action	Post-Approval
Not controlled action			
96-108 Gaze Road - Residential upgrade	2006/2632	Not Controlled Action	Completed
Aerial Baiting, Yellow Crazy Ant Supercolonies, Christmas Island, WA	2019/8492	Not Controlled Action	Completed
APX-West Fibre-optic telecommunications cable system, WA to Singapore	2013/7102	Not Controlled Action	Completed
Boat Ramp Construction	2001/237	Not Controlled Action	Completed
Building of a carport adjacent to residential house	2004/1538	Not Controlled Action	Completed
Christmas Island/Construction of a double storey shed/carport at MQ387 Gaze Road	2004/1561	Not Controlled Action	Completed
Christmas Island Fuel Consolidation Project, Christmas Island	2012/6454	Not Controlled Action	Completed
Community Recreation Centre	2003/1279	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
courtyard shower & handbasin facilities	2006/2803	Not Controlled Action	Completed
Dwelling demolition, maintenance and carpark/carport/storage shed works	2004/1837	Not Controlled Action	Completed
Extension of a Masonary Brick Wall adjacent to the Poon Saan Club by 500 mm	2004/1564	Not Controlled Action	Completed
Flying Fish Cove Christmas Island Boat Ramp Maintenance	2021/8924	Not Controlled Action	Completed
Flying Fish Cove Landslide Mitigation Project	2020/8616	Not Controlled Action	Completed
Garage and Office Facilities	2004/1919	Not Controlled Action	Completed
Housing and Garden Maintenance Works	2004/1487	Not Controlled Action	Completed
Hydroponics Research Program	2007/3338	Not Controlled Action	Completed
Identification of unmarked grave, exhumation/identification of remains which may belong to a sailor	2006/2992	Not Controlled Action	Completed
INDIGO West Submarine Telecommunications Cable, WA	2017/8126	Not Controlled Action	Completed
Internal and external modifications Lot 1014 Gaze Road	2004/1807	Not Controlled Action	Completed
Light Industrial Subdivision Development	2004/1799	Not Controlled Action	Completed
Lot 1056 Extensions and Alterations	2004/1801	Not Controlled Action	Completed
Maintenance of Tai Jin House, Smith Point	2009/4933	Not Controlled Action	Completed
Mobile Radio Communications System Upgrade	2002/718	Not Controlled Action	Completed
Placement of bitumen/ concrete on rail sections of heritage listed incline, Christmas Island	2013/7009	Not Controlled Action	Completed
Power Station Diesel Generator Replacement	2009/4685	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Proposed sale or lease of Crown land, 11 lots, Christmas Island	2018/8220	Not Controlled Action	Completed
Realignment of Gaze Road Service Road and Gaze Road Junction	2004/1735	Not Controlled Action	Completed
Refurbishment and Extension of Seaview Lodge	2012/6353	Not Controlled Action	Completed
renovate free-standing servant's quarters	2006/2811	Not Controlled Action	Completed
Replacement of deteriorating flat roof at rear of Mosque and extending side verandahs, Christmas Is	2013/6851	Not Controlled Action	Completed
Residential upgrade, 2 Coconut Grove	2007/3295	Not Controlled Action	Completed
Stormwater Remediation Project, Christmas Island	2019/8467	Not Controlled Action	Completed
Subdivision of Lot 571 on DP 26701	2008/4230	Not Controlled Action	Completed
Subdivision of Part 7 of Lot 1014	2009/4851	Not Controlled Action	Completed
Supermarket Extensions	2006/2515	Not Controlled Action	Completed
Upgrade of Residence, Coconut Grove	2006/2728	Not Controlled Action	Completed
Verandah Extension to Existing Breezeway Unit, Gaze Road	2005/1970	Not Controlled Action	Completed
Not controlled action (particular manner)			
Addition of Verandah to Block of Four Units	2005/2315	Not Controlled Action (Particular Manner)	Post-Approval
Aerial Baiting of Yellow Crazy Ants	2012/6438	Not Controlled Action (Particular Manner)	Post-Approval
Asbestos Removal from Commonwealth Owned Assests including Commonwealth Heritage	2009/4873	Not Controlled Action (Particular Manner)	Post-Approval
Australia to Singapore Fibre Optic Submarine Cable System	2011/6127	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Baiting Efficacy Trial of Feral Cat Bait and PAPP Toxicant	2008/4383	Not Controlled Action (Particular Manner)	Post-Approval
Commonwealth Marine/Flying Fish Cove Jetty Extension	2012/6675	Not Controlled Action (Particular Manner)	Post-Approval
Crazy Ant Aerial Baiting Control Program	2002/722	Not Controlled Action (Particular Manner)	Post-Approval
Helicopter baiting of exotic yellow crazy ant supercolonies, Christmas Island, Indian Ocean	2009/5016	Not Controlled Action (Particular Manner)	Post-Approval
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval
Laying a submarine optical fibre telecommunications cable, Perth to Singapore and Jakarta	2014/7332	Not Controlled Action (Particular Manner)	Post-Approval
New Housing Program	2011/6056	Not Controlled Action (Particular Manner)	Post-Approval
Swimming Pool modification	2007/3312	Not Controlled Action (Particular Manner)	Post-Approval
Trials of a bait delivery system for the control of Yellow Crazy Ants	2009/4763	Not Controlled Action (Particular Manner)	Post-Approval
Water supply upgrade	2005/2269	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
Alterations and Improvements to existing residence at Lot 3015 Gaze Rd, Christmas Island	2009/5039	Referral Decision	Completed
Rocky Point Dwelling Redevelopment	2005/2203	Referral Decision	Referral Decision

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 are 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

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

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

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
- 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: 01-Feb-2023

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:	2
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	52
Listed Migratory Species:	63

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:	79
Commonwealth Heritage Places:	2
Listed Marine Species:	109
Whales and Other Cetaceans:	32
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
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:	44
Regional Forest Agreements:	None
Nationally Important Wetlands:	4
EPBC Act Referrals:	248
Key Ecological Features (Marine):	6
Biologically Important Areas:	43
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

World Heritage Properties		[Resource Information]
Name	State	Legal Status
The Ningaloo Coast	WA	Declared property

National Heritage Places		[Resource Information]
Name	State	Legal Status
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	WA	Listed place
Natural		
The Ningaloo Coast	WA	Listed place

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
EEZ and Territorial Sea
Extended Continental Shelf

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 canutus		
Red Knot, Knot [855]	Endangered	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
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Malurus leucopterus edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	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
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
CRUSTACEAN		
Kumonga exleyi Cape Range Remipede [86875]	Vulnerable	Species or species habitat known to occur within area
FISH		
Milyeringa veritas Cape Range Cave Gudgeon, Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area
Ophisternon candidum Blind Cave Eel [66678]	Vulnerable	Species or species habitat known to occur within area
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to occur within area
MAMMAL		
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
Bettongia lesueur Barrow and Boodie Islands subspecies Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Dasyurus hallucatus		
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isoodon auratus barrowensis		
Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes conspicillatus conspicillatus		
Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies		
Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
Macroderma gigas		
Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Osphranter robustus isabellinus		
Barrow Island Wallaroo, Barrow Island Euro [89262]	Vulnerable	Species or species habitat likely to occur within area
Petrogale lateralis lateralis		
Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
PLANT		
Minuria tridens		
Minnie Daisy [13753]	Vulnerable	Species or species habitat known to occur within area
REPTILE		
Aipysurus apraefrontalis		
Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Ctenotus zastictus Hamelin Ctenotus [25570]	Vulnerable	Species or species habitat 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
Lerista nevinae Nevin's Slider [85296]	Endangered	Species or species habitat known to occur within area
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARK		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	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 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
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]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		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 likely to occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Fregata minor		
Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Hydroprogne caspia		
Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Onychoprion anaethetus		
Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus		
White-tailed Tropicbird [1014]		Species or species habitat known to occur within area
Sterna dougallii		
Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons		
Little Tern [82849]		Species or species habitat may occur within area
Sula leucogaster		
Brown Booby [1022]		Breeding known to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata		
Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera bonaerensis		
Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely 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 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
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to 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
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Eubalaena australis as Balaena glacialis australis		
Southern Right Whale [40]	Endangered	Species or species habitat likely 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
Lamna nasus		
Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Megaptera novaeangliae		
Humpback Whale [38]		Breeding known 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 known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni		
Australian Snubfin Dolphin [81322]		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 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 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]		Species or species habitat 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		
Hirundo rustica		
Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
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 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]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		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
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		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
Defence	
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50127]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50129]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50128]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50125]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50124]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50126]	WA
Defence - EXMOUTH VLF TRANSMITTER STATION [50122]	WA
Defence - EXMOUTH VLF TRANSMITTER STATION [50123]	WA
Defence - LEARMONTH - AIR WEAPONS RANGE [50193]	WA
Defence - LEARMONTH - RAAF BASE [50103]	WA
Defence - LEARMONTH - RAAF BASE [50108]	WA
Defence - LEARMONTH - RAAF BASE [50100]	WA
Defence - LEARMONTH - RAAF BASE [50109]	WA
Defence - LEARMONTH - RAAF BASE [50102]	WA
Defence - LEARMONTH - RAAF BASE [50106]	WA
Defence - LEARMONTH - RAAF BASE [50105]	WA
Defence - LEARMONTH - RAAF BASE [50101]	WA
Defence - LEARMONTH - RAAF BASE [50107]	WA
Defence - LEARMONTH - RAAF BASE [50097]	WA
Defence - LEARMONTH RADAR SITE - TWIN TANKS EXMOUTH [50002]	WA
Defence - LEARMONTH RADAR SITE - VLAMING HEAD EXMOUTH [50001]	WA
Defence - LEARMONTH TRANSMITTING STATION [50239]	WA

Commonwealth Land Name	State
Unknown	
Commonwealth Land - [51887]	WA
Commonwealth Land - [51884]	WA
Commonwealth Land - [52101]	WA
Commonwealth Land - [51104]	WA
Commonwealth Land - [52106]	WA
Commonwealth Land - [52108]	WA
Commonwealth Land - [52104]	WA
Commonwealth Land - [52107]	WA
Commonwealth Land - [52102]	WA
Commonwealth Land - [52105]	WA
Commonwealth Land - [52100]	WA
Commonwealth Land - [51463]	WA
Commonwealth Land - [52109]	WA
Commonwealth Land - [52198]	WA
Commonwealth Land - [52097]	WA
Commonwealth Land - [52099]	WA
Commonwealth Land - [52098]	WA
Commonwealth Land - [51472]	WA
Commonwealth Land - [51469]	WA
Commonwealth Land - [51468]	WA
Commonwealth Land - [51465]	WA
Commonwealth Land - [51464]	WA
Commonwealth Land - [51466]	WA
Commonwealth Land - [51467]	WA
Commonwealth Land - [51460]	WA
Commonwealth Land - [51461]	WA

Commonwealth Land Name	State
Commonwealth Land - [51462]	WA
Commonwealth Land - [51477]	WA
Commonwealth Land - [51474]	WA
Commonwealth Land - [51476]	WA
Commonwealth Land - [51473]	WA
Commonwealth Land - [51471]	WA
Commonwealth Land - [51470]	WA
Commonwealth Land - [51443]	WA
Commonwealth Land - [51442]	WA
Commonwealth Land - [51445]	WA
Commonwealth Land - [51444]	WA
Commonwealth Land - [51447]	WA
Commonwealth Land - [51446]	WA
Commonwealth Land - [51450]	WA
Commonwealth Land - [51453]	WA
Commonwealth Land - [51456]	WA
Commonwealth Land - [51451]	WA
Commonwealth Land - [52195]	WA
Commonwealth Land - [52236]	WA
Commonwealth Land - [51458]	WA
Commonwealth Land - [51459]	WA
Commonwealth Land - [51452]	WA
Commonwealth Land - [51448]	WA
Commonwealth Land - [51449]	WA
Commonwealth Land - [50385]	WA
Commonwealth Land - [51454]	WA
Commonwealth Land - [51455]	WA

Commonwealth Land Name	State
Commonwealth Land - [51457]	WA
Commonwealth Land - [51475]	WA
Commonwealth Land - [52110]	WA
Commonwealth Land - [52103]	WA

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Learmonth Air Weapons Range Facility	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding 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]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Endangered	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 likely to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within 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
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known 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 may occur within area

Scientific Name	Threatened Category	Presence Text
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
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		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
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within 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 may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Motacilla flava		
Yellow Wagtail [644]		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
Onychoprion anaethetus as Sterna anaethetus		
Bridled Tern [82845]		Breeding known to occur within area
Onychoprion fuscatus as Sterna fuscata		
Sooty Tern [90682]		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]		Species or species habitat known to occur within area
Phaethon lepturus fulvus		
Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Pterodroma mollis		
Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Rostratula australis as Rostratula benghalensis (sensu lato)		
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area
Sterna dougallii		
Roseate Tern [817]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Sternula albifrons as Sterna albifrons Little Tern [82849]		Species or species habitat may occur within area
Sternula nereis as Sterna nereis Fairy Tern [82949]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may 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 nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		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 latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		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
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
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		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 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

Scientific Name	Threatened Category	Presence Text
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		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
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		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

Scientific Name	Threatened Category	Presence Text
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		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli Small-headed Seasnake [75601]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Leioselasma czeblukovi as Hydrophis czeblukovi		
Fine-spined Seasnake, Geometrical Seasnake [87374]		Species or species habitat may occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus		
Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans [Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata		
Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis		
Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely 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
Delphinus delphis		
Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to 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 as Kogia simus 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]		Breeding known 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

Current Scientific Name	Status	Type of Presence
Orcaella heinsohni as Orcaella brevirostris Australian Snubfin Dolphin [81322]		Species or species habitat 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 as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat 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

Current Scientific Name	Status	Type of Presence
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
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Dampier	Habitat Protection Zone (IUCN IV)
Gascoyne	Habitat Protection Zone (IUCN IV)
Dampier	Multiple Use Zone (IUCN VI)
Eighty Mile Beach	Multiple Use Zone (IUCN VI)
Gascoyne	Multiple Use Zone (IUCN VI)
Montebello	Multiple Use Zone (IUCN VI)
Dampier	National Park Zone (IUCN II)
Gascoyne	National Park Zone (IUCN II)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Ningaloo	Recreational Use Zone (IUCN IV)

Habitat Critical to the Survival of Marine Turtles

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus		
Flatback Turtle [59257]	Nesting	Known to occur

Scientific Name	Behaviour	Presence
Dec - Jan		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Nov-Feb		
Caretta caretta Loggerhead Turtle [1763]	Nesting	Known to occur
Nov - May		
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Airlie Island	Nature Reserve	WA
Barrow Island	Nature Reserve	WA
Barrow Island	Marine Park	WA
Barrow Island	Marine Management Area	WA
Bessieres Island	Nature Reserve	WA
Boodie, Double Middle Islands	Nature Reserve	WA
Bundegi Coastal Park	5(1)(h) Reserve	WA
Burnside And Simpson Island	Nature Reserve	WA
Cape Range	National Park	WA
Gnandaroo Island	Nature Reserve	WA
Great Sandy Island	Nature Reserve	WA
Jurabi Coastal Park	5(1)(h) Reserve	WA
Little Rocky Island	Nature Reserve	WA
Locker Island	Nature Reserve	WA
Lowendal Islands	Nature Reserve	WA
Montebello Islands	Conservation Park	WA

Protected Area Name	Reserve Type	State
Montebello Islands	Marine Park	WA
Montebello Islands	Conservation Park	WA
Muiron Islands	Nature Reserve	WA
Muiron Islands	Marine Management Area	WA
Murujuga	National Park	WA
Ningaloo	Marine Park	WA
North Sandy Island	Nature Reserve	WA
Rocky Island	Nature Reserve	WA
Round Island	Nature Reserve	WA
Serrurier Island	Nature Reserve	WA
Tent Island	Nature Reserve	WA
Thevenard Island	Nature Reserve	WA
Unnamed WA36907	5(1)(h) Reserve	WA
Unnamed WA36909	5(1)(h) Reserve	WA
Unnamed WA36910	5(1)(h) Reserve	WA
Unnamed WA36913	Nature Reserve	WA
Unnamed WA36915	Nature Reserve	WA
Unnamed WA37500	5(1)(g) Reserve	WA
Unnamed WA40322	5(1)(h) Reserve	WA
Unnamed WA40828	5(1)(h) Reserve	WA
Unnamed WA40877	5(1)(h) Reserve	WA
Unnamed WA41080	5(1)(h) Reserve	WA
Unnamed WA44665	5(1)(h) Reserve	WA
Unnamed WA44667	5(1)(h) Reserve	WA
Victor Island	Nature Reserve	WA
Weld Island	Nature Reserve	WA

Protected Area Name	Reserve Type	State
Whalebone Island	Nature Reserve	WA
Y Island	Nature Reserve	WA

Nationally Important Wetlands

[Resource Information]

Wetland Name	State
Bundera Sinkhole	WA
Cape Range Subterranean Waterways	WA
Exmouth Gulf East	WA
Learmonth Air Weapons Range - Saline Coastal Flats	WA

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Ashburton Infrastructure Project	2021/9064		Completed
Browse to North West Shelf Development, Indian Ocean, WA	2018/8319		Approval
North West Shelf Project Extension, Carnarvon Basin, WA	2018/8335		Approval
Optimised Mardie Solar Salt Project	2022/9169		Assessment
Project Highclere Cable Lay and Operation	2022/09203		Completed
Action clearly unacceptable			
Highlands 3D Marine Seismic Survey	2012/6680	Action Clearly Unacceptable	Completed
Controlled action			
'Van Gogh' Petroleum Field Development	2007/3213	Controlled Action	Post-Approval
Anketell Point Iron Ore Processing & Export Port	2009/5120	Controlled Action	Post-Approval
Balmoral South Iron Ore Mine	2008/4236	Controlled Action	Post-Approval
Binowee Iron Ore Project	2001/366	Controlled Action	Proposed Decision
Boating Facility	2002/830	Controlled Action	Completed
Cape Lambert Port B Development	2008/4032	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatston	2008/4469	Controlled Action	Post-Approval
Construction and operation of a Solar Salt Project, SW Onslow, WA	2016/7793	Controlled Action	Assessment Approach
Develop Jansz-Io deepwater gas field in Permit Areas WA-18-R, WA-25-R and WA-26-	2005/2184	Controlled Action	Post-Approval
Development of Angel gas and condensate field, North West Shelf	2004/1805	Controlled Action	Post-Approval
Development of an iron ore mine and associated infrastructure	2010/5630	Controlled Action	Assessment Approach
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Development of Coniston/Novara fields within the Exmouth Sub-basin	2011/5995	Controlled Action	Post-Approval
Development of Stybarrow petroleum field incl drilling and facility installation	2004/1469	Controlled Action	Post-Approval
Echo-Yodel Production Wells	2000/11	Controlled Action	Post-Approval
Enfield full field development	2001/257	Controlled Action	Post-Approval
Equus Gas Fields Development Project, Carnarvon Basin	2012/6301	Controlled Action	Completed
Eramurra Industrial Salt Project	2021/9027	Controlled Action	Assessment Approach
Eramurra Industrial Salt Project, near Karratha, WA	2019/8448	Controlled Action	Completed
Gorgon Gas Development	2003/1294	Controlled Action	Post-Approval
Gorgon Gas Development 4th Train Proposal	2011/5942	Controlled Action	Post-Approval
Gorgon Gas Revised Development	2008/4178	Controlled Action	Post-Approval
Greater Enfield (Vincent) Development	2005/2110	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Greater Gorgon Development - Optical Fibre Cable, Mainland to Barrow Island	2005/2141	Controlled Action	Completed
Learmonth Bundle Site and Launchway, WA	2017/8079	Controlled Action	Completed
Light Crude Oil Production	2001/365	Controlled Action	Post-Approval
Mardie Project, 80 km south west of Karratha, WA	2018/8236	Controlled Action	Post-Approval
Mauds Landing Marina	2000/98	Controlled Action	Completed
Nava-1 Cable System	2001/510	Controlled Action	Completed
Ningaloo Lighthouse Development, 17km north west Exmouth, Western Australia	2020/8693	Controlled Action	Assessment Approach
Perdaman Urea Project, near Karratha, WA	2018/8383	Controlled Action	Post-Approval
Pluto Gas Project	2005/2258	Controlled Action	Completed
Pluto Gas Project Including Site B	2006/2968	Controlled Action	Post-Approval
Port Hedland Outer Harbour Development and associated marine and terrestrial in	2008/4159	Controlled Action	Post-Approval
Proposed West Pilbara Iron Ore Project	2009/4706	Controlled Action	Post-Approval
Pyrenees Oil Fields Development	2005/2034	Controlled Action	Post-Approval
Simpson Development	2000/59	Controlled Action	Completed
Simpson Oil Field Development	2001/227	Controlled Action	Post-Approval
Single Jetty Deep Water Port Renewable Hub, WA	2021/8942	Controlled Action	Proposed Decision
The Scarborough Project - FLNG & assoc subsea infrastructure, Carnarvon Basin	2013/6811	Controlled Action	Post-Approval
Vincent Appraisal Well	2000/22	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Yardie Creek Road Realignment Project	2021/8967	Controlled Action	Assessment Approach
Not controlled action			
'Goodwyn A' Low Pressure Train Project	2003/914	Not Controlled Action	Completed
'Van Gogh' Oil Appraisal Drilling Program, Exploration Permit Area WA-155-P(1)	2006/3148	Not Controlled Action	Completed
Airlie Island soil and groundwater investigations, Exmouth Gulf, offshore Pilbara coast	2014/7250	Not Controlled Action	Completed
APX-West Fibre-optic telecommunications cable system, WA to Singapore	2013/7102	Not Controlled Action	Completed
Baniyas-1 Exploration Well, EP-424, near Onslow	2007/3282	Not Controlled Action	Completed
Barrow Island 2D Seismic survey	2006/2667	Not Controlled Action	Completed
Boating Facility	2002/832	Not Controlled Action	Completed
Bollinger 2D Seismic Survey 200km North of North West Cape WA	2004/1868	Not Controlled Action	Completed
Bultaco-2, Laverda-2, Laverda-3 and Montesa-2 Appraisal Wells	2000/103	Not Controlled Action	Completed
Cape Lambert Port A Marine Structures Refurbishment Project	2018/8370	Not Controlled Action	Completed
Carnarvon 3D Marine Seismic Survey	2004/1890	Not Controlled Action	Completed
Cazadores 2D seismic survey	2004/1720	Not Controlled Action	Completed
Construct 110km buried natural gas pipeline from Onslow, connecting to Dampier/Bunbury natural gas p	2013/7039	Not Controlled Action	Completed
Construction and operation of an unmanned sea platform and connecting pipeline to Varanus Island for	2004/1703	Not Controlled Action	Completed
Controlled Source Electromagnetic Survey	2007/3262	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Development of Halyard Field off the west coast of WA	2010/5611	Not Controlled Action	Completed
Development of iron ore facilities	2013/7013	Not Controlled Action	Completed
Development of Mutineer and Exeter petroleum fields for oil production, Permit	2003/1033	Not Controlled Action	Completed
Differential Global Positioning System (DGPS)	2001/445	Not Controlled Action	Completed
Drilling of an exploration well Gats-1 in Permit Area WA-261-P	2004/1701	Not Controlled Action	Completed
Eagle-1 Exploration Drilling, North West Shelf, WA	2019/8578	Not Controlled Action	Completed
Echo A Development WA-23-L, WA-24-L	2005/2042	Not Controlled Action	Completed
Expansion of the Sino Iron Ore Mine and export facilities, Cape Preston, WA	2017/7862	Not Controlled Action	Completed
Expansion Proposal, Mineralogy Cape Preston Iron Ore Project, Cape Preston, WA	2009/5010	Not Controlled Action	Completed
Exploration drilling well WA-155-P(1)	2003/971	Not Controlled Action	Completed
Exploration of appraisal wells	2006/3065	Not Controlled Action	Completed
Exploration Well (Taunton-2)	2002/731	Not Controlled Action	Completed
Exploration Well in Permit Area WA-155-P(1)	2002/759	Not Controlled Action	Completed
Exploratory drilling in permit area WA-225-P	2001/490	Not Controlled Action	Completed
Extension of Simpson Oil Platforms & Wells	2002/685	Not Controlled Action	Completed
Gulf Fishing Lodge	2010/5499	Not Controlled Action	Completed
HCA05X Macedon Experimental Survey	2004/1926	Not Controlled Action	Completed
Hess Exploration Drilling Programme	2007/3566	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Huascaran-1 exploration well (WA-292-P)	2001/539	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
INDIGO West Submarine Telecommunications Cable, WA	2017/8126	Not Controlled Action	Completed
Infill Production Well (Griffin-9)	2001/417	Not Controlled Action	Completed
Jansz-2 and 3 Appraisal Wells	2002/754	Not Controlled Action	Completed
Klammer 2D Seismic Survey	2002/868	Not Controlled Action	Completed
Mahimahi Aquaculture Facility	2002/891	Not Controlled Action	Completed
Maia-Gaea Exploration wells	2000/17	Not Controlled Action	Completed
Manaslu - 1 and Huascaran - 1 Offshore Exploration Wells	2001/235	Not Controlled Action	Completed
Mermaid Marine Australia Desalination Project	2011/5916	Not Controlled Action	Completed
Montesa-1 and Bultaco-1 Exploration Wells	2000/102	Not Controlled Action	Completed
Murujuga archaeological excavation, collection and sampling, Dampier Archipelago, WA	2014/7160	Not Controlled Action	Completed
North Rankin B gas compression facility	2005/2500	Not Controlled Action	Completed
Onslow Power Infrastructure Upgrade Project, Onslow, WA	2014/7314	Not Controlled Action	Completed
Onslow Water Supply Infrastructure Upgrade Project, Onslow, WA	2014/7329	Not Controlled Action	Completed
Pipeline System Modifications Project	2000/3	Not Controlled Action	Completed
Port Expansion and Dredging	2003/1265	Not Controlled Action	Completed
Port Hedland Channel Risk and Optimisation Project, WA	2017/7915	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Searipple gas and condensate field development	2000/89	Not Controlled Action	Completed
Spool Base Facility	2001/263	Not Controlled Action	Completed
Subsea Gas Pipeline From Stybarrow Field to Griffin Venture Gas Export Pipeline	2005/2033	Not Controlled Action	Completed
sub-sea tieback of Perseus field wells	2004/1326	Not Controlled Action	Completed
Telstra North Rankin Spur Fibre Optic Cable	2016/7836	Not Controlled Action	Completed
Thevenard Island Retirement Project	2015/7423	Not Controlled Action	Completed
To construct and operate an offshore submarine fibre optic cable, WA	2014/7373	Not Controlled Action	Completed
Wanda Offshore Research Project, 80 km north-east of Exmouth, WA	2018/8293	Not Controlled Action	Completed
Western Flank Gas Development	2005/2464	Not Controlled Action	Completed
Wheatstone 3D seismic survey, 70km north of Barrow Island	2004/1761	Not Controlled Action	Completed
Not controlled action (particular manner)			
'Kate' 3D marine seismic survey, exploration permits WA-320-P and WA-345-P, 60km	2005/2037	Not Controlled Action (Particular Manner)	Post-Approval
'Tourmaline' 2D marine seismic survey, permit areas WA-323-P, WA-330-P and WA-32	2005/2282	Not Controlled Action (Particular Manner)	Post-Approval
"Leanne" offshore 3D seismic exploration, WA-356-P	2005/1938	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D seismic surveys	2005/2151	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey	2012/6296	Not Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		(Particular Manner)	
2D seismic survey	2008/4493	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey	2005/2146	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey Permit Area WA-352-P	2008/4628	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey within permit WA-291	2007/3265	Not Controlled Action (Particular Manner)	Post-Approval
3D marine seismic survey	2008/4281	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey (WA-482-P, WA-363-P), WA	2013/6761	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey in Permit Areas WA-15-R, WA-18-R, WA-205-P, WA-253-P, WA-267-P and WA-268-P	2003/1271	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey in WA 457-P & WA 458-P, North West Shelf, offshore WA	2013/6862	Not Controlled Action (Particular Manner)	Post-Approval
3D marine seismic survey over petroleum title WA-268-P	2007/3458	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Surveys - Contos CT-13 & Supertubes CT-13, offshore WA	2013/6901	Not Controlled Action (Particular Manner)	Post-Approval
3D seismic survey	2006/2715	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
3D Seismic Survey, WA	2008/4428	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey in the Carnarvon Bsin on the North West Shelf	2002/778	Not Controlled Action (Particular Manner)	Post-Approval
3D sesmic survey	2006/2781	Not Controlled Action (Particular Manner)	Post-Approval
Acheron Non-Exclusive 2D Seismic Survey	2008/4565	Not Controlled Action (Particular Manner)	Post-Approval
Acheron Non-Exclusive 2D Seismic Survey	2009/4968	Not Controlled Action (Particular Manner)	Post-Approval
Agrippina 3D Seismic Marine Survey	2009/5212	Not Controlled Action (Particular Manner)	Post-Approval
Apache Northwest Shelf Van Gogh Field Appraisal Drilling Program	2007/3495	Not Controlled Action (Particular Manner)	Post-Approval
Aperio 3D Marine Seismic Survey, WA	2012/6648	Not Controlled Action (Particular Manner)	Post-Approval
Artemis-1 Drilling Program (WA-360-P)	2010/5432	Not Controlled Action (Particular Manner)	Post-Approval
Australia to Singapore Fibre Optic Submarine Cable System	2011/6127	Not Controlled Action (Particular Manner)	Post-Approval
Babylon 3D Marine Seismic Survey, Commonwealth Waters, nr Exmouth WA	2013/7081	Not Controlled Action (Particular Manner)	Post-Approval
Balnaves Condensate Field Development	2011/6188	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Bonaventure 3D seismic survey	2006/2514	Not Controlled Action (Particular Manner)	Post-Approval
Cable Seismic Exploration Permit areas WA-323-P and WA-330-P	2008/4227	Not Controlled Action (Particular Manner)	Post-Approval
Cape Preston East - Iron Ore Export Facilities, Pilbara, WA	2013/6844	Not Controlled Action (Particular Manner)	Post-Approval
Cerberus exploration drilling campaign, Carnarvon Basin, WA	2016/7645	Not Controlled Action (Particular Manner)	Post-Approval
CGGVERITAS 2010 2D Seismic Survey	2010/5714	Not Controlled Action (Particular Manner)	Post-Approval
Charon 3D Marine Seismic Survey	2007/3477	Not Controlled Action (Particular Manner)	Post-Approval
Consturction & operation of the Varanus Island kitchen & mess cyclone refuge building, compression p	2013/6952	Not Controlled Action (Particular Manner)	Post-Approval
Coverack Marine Seismic Survey	2001/399	Not Controlled Action (Particular Manner)	Post-Approval
Cue Seismic Survey within WA-359-P, WA-361-P and WA-360-P	2007/3647	Not Controlled Action (Particular Manner)	Post-Approval
CVG 3D Marine Seismic Survey	2012/6654	Not Controlled Action (Particular Manner)	Post-Approval
DAVROS MC 3D marine seismic survey northwaet of Dampier, WA	2013/7092	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Decommissioning of the Legendre facilities	2010/5681	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Drilling Program	2010/5532	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	Not Controlled Action (Particular Manner)	Post-Approval
Demeter 3D Seismic Survey, off Dampier, WA	2002/900	Not Controlled Action (Particular Manner)	Post-Approval
Diesel Fuel Bunker Operation	2012/6289	Not Controlled Action (Particular Manner)	Post-Approval
Draeck 3D Marine Seismic Survey, WA-205-P	2006/3067	Not Controlled Action (Particular Manner)	Post-Approval
Drilling 35-40 offshore exploration wells in deep water	2008/4461	Not Controlled Action (Particular Manner)	Post-Approval
Earthworks for kitchen/mess, cyclone refuge building & Compression Plant, Varanus Island	2013/6900	Not Controlled Action (Particular Manner)	Post-Approval
Eendracht Multi-Client 3D Marine Seismic Survey	2009/4749	Not Controlled Action (Particular Manner)	Post-Approval
Effect of marine seismic sounds to demersal fish and pearl oysters, north-west WA	2018/8169	Not Controlled Action (Particular Manner)	Post-Approval
Enfield M3 & Vincent 4D Marine Seismic Surveys	2008/3981	Not Controlled Action (Particular Manner)	Completed
Enfield M3 4D, Vincent 4D & 4D Line Test Marine Seismic Surveys	2008/4122	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Enfield M4 4D Marine Seismic Survey	2008/4558	Not Controlled Action (Particular Manner)	Post-Approval
Enfield oilfield 3D Seismic Survey	2006/3132	Not Controlled Action (Particular Manner)	Post-Approval
Exmouth West 2D Marine Seismic Survey	2008/4132	Not Controlled Action (Particular Manner)	Post-Approval
Exploration drilling of Zeus-1 well	2008/4351	Not Controlled Action (Particular Manner)	Post-Approval
Fletcher-Finucane Development, WA26-L and WA191-P	2011/6123	Not Controlled Action (Particular Manner)	Post-Approval
Foxhound 3D Non-Exclusive Marine Seismic Survey	2009/4703	Not Controlled Action (Particular Manner)	Post-Approval
Gazelle 3D Marine Seismic Survey in WA-399-P and WA-42-L	2010/5570	Not Controlled Action (Particular Manner)	Post-Approval
Geco Eagle 3D Marine Seismic Survey	2008/3958	Not Controlled Action (Particular Manner)	Post-Approval
Glencoe 3D Marine Seismic Survey WA-390-P	2007/3684	Not Controlled Action (Particular Manner)	Post-Approval
Greater Western Flank Phase 1 gas Development	2011/5980	Not Controlled Action (Particular Manner)	Post-Approval
Grimalkin 3D Seismic Survey	2008/4523	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Guacamole 2D Marine Seismic Survey	2008/4381	Not Controlled Action (Particular Manner)	Post-Approval
Harmony 3D Marine Seismic Survey	2012/6699	Not Controlled Action (Particular Manner)	Post-Approval
Harpy 1 exploration well	2001/183	Not Controlled Action (Particular Manner)	Post-Approval
Honeycombs MC3D Marine Seismic Survey	2012/6368	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas MC3D Marine Seismic Survey (HZ-13) Carnarvon Basin, offshore WA	2013/7003	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas phase 2 marine seismic survey, Exmouth Plateau, Northern Carnarvon Basin, WA	2013/7093	Not Controlled Action (Particular Manner)	Post-Approval
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval
John Ross & Rosella Off Bottom Cable Seismic Exploration Program	2008/3966	Not Controlled Action (Particular Manner)	Post-Approval
Judo Marine 3D Seismic Survey within and adjacent to WA-412-P	2008/4630	Not Controlled Action (Particular Manner)	Post-Approval
Judo Marine 3D Seismic Survey within and adjacent to WA-412-P	2009/4801	Not Controlled Action (Particular Manner)	Post-Approval
Julimar Brunello Gas Development Project	2011/5936	Not Controlled Action (Particular Manner)	Post-Approval
Klimt 2D Marine Seismic Survey	2007/3856	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Laverda 3D Marine Seismic Survey and Vincent M1 4D Marine Seismic Survey	2010/5415	Not Controlled Action (Particular Manner)	Post-Approval
Laying a submarine optical fibre telecommunications cable, Perth to Singapore and Jakarta	2014/7332	Not Controlled Action (Particular Manner)	Post-Approval
Leopard 2D marine seismic survey	2005/2290	Not Controlled Action (Particular Manner)	Post-Approval
Lion 2D Marine Seismic Survey	2007/3777	Not Controlled Action (Particular Manner)	Post-Approval
Macedon Gas Field Development	2008/4605	Not Controlled Action (Particular Manner)	Post-Approval
Marine Geotechnical Drilling Program	2008/4012	Not Controlled Action (Particular Manner)	Post-Approval
Marine reconnaissance survey	2008/4466	Not Controlled Action (Particular Manner)	Post-Approval
Millstream 20GL Pipeline, Bungaroo, Borefield Integration	2012/6379	Not Controlled Action (Particular Manner)	Post-Approval
Moosehead 2D seismic survey within permit WA-192-P	2005/2167	Not Controlled Action (Particular Manner)	Post-Approval
Munmorah 2D seismic survey within permits WA-308/9-P	2003/970	Not Controlled Action (Particular Manner)	Post-Approval
Ocean Bottom Cable Seismic Program, WA-264-P	2007/3844	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Ocean Bottom Cable Seismic Survey	2005/2017	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Canning Multi Client 2D Marine Seismic Survey	2010/5393	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Drilling Campaign	2011/5830	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
Onslow Seawater Desalination Plant Marine Geophysical Investigation	2020/8794	Not Controlled Action (Particular Manner)	Post-Approval
Orcus 3D Marine Seismic Survey in WA-450-P	2010/5723	Not Controlled Action (Particular Manner)	Post-Approval
Osprey and Dionysus Marine Seismic Survey	2011/6215	Not Controlled Action (Particular Manner)	Post-Approval
Palta-1 exploration well in Petroleum Permit Area WA-384-P	2011/5871	Not Controlled Action (Particular Manner)	Post-Approval
Phoenix 3D Seismic Survey, Bedout Sub-Basin	2010/5360	Not Controlled Action (Particular Manner)	Post-Approval
Pomodoro 3D Marine Seismic Survey in WA-426-P and WA-427-P	2010/5472	Not Controlled Action (Particular Manner)	Post-Approval
Port Walcott upgrade, dredging & spoil disposal, & channel realignment	2006/2806	Not Controlled Action (Particular Manner)	Post-Approval
Pyrenees 4D Marine Seismic Monitor Survey, HCA12A	2012/6579	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Pyrenees-Macedon 3D marine seismic survey	2005/2325	Not Controlled Action (Particular Manner)	Post-Approval
Quiberon 2D Seismic Survey, permit area WA-385P, offshore of Carnarvon	2009/5077	Not Controlled Action (Particular Manner)	Post-Approval
Reindeer gas reservior development, Devil Creek, Carnarvon Basin - WA	2007/3917	Not Controlled Action (Particular Manner)	Post-Approval
Rose 3D Seismic Program	2008/4239	Not Controlled Action (Particular Manner)	Post-Approval
Rydal-1 Petroleum Exploration Well, WA	2012/6522	Not Controlled Action (Particular Manner)	Post-Approval
Salsa 3D Marine Seismic Survey	2010/5629	Not Controlled Action (Particular Manner)	Post-Approval
Santos Winchester three dimensional seismic survey - WA-323-P & WA-330-P	2011/6107	Not Controlled Action (Particular Manner)	Post-Approval
Scarborough Development nearshore component, NWS, WA	2018/8362	Not Controlled Action (Particular Manner)	Post-Approval
Skorpion Marine Seismic Survey WA	2001/416	Not Controlled Action (Particular Manner)	Post-Approval
Sovereign 3D Marine Seismic Survey	2011/5861	Not Controlled Action (Particular Manner)	Post-Approval
Stag 4D & Reindeer MAZ Marine Seismic Surveys, WA	2013/7080	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Stag Off-bottom Cable Seismic Survey	2007/3696	Not Controlled Action (Particular Manner)	Post-Approval
Stybarrow 4D Marine Seismic Survey	2011/5810	Not Controlled Action (Particular Manner)	Post-Approval
Stybarrow Baseline 4D marine seismic survey	2008/4530	Not Controlled Action (Particular Manner)	Post-Approval
Tantabiddi Boat Ramp Sand Bypassing	2015/7411	Not Controlled Action (Particular Manner)	Post-Approval
The Dampier Heavy Load Out Facility Berth and Swing Basin Expansion	2012/6271	Not Controlled Action (Particular Manner)	Post-Approval
Tidepole Maz 3D Seismic Survey Campaign	2007/3706	Not Controlled Action (Particular Manner)	Post-Approval
Tortilla 2D Seismic Survey, WA	2011/6110	Not Controlled Action (Particular Manner)	Post-Approval
Triton 3D Marine Seismic Survey, WA-2-R and WA-3-R	2006/2609	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a 3D marine seismic survey	2010/5695	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a three dimensional marine seismic survey	2010/5679	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a three dimensional marine seismic survey	2010/5715	Not Controlled Action (Particular Manner)	Post-Approval
Vincent M1 and Enfield M5 4D Marine Seismic Survey	2010/5720	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Warramunga Non-Inclusive 3D Seismic Survey	2008/4553	Not Controlled Action (Particular Manner)	Post-Approval
West Anchor 3D Marine Seismic Survey	2008/4507	Not Controlled Action (Particular Manner)	Post-Approval
West Panaeus 3D seismic survey	2006/3141	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone 3D MAZ Marine Seismic Survey	2011/6058	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2007/3941	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2008/4134	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
3D Marine Seismic Survey in the offshore northwest Carnarvon Basin	2011/6175	Referral Decision	Completed
3D Seismic Survey	2008/4219	Referral Decision	Completed
Bianchi 3D Marine Seismic Survey, Carnavon Basin, WA	2013/7078	Referral Decision	Completed
CVG 3D Marine Seismic Survey	2012/6270	Referral Decision	Completed
Enfield 4D Marine Seismic Surveys, Production Permit WA-28-L	2005/2370	Referral Decision	Completed
Mardie Salt Project, Pilbara region, WA	2018/8183	Referral Decision	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Referral decision			
Outer Harbour Development and associated marine and terrestial infrastructure	2008/4148	Referral Decision	Completed
Rose 3D Seismic acquisition survey	2008/4220	Referral Decision	Completed
Stybarrow Baseline 4D Marine Seismic Survey (Permit Areas WA-255-P, WA-32-L, WA-	2008/4165	Referral Decision	Completed
Two Dimensional Transition Zone Seismic Survey - TP/7 (R1)	2010/5507	Referral Decision	Completed
Varanus Island Compression Project	2012/6698	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
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	North-west
Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west
Glomar Shoals	North-west

Biologically Important Areas

Scientific Name	Behaviour	Presence
Dugong		
Dugong dugon Dugong [28]	Breeding	Known to occur
Dugong dugon Dugong [28]	Calving	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
Caretta caretta Loggerhead Turtle [1763]	Internesting buffer	Known to occur
Caretta caretta Loggerhead Turtle [1763]	Nesting	Known to occur
Chelonia mydas Green Turtle [1765]	Aggregation	Known to occur
Chelonia mydas Green Turtle [1765]	Basking	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Likely to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Chelonia mydas Green Turtle [1765]	Mating	Known to occur
Chelonia mydas Green Turtle [1765]	Migration corridor	Known to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Known to occur

Scientific Name	Behaviour	Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Mating	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Migration corridor	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Natator depressus Flatback Turtle [59257]	Aggregation	Known to occur
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Natator depressus Flatback Turtle [59257]	Mating	Known to occur
Natator depressus Flatback Turtle [59257]	Migration corridor	Known to occur
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Seabirds		
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Fregata ariel Lesser Frigatebird [1012]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sternula nereis Fairy Tern [82949]	Breeding	Known to occur
Sula leucogaster Brown Booby [1022]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Rhincodon typus Whale Shark [66680]	Foraging (high density prey)	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Resting	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 are 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

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

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

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
- 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: 01-Feb-2023

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:	25
Listed Migratory Species:	49

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:	2
Listed Marine Species:	83
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	8
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:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	1
EPBC Act Referrals:	42
Key Ecological Features (Marine):	5
Biologically Important Areas:	28
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
EEZ and Territorial Sea
Extended Continental Shelf
Extended Continental Shelf

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	Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
FISH		
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to occur within area
MAMMAL		
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
REPTILE		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	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	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
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	Foraging, feeding or related behaviour likely 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
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	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		

Scientific Name	Threatened Category	Presence Text
Anous stolidus Common Noddy [825]		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 known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Foraging, feeding or related behaviour likely to occur within area
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]		Foraging, feeding or related behaviour likely to occur within area
Sternula albifrons Little Tern [82849]		Congregation or aggregation 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 likely 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 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
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 known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour 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 likely to occur within area

Scientific Name	Threatened Category	Presence Text
Dugong dugon Dugong [28]		Species or species habitat may 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	Foraging, feeding or related behaviour likely to occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known 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	Congregation or aggregation known 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

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 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	Foraging, feeding or related behaviour known to 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 likely to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may 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 may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		

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]		Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	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

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Mermaid Reef - Rowley Shoals	WA	Listed place
Scott Reef and Surrounds - Commonwealth Area	EXT	Listed place

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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
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
Cecropis daurica as Hirundo daurica Red-rumped Swallow [80610]		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]		Foraging, feeding or related behaviour likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		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 may 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	Species or species habitat may occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Congregation or aggregation 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

Scientific Name	Threatened Category	Presence Text
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 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

Scientific Name	Threatened Category	Presence Text
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
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 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

Scientific Name	Threatened Category	Presence Text
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]		Species or species habitat may occur within area
Reptile		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Aipysurus fuscus Dusky Seasnake [1119]		Species or species habitat known to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		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	Foraging, feeding or related behaviour known to occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may 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 likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		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 Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli Small-headed Seasnake [75601]		Species or species habitat may occur within area
Lapemis curtus as Lapemis hardwickii Spine-bellied Seasnake [83554]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Leioselasma coggeri as Hydrophis coggeri		
Black-headed Sea Snake, Slender-necked Seasnake [87373]		Species or species habitat may occur within area
Lepidochelys olivacea		
Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Pelamis platurus		
Yellow-bellied Seasnake [1091]		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

Current Scientific Name	Status	Type of Presence
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 as Kogia simus 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]		Breeding known 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 as Orcaella brevirostris 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

Current Scientific Name	Status	Type of Presence
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 as Sousa chinensis 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
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 likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
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
Kimberley	Habitat Protection Zone (IUCN IV)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Kimberley	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	National Park Zone (IUCN II)
Kimberley	National Park Zone (IUCN II)
Mermaid Reef	National Park Zone (IUCN II)
Argo-Rowley Terrace	Special Purpose Zone (Trawl) (IUCN VI)

Habitat Critical to the Survival of Marine Turtles

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

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Rowley Shoals	Marine Park	WA
Scott Reef	Nature Reserve	WA

Nationally Important Wetlands [Resource Information]

Wetland Name	State
Mermaid Reef	EXT

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Browse to North West Shelf Development, Indian Ocean, WA	2018/8319		Approval
Controlled action			
2-D seismic survey Scott Reef	2000/125	Controlled Action	Post-Approval
Browse FLNG Development, Commonwealth Waters	2013/7079	Controlled Action	Post-Approval
Conduct an exploration drilling campaign	2010/5718	Controlled Action	Completed
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Torosa South Initial Appraisal Drilling	2007/3500	Controlled Action	Completed
Not controlled action			
3D marine seismic survey in WA 314P and WA 315P	2004/1927	Not Controlled Action	Completed
Drilling of exploration wells, Permit areas WA-301-P to WA-305-P	2002/769	Not Controlled Action	Completed
Not controlled action (particular manner)			
2 (3D) Marine Seismic Surveys	2009/4994	Not Controlled Action (Particular Manner)	Completed
2D seismic survey in permit areas WA-274P and WA-281P	2004/1521	Not Controlled Action (Particular Manner)	Post-Approval
2 geotechnical surveys - preliminary and final	2006/2886	Not Controlled Action (Particular Manner)	Post-Approval
3D marine seismic Survey - Maxima 3D MSS	2006/2945	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	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
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
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	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
Geoscience Australia - Marine survey in Browse Basin to acquire data to assist assessment of CO2 sto	2013/6747	Not Controlled Action (Particular Manner)	Post-Approval
Gigas 2D Pilot Ocean Bottom Cable Marine Seismic Survey	2007/3839	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
Koolama 2D Seismic Survey Dampier Basin	2010/5420	Not Controlled Action (Particular Manner)	Post-Approval
Kraken, Lusca & Asperus 3D Marine Seismic Survey	2013/6730	Not Controlled Action (Particular Manner)	Post-Approval
Mariner Non-Exclusive 2D Seismic Survey	2011/6172	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Offshore Canning Multi Client 2D Marine Seismic Survey	2010/5393	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
Outer Canning exploration drilling program off NW coast of WA	2012/6618	Not Controlled Action (Particular Manner)	Post-Approval
Pilot Appraisal Well - Torosa South 1	2008/3991	Not Controlled Action (Particular Manner)	Post-Approval
Repsol 3d & 2D Marine Seismic Survey	2012/6658	Not Controlled Action (Particular Manner)	Post-Approval
Rosebud 3D Marine Seismic Survey in WA-30-R and TR/5	2012/6493	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
Scott Reef Seismic Research	2006/2647	Not Controlled Action (Particular Manner)	Post-Approval
Tridacna 3D Ocean Bottom Cable Marine Seismic Survey	2011/5959	Not Controlled Action (Particular Manner)	Post-Approval
Vampire 2D Non Exclusive Seismic Survey, WA	2010/5543	Not Controlled Action (Particular Manner)	Post-Approval
Veritas Voyager 2D Marine Seismic Survey	2009/5151	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Woodside Southern Browse 3D Seismic Survey, WA	2007/3534	Not Controlled Action (Particular Manner)	Post-Approval
Zeemeermin MC3D seismic survey, Browse Basin, Offshore WA	2009/5023	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
Experimental Study of Behavioural and Physiological Impact on Fish of Seismic Ex	2006/2625	Referral Decision	Completed
Pilot Appraisal Well - Torosa South-1	2008/3985	Referral Decision	Completed
Seismic Data Acquisition, Browse Basin	2010/5475	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
Canyons linking the Argo Abyssal Plain with the Scott Plateau	North-west
Continental Slope Demersal Fish Communities	North-west
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	North-west
Seringapatam Reef and Commonwealth waters in the Scott Reef Complex	North-west

Biologically Important Areas

Scientific Name	Behaviour	Presence
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Likely to occur

Scientific Name	Behaviour	Presence
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Natator depressus Flatback Turtle [59257]	Foraging	Known 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

Scientific Name	Behaviour	Presence
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
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Calving	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Nursing	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Resting	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 are 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

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

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

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
- 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: 01-Feb-2023

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:	22
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:	81
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	3
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:	1
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	25
Key Ecological Features (Marine):	2
Biologically Important Areas:	9
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
EEZ and Territorial Sea
Extended Continental Shelf

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 canutus		
Red Knot, Knot [855]	Endangered	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
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	Species or species habitat may occur within area
FISH		
Thunnus maccoyii		
Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to occur within area
MAMMAL		

Scientific Name	Threatened Category	Presence Text
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
REPTILE		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
SHARK		

Scientific Name	Threatened Category	Presence Text
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	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	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]		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 likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area
Sternula albifrons Little Tern [82849]		Congregation or aggregation known to occur within area
Sula leucogaster Brown Booby [1022]		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 likely to 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 likely to occur within area

Scientific Name	Threatened Category	Presence Text
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour likely 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
Megaptera novaeangliae Humpback Whale [38]		Breeding known 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	Congregation or aggregation known 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

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 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	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		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 Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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 likely 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 may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		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 may occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Congregation or aggregation known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		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 latispinosus Muiron Island Pipefish [66196]		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 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
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 nitidus Glittering Pipefish [66224]		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 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

Scientific Name	Threatened Category	Presence Text
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
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		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
Reptile		

Scientific Name	Threatened Category	Presence Text
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli Small-headed Seasnake [75601]		Species or species habitat may occur within area
Leioselasma czeblukovi as Hydrophis czeblukovi Fine-spined Seasnake, Geometrical Seasnake [87374]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area

Scientific Name	Threatened Category	Presence Text
Pelamis platurus Yellow-bellied Seasnake [1091]		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 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

Current Scientific Name	Status	Type of Presence
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima as Kogia simus 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]		Breeding known 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 as Orcaella brevirostris 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

Current Scientific Name	Status	Type of Presence
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat may 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 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

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	Special Purpose Zone (Trawl) (IUCN VI)

Extra Information

State and Territory Reserves		[Resource Information]
Protected Area Name	Reserve Type	State
Rowley Shoals	Marine Park	WA

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
Browse to North West Shelf Development, Indian Ocean, WA	2018/8319		Approval
Controlled action			
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Not controlled action			
Cazadores 2D seismic survey	2004/1720	Not Controlled Action	Completed
Controlled Source Electromagnetic Survey	2007/3262	Not Controlled Action	Completed
Huascaran-1 exploration well (WA-292-P)	2001/539	Not Controlled Action	Completed
Manaslu - 1 and Huascaran - 1 Offshore Exploration Wells	2001/235	Not Controlled Action	Completed
WA-295-P Kerr-McGee Exploration Wells	2001/152	Not Controlled Action	Completed
Not controlled action (particular manner)			
2D seismic survey within permit WA-291	2007/3265	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey (WA-482-P, WA-363-P), WA	2013/6761	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Australia to Singapore Fibre Optic Submarine Cable System	2011/6127	Not Controlled Action (Particular Manner)	Post-Approval
Cue Seismic Survey within WA-359-P, WA-361-P and WA-360-P	2007/3647	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	Not Controlled Action (Particular Manner)	Post-Approval
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
Klimt 2D Marine Seismic Survey	2007/3856	Not Controlled Action (Particular Manner)	Post-Approval
Mariner Non-Exclusive 2D Seismic Survey	2011/6172	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Canning Multi Client 2D Marine Seismic Survey	2010/5393	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
Outer Canning exploration drilling program off NW coast of WA	2012/6618	Not Controlled Action (Particular Manner)	Post-Approval
Phoenix 3D Seismic Survey, Bedout Sub-Basin	2010/5360	Not Controlled Action (Particular Manner)	Post-Approval
Repsol 3d & 2D Marine Seismic Survey	2012/6658	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Rose 3D Seismic Program	2008/4239	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			
3D Seismic Survey	2008/4219	Referral Decision	Completed
Rose 3D Seismic acquisition survey	2008/4220	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
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	North-west

Biologically Important Areas

Scientific Name	Behaviour	Presence
Marine Turtles		
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Seabirds		
Fregata ariel Lesser Frigatebird [1012]	Breeding	Known to occur
Phaethon lepturus White-tailed Tropicbird [1014]	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
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	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 are 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

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

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

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
- 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 E Aboriginal Cultural Heritage Inquiry System Report for Hydrocarbon Spill EMBA

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

Search Criteria

208 Aboriginal Cultural Heritage (ACH) Directory in Shapefile - EMBA clip 1. Warning: Search area complex so results may be inaccurate. Contact DPLH for assistance.

Disclaimer

The *Aboriginal Cultural Heritage Act 2021 (Act)* recognises, protects, conserves, and preserves Aboriginal cultural heritage (ACH), and recognises the fundamental importance of ACH to Aboriginal people and its role in Aboriginal communities past, present and future. The Act recognises the value of ACH to Aboriginal people as well as to the wider Western Australian community.

Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported to the ACH Council or exists on the Directory.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at AboriginalHeritage@dplh.wa.gov.au and we will make every effort to rectify it as soon as possible.

Terminology

ID: Reported ACH is assigned a unique ID by the Department of Planning, Lands and Heritage using the format: ACH-00000001. For ACH places on the former Register the ID numbers remain unchanged and use the new format. For example the ACH ID of the place Swan River was previously '3536' and is now 'ACH-00003536'.

Access and Restrictions:

- **Boundary Reliable (Yes/No):** Indicates whether the location and extent of the ACH boundary is considered reliable.
- **Boundary Restricted = No:** ACH location is shown as accurately as the information submitted allows.
- **Boundary Restricted = Yes:** To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least $4km^2$) provides a general indication of where the ACH is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- **Culturally Sensitive = No:** Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.
- **Culturally Sensitive = Yes:** Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information. To request access please contact AboriginalHeritage@dplh.wa.gov.au.
- **Culturally Sensitive Nature:**
  - **No Gender / Initiation Restrictions:** *Anyone* can view the information.
  - **Men only:** Only *males* can view restricted information.
  - **Women only:** Only *females* can view restricted information.

Status:

- **ACH Directory**: Aboriginal cultural heritage place or cultural landscape.
- **Pending**: Aboriginal cultural heritage place or cultural landscape with information in a verification stage.
- **Historic**: Aboriginal heritage places determined to not meet the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

ACH Type:

- **Cultural Landscape:** a group of areas interconnected through the tangible elements of Aboriginal culture heritage present.
- **Place**: an area in which tangible elements of Aboriginal cultural heritage are present.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.

Legacy Place Status: A status determined under the previous *Aboriginal Heritage Act 1972*:

- **Registered Site:** the place was assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972.*
- **Lodged:** Information was received in relation to the place, but an assessment was not completed to determine if it met section 5 of the *Aboriginal Heritage Act 1972.*
- **Stored Data/Not a Site:** The place was assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972.*

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

Coordinates

Map coordinates are based on the GDA 94 Datum.

Basemap Copyright

Satellite, Hybrid, Road basemap sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, HERE, DeLorme, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community.

Topographic basemap sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
873	MONTEBELLO IS: NOALA CAVE.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden; Rock Shelter	*Registered Knowledge Holder names available from DPLH	Registered Site	P07287
883	BARROW ISLAND 01	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	P07291
884	BARROW ISLAND 02	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	P07292
885	BARROW ISLAND 03	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	P07293
886	BARROW ISLAND 04	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	P07294
887	BARROW ISLAND 05	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	P07295
888	BARROW ISLAND 06 A-F	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	P07296
889	BARROW ISLAND 07	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	P07297
890	BARROW ISLAND 08	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	P07298
891	BARROW ISLAND 09	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	P07299
892	BARROW ISLAND 10	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	P07300
893	BARROW ISLAND 11	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	P07301

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
894	BARROW ISLAND 12	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	P07302
910	FORTESCUE MOUTH	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07270
911	40 MILE - EASTERN POINT	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07271
912	40 MILE - EASTERN DUNES	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Grinding areas / Grooves; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07272
919	ENDERBY IS.27: GOODWYN VIEW	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07279
926	MONTEBELLO IS: HAYNES CAVE.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Sub surface cultural material; Artefacts / Scatter; Midden; Rock Shelter	*Registered Knowledge Holder names available from DPLH	Registered Site	P07286
927	ENDERBY IS.16: WHITE BASIN	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07233
929	ENDERBY IS.18: MANGROVE CK	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	P07235
930	ENDERBY IS.19: MANGROVE CK	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	P07236
931	ENDERBY IS.20: MANGROVE CK	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07237
932	ENDERBY IS.21: BACK QUARRY	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	P07238
933	ENDERBY IS.22: TEREBRALIA	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07239

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
934	ENDERBY IS.23: GRINDING	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving; Grinding areas / Grooves	*Registered Knowledge Holder names available from DPLH	Registered Site	P07240
935	ENDERBY IS.24: LIMESTONE	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Traditional Structure	*Registered Knowledge Holder names available from DPLH	Lodged	P07241
936	ENDERBY IS.25: DINGHY MIDDEN	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07242
937	ENDERBY IS.26: NORTH POINT	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	P07243
966	ROSEMARY IS.11: CHOOKIE BAY	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07219
967	ROSEMARY IS.12: CHOOKIE BAY	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	P07220
968	ROSEMARY IS.13	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Grinding areas / Grooves; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07221
969	ROSEMARY IS.14	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Grinding areas / Grooves; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07222
970	ROSEMARY IS.15: AIRSTRIP	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Grinding areas / Grooves; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07223
971	ROSEMARY IS.16: AIRSTRIP	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	P07224
972	ROSEMARY IS.17: AIRSTRIP	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	P07225
973	ROSEMARY IS.18: DEEP WATER	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07226

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
974	ROSEMARY IS.19: CHITON	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07227
975	ROSEMARY IS.20: HALFWAY CK	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07228
976	ROSEMARY IS.21: HALFWAY CK	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Traditional Structure	*Registered Knowledge Holder names available from DPLH	Lodged	P07229
977	ROSEMARY IS.22	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving; Traditional Structure	*Registered Knowledge Holder names available from DPLH	Registered Site	P07230
978	ROSEMARY IS.23: WADJURU R/H	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving; Grinding areas / Grooves; Traditional Structure; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P07231
979	ROSEMARY IS.24: HUNGERFORD	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07232
1062	LEGENDRE 11	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	P07204
1103	LEGENDRE HILL	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07193
1104	LEGENDRE 01.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Shell; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P07194
1105	LEGENDRE 02	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07195
1106	LEGENDRE 03.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	P07196
1109	LEGENDRE 06.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	P07199

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
1110	LEGENDRE 07.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	P07200
1111	LEGENDRE 08.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Traditional Structure; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	P07201
1112	LEGENDRE 09.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	P07202
1113	LEGENDRE 10.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Rock Shelter; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	P07203
6078	ROSEMARY ISLAND 10	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P07019
6079	ENDERBY ISLAND 12	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Traditional Structure	*Registered Knowledge Holder names available from DPLH	Registered Site	P07020
6080	ENDERBY ISLAND 13	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P07021
6081	ENDERBY ISLAND 14	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P07022
6082	ENDERBY ISLAND 15	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P07023
6184	ENDERBY ISLAND 09: SE	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Fish Trap; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06917
6185	ENDERBY ISLAND 10: N.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Engraving; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	P06918

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
6186	ENDERBY ISLAND 11: NE.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Ritual / Ceremonial; Engraving; Grinding areas / Grooves; Traditional Structure	*Registered Knowledge Holder names available from DPLH	Registered Site	P06919
6227	MALUS ISLAND.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Engraving; Grinding areas / Grooves; Traditional Structure	*Registered Knowledge Holder names available from DPLH	Registered Site	P06908
6228	WEST LEWIS ISLAND: SW.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Grinding areas / Grooves; Midden; Other; Quarry; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P06909
6229	WEST LEWIS ISLAND: NW ARM 1	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Ritual / Ceremonial; Engraving; Grinding areas / Grooves; Traditional Structure	*Registered Knowledge Holder names available from DPLH	Registered Site	P06910
6230	WEST LEWIS ISLAND: NW ARM 2	Yes	Yes	Yes	Men only	ACH Directory	Place	Artefacts / Scatter; Ritual / Ceremonial; Engraving; Grinding areas / Grooves; Traditional Structure	*Registered Knowledge Holder names available from DPLH	Registered Site	P06911
6231	WEST LEWIS ISLAND: NE	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving; Fish Trap; Grinding areas / Grooves; Traditional Structure	*Registered Knowledge Holder names available from DPLH	Registered Site	P06912
6232	WEST LEWIS ISLAND: N	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving; Traditional Structure	*Registered Knowledge Holder names available from DPLH	Registered Site	P06913
6346	MT SALT	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Lodged	P06610
6575	JINTA 1 MIDDEN	Yes	No	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06370

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
6617	BURUBARLADJI	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	P06362
6618	DEW TALU.	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Ritual / Ceremonial; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P06363
6619	JINTA 1.	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P06364
6965	ENDERBY ISLAND 07	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden	*Registered Knowledge Holder names available from DPLH	Lodged	P05954
6966	ENDERBY ISLAND 08	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P05955
7859	CAPE LAMBERT BURIAL	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Registered Site	P05009
7899	MALUS ISLAND	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	P04947
7906	DELAMBRE ISLAND SOUTH.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P04954
8014	CAPE LAMBERT MIDDEN 07	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	P04665
8299	BEADON CREEK	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial; Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	P04351
8920	ONSLOW 1	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P03563
8950	BOAT BEACH	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Lodged	P03541

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
9737	ENDERBY ISLAND 06: BOILER B	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	P02449
10056	CAPE LAMBERT.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp	*Registered Knowledge Holder names available from DPLH	Registered Site	P02120
10057	CAPE LAMBERT.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp	*Registered Knowledge Holder names available from DPLH	Lodged	P02121
10058	CAPE LAMBERT DUNE BLOWOUT.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp	*Registered Knowledge Holder names available from DPLH	Registered Site	P02122
11328	GAP WELL	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00836
11645	DOLPHIN LOCATION 8 NO. 3	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00509
11646	DOLPHIN LOCATION 8 NO. 1	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00510
11647	DOLPHIN LOCATION 8 NO. 2	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00511
11648	DOLPHIN ISLAND	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00512
11664	CAPE LAMBERT	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00528
11698	ANGELA COVE	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00457
11699	GIDLEY BAY, GIDLEY ISLAND.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Camp; Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00458

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
11714	GIDLEY ISLAND	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00474
11715	RIM ROCK GORGE.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Camp; Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00475
11729	NGARLUMA POINT, GIDLEY IS.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving; Traditional Structure	*Registered Knowledge Holder names available from DPLH	Registered Site	P00434
11730	MORS HILL, GIDLEY ISLAND.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial; Artefacts / Scatter; Engraving; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	P00435
11767	FISH POINT, GIDLEY ISLAND	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00418
11771	ENDERBY ISLAND 05	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00368
11772	ROSEMARY ISLAND 09	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P00369
11773	ROSEMARY ISLAND 08	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving; Grinding areas / Grooves; Traditional Structure	*Registered Knowledge Holder names available from DPLH	Registered Site	P00370
11774	ROSEMARY ISLAND 07	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00371
11775	ROSEMARY ISLAND 06	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00372
11776	ROSEMARY ISLAND 04.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Camp; Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00373
11777	ROSEMARY ISLAND 03	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00374

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
11789	ROSEMARY ISLAND 01	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	P00386
11818	ROSEMARY ISLAND 02	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00362
11819	ROSEMARY ISLAND 05	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00363
11820	ENDERBY ISLAND 01	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00364
11821	ENDERBY ISLAND 02	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P00365
11822	ENDERBY ISLAND 03	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00366
11823	ENDERBY ISLAND 04	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P00367
18819	Cape Preston 16	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	
18822	Cape Preston 19	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
18823	Cape Preston 20	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
18824	Cape Preston 21	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	
18825	Cape Preston 22	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
18826	Cape Preston 23	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
18827	Cape Preston 24	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
18828	Cape Preston 25	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	
18829	Cape Preston 26	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
18838	Cape Preston 35	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	
18839	Cape Preston 36	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	
18840	Cape Preston 37	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	
18854	Cape Preston 51	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Lodged	
18855	Cape Preston 52	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Lodged	
18858	Cape Preston 55	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	
18859	Cape Preston 56	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Grinding areas / Grooves; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	
18862	Cape Preston 59	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
18863	Cape Preston 60	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	
18864	Cape Preston 61	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Grinding areas / Grooves; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	
18865	Cape Preston 62	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	
18890	Cape Preston 39-B	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden	*Registered Knowledge Holder names available from DPLH	Lodged	
18891	Cape Preston 39-C	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden	*Registered Knowledge Holder names available from DPLH	Lodged	
19171	Ceremonial Ground	Yes	Yes	Yes	Men only	ACH Directory	Place	Ritual / Ceremonial; Creation / Dreaming Narrative; Engraving	*Registered Knowledge Holder names available from DPLH	Lodged	
19289	Mt Rough 1	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Creation / Dreaming Narrative; Midden	*Registered Knowledge Holder names available from DPLH	Lodged	
19297	Tidal Flats Engraving	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Lodged	
19298	Cape Preston Soak	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Camp; Creation / Dreaming Narrative; Historical; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	
21500	Gidley Island RAMMC2	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Lodged	
21503	Gidley Island RAMMC9	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Lodged	

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
21526	Robe River (Gadjiwura)	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Ritual / Ceremonial; Creation / Dreaming Narrative; Modified Tree; Other	*Registered Knowledge Holder names available from DPLH	Registered Site	
22111	WCL05-4	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	
22943	Flacourt Bay 01	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Rock Shelter	*Registered Knowledge Holder names available from DPLH	Lodged	
25853	P08 - 01	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
25858	ICC 08-01	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
25859	ICC 08-02	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	
25860	ICC 08-03	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	
25861	ICC 08-04	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	
25862	ICC 08-05	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving; Grinding areas / Grooves; Traditional Structure; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
25863	ICC 08-06	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving; Other; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
25864	ICC 08-07	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
25866	ICC 08-09	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	
25867	ICC 08-10	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	
25868	ICC 08-14	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving; Quarry; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
25869	ICC 08-17	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	
25931	EU-IC-Q 0802	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
25943	EU-IC-M 0828	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	
25986	Site No 4	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	
25995	Site No 17	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	
26000	Site No 23	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	
26005	Site No. 18	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	
26006	Site No. 25	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	
26017	P08 - 02	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving; Grinding areas / Grooves; Midden; Quarry; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
26019	P08 - 08	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
26020	P08 - 09	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
26441	P09 - 01	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
26444	P09 - 04	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
26446	P09 - 06	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
26736	ACHM - 09-05	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	
27561	Sam's Creek Burial Site	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Registered Site	
29549	Boodie Soak	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
31762	Site 1	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
31763	Site 2	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
32659	Maitland River Scatter 11	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	
32661	Maitland River Scatter 13	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
32662	Maitland River Scatter 14	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	
32666	Maitland River Scatter 06	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	
32667	Maitland River Scatter 10	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	
32668	Maitland River Scatter 09	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	
32670	Maitland River Scatter 07	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	
32879	Lower Fortescue River (Mardathuni)	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Camp; Creation / Dreaming Narrative; Hunting Place; Landscape / Seascape Feature; Plant Resource; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	
33926	Iron Ore Holdings Artefacts 91	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
33927	Iron Ore Holdings Artefacts 90	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Grinding areas / Grooves; Quarry	*Registered Knowledge Holder names available from DPLH	Lodged	
33940	Iron Ore Holdings Artefacts 15	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	Lodged	
34016	IOHENG07	No	Yes	No		ACH Directory	Place	Artefacts / Scatter; Engraving; Grinding areas / Grooves; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	
35628	Onslow Old Law Ground	No	Yes	Yes		ACH Directory	Place	Ritual / Ceremonial; Meeting Place	*Registered Knowledge Holder names available from DPLH	Registered Site	

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
36199	Boodie Cave	No	Yes	No		ACH Directory	Place	Artefacts / Scatter; Rock Shelter	*Registered Knowledge Holder names available from DPLH	Lodged	
36200	John Wayne Country Rockshelter	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Rock Shelter	*Registered Knowledge Holder names available from DPLH	Lodged	
36234	South End structures, Barrow Island.	No	No	No		ACH Directory	Place	Historical; Traditional Structure	*Registered Knowledge Holder names available from DPLH	Lodged	
36261	G-13-S0001	No	Yes	No		ACH Directory	Place	Quarry	*Registered Knowledge Holder names available from DPLH	Lodged	
36262	H-24-S0001	No	Yes	No		ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36263	H-24-S0002	No	Yes	No		ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36264	I-23-S0001	No	Yes	No		ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36265	I-23-S0002	No	Yes	No		ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36266	I-24-S0003	No	Yes	No		ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36267	J-23-S0001	No	Yes	No		ACH Directory	Place	Grinding areas / Grooves	*Registered Knowledge Holder names available from DPLH	Lodged	
36268	J-23-S0002	No	Yes	No		ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36269	J-23-S0003	No	Yes	No		ACH Directory	Place	Modified Tree	*Registered Knowledge Holder names available from DPLH	Lodged	

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
36270	M-03-S0001	No	Yes	No		ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36271	N-02-S0001	No	Yes	No		ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36272	O-02-S0002	No	Yes	No		ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36273	O-05-S0003	No	Yes	No		ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36344	N-05-S0002	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36345	N-05-S0001	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36346	O-05-S0001	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36347	O-05-S0002	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
36348	P-04-S0001	No	Yes	No		ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
38533	Cape Bruguieres Channel	No	Yes	No		ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	
39191	Warnangura (Cape Range) Cultural Precinct	No	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Ritual / Ceremonial; Creation / Dreaming Narrative; Engraving; Midden; Rock Shelter; Water Source	*Registered Knowledge Holder names available from DPLH	Lodged	

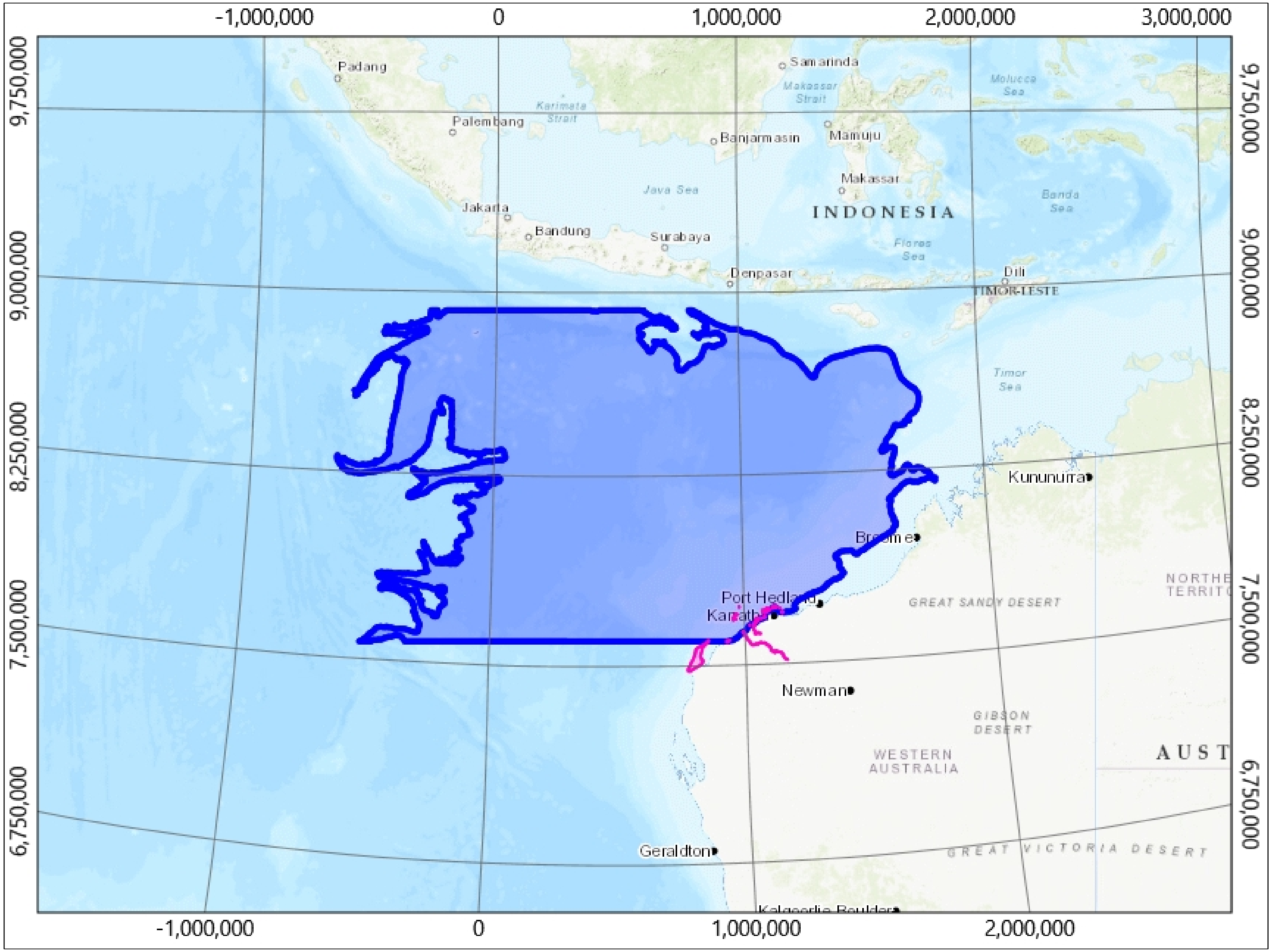
Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Directory

For further important information on using this information please see the Department of Planning, Lands and Heritage's Disclaimer statement at https://www.wa.gov.au/disclaimer



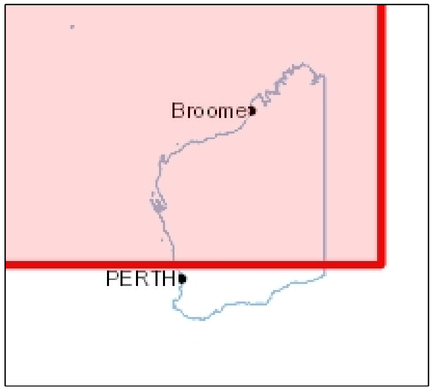
Legend

- Aboriginal Cultural Heritage (ACH) Directory
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

802.23 kilometres

Map Scale 1 : 24,310,000

MGA Zone 49 (GDA94)



Search Criteria

153 Aboriginal Cultural Heritage (ACH) Directory in Shapefile - EMBA clip 2

Disclaimer

The Aboriginal Cultural Heritage Act 2021 (Act) recognises, protects, conserves, and preserves Aboriginal cultural heritage (ACH), and recognises the fundamental importance of ACH to Aboriginal people and its role in Aboriginal communities past, present and future. The Act recognises the value of ACH to Aboriginal people as well as to the wider Western Australian community.

Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported to the ACH Council or exists on the Directory.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at AboriginalHeritage@dplh.wa.gov.au and we will make every effort to rectify it as soon as possible.

Terminology

ID: Reported ACH is assigned a unique ID by the Department of Planning, Lands and Heritage using the format: ACH-00000001. For ACH places on the former Register the ID numbers remain unchanged and use the new format. For example the ACH ID of the place Swan River was previously '3536' and is now 'ACH-00003536'.

Access and Restrictions:

- Boundary Reliable (Yes/No): Indicates whether the location and extent of the ACH boundary is considered reliable.
- Boundary Restricted = No: ACH location is shown as accurately as the information submitted allows.
- Boundary Restricted = Yes: To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least $4km^2$) provides a general indication of where the ACH is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- Culturally Sensitive = No: Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.
- Culturally Sensitive = Yes: Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information. To request access please contact AboriginalHeritage@dplh.wa.gov.au.
- Culturally Sensitive Nature:
  - No Gender / Initiation Restrictions: Anyone can view the information.
  - Men only: Only males can view restricted information.
  - Women only: Only females can view restricted information.

Status:

- ACH Directory: Aboriginal cultural heritage place or cultural landscape.
- Pending: Aboriginal cultural heritage place or cultural landscape with information in a verification stage.
- Historic: Aboriginal heritage places determined to not meet the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

ACH Type:

- Cultural Landscape: a group of areas interconnected through the tangible elements of Aboriginal culture heritage present.
- Place: an area in which tangible elements of Aboriginal cultural heritage are present.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.

Legacy Place Status: A status determined under the previous Aboriginal Heritage Act 1972:

- Registered Site: the place was assessed as meeting Section 5 of the Aboriginal Heritage Act 1972.
- Lodged: Information was received in relation to the place, but an assessment was not completed to determine if it met section 5 of the Aboriginal Heritage Act 1972.
- Stored Data/Not a Site: The place was assessed as not meeting Section 5 of the Aboriginal Heritage Act 1972.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

Coordinates

Map coordinates are based on the GDA 94 Datum.

Basemap Copyright

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
508	POINT MURAT 03	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07503
509	POINT MURAT 04	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	P07504
561	MOWBOWRA CREEK 01	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	P07499
562	MOWBOWRA CREEK 02	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	P07500
563	POINT MURAT 01	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07501
564	POINT MURAT 02	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07502
628	CAMP THIRTEEN BURIAL	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Registered Site	P07434
810	URALA 94 A	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden	*Registered Knowledge Holder names available from DPLH	Lodged	P07321
811	URALA 94 B	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07322
6017	YARDIE CREEK CARAVAN BURIAL	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Registered Site	P07115
6060	CAPE CUVIER	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07053
6115	EXMOUTH NORTH-EAST	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Lodged	P07004

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
6116	EXMOUTH SOUTH-WEST	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Lodged	P07005
6117	MOWBOWRA POOL.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Camp; Grinding areas / Grooves; Other	*Registered Knowledge Holder names available from DPLH	Registered Site	P07006
6118	QUALING POOL.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Camp; Other	*Registered Knowledge Holder names available from DPLH	Registered Site	P07007
6119	PAP HILL 1.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Rock Shelter	*Registered Knowledge Holder names available from DPLH	Lodged	P07008
6120	PAP HILL 2.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Grinding areas / Grooves; Rock Shelter	*Registered Knowledge Holder names available from DPLH	Lodged	P07009
6311	POINT MURAT.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial; Artefacts / Scatter; Camp; Midden; Other	*Registered Knowledge Holder names available from DPLH	Registered Site	P06628
6312	EXMOUTH NORTH-EAST	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	P06629
6535	URALA STATION SOUTH	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06432
6541	URALA STATION WEST	Yes	No	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Ritual / Ceremonial	*Registered Knowledge Holder names available from DPLH	Registered Site	P06438
6575	JINTA 1 MIDDEN	Yes	No	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06370
6596	POINT ANDERSON.	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Hunting Place; Midden; Shell; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P06341
6616	CORAL BAY ACCESS 2	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06361

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
6617	BURUBARLADJI	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	P06362
6618	DEW TALU.	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Ritual / Ceremonial; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P06363
6619	JINTA 1.	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P06364
6620	JINTA 2.	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P06365
6723	MULANDA 2	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06257
6724	MULANDA 3	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06258
6725	MULANDA 4	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06259
6754	OSPREY BAY 6	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06165
6755	OSPREY BAY INTERDUNAL 1	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06166
6756	OSPREY BAY INTERDUNAL 2	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06167
6757	BLOODWOOD CREEK MIDDEN 1	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06168
6758	BLOODWOOD CREEK MIDDEN 2	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06169

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
6759	BLOODWOOD CREEK MIDDEN 3	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06170
6760	BLOODWOOD CREEK SHORELINE	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06171
6761	LOW POINT MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06172
6762	MILYERING MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06173
6763	YARDIE ROCKSHELTERS NORTH.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden; Rock Shelter	*Registered Knowledge Holder names available from DPLH	Registered Site	P06174
6764	CAMP 17 SOUTH MIDDENS	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06175
6765	CAMP 17 NORTH MIDDENS	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06176
6769	MULANDA 1	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06180
6782	28 MILE CREEK NORTH 1	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06140
6783	28 MILE CREEK NORTH 2	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Lodged	P06141
6784	MANDU MANDU CREEK SOUTH	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06142
6785	MANDU MANDU CREEK NORTH	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06143

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
6786	LAKESIDE COASTAL PLAIN	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Lodged	P06144
6789	TURQUOISE BAY NORTH	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Lodged	P06147
6790	YARDIE CREEK SOUTH 1	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06148
6791	YARDIE CREEK SOUTH 2	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06149
6793	ROAD ALIGNMENT 1	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06151
6794	ROAD ALIGNMENT 2	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06152
6795	ROAD ALIGNMENT 3	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06153
6797	YARDIE WELL ROCKSHELTER.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Sub surface cultural material; Artefacts / Scatter; Midden; Other; Rock Shelter	*Registered Knowledge Holder names available from DPLH	Registered Site	P06155
6798	YARDIE INTERDUNAL SWALE	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06156
6799	YARDIE BEACH MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06157
6800	OYSTER STACKS MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06158
6801	NORTH T-BONE BAY	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06159

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
6802	OSPREY BAY 1	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06160
6803	OSPREY BAY 2	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06161
6804	OSPREY BAY 3	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06162
6805	OSPREY BAY 4	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06163
6806	OSPREY BAY 5	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06164
6827	CORAL BAY SKELETON	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Registered Site	P06132
6831	GNARALOO STATION	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Lodged	P06136
7059	FOUR MILE CREEK MIDDEN	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05890
7126	MESA CAMP	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05792
7203	BAUBOODJOO POINT (Bruboodjoo Midden Site)	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Hunting Place; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05707
7204	CHABJUWARDOO BAY.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Hunting Place	*Registered Knowledge Holder names available from DPLH	Lodged	P05708
7205	TWIN HILL FISHING PLACE.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Hunting Place	*Registered Knowledge Holder names available from DPLH	Registered Site	P05709

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
7206	WEALJUGOO MIDDEN.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Hunting Place; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05710
7207	NORWEGIAN BAY MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden	*Registered Knowledge Holder names available from DPLH	Lodged	P05711
7208	MILYERING ROCKS.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Hunting Place	*Registered Knowledge Holder names available from DPLH	Lodged	P05712
7209	BULBARLI POINT COMPLEX.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P05713
7211	MAUD LANDING.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial; Camp; Meeting Place; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P05715
7212	GREYLING CLIFFS.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Hunting Place	*Registered Knowledge Holder names available from DPLH	Lodged	P05716
7254	SANDY BAY NORTH	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05652
7265	LAKE SIDE VIEW	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05664
7286	KAPOK WELL BURIAL	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Registered Site	P05632
7298	YARDIE CREEK ROCKSHELTERS	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	P05644
7299	YARDIE CREEK	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05645
7300	MANDU MANDU CK ROCKSHELTERS	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	P05646

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
7303	TULKI WELL MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05649
7304	PILGRAMUNNA BAY MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05650
7305	MANGROVE BAY.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial; Artefacts / Scatter; Hunting Place; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05651
7332	URALA STATION 12	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05574
7333	URALA STATION 13	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Lodged	P05575
7334	URALA STATION 14	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05576
7380	URALA STATION 08	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden	*Registered Knowledge Holder names available from DPLH	Lodged	P05568
7382	ROCKY POINT MIDDEN COMPLEX	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05570
7383	ROCKY POINT EAST	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05571
7385	URALA STATION 11	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P05573
8300	CORAL BAY	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Registered Site	P04352
8301	NINGALOO STATION	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	P04353

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
8302	WARROORA	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P04354
8927	TEN MILE WELL BURIAL	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Registered Site	P03570
10099	POINT MAUD, CORAL BAY	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Lodged	P02064
10100	GNARALOO BAY	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Lodged	P02065
10381	VLAMING HEAD	Yes	No	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Ritual / Ceremonial; Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	P01799
10595	CORAL BAY BURIAL	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Lodged	P01594
11044	RED BLUFF	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Lodged	P01144
11400	YARDIE CREEK STATION	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Engraving	*Registered Knowledge Holder names available from DPLH	Registered Site	P00750
11401	5 Mile Well (Cape Range)	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Sub surface cultural material; Artefacts / Scatter; Engraving; Painting; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	P00751
11402	URALA DUNE BURIAL	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Burial; Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P00752
11458	NINGALOO (near)	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Painting	*Registered Knowledge Holder names available from DPLH	Registered Site	P00701
11801	COASTAL MIDDEN, 5 MILE	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Lodged	P00345

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
11885	PADJARI MANU CAVE (Formerly Bunbury Cave)	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Sub surface cultural material; Artefacts / Scatter; Ritual / Ceremonial; Engraving; Painting; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P00267
15322	POINT MURAT/WHITE OPAL	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P07916
15926	TUBRIDGI 01	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
15927	TUBRIDGI 02	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
15928	TUBRIDGI 04	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
15929	TUBRIDGI 05	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
15930	TUBRIDGI 06	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
16594	Cardabia Station	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
16597	Baler Bluff	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
16792	Site A	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
16793	Site B	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
17193	Ningaloo Station	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Registered Site	

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
17447	PAP HILL OCHRE	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Ritual / Ceremonial; Grinding areas / Grooves; Ochre; Rock Shelter	*Registered Knowledge Holder names available from DPLH	Registered Site	
17448	CHUGORI ROCKHOLE	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Ritual / Ceremonial; Creation / Dreaming Narrative; Grinding areas / Grooves; Traditional Structure; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	
19838	Midden Site at Exmouth River mouth	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Lodged	
19839	Waterhole, Exmouth	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Water Source	*Registered Knowledge Holder names available from DPLH	Lodged	
21439	Cardabia Station Waterhole	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Water Source	*Registered Knowledge Holder names available from DPLH	Lodged	
21607	Roller/Skate Site 2	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
24401	OS06-01	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Sub surface cultural material; Artefacts / Scatter; Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
24768	OWS07-01	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
24769	OWS07-02	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
24770	OWS07-03	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
24771	OWS07-04	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
24772	OWS07-05	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
24773	OWS07-06	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
24774	OWS07-07	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
24775	OWS07-08	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
24776	OWS07-09	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
24777	OWS07-10	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
24778	OWS07-11	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
24779	OWS07-12	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
24780	OWS07-13	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
24781	OWS07-14	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
25076	Norwegian Bay Burial 01/2008	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Lodged	
28615	MP08-53	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Ritual / Ceremonial; Creation / Dreaming Narrative; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
28700	MP08 - 50	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp	*Registered Knowledge Holder names available from DPLH	Registered Site	
28701	MP08 - 52	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Midden; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
35628	Onslow Old Law Ground	No	Yes	Yes		ACH Directory	Place	Ritual / Ceremonial; Meeting Place	*Registered Knowledge Holder names available from DPLH	Registered Site	
36718	Skeleton Bay	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Lodged	
37522	Mindurru (Ashburton River)	Yes	Yes	Yes		ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	
38299	Farquhar	No	Yes	No		ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Lodged	
38662	Farquhar on Gnarloo Station	No	Yes	No		ACH Directory	Place	Burial; Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
38844	Warroora Burial Site	No	Yes	No		ACH Directory	Place	Burial; Artefacts / Scatter; Ochre	*Registered Knowledge Holder names available from DPLH	Lodged	
39191	Warnangura (Cape Range) Cultural Precinct	No	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Ritual / Ceremonial; Creation / Dreaming Narrative; Engraving; Midden; Rock Shelter; Water Source	*Registered Knowledge Holder names available from DPLH	Lodged	
39730	Tantabiddi Midden 1	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place		*Registered Knowledge Holder names available from DPLH	Lodged	

Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Directory

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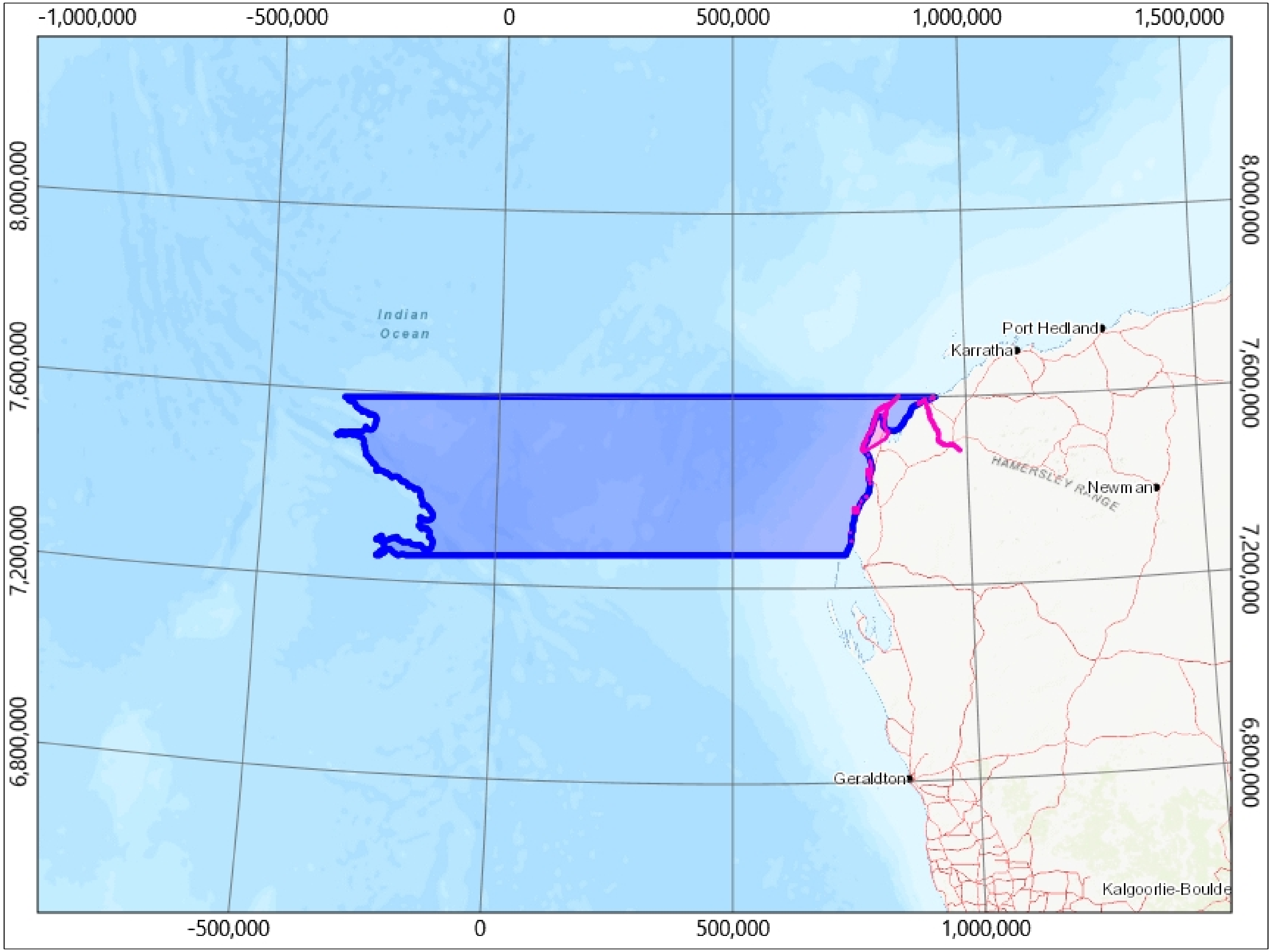


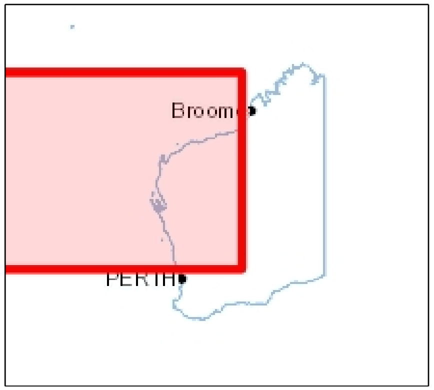
Legend

- Aboriginal Cultural Heritage (ACH) Directory
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

440.27 kilometres

Map Scale 1 : 13,340,000

MGA Zone 49 (GDA94)



Map created: 09/08/2023 11:02:25 AM by: GIS_NET_USER

Identifier: 786211

Search Criteria

29 Aboriginal Cultural Heritage (ACH) Directory in Shapefile - EMBA clip 3

Disclaimer

The Aboriginal Cultural Heritage Act 2021 (Act) recognises, protects, conserves, and preserves Aboriginal cultural heritage (ACH), and recognises the fundamental importance of ACH to Aboriginal people and its role in Aboriginal communities past, present and future. The Act recognises the value of ACH to Aboriginal people as well as to the wider Western Australian community.

Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported to the ACH Council or exists on the Directory.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at AboriginalHeritage@dplh.wa.gov.au and we will make every effort to rectify it as soon as possible.

Copyright

Terminology

ID: Reported ACH is assigned a unique ID by the Department of Planning, Lands and Heritage using the format: ACH-00000001. For ACH places on the former Register the ID numbers remain unchanged and use the new format. For example the ACH ID of the place Swan River was previously '3536' and is now 'ACH-00003536'.

Access and Restrictions:

- Boundary Reliable (Yes/No): Indicates whether the location and extent of the ACH boundary is considered reliable.
- Boundary Restricted = No: ACH location is shown as accurately as the information submitted allows.
- Boundary Restricted = Yes: To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least $4km^2$) provides a general indication of where the ACH is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- Culturally Sensitive = No: Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.
- Culturally Sensitive = Yes: Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information. To request access please contact AboriginalHeritage@dplh.wa.gov.au.
- Culturally Sensitive Nature:
  - No Gender / Initiation Restrictions: Anyone can view the information.
  - Men only: Only males can view restricted information.
  - Women only: Only females can view restricted information.

Status:

- ACH Directory: Aboriginal cultural heritage place or cultural landscape.
- Pending: Aboriginal cultural heritage place or cultural landscape with information in a verification stage.
- Historic: Aboriginal heritage places determined to not meet the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

ACH Type:

- Cultural Landscape: a group of areas interconnected through the tangible elements of Aboriginal culture heritage present.
- Place: an area in which tangible elements of Aboriginal cultural heritage are present.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.

Legacy Place Status: A status determined under the previous Aboriginal Heritage Act 1972:

- Registered Site: the place was assessed as meeting Section 5 of the Aboriginal Heritage Act 1972.
- Lodged: Information was received in relation to the place, but an assessment was not completed to determine if it met section 5 of the Aboriginal Heritage Act 1972.
- Stored Data/Not a Site: The place was assessed as not meeting Section 5 of the Aboriginal Heritage Act 1972.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

Coordinates

Map coordinates are based on the GDA 94 Datum.

Basemap Copyright

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
1063	GREENOUGH RIVER MIDDEN.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Ritual / Ceremonial; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	S02850
1064	SOUTHGATE DUNE	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	S02851
1067	GREENOUGH RIVER WELL.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Camp; Other; Water Source	*Registered Knowledge Holder names available from DPLH	Lodged	S02854
4667	GREENOUGH RIVER	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	S02275
4669	GREENOUGH MOUTH	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Lodged	S02280
4761	GREENOUGH MIDDEN	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Midden	*Registered Knowledge Holder names available from DPLH	Lodged	S01964
5287	SOUTH GATES BURIAL SITE	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial; Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	S01009
6498	DIRK HARTOG ISLAND	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Traditional Structure	*Registered Knowledge Holder names available from DPLH	Registered Site	P06448
6606	CRAYFISH BAY 1	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	P06351
6607	CRAYFISH BAY 2	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	P06352
6608	ZUYTDORP POINT	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P06353
7123	BERNIER ISLAND	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Registered Site	P05789

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
7124	DORRE ISLAND	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Registered Site	P05790
10999	CRAYFISH BAY.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Historical; Traditional Structure; Other	*Registered Knowledge Holder names available from DPLH	Registered Site	P01151
11552	FALSE ENTRANCE.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	P00634
17957	SGA-1	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
17958	SGA-2	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	Registered Site	
17959	SGA-3	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden; Shell	*Registered Knowledge Holder names available from DPLH	Registered Site	
17960	SGA-4	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
17962	SGS-1	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
17963	SGS-2	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
17965	SGS-4	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
17966	SGS-5	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
17967	SGS-6	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Shell	*Registered Knowledge Holder names available from DPLH	Lodged	

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
18794	Westbank Beach Burial	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Burial; Other	*Registered Knowledge Holder names available from DPLH	Registered Site	
20853	Geraldton Southern Transport Corridor Field Site 04	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Landscape / Seascape Feature	*Registered Knowledge Holder names available from DPLH	Registered Site	
24761	Greenough River	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative; Landscape / Seascape Feature	*Registered Knowledge Holder names available from DPLH	Registered Site	
26119	Dirk Hartog Island: Preseverant Camp-Fireplace	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
26120	Dirk Hartog Island: West Point Midden	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Sub surface cultural material; Midden	*Registered Knowledge Holder names available from DPLH	Lodged	

Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Directory

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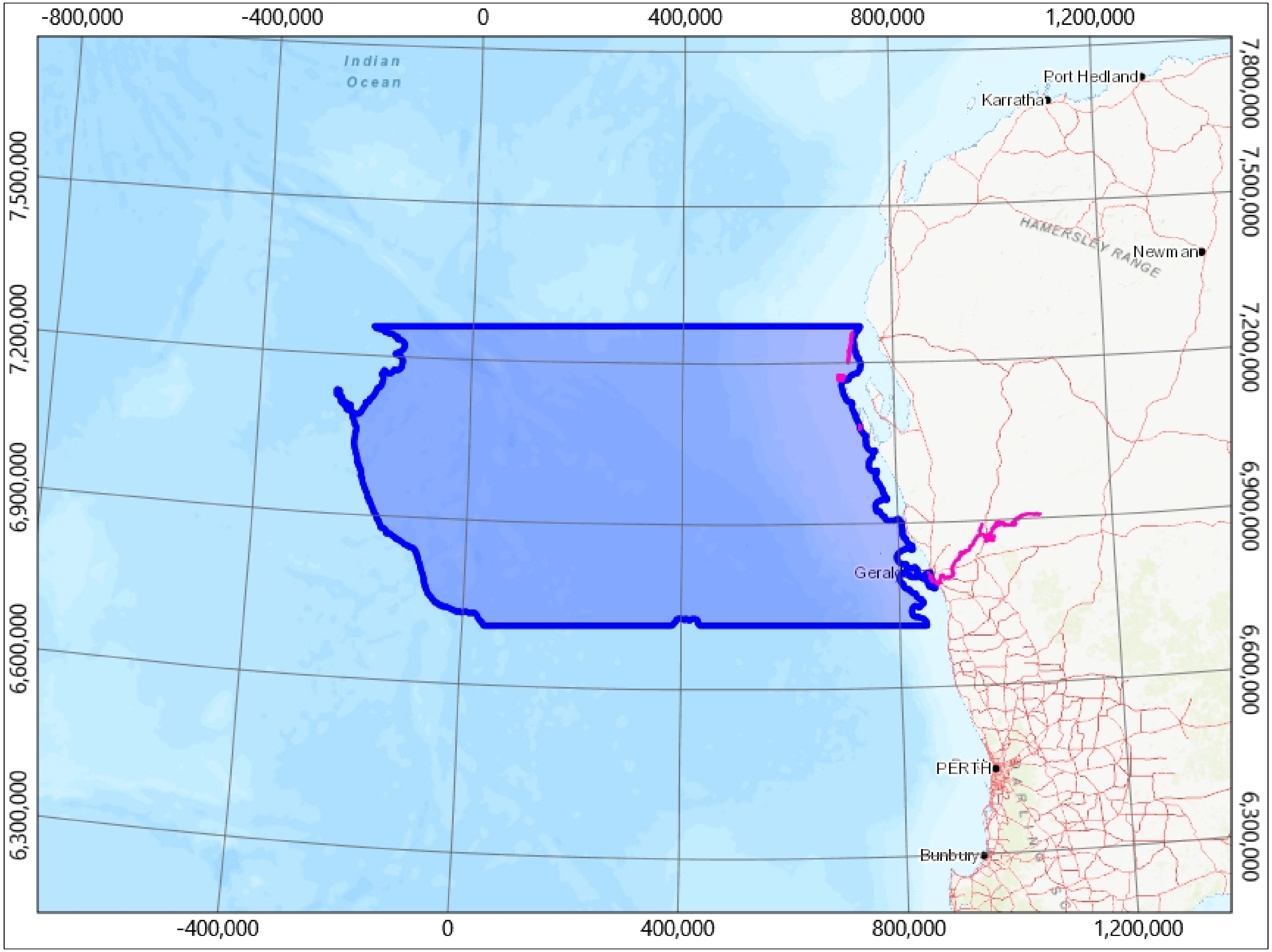


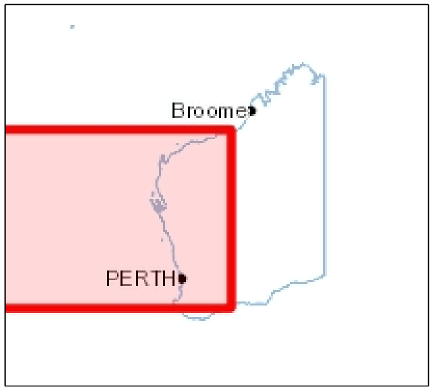
Legend

- Aboriginal Cultural Heritage (ACH) Directory
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

399.82 kilometres

Map Scale 1 : 12,120,000

MGA Zone 49 (GDA94)



Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

Search Criteria

27 Aboriginal Cultural Heritage (ACH) Directory in Shapefile - EMBA clip 4

Disclaimer

The Aboriginal Cultural Heritage Act 2021 (Act) recognises, protects, conserves, and preserves Aboriginal cultural heritage (ACH), and recognises the fundamental importance of ACH to Aboriginal people and its role in Aboriginal communities past, present and future. The Act recognises the value of ACH to Aboriginal people as well as to the wider Western Australian community.

Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported to the ACH Council or exists on the Directory.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at AboriginalHeritage@dplh.wa.gov.au and we will make every effort to rectify it as soon as possible.

South West Settlement ILUA Disclaimer

Your heritage enquiry is on land within or adjacent to the following Indigenous Land Use Agreement(s): Yued Indigenous Land Use Agreement, Whadjuk People Indigenous Land Use Agreement.

On 8 June 2015, six identical Indigenous Land Use Agreements (ILUAs) were executed across the South West by the Western Australian Government and, respectively, the Yued, Whadjuk People, Gnaala Karla Booja, Ballardong People, South West Boojarah #2 and Wagyl Kaip & Southern Noongar groups, and the South West Aboriginal Land and Sea Council (SWALSC).

The ILUAs bind the parties (including 'the State', which encompasses all State Government Departments and certain State Government agencies) to enter into a Noongar Standard Heritage Agreement (NSHA) when conducting Aboriginal Heritage Surveys in the ILUA areas, unless they have an existing heritage agreement. It is also intended that other State agencies and instrumentalities enter into the NSHA when conducting Aboriginal Heritage Surveys in the ILUA areas. It is recommended a NSHA is entered into, and an 'Activity Notice' issued under the NSHA, if there is a risk that an activity will 'impact' (i.e. by excavating, damaging, destroying or altering in any way) an Aboriginal heritage site. The Aboriginal Heritage Due Diligence Guidelines, which are referenced by the NSHA, provide guidance on how to assess the potential risk to Aboriginal heritage.

Likewise, from 8 June 2015 the Department of Mines, Industry Regulation and Safety (DMIRS) in granting Mineral, Petroleum and related Access Authority tenures within the South West Settlement ILUA areas, will place a condition on these tenures requiring a heritage agreement or a NSHA before any rights can be exercised.

If you are a State Government Department, Agency or Instrumentality, or have a heritage condition placed on your mineral or petroleum title by DMIRS, you should seek advice as to the requirement to use the NSHA for your proposed activity. The full ILUA documents, maps of the ILUA areas and the NSHA template can be found at https://www.wa.gov.au/organisation/department-of-the-premier-and-cabinet/south-west-native-title-settlement.

Further advice can also be sought from the Department of Planning, Lands and Heritage at AboriginalHeritage@dplh.wa.gov.au.

Terminology

ID: Reported ACH is assigned a unique ID by the Department of Planning, Lands and Heritage using the format: ACH-00000001. For ACH places on the former Register the ID numbers remain unchanged and use the new format. For example the ACH ID of the place Swan River was previously '3536' and is now 'ACH-00003536'.

Access and Restrictions:

- Boundary Reliable (Yes/No): Indicates whether the location and extent of the ACH boundary is considered reliable.
- Boundary Restricted = No: ACH location is shown as accurately as the information submitted allows.
- Boundary Restricted = Yes: To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least $4km^2$) provides a general indication of where the ACH is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- Culturally Sensitive = No: Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.
- Culturally Sensitive = Yes: Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information. To request access please contact AboriginalHeritage@dplh.wa.gov.au.
- Culturally Sensitive Nature:
  - No Gender / Initiation Restrictions: Anyone can view the information.
  - Men only: Only males can view restricted information.
  - Women only: Only females can view restricted information.

Status:

- ACH Directory: Aboriginal cultural heritage place or cultural landscape.
- Pending: Aboriginal cultural heritage place or cultural landscape with information in a verification stage.
- Historic: Aboriginal heritage places determined to not meet the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

ACH Type:

- Cultural Landscape: a group of areas interconnected through the tangible elements of Aboriginal culture heritage present.
- Place: an area in which tangible elements of Aboriginal cultural heritage are present.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.

Legacy Place Status: A status determined under the previous Aboriginal Heritage Act 1972:

- Registered Site: the place was assessed as meeting Section 5 of the Aboriginal Heritage Act 1972.
- Lodged: Information was received in relation to the place, but an assessment was not completed to determine if it met section 5 of the Aboriginal Heritage Act 1972.
- Stored Data/Not a Site: The place was assessed as not meeting Section 5 of the Aboriginal Heritage Act 1972.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

Coordinates

Map coordinates are based on the GDA 94 Datum.

Basemap Copyright

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
3193	LEDGE POINT WELL.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Water Source	*Registered Knowledge Holder names available from DPLH	Lodged	S00600
3357	GUILDERTON SOUTH.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp	*Registered Knowledge Holder names available from DPLH	Lodged	S00149
3358	MOORE RIVER SOUTH 1 - 5.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp	*Registered Knowledge Holder names available from DPLH	Lodged	S00150
3509	KARLI SPRING.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	S02589
4403	NABAROO.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp	*Registered Knowledge Holder names available from DPLH	Lodged	S00049
17596	Limestone Reef	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	
17599	Yanchep Beach	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	
20008	Gingin Brook Waggyl Site	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Camp; Creation / Dreaming Narrative; Historical; Hunting Place; Plant Resource; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	
20051	Kwelena Mambakort - Wedge Island	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Sub surface cultural material; Artefacts / Scatter; Camp; Ritual / Ceremonial; Grinding areas / Grooves; Historical; Hunting Place; Meeting Place; Midden; Rock Shelter; Shell; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	
20053	Wedge Island Camping Ground Shell Middens	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Historical; Midden	*Registered Knowledge Holder names available from DPLH	Lodged	

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List of Aboriginal Cultural Heritage (ACH) Directory

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20650	Lennard Brook	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative; Landscape / Seascape Feature; Other; Water Source	*Registered Knowledge Holder names available from DPLH	Lodged	
20749	MOORE RIVER WAUGAL	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	
20772	Jindalee	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative; Landscape / Seascape Feature; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	
21616	Boonanarring Brook	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Lodged	
21617	Wallering Brook	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Lodged	
21618	Nullilla Brook	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Lodged	
21619	Breera Brook	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Lodged	
21620	Chandala Brook #Duplicate of ID 3525	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	
24404	Swamp	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative; Water Source	*Registered Knowledge Holder names available from DPLH	Lodged	
24408	Dunes	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative; Landscape / Seascape Feature	*Registered Knowledge Holder names available from DPLH	Lodged	
26191	Chillion Kornt, Wetj Boya	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Fish Trap; Midden; Rock Shelter	*Registered Knowledge Holder names available from DPLH	Lodged	
38567	Moodja Keepla	No	Yes	No		ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Lodged	

Aboriginal Cultural Heritage Inquiry System

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
38568	Kart Balai	No	Yes	No		ACH Directory	Place	Artefacts / Scatter; Camp; Ritual / Ceremonial; Creation / Dreaming Narrative; Meeting Place; Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
38765	Kapa	No	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Ritual / Ceremonial; Creation / Dreaming Narrative; Traditional Structure; Meeting Place; Midden; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	
38767	Moort Koornt	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Sub surface cultural material; Artefacts / Scatter; Camp; Grinding areas / Grooves; Historical; Meeting Place; Midden; Shell; Water Source	*Registered Knowledge Holder names available from DPLH	Lodged	
38769	Nyininy Boya	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Camp; Ritual / Ceremonial; Midden; Shell; Water Source	*Registered Knowledge Holder names available from DPLH	Lodged	
38814	Wedj Noongar Koorl	Yes	Yes	Yes	Men only	ACH Directory	Place	Artefacts / Scatter; Camp; Grinding areas / Grooves; Shell	*Registered Knowledge Holder names available from DPLH	Lodged	

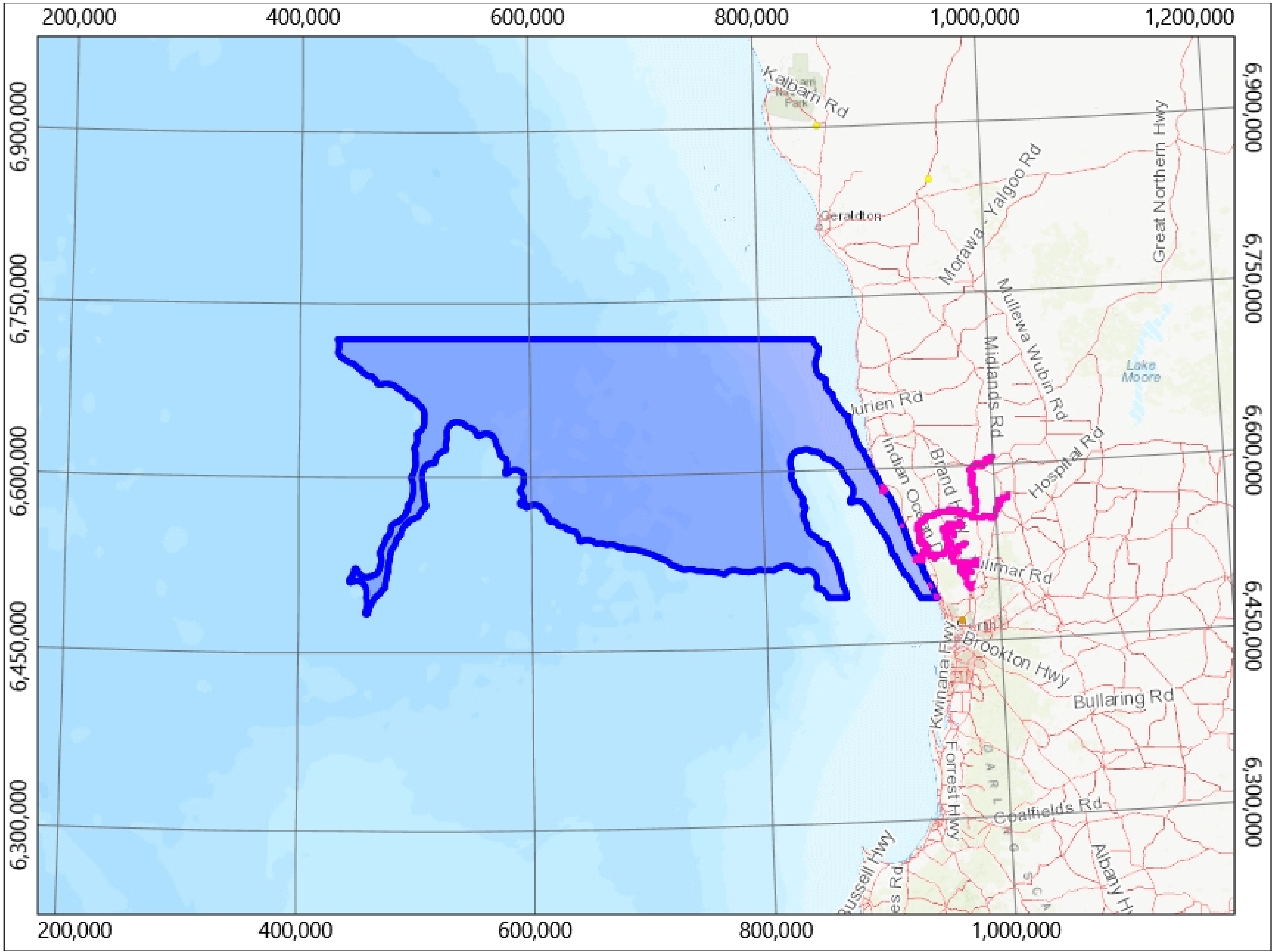
Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Directory

For further important information on using this information please see the Department of Planning, Lands and Heritage's Disclaimer statement at https://www.wa.gov.au/disclaimer



Legend

- Aboriginal Cultural Heritage (ACH) Directory
- Search Area

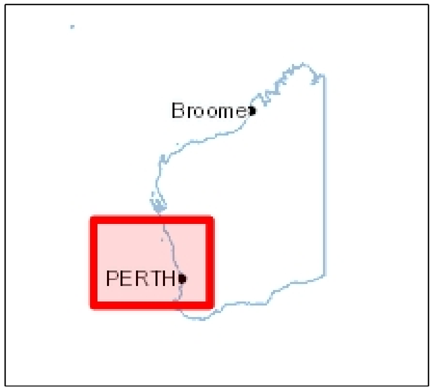
Aboriginal Community

- *Permanent*
- *Seasonal*
- *Town Based*
- Town
- Road
- River
- Local Government Authority

191.71 kilometres

Map Scale 1 : 5,810,000

MGA Zone 49 (GDA94)



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Search Criteria

44 Aboriginal Cultural Heritage (ACH) Directory in Shapefile - EMBA clip 5

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Coordinates

Map coordinates are based on the GDA 94 Datum.

Basemap Copyright

Satellite, Hybrid, Road basemap sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, HERE, DeLorme, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community.

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435	MOONDERUP	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Ritual / Ceremonial; Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	S02940
3399	ROTTNEST: LITTLE ARMSTRONG.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Sub surface cultural material; Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	S02775
3418	ROTTNEST: PEACOCK HILL	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	S02700
3419	FREMANTLE: CANTONMENT HILL.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Camp; Ritual / Ceremonial; Creation / Dreaming Narrative; Plant Resource	*Registered Knowledge Holder names available from DPLH	Registered Site	S02701
3420	FREMANTLE: ANGLESEA POINT.	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place		*Registered Knowledge Holder names available from DPLH	Lodged	S02702
3440	ROTTNEST: CYCLEWAY	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	S02750
3467	ROTTNEST: TRANSIT CELL	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Traditional Structure	*Registered Knowledge Holder names available from DPLH	Registered Site	S02698
3468	ROTTNEST: OLD HOSPITAL	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Historical	*Registered Knowledge Holder names available from DPLH	Registered Site	S02699
3536	SWAN RIVER	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	S02548
3540	ROTTNEST: LODGE/QUAD.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Ritual / Ceremonial; Historical; Repository / Storage Place	*Registered Knowledge Holder names available from DPLH	Registered Site	S02555
3567	MINDARIE WAUGAL	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	S02471
3596	ROCKY BAY	Yes	No	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	S02422

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
3673	MULLALOO DESERT NORTH	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	S02300
3707	ROBB JETTY CAMP.	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Camp; Historical; Traditional Structure	*Registered Knowledge Holder names available from DPLH	Registered Site	S02207
3780	ROTTNEST: LONGREACH BAY	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	S02116
3781	Wadjemup Aboriginal Prisoners Cemetery (ROTTNEST)	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Registered Site	S02118
3782	ROTTNEST: GOLF COURSE	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	S02119
3784	ROTTNEST: STABLES	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	S02121
3828	GARDEN ISLAND 2	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	S02098
3829	ROTTNEST: FISH HOOK BAY	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Engraving	*Registered Knowledge Holder names available from DPLH	Lodged	S02099
15840	COCKBURN ROAD	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	
15841	WOODMAN POINT	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	
18417	Garden Island (Cockburn sound)	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Creation / Dreaming Narrative; Historical; Midden	*Registered Knowledge Holder names available from DPLH	Lodged	
20178	Bold Park	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Camp; Creation / Dreaming Narrative; Historical; Hunting Place; Other; Plant Resource	*Registered Knowledge Holder names available from DPLH	Registered Site	

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
20592	Bathurst Point Lighthouse Site	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Other	*Registered Knowledge Holder names available from DPLH	Lodged	
20772	Jindalee	Yes	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative; Landscape / Seascape Feature; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	
20863	Carnac Island	Yes	Yes	Yes	Men only	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Lodged	
20865	Mount Brown - Booyeeanup	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Lodged	
21588	Kinsale	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative; Plant Resource	*Registered Knowledge Holder names available from DPLH	Registered Site	
21589	Rosslare Soak	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Camp; Ritual / Ceremonial; Creation / Dreaming Narrative; Water Source	*Registered Knowledge Holder names available from DPLH	Registered Site	
22672	Burns Beach Waugal	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative; Landscape / Seascape Feature	*Registered Knowledge Holder names available from DPLH	Lodged	
23867	Bathurst Point Artefact	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	
31746	Golf Course South Glass Artefact Scatter	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Sub surface cultural material; Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	
31747	Golf Course Northeast Site Glass Artefact Scatter	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Sub surface cultural material; Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	
31748	Golf Course Isolated Finds	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Other	*Registered Knowledge Holder names available from DPLH	Lodged	
38004	Rottnest Island Wadjemup	No	Yes	Yes	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Fish Trap	*Registered Knowledge Holder names available from DPLH	Lodged	

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39235	WAD-2021-001	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Historical	*Registered Knowledge Holder names available from DPLH	Registered Site	
39236	WAD-2021-003	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Historical	*Registered Knowledge Holder names available from DPLH	Registered Site	
39237	WAD-2021-002	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Historical	*Registered Knowledge Holder names available from DPLH	Registered Site	
39238	WAD-2021-004	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Sub surface cultural material; Artefacts / Scatter; Historical	*Registered Knowledge Holder names available from DPLH	Registered Site	
39239	SSPAA-2017-01	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Sub surface cultural material; Artefacts / Scatter; Historical	*Registered Knowledge Holder names available from DPLH	Registered Site	
39352	WH22-002	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Ritual / Ceremonial; Creation / Dreaming Narrative; Historical; Landscape / Seascape Feature; Other	*Registered Knowledge Holder names available from DPLH	Lodged	
39353	WH22-001	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Other	*Registered Knowledge Holder names available from DPLH	Lodged	
39697	SM22-A-01	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter; Historical; Other; Quarry	*Registered Knowledge Holder names available from DPLH	Registered Site	

Department of Planning, Lands and Heritage

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Directory

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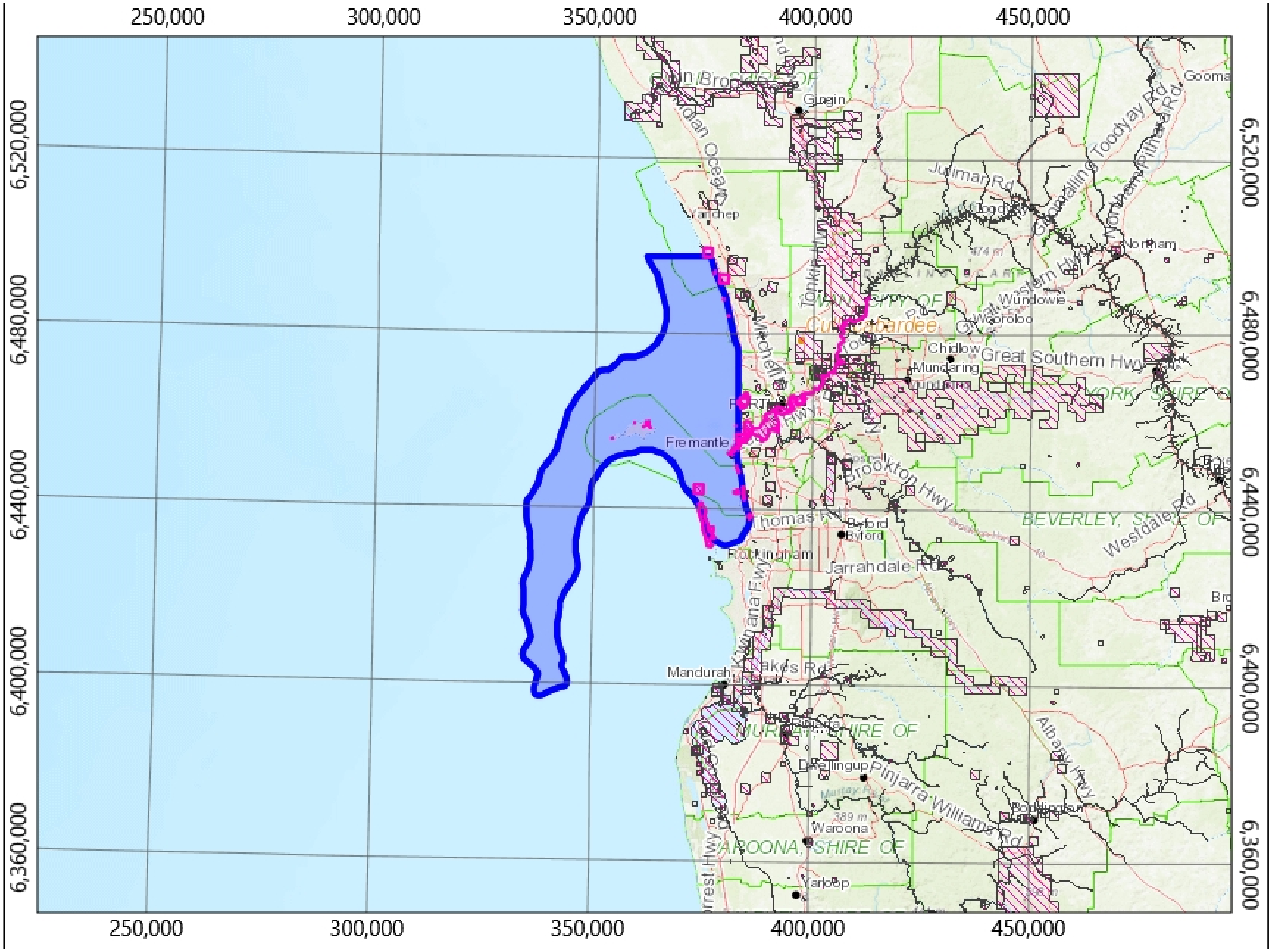

Legend

- Aboriginal Cultural Heritage (ACH) Directory
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

51.48 kilometres

Map Scale 1 : 1,560,000

MGA Zone 50 (GDA94)

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

Search Criteria

5 Aboriginal Cultural Heritage (ACH) Directory in Shapefile - EMBA clip 6

Disclaimer

The Aboriginal Cultural Heritage Act 2021 (Act) recognises, protects, conserves, and preserves Aboriginal cultural heritage (ACH), and recognises the fundamental importance of ACH to Aboriginal people and its role in Aboriginal communities past, present and future. The Act recognises the value of ACH to Aboriginal people as well as to the wider Western Australian community.

Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported to the ACH Council or exists on the Directory.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at AboriginalHeritage@dplh.wa.gov.au and we will make every effort to rectify it as soon as possible.

South West Settlement ILUA Disclaimer

Your heritage enquiry is on land within or adjacent to the following Indigenous Land Use Agreement(s): South West Boojarah #2 Indigenous Land Use Agreement.

On 8 June 2015, six identical Indigenous Land Use Agreements (ILUAs) were executed across the South West by the Western Australian Government and, respectively, the Yued, Whadjuk People, Gnaala Karla Booja, Ballardong People, South West Boojarah #2 and Wagyl Kaip & Southern Noongar groups, and the South West Aboriginal Land and Sea Council (SWALSC).

The ILUAs bind the parties (including 'the State', which encompasses all State Government Departments and certain State Government agencies) to enter into a Noongar Standard Heritage Agreement (NSHA) when conducting Aboriginal Heritage Surveys in the ILUA areas, unless they have an existing heritage agreement. It is also intended that other State agencies and instrumentalities enter into the NSHA when conducting Aboriginal Heritage Surveys in the ILUA areas. It is recommended a NSHA is entered into, and an 'Activity Notice' issued under the NSHA, if there is a risk that an activity will 'impact' (i.e. by excavating, damaging, destroying or altering in any way) an Aboriginal heritage site. The Aboriginal Heritage Due Diligence Guidelines, which are referenced by the NSHA, provide guidance on how to assess the potential risk to Aboriginal heritage.

Likewise, from 8 June 2015 the Department of Mines, Industry Regulation and Safety (DMIRS) in granting Mineral, Petroleum and related Access Authority tenures within the South West Settlement ILUA areas, will place a condition on these tenures requiring a heritage agreement or a NSHA before any rights can be exercised.

If you are a State Government Department, Agency or Instrumentality, or have a heritage condition placed on your mineral or petroleum title by DMIRS, you should seek advice as to the requirement to use the NSHA for your proposed activity. The full ILUA documents, maps of the ILUA areas and the NSHA template can be found at https://www.wa.gov.au/organisation/department-of-the-premier-and-cabinet/south-west-native-title-settlement.

Further advice can also be sought from the Department of Planning, Lands and Heritage at AboriginalHeritage@dplh.wa.gov.au.

Terminology

ID: Reported ACH is assigned a unique ID by the Department of Planning, Lands and Heritage using the format: ACH-00000001. For ACH places on the former Register the ID numbers remain unchanged and use the new format. For example the ACH ID of the place Swan River was previously '3536' and is now 'ACH-00003536'.

Access and Restrictions:

- Boundary Reliable (Yes/No): Indicates whether the location and extent of the ACH boundary is considered reliable.
- Boundary Restricted = No: ACH location is shown as accurately as the information submitted allows.
- Boundary Restricted = Yes: To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least $4km^2$) provides a general indication of where the ACH is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- Culturally Sensitive = No: Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.
- Culturally Sensitive = Yes: Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information. To request access please contact AboriginalHeritage@dplh.wa.gov.au.
- Culturally Sensitive Nature:
  - No Gender / Initiation Restrictions: Anyone can view the information.
  - Men only: Only males can view restricted information.
  - Women only: Only females can view restricted information.

Status:

- ACH Directory: Aboriginal cultural heritage place or cultural landscape.
- Pending: Aboriginal cultural heritage place or cultural landscape with information in a verification stage.
- Historic: Aboriginal heritage places determined to not meet the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

ACH Type:

- Cultural Landscape: a group of areas interconnected through the tangible elements of Aboriginal culture heritage present.
- Place: an area in which tangible elements of Aboriginal cultural heritage are present.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.

Legacy Place Status: A status determined under the previous Aboriginal Heritage Act 1972:

- Registered Site: the place was assessed as meeting Section 5 of the Aboriginal Heritage Act 1972.
- Lodged: Information was received in relation to the place, but an assessment was not completed to determine if it met section 5 of the Aboriginal Heritage Act 1972.
- Stored Data/Not a Site: The place was assessed as not meeting Section 5 of the Aboriginal Heritage Act 1972.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

Coordinates

Map coordinates are based on the GDA 94 Datum.

Basemap Copyright

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Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Directory

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	ACH Type	Place Type	Knowledge Holders	Legacy Place Status	Legacy ID
5177	SKIPPY ROCKS	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Registered Site	S01345
5795	TURNER BROOK	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	Lodged	S00298
20434	Blackwood River	No	Yes	No	No Gender / Initiation Restrictions	ACH Directory	Place	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	Registered Site	
21489	Augusta Standing Stone	No	No	No	No Gender / Initiation Restrictions	ACH Directory	Place	Traditional Structure	*Registered Knowledge Holder names available from DPLH	Lodged	
38773	Foundation Cave	Yes	Yes	Yes		ACH Directory	Place	Burial	*Registered Knowledge Holder names available from DPLH	Registered Site	

Department of Planning, Lands and Heritage
GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Directory

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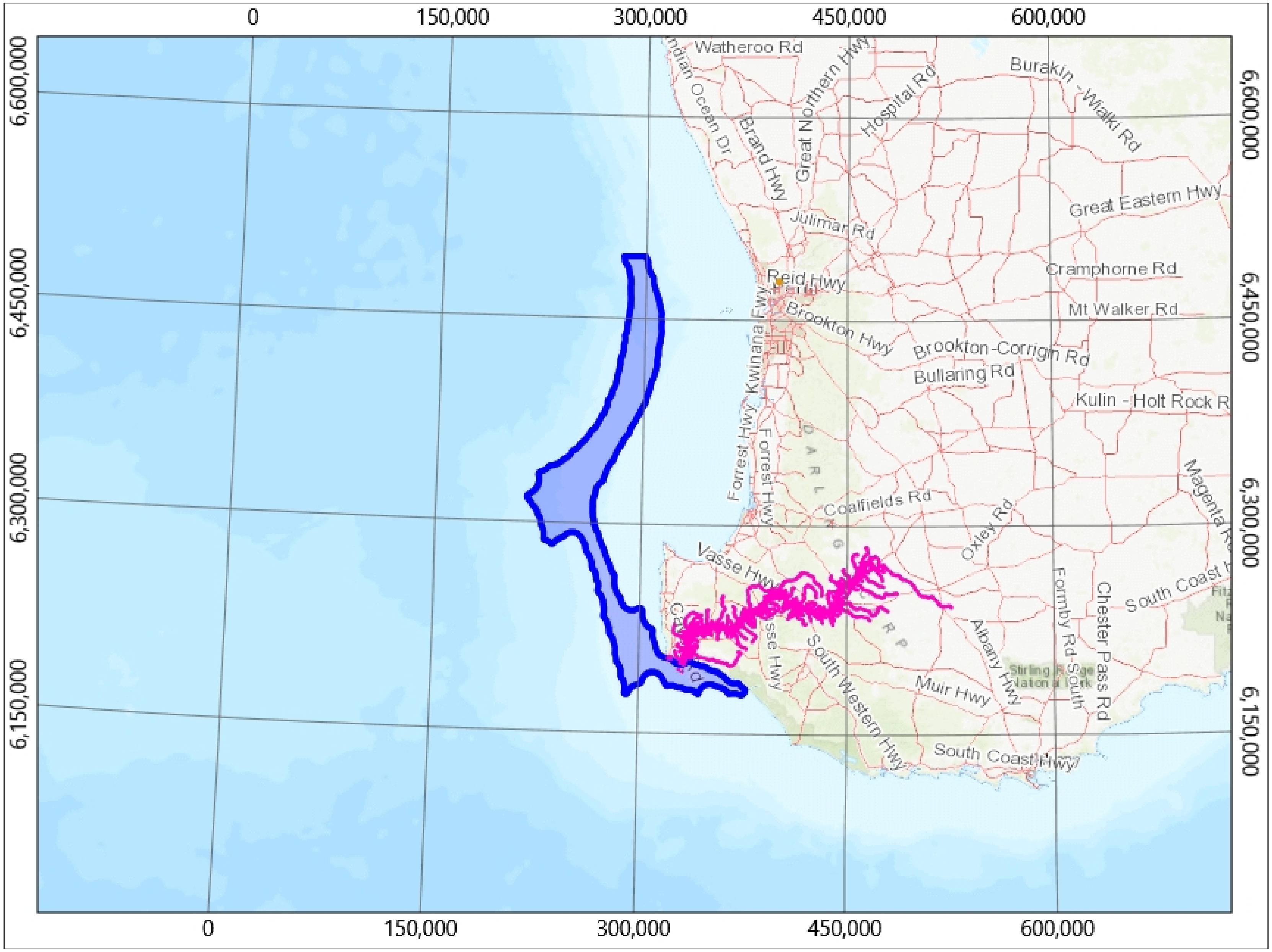


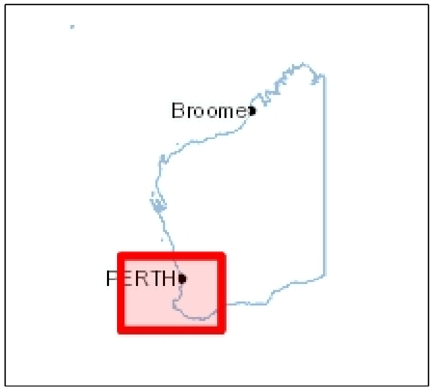
Legend

- Aboriginal Cultural Heritage (ACH) Directory
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

166.17 kilometres

Map Scale 1 : 5,040,000

MGA Zone 50 (GDA94)



Map created: 09/08/2023 10:50:52 AM by: GIS_NET_USER

Identifier: 786201

Appendix F Consultation

Appendix G Environmental Consequence Descriptors

	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 WA Biodiversity Conservation Act 2016 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; Wide spread (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[5]; habitat within a protected area; habitats that include benthic primary producers[6] and/ or epi-fauna[7]	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 ~ 2 year (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 wide spread 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;	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;	Major, long term decline in threatened ecological community population size, diversity or function; Major reduction in area of threatened ecological community;	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.

5 As defined by the Department of Agriculture, Water and Environment (DaWE)
6 Benthic photosynthetic organisms such as seagrass, algae, hard corals and mangroves
7 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.***
		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.		Introduction of disease likely to cause significant decline in threatened ecological community population size, diversity or function.	Fragmentation of threatened ecological community; Introduce disease likely to cause long term decline in threatened ecological community population size, diversity or function.		
	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.
	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.

Santos

Appendix H Spill Modelling Results

LOWC at the Halyard 2 well location with the release of 173,755 m^3 of Halyard condensate at the seabed

Receptor	Receptor Type	Minimum Time to Contact (hrs)						Maximum Hydrocarbon Concentration			Maximum Oil Ashore (m^3)	Maximum Length of Oiled Shoreline at 100 g/m^2 (km)
		Moderate Exposure Values				High Exposure Values						
		Shoreline accumulation (100 g/m^2)	Surface hydrocarbons (10 g/m^2)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m^2)	Surface hydrocarbons (50 g/m^2)	Shoreline accumulation (g/m^2)	Dissolved hydrocarbons (ppb)	Entrained hydrocarbons (ppb)		
Abrolhos - Nearshore	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	16	NA	NA
Abrolhos - Offshore NW	Submerged	NA	NC	NC	425	NA	NA	NA	17	216	NA	NA
Abrolhos - Offshore Perth North	Submerged	NA	NC	NA	NC	NA	NA	NA	40	785	NA	NA
Abrolhos - Outer Island Shoals	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	37	NA	NA
Abrolhos Islands Easter Group	Emergent	NC	NC	NA	NC	NA	NA	29	29	860	2	NC
Abrolhos Islands Pelsaert Group	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	43	NA	NA
Abrolhos Islands Wallabi Group	Emergent	NC	NC	NA	NC	NA	NA	NA	26	865	NA	NA

Santos

Receptor	Receptor Type	Minimum Time to Contact (hrs)						Maximum Hydrocarbon Concentration				
		Moderate Exposure Values				High Exposure Values						
		Shoreline accumulation (100 g/m²)	Surface hydrocarbons (10 g/m²)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m²)	Surface hydrocarbons (50 g/m²)	Shoreline accumulation (g/m²)	Dissolved hydrocarbons (ppb)	Entrained hydrocarbons (ppb)	Maximum Oil Ashore (m³)	Maximum Length of Oiled Shoreline at 100 g/m² (km)
Abrolhos West	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	23	NA	NA
Adele Island	Emergent	NC	NC	NA	NA	NA	NA	NA	25	375	NA	NA
Albany - Esperance	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	19	NA	NA
Ashmore-Cartier - Outer	Submerged	NA	NC	NA	NA	NA	NA	NA	NA	22	NA	NA
Ashmore Reef AMP	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	32	NA	NA
Augusta - Walpole	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	NA	NA	NA
Barracouta Shoals	Submerged	NA	NC	NA	NA	NA	NA	NA	NA	11	NA	NA
Barrow-Montebello Surrounds	Intertidal	NA	NC	NC	302	NC	NA	NA	NA	NA	NA	NA
Barrow Island	Emergent	NC	NC	NC	208	NA	NA	NA	NA	NA	NA	NA
Beagle Knoll	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	NA	NA	NA
Bedout Island	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	13	NA	NA
Bennett Shoal	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	31	NA	NA

Receptor	Receptor Type	Minimum Time to Contact (hrs)						Maximum Hydrocarbon Concentration				
		Moderate Exposure Values				High Exposure Values						
		Shoreline accumulation (100 g/m²)	Surface hydrocarbons (10 g/m²)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m²)	Surface hydrocarbons (50 g/m²)	Shoreline accumulation (g/m²)	Dissolved hydrocarbons (ppb)	Entrained hydrocarbons (ppb)	Maximum Oil Ashore (m³)	Maximum Length of Oiled Shoreline at 100 g/m² (km)
Bremer AMP	Submerged	NA	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA
Brewis Reef	Submerged	NA	NC	NC	144	NA	NA	NA	NA	34	NA	NA
Broome North Coast	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	31	NA	NA
Browse Island	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA
Camden Sound	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	82	NA	NA
Camplin Shoal	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	39	NA	NA
Carnarvon - Inner Shark Bay	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	NA	NA	NA
Carnarvon Canyon AMP	Submerged	NA	NC	NC	439	NA	NA	NA	NA	66	NA	NA
Cartier Island AMP	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	45	NA	NA
Christmas Island AMP	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	NA	NA	NA
Clerke Reef MP	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	28	NA	NA
Cocos Islands	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA

Receptor	Receptor Type	Minimum Time to Contact (hrs)						Maximum Hydrocarbon Concentration				
		Moderate Exposure Values				High Exposure Values						
		Shoreline accumulation (100 g/m²)	Surface hydrocarbons (10 g/m²)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m²)	Surface hydrocarbons (50 g/m²)	Shoreline accumulation (g/m²)	Dissolved hydrocarbons (ppb)	Entrained hydrocarbons (ppb)	Maximum Oil Ashore (m³)	Maximum Length of Oiled Shoreline at 100 g/m² (km)
Cocos Islands AMP	Submerged	NA	NC	NA	NA	NA	NA	NA	NA	59	NA	NA
Cod Bank	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	NA	NA	NA
Cooper Shoal	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	13	NA	NA
Dampier AMP	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	13	NA	NA
Dampier Archipelago	Emergent	NC	NC	NA	NC	NA	NA	NA	44	418	NA	NA
Dart Shoal	Submerged	NA	NC	NA	NA	NA	NA	NA	26	89	NA	NA
Dawesville - Bunbury	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	NA	NA	NA
Eastern Recherche AMP	Submerged	NA	NC	NA	NA	NA	NA	NA	147	1587	NA	NA
Eighty Mile Beach	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	15	NA	NA
Eighty Mile Beach AMP	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	16	NA	NA
Esperance - Cape Arid NP	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exmouth Gulf Coast	Emergent	NC	NC	NC	320	NA	NA	NA	NA	12	NA	NA

Receptor	Receptor Type	Minimum Time to Contact (hrs)						Maximum Hydrocarbon Concentration				
		Moderate Exposure Values				High Exposure Values						
		Shoreline accumulation (100 g/m²)	Surface hydrocarbons (10 g/m²)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m²)	Surface hydrocarbons (50 g/m²)	Shoreline accumulation (g/m²)	Dissolved hydrocarbons (ppb)	Entrained hydrocarbons (ppb)	Maximum Oil Ashore (m³)	Maximum Length of Oiled Shoreline at 100 g/m² (km)
Exmouth Reef	Submerged	NA	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA
Fantome Shoals	Submerged	NA	NC	NA	NA	NA	NA	NA	NA	13	NA	NA
Gascoyne AMP	Submerged	NA	NC	243	154	NA	NA	NA	NA	12	NA	NA
Geographe - Augusta Deep	Submerged	NA	NC	NA	NA	NA	NA	NA	26	704	NA	NA
Geographe - Offshore Augusta 1	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	343	NA	NA
Geographe - Offshore Augusta 2	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	27	NA	NA
Geographe - Outer	Submerged	NA	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA
Geographe Bay	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	31	NA	NA
Geographe Bay - Augusta	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	13	NA	NA
Geraldton - Jurien Bay	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	NA	NA	NA
Glomar Shoals	Submerged	NA	NC	NC	300	NA	NA	NA	NA	20	NA	NA

Receptor	Receptor Type	Minimum Time to Contact (hrs)						Maximum Hydrocarbon Concentration				
		Moderate Exposure Values				High Exposure Values						
		Shoreline accumulation (100 g/m²)	Surface hydrocarbons (10 g/m²)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m²)	Surface hydrocarbons (50 g/m²)	Shoreline accumulation (g/m²)	Dissolved hydrocarbons (ppb)	Entrained hydrocarbons (ppb)	Maximum Oil Ashore (m³)	Maximum Length of Oiled Shoreline at 100 g/m² (km)
Heywood Shoals	Submerged	NA	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hibernia Reef	Intertidal	NA	NC	NA	NA	NA	NA	NA	NA	38	NA	NA
Imperieuse Reef MP	Emergent	NC	NC	NA	625	NA	NA	NA	NA	17	NA	NA
Indonesia - East	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indonesia - West	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	179	NA	NA
Inner Geographe AMP	Submerged	NA	NC	NA	NA	NA	NA	NA	NA	25	NA	NA
Johnson Bank	Submerged	NA	NC	NA	NA	NA	NA	NA	NA	11	NA	NA
Jurien AMP	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	NA	NA	NA
Jurien Bay - Yanchep	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	58	NA	NA
Kalbarri - Geraldton	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	817	NA	NA
Karratha-Port Hedland	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	NA	NA	NA
Kimberley AMP	Submerged	NA	NC	NA	NC	NA	NC	NA	216	3053	NA	NA
King Sound	Emergent	NC	NC	NA	NA	NA	NA	NA	24	587	NA	NA
Lacepede Islands	Emergent	NC	NC	NA	NA	NA	NA	NA	176	1949	NA	NA

Receptor	Receptor Type	Minimum Time to Contact (hrs)						Maximum Hydrocarbon Concentration				
		Moderate Exposure Values				High Exposure Values						
		Shoreline accumulation (100 g/m²)	Surface hydrocarbons (10 g/m²)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m²)	Surface hydrocarbons (50 g/m²)	Shoreline accumulation (g/m²)	Dissolved hydrocarbons (ppb)	Entrained hydrocarbons (ppb)	Maximum Oil Ashore (m³)	Maximum Length of Oiled Shoreline at 100 g/m² (km)
Larkin Shoal	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	NA	NA	NA
Lowendal Islands	Emergent	NC	NC	NA	332	NA	7	NA	632	13416	NA	NA
Madeleine Shoals	Submerged	NA	NC	NA	NC	NA	NC	63	171	2166	5	NC
Mandurah - Dawesville	Emergent	NC	NC	NA	NC	NA	NA	NA	283	2770	NA	NA
Mermaid Reef AMP	Intertidal	NA	NC	NA	NC	NA	NC	63	161	1930	5	NC
Middle Islands Coast	Emergent	NC	NC	NA	459	NA	NA	NA	NA	NA	NA	NA
Montebello AMP	Submerged	NA	NC	87	62	NA	NA	NA	NA	NA	NA	NA
Montebello Islands	Emergent	NC	NC	NC	288	NA	NA	NA	NA	NA	NA	NA
Muiron Islands	Emergent	NC	NC	106	92	NA	NA	NA	NA	NA	NA	NA
Ningaloo - Offshore	Submerged	NA	0.1	5	2	NA	NA	NA	NA	NA	NA	NA
Ningaloo - Outer Coast North	Submerged	NA	NC	141	96	NC	NA	NA	NA	NA	NA	NA
Ningaloo - Outer NW	Submerged	NA	NC	100	78	NA	NA	NA	NA	NA	NA	NA
Ningaloo Coast North	Emergent	NC	NC	255	106	NC	NA	NA	NA	NA	NA	NA

Receptor	Receptor Type	Minimum Time to Contact (hrs)						Maximum Hydrocarbon Concentration				
		Moderate Exposure Values				High Exposure Values						
		Shoreline accumulation (100 g/m²)	Surface hydrocarbons (10 g/m²)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m²)	Surface hydrocarbons (50 g/m²)	Shoreline accumulation (g/m²)	Dissolved hydrocarbons (ppb)	Entrained hydrocarbons (ppb)	Maximum Oil Ashore (m^3)	Maximum Length of Oiled Shoreline at 100 g/m² (km)
Ningaloo Coast South	Emergent	NC	NC	NC	308	NA	NA	NA	17	479	NA	NA
Northern Islands Coast	Emergent	NC	NC	NA	670	NC	NA	11	NA	302	<1	NC
Outer Argo-Rowley Terrace AMP	Submerged	NA	NC	NA	540	NA	NA	NA	NA	714	NA	NA
Outer Oceanic Shoals AMP	Submerged	NA	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA
Penguin Bank	Submerged	NA	NC	434	170	NA	NA	NA	96	1074	NA	NA
Perth Canyon AMP	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	NA	NA	NA
Perth Northern Coast	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	26	NA	NA
Perth South - Geographe - Offshore	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	NA	NA	NA
Perth Southern Coast	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	20	NA	NA
Poivre Reef	Intertidal	NA	NC	NC	327	NA	NA	NA	19	406	NA	NA
Port Hedland-Eighty Mile Beach	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA

Receptor	Receptor Type	Minimum Time to Contact (hrs)						Maximum Hydrocarbon Concentration				
		Moderate Exposure Values				High Exposure Values						
		Shoreline accumulation (100 g/m²)	Surface hydrocarbons (10 g/m²)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m²)	Surface hydrocarbons (50 g/m²)	Shoreline accumulation (g/m²)	Dissolved hydrocarbons (ppb)	Entrained hydrocarbons (ppb)	Maximum Oil Ashore (m³)	Maximum Length of Oiled Shoreline at 100 g/m² (km)
Rankin Bank	Submerged	NA	NC	157	94	NA	NA	NA	197	2048	NA	NA
Ripple Shoals	Submerged	NA	NC	NC	343	NA	NA	NA	14	596	NA	NA
Rosily Shoals	Submerged	NA	NC	1335	121	NA	NA	NA	63	877	NA	NA
Rottnest Island	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	17	NA	NA
Rowley Shoals surrounds	Submerged	NA	NC	NA	587	NA	NA	NA	NA	298	NA	NA
Scott Reef North	Intertidal	NA	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA
Scott Reef South	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA
Seringapatam Reef	Intertidal	NA	NC	NA	NC	NA	NA	NA	NA	11	NA	NA
Shark Bay - Coast Outer	Emergent	NC	NC	NA	NC	NA	NA	NA	NA	52	NA	NA
Shark Bay AMP	Submerged	NA	NC	NC	619	NA	NA	NA	14	144	NA	NA
Snapper Shoal	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	14	NA	NA
South-west Corner AMP	Submerged	NA	NC	120	90	NC	NA	NA	NA	14	NA	NA

Receptor	Receptor Type	Minimum Time to Contact (hrs)						Maximum Hydrocarbon Concentration				
		Moderate Exposure Values				High Exposure Values						
		Shoreline accumulation (100 g/m²)	Surface hydrocarbons (10 g/m²)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m²)	Surface hydrocarbons (50 g/m²)	Shoreline accumulation (g/m²)	Dissolved hydrocarbons (ppb)	Entrained hydrocarbons (ppb)	Maximum Oil Ashore (m³)	Maximum Length of Oiled Shoreline at 100 g/m² (km)
Southern Islands Coast	Emergent	NC	NC	NA	NC	NA	NC	11	148	3113	<1	NC
State Waters - WA	Emergent	NC	NC	106	87	NA	NA	NA	176	3113	NA	NA
Sultan Reef	Submerged	NA	NC	NA	385	NA	NA	NA	NA	540	NA	NA
Thevenard Islands	Emergent	NC	NC	791	142	NA	NA	NA	76	1042	NA	NA
Trap Reef	Submerged	NA	NC	NC	168	NA	NA	NA	29	595	NA	NA
Twilight AMP	Submerged	NA	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA
Two Rocks AMP	Submerged	NA	NC	NA	NC	NA	NA	NA	NA	20	NA	NA
Vulcan Shoals	Submerged	NA	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA
Walpole - Albany	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA
Western Abrolhos AMP	Submerged	NA	NC	NA	817	NA	NA	NA	NA	142	NA	NA
Western Shark Bay AMP	Submerged	NA	NC	NC	591	NA	NA	NA	27	250	NA	NA
Woodbine Bank	Submerged	NA	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA

Receptor	Receptor Type	Minimum Time to Contact (hrs)						Maximum Hydrocarbon Concentration				
		Moderate Exposure Values				High Exposure Values						
		Shoreline accumulation (100 g/m^2)	Surface hydrocarbons (10 g/m^2)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m^2)	Surface hydrocarbons (50 g/m^2)	Shoreline accumulation (g/m^2)	Dissolved hydrocarbons (ppb)	Entrained hydrocarbons (ppb)	Maximum Oil Ashore (m^3)	Maximum Length of Oiled Shoreline at 100 g/m^2 (km)
Zuytdorp Cliffs - Kalbarri	Emergent	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA