ENVIRONMENT PLAN

NON-PRODUCTION WELL OPERATIONS (WHITE IBIS-1, TREFOIL-1 and YOLLA-1)

Revision	Date	Reason for issue	Originator	Reviewers	Approver
1	21/04/2021	Re-issued for NOPSEMA assessment	Aventus Consulting	PW	PW
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Review frequency	Revision frequency
Five-yearly	As required

THE THREE WHATS
What can go wrong?
What could cause it to go wrong?
What can I do to prevent it?

Document Information and History

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Document history

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Abbreviations

Acronym	Definition
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ACMA	Australian Communications and Media Authority
ADIOS	Automated Data Inquiry for Oil Spills
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AHO	Australian Hydrographic Office
AHR	Aboriginal Heritage Register
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
APPEA	Australian Petroleum Production and Exploration Association
AS	Action Statement
ASBTIA	Australian Southern Bluefin Tuna Industry Alliance
AUV	Autonomous Underwater Vehicle
Bar(g)	Gauge pressure
BAT	Best Available Technique/s
BIA	Biologically Important Area
BoM	Bureau of Meteorology
BPEM	Best Practice Environmental Management
BSCZSF	Bass Strait Central Zone Scallop Fishery
BSSIA	Bass Strait Scallop Industry Association
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CA	Conservation Advice
CAMBA	China-Australia Migratory Bird Agreement
CASA	Civil Aviation Safety Authority
CBS	Central Bass Strait
CCTV	Closed Circuit Television
CE	Critically Endangered
CER	Commission for Energy Regulation
CFA	Commonwealth Fisheries Authority
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora 1973
CMMS	Computerised Maintenance Management System
CMP	Conservation Management Plan
CM&ER	Crisis Management and Emergency response
CMT	Crisis Management Team
CoEP	Code of Environmental Practice

Acronym	Definition
CO2	Carbon dioxide
CoEP	APPEA Code of Environmental Practice
COLREG	Convention on the International Regulations for Preventing Collisions at Sea (1972)
CFSR	Climate Forecast System Reanalysis
Cth	Commonwealth
CTS	Commonwealth Trawl Sector
CVI	Close visual inspection
DAFF	Department of Agriculture, Fisheries and Forestry (Cth) (former)
DAWE	Department of Agriculture, Water and the Environment (Cth)
DAWR	Department of Agriculture and Water Resources (Cth) (former)
DEH	Department of Environment and Heritage (Cth) (former)
DELWP	Department of Environment, Land, Water and Planning
DIRD	Department of Infrastructure and Regional Development
DIIS	Department of Industry, Innovation and Science (Cth) (former)
DISER	Department of Industry, Science, Energy and Resources (Cth)
DJPR	Department of Jobs, Precincts and Regions (Vic)
DNP	Director of National Parks
DoEE	Department of the Environment and Energy (Cth) (former)
DP	Dynamic Positioning
DPI	Department of Primary Industries
DPIPWE	Department of Primary Industries, Parks, Water and Environment
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities (Cth) (former)
E	Endangered
EAC	East Australian Current
EARPL	Esso Australia Resources Pty Ltd
EIA	Environment Impact Assessment
EIAPP	Engine International Air Pollution Prevention
EMBA	Environment that May Be Affected
EMB	Emergency Management Branch (Vic)
EMP	Emergency Management Plan
EMT	Emergency Management Team
ENVID	Environmental Identification
EP	Environment Plan
E&P	Exploration and Production
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cth)
EPIRB	Emergency Position Indicating Radio Beacon
EPO	Environmental Performance Objectives
EPS	Environmental Performance Standards

Acronym	Definition
ERA	Environmental Risk Assessment
ERP	Emergency Response Plan
ERR	Earth Resources Regulation
ESD	Ecologically Sustainable Development
ESD	Emergency Shutdown
ESDSC	Ecologically Sustainable Development Steering Committee
FFG Act	Flora and Fauna Guarantee Act 1988 (Vic)
GAB	Great Australian Bight
GHaT	Gillnet Hook and Trap
GHG	Greenhouse Gas
GMDSS	Global Maritime Distress and Safety System
GPS	Global positioning system
GVI	General visual inspection
HAZID	Hazard Identification
HSE	Health Safety and Environment
HTB	High-Temperature Blend
HYCOM	Hybrid Coordinate Ocean Model
IAGC	International Association of Geophysical Contractors
IAP	Incident Action Plan
IAPP	International Air Pollution Prevention Certificate
IBA	Important Bird Area
IEE	International Energy Efficiency
IMCRA	Interim Marine and Coastal Regionalisation for Australia
IMDG	International Marine Dangerous Goods
IMO	International Maritime Organization
IMS	Invasive Marine Species
IOGP	International Association of Oil & Gas Producers
IOPP	International Oil Pollution Prevention
IPP	International Pollution Prevention
IPIECA	International Petroleum Industry Environmental Conservation Association
ISO	International Standards Organisation
ISV	Inspection Support Vessel
ISPP	International Sewage Pollution Prevention
ITOPF	International Tanker Owners Pollution Federation Limited
IUCN	International Union for the Conservation of Nature
JAMBA	Japan-Australia Migratory Bird Agreement
JIP	IOGP’s Joint Industry Programme
KEF	Key Ecological Features
KI-BDSE	King Island Blue Dot South East

Acronym	Definition
LGA	Local Government Authority
LoC	Loss of Containment
LPG	Liquefied Petroleum Gas
LTD	Limited
MARPOL	IMO International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)
MDO	Marine Diesel Oil
MDKB	Measured Depth Kelly Busing
MDRT	Measured Depth Rotary Table
MMO	Marine Mammal Observer
MNES	Matters of National Environmental Significance
MNP	Marine National Park
MO	Marine Orders
MOC	Management of Change
MODU	Mobile Offshore Drilling Unit
MV	Marine vessel
MP	Marine Park
MPa	Megapascal(s)
MRT	Mineral Resources Tasmania
NatPlan	Australian National Plan for Maritime Environmental Emergencies
NA	Not applicable
NC	No Contact
NCEP	National Centre for Environmental Prediction
NCVA	National Conservation Values Atlas
NEBA	Net Environmental Benefits Analysis
NGER	National Greenhouse and Energy Reporting
NGO	Non-governmental Organisations
NIW	Nationally important wetlands
NOO	National Oceanographic Office
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administration
NP	National Park
NSW	New South Wales
NTM	Notice to Mariners
OCNS	Offshore Chemical Notification Scheme
ODS	Ozone depleting substances
OEM	Original Equipment Manufacturer
OEMS	Operational Excellence Management System
OGUK	Oil & Gas UK
OIW	Oil In Water

Acronym	Definition
OPEP	Oil Pollution Emergency Plan
OPGGS Act	Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth)
OPGGS(E)	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth)
OSMP	Operational and Scientific Monitoring Plan
OSRA	Oil Spill Response Atlas
OSTM	Oil Spill Trajectory Modelling
OWR	Oiled Wildlife Response
OWS	Oily Water Separator
P&A	Plug and abandon
PCB	Polychlorinated biphenyls
PBW	Pygmy Blue Whale
PMS	Planned Maintenance System
PMST	Protected Matters Search Tool
POWBONS	Pollution of Waters by Oil and Noxious Substances Act 1986
PPE	Personal Protective Equipment
PSV	Platform Support Vessel
PSZ	Petroleum Safety Zone
PTS	Permanent Threshold Shift
PTW	Permit To Work
PVC	Polyvinyl chlorides
QLD	Queensland
RGPS	Relative Global Positioning System
RO	Reverse Osmosis
ROKAMBA	Republic of Korea–Australia Migratory Birds Agreement
ROV	Remotely Operated Vehicle
RP	Recovery Plan
SA	South Australia
SARLAC	South Australian Rock Lobster Advisory Council
SIV	Seafood Industry Victoria
SEL	Sound Exposure Level
SEMR	South East Marine Region
SEP	Stakeholder Engagement Plan
SEPFA	South Eastern Professional Fisherman Association
SESSF	Southern and Eastern Scalefish and Shark Fishery
SETFIA	South East Trawl Fishing Industry Association
SIMOPS	Simultaneous Operations
SMPEP	Shipboard Marine Pollution Emergency Plan
SMS	Short message Service
SOLAS	International Convention for the Safety of Life at Sea

Acronym	Definition
SPL	Sound Pressure Level
SRD	Streamer Retrieval Devices
SRL	Southern Rock Lobster
SRW	Southern Right Whale
SSS	Side Scan Sonar
SPRAT	Species Profile and Threats (database)
SSJF	Southern Squid Jig Fishery
SSFA	Sustainable Shark Fishing Association
SSIA	Southern Shark Industry Alliance
SST	Sea Surface Temperature
STLM	Sound Transmission Loss Modelling
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
STP	Sewage Treatment Plant
TA	Temporary Abandonment/Temporarily abandoned
TACC	Total Allowable Commercial Catch
TARFish	Tasmanian Association for Recreational Fishing
Tas	Tasmania
TasPlan	Tasmanian Marine Oil and Chemical Spill Contingency Plan
TEC	Threatened Ecological Community
TICT	Tourism Industry Council of Tasmania
TRLFA	Tasmanian Rock Lobster Fisheries Association
TSSC	Threatened Species Scientific Committee
TSIC	Tasmanian Seafood Industry Council
TTS	Temporary Threshold Shift
TRSC-SSSV	Tubing Retrievable Surface Controlled Sub-Surface Safety Valve
UHF	Ultra-High Frequency
UNCLOS	United Nations Convention on the Law of the Sea (1982)
UNEP IE	United Nations Environment Programme Industry and Environment
UNFCCC	United Nations Framework Convention on Climate Change (1994)
V	Vulnerable
VFA	Victorian Fishing Authority
VHF	Very High Frequency
Vic	Victoria
VGP	Victorian Gas Program
VicPlan	Victorian State Maritime Emergencies (Non-search and Rescue) Plan
VoO	Vessels of Opportunity
VR	Victorian Recreational
VRLA	Victorian Rock Lobster Fishing Association
WA	Western Australia

Acronym	Definition
WIMS	Well Integrity Management System
WIMP	Well Integrity Management Plan
WOMP	Well Operations Management Plan

Units of Measurement

Abbreviation	Definition
3D	Three dimensional
bbls	Barrels
cm	Centrimetre
cui	Cubic inches
km	Kilometre
lb	Pound (s)
M	Million
m	Metre (s)
mm	Millimetre
msl	Mean sea level
nm	Nautical miles
psi	Pounds per square inch
m^2	Metres squared
km^2	Kilometres squared
ppm	Parts per million
ppb	Parts per billion
ppf	Pounds per foot
"	Inches

1. Introduction

1.1 Background

Beach Energy (Operations) Ltd (Beach) is the operator of the Retention Leases T/RL2 and T/RL4 and production licence T/L1, located in Commonwealth waters in central Bass Strait. These retention leases contain the following gas fields or prospects:

- T/RL2 – Trefoil;
- T/RL4 – White Ibis; and
- T/L1 – Yolla.

Beach acquired Lattice Energy Ltd (previously Origin Energy Resources Limited (Origin)) on 31 January 2018. Origin previously explored and appraised recoverable and commercially viable petroleum resources within T/RL2, T/RL4 and T/L1. As a result, Lattice acquired three plugged and suspended exploration wells in these lease areas known as Trefoil-1 (drilled in 2004), White Ibis-1 (drilled in 1998) and Yolla-1 (drilled in 1985).

All three wellheads are non-producing, remain suspended and temporarily abandoned (TA). The location of the suspended wells is provided in Figure 1.1.

1.2 The Titleholder

Beach is the titleholder and operator of the leases on behalf of several joint venture partners. The composition of each lease is outlined in Table 1.1 and Table 1.2.

Table 1.1. Titleholder details for T/RL2 and T/RL4

Titleholder	ABN	Holding
Beach Energy (Operations) Limited	66 007 845 338	39% (Operator)
AWE Petroleum Pty Ltd	52 009 440 975	40%
Beach Energy Limited	20 007 617 969	11.25%
Prize Petroleum International Pte. Ltd	16 601 684 048	9.75%

Table 1.2. Titleholder details for T/L1

Titleholder	ABN	Holding
Beach Energy (Operations) Limited	66 007 845 338	37.5% (Operator)
Beach Energy (BassGas) Limited	40 009 475 325	5.0%
Beach Energy Limited	20 007 617 969	11.25%
AWE Petroleum Pty Ltd	52 009 440 975	22.5%
AWE (Bass Gas) Pty Ltd	81 124 779 068	12.5%
Prize Petroleum International Pty Ltd	16 601 684 048	11.25%

In January 2020, Beach completed a name change of Lattice Energy to Beach Energy.

Beach was formed in 1961 and is an Australian Stock Exchange-listed oil and gas, exploration and production company headquartered in Adelaide, South Australia. It has operated and non-operated onshore and offshore oil and gas production from five petroleum basins across Australia and New Zealand and is a key supplier to the Australian east coast gas market. Beach's asset portfolio includes ownership interests in strategic oil and gas infrastructure, as well as a suite of high potential exploration prospects. Beach's gas exploration and production portfolio includes acreage in the Otway, Bass, Cooper/Eromanga, Perth, Browse and Bonaparte basins in Australia, as well as the Taranaki and Canterbury basins in New Zealand (Figure 1.2).

Beach is Australia's largest onshore oil producer and a key supplier to the Australian east coast gas market, supplying approximately 15% of the east coast's domestic gas demand, with two offshore production platforms and two gas plants in Victoria.

The Titleholder for this activity is:

Beach Energy (Operations) Ltd
Level 8, 80 Flinders Street, Adelaide, South Australia, 5000
Phone: 08-8338 2833
Email: info@beachenergy.com.au

The nominated liaison person for this EP is:

Phil Wemyss
Principal Environmental Advisor
Level 8, 80 Flinders Street, Adelaide, South Australia, 5000
Phone: 08-8338 2833
Email: info@beachenergy.com.au

Beach will notify NOPSEMA of any change in titleholder, a change in the titleholder's nominated liaison person, or a change in the contact details for either the titleholder or the liaison person as soon as practicable after such a change takes place.

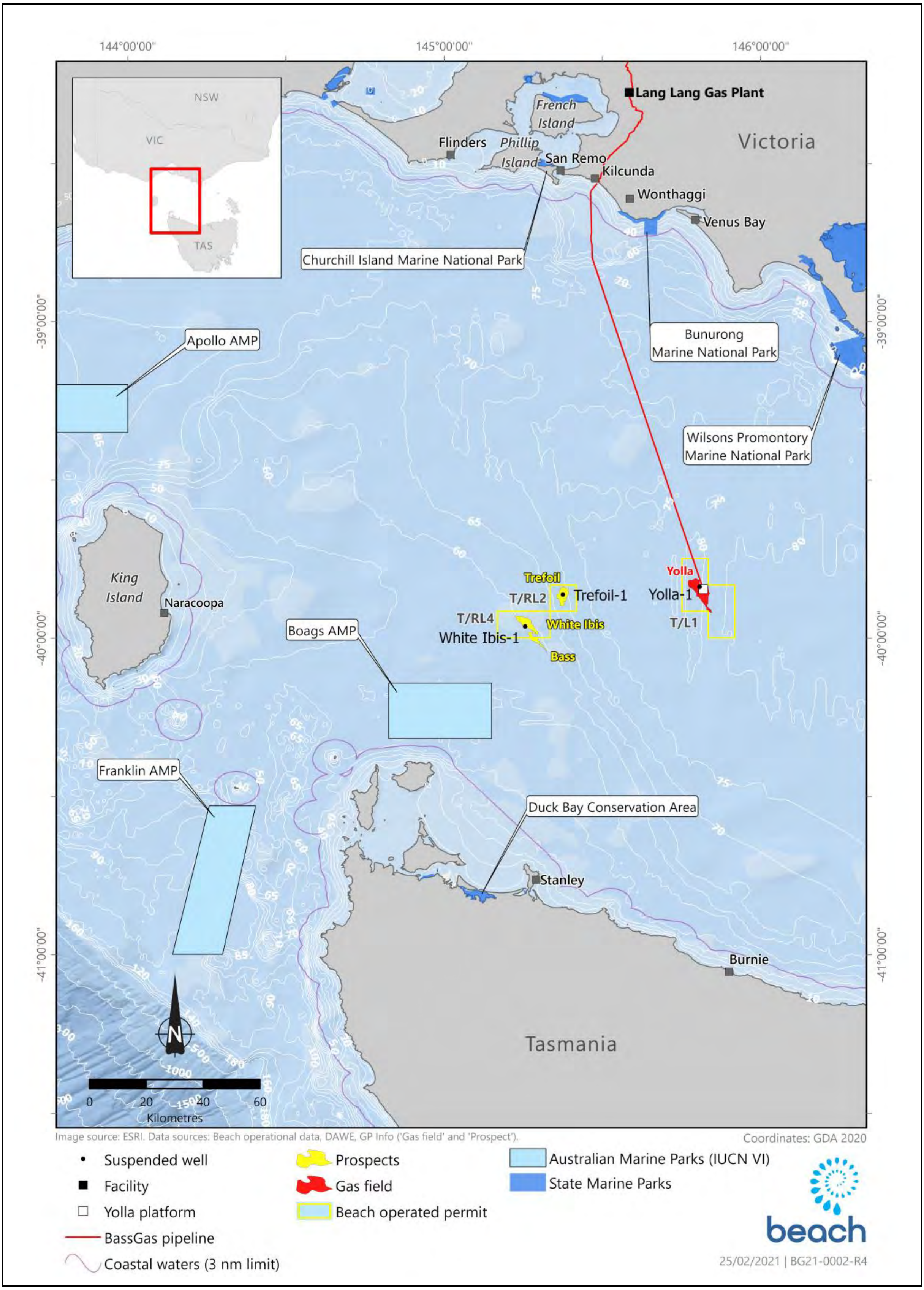


Figure 1.1. White Ibis (T/RL4), Trefoil (T/RL2) and Yolla (T/L1) location map

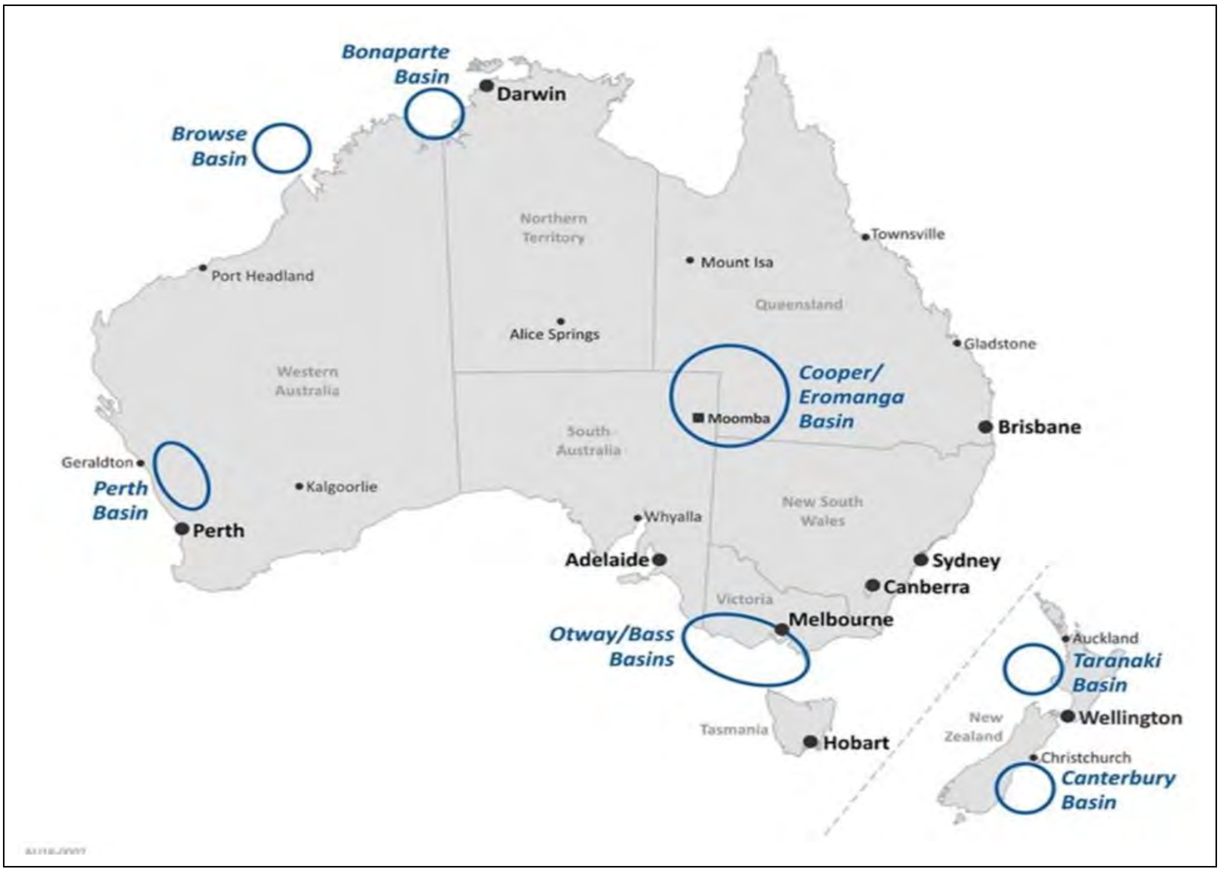


Figure 1.2. Locations of Beach assets

1.3 Purpose

Preparation of this Environment (EP) addresses and meets the *Request for an Environment Plan – Trefoil 1 (T/RL2), White Ibis 1 (T/RL4) and Yolla 1 (T/L1) Wells* issued by NOPSEMA (on 14 October 2020) to Beach. The purpose of this EP is to secure environmental approval under the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (herein referred to as the OPGGS(E)) for the ongoing suspension and temporary abandonment (TA) of the White Ibis-1, Trefoil-1 and Yolla-1 wells, including planned routine visual inspections of the wellheads.

1.4 Scope

The activity (as defined in Section 3.3) is conducted in accordance with all applicable legislation and regulations, and specifically to meet the requirements of the *Offshore Petroleum and Greenhouse Gas Storage Act* 2006 (Cth) (OPGGS Act) and its associated Regulations.

This EP is prepared in accordance with Division 2.3 of the OPGGS(E). It is submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for assessment and acceptance under Division 2.2 of the OPGGS(E).

This EP includes a description of:

- The nature of the activity (location, activity area operational details);
- The legislative framework relevant to the activity;
- Stakeholder consultation activities;
- The environment affected by the activity;

- Environmental impacts and risks;
- Mitigation and management measures;
- Environmental performance outcomes, standards and measurement criteria;
- A demonstration of how impacts and risks will be reduced be As Low As Reasonably Practicable (ALARP) and to acceptable levels;
- The implementation strategy to ensure that the environmental impacts and risks are managed in a systematic manner; and
- Reporting arrangements.

1.5 Interfaces with other documents

As a non-operational asset, the non-production well operations interfaces with several other plans, including the:

- White Ibis-1, Trefoil-1 and Yolla-1 Well Operations Management Plan (WOMP) (CDN/ID 12348708, Rev 5.0, Dec 2020) (NOPSEMA accepted July 2017); and
- Well Integrity Management Plan (WIMP) (CDN/ID 7726350, Rev 2.0, February 2019).

1.6 Environment Plan Summary

Table 1.3 provides a summary of this EP as required by Regulation 11(4) of the OPGGS(E)).

Table 1.3. EP Summary of material requirements

EP Summary requirement	Relevant EP section
The location of the activity	Section 3.2
A description of the receiving environment	Chapter 5
A description of the activity	Chapter 3
Details of the environmental impacts and risks	Chapter 7
The control measures for the activity	Chapter 7
The arrangements for ongoing monitoring of the titleholder's environmental performance	Chapter 8
Response arrangements in the oil pollution emergency plan (OPEP)	Chapter 9
Consultation already undertaken and plans for ongoing consultation	Chapter 4
Details of the titleholder's nominated liaison person for the activity	Section 1.2

2. Environmental Regulatory Framework

In accordance with Regulation 13(4) of the OPGGS(E), this chapter describes the legislative requirements that apply to the activities described in this EP.

No part of the activity described in this EP is located within Victorian state waters or Tasmanian state waters (between the low water mark and the 3 nm limit) and as such, no environmental approvals for the activity are required from the Victorian or Tasmanian governments.

The spill EMBA is entirely within Commonwealth waters and does not approach or intersect with any shorelines. Therefore, this chapter does not describe state Victorian and Tasmanian legislation pertaining to marine pollution from a marine diesel oil (MDO) spill.

2.1 Beach Environment Policy

In accordance with Regulation 16(a) of the OPGGS(E), Beach's Environment Policy is provided in Figure 2.1. The policy provides a public statement of the company's commitment to minimise adverse effects on the environment and to improve environmental performance.

2.2 Commonwealth Legislation

Table 2.1 presents a summary of the key Commonwealth legislation and regulations relevant to the environmental management of the activity, with details of the most pertinent legislation and regulations provided below.

Offshore Petroleum and Greenhouse Gas Storage Act 2006

The *Offshore Petroleum and Greenhouse Gas Storage Act* 2006 (OPGGS Act) sets up a system for regulating the exploration for and recovery of petroleum in offshore areas and provides for the grant of exploration permits, retention leases, production licences, infrastructure and pipeline licences, among other things.

Under this Act, NOPSEMA is responsible for the administration of the occupational health and safety, structural integrity and environmental management provisions. Offshore areas start 3 nautical miles (nm) from the baseline from which the territorial sea is measured and extend seaward to the outer limits of the continental shelf.

Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009

The OPGGS(E) addresses all licensing and environmental issues for offshore petroleum and greenhouse gas (GHG) activities in Commonwealth waters. This EP has been prepared in accordance with Part 2 of the OPGGS(E) for NOPSEMA's assessment.

The OPGGS(E) requires the preparation of an EP prior to conducting a petroleum activity for acceptance by NOPSEMA. The EP is an activity-specific document that provides a detailed impact and risk assessment and describes how identified risks will be managed. Upon EP acceptance, the activity may commence.

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) is the key legislation regulating projects that may have an impact on matters of national environmental significance (MNES). The Commonwealth Department of Agriculture, Water and the Environment (DAWE) is the Regulator of the EPBC Act. Activities that may have impacts to MNES are required to prepare and submit a Referral to the DAWE for determination on the level of environmental impact assessment (EIA) required.

In February 2014, NOPSEMA became the sole designated assessor of petroleum and GHG activities in Commonwealth waters in accordance with the Minister for the Environment's endorsement of NOPSEMA's environmental authorisation process under Part 10, section 146 of the EPBC Act. Under the streamlined arrangements, impacts on the Commonwealth marine area by petroleum and GHG activities are assessed solely through NOPSEMA. As such, an EPBC Act Referral has not been prepared and submitted to the DAWE for this activity.

beach

Environment Policy

Objective

Beach is committed to conducting operations in an environmentally responsible and sustainable manner.

Strategy

To achieve this, Beach will:

- Comply with relevant environmental laws, regulations, and the Beach Health, Safety and Environment Management System which is the method by which Beach identifies and manages environmental risk.
- Establish environmental objectives and targets, and implement programs to achieve them that will support continuous improvement;
- Identify, assess and control environmental impacts of our operations by proactive management of activities and mitigation of impacts;
- Ensure that incidents, near misses, concerns and complaints are reported, investigated and lessons learnt are implemented;
- Inform all employees and contractors of their environmental responsibilities including consultation and distribution of appropriate environmental management guidelines, regulations and publications for all relevant activities;
- Efficiently use natural resources and energy, and engage with stakeholders on environmental issues; and
- Publicly report on our environmental performance.

Application

This policy applies to all personnel associated with Beach activities.

Matt Kay
Managing Director and CEO
December 2019

Figure 2.1. Beach Environmental Policy

Table 2.1. Summary of key Commonwealth environmental legislation relevant to the activity

Legislation/Regulation	Scope	Related International Conventions	Administering Authority
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (& Regulations 2000)	Protects MNES, provides for Commonwealth environmental assessment and approval processes and provides an integrated system for biodiversity conservation and management of protected areas. The nine MNES are: 1. World heritage properties; 2. National heritage places; 3. Wetlands of international importance (Ramsar wetlands); 4. Nationally threatened species and ecological communities; 5. Migratory species; 6. Commonwealth marine environment; 7. The Great Barrier Reef Marine Park; 8. Nuclear actions (including uranium mining); and 9. A water resource, in relation to coal seam gas development and large coal mining development. **Relevance to this activity:** This EP includes a description and assessment of the MNES that may be impacted by the activity (principally items 4 and 5 in this list).	• Convention on Biological Diversity and Agenda 21 1992. • Convention on International Trade in Endangered Species of Wild Fauna and Flora 1973 (CITES). • Agreement between the Government and Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment 1974 (JAMBA). • Agreement between the Government and Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment 1986 (CAMBA). • Republic of Korea Migratory Birds Agreement 2006 (ROKAMBA). • Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971 (Ramsar). • International Convention for the Regulation of Whaling 1946. • Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979.	DAWE (NOPSEMA in the case of this activity)
OPGGS Act 2006 and OPGGS (Environment) Regulations 2009	The Act addresses all licensing and HSE issues for offshore petroleum and GHG activities extending beyond the 3 nm limit. The Regulations (Part 2) specify that an EP must be prepared for any GHG activity and that activities are undertaken in an ecologically sustainable manner. **Relevance to this activity:** The preparation and acceptance of this EP satisfies the key requirements of this legislation.	Not applicable.	NOPSEMA
Environment Protection (Sea Dumping) Act 1981 (& Regulations 1983)	Aims to prevent the deliberate disposal of wastes (loading, dumping, and incineration) at sea from vessels, aircraft, and platforms. **Relevance to this activity:** There will be no dumping at sea within the meaning of the legislation that would require a sea dumping permit to be obtained.	• Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter 1972 [London Convention] • Protocol on the Prevention of Marine Pollution by Dumping of Waste and Other Matter 1996 [London Protocol]	DAWE

Legislation/Regulation	Scope	Related International Conventions	Administering Authority
Australian Maritime Safety Authority Act 1990 *(*AMSA Act*)*	Facilitates international cooperation and mutual assistance in preparing and responding to major oil spill incidents and encourages countries to develop and maintain an adequate capability to deal with oil pollution emergencies. Requirements are implemented through the Australian Maritime Safety Authority (AMSA). AMSA is the lead agency for responding to oil spills in the Commonwealth marine environment and is responsible for implementing the Australian National Plan for Maritime Environmental Emergencies ('NatPlan)'. **Relevance to this activity:** In the event of a Level 2 or 3 hydrocarbon spill to sea from the vessel, AMSA may take over from Beach as the Combat Agency and implement the NatPlan.	• International Convention on Oil Pollution Preparedness, Response and Cooperation 1990. • Protocol on Preparedness, Response and Cooperation to Pollution Incidents by Hazardous and Noxious Substances 2000. • International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties 1969. • United Nations Convention on the Law of the Sea 1982 (UNCLOS) (articles 198 & 221).	AMSA
Underwater Cultural Heritage Act 2018	Protects the heritage values of shipwrecks, sunken aircraft and relics (older than 75 years) in Australian Territorial waters below the low water mark to the outer edge of the continental shelf (excluding the State's internal waterways. It is an offence to interfere with a shipwreck covered by this Act. **Relevance to this activity:** An historic shipwreck is mapped in the EMBA (but not in the activity area). In the event of the discovery of, and damage to previously unrecorded wrecks, this legislation may be triggered.	• Agreement between the Netherlands and Australia concerning old Dutch Shipwrecks 1972.	DAWE
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989	Regulates the manufacture, importation and use of ozone depleting substances. **Relevance to this activity:** The vessel will have a register of ozone-depleting substances (ODS).	• Montreal Protocol on Substances that Deplete the Ozone Layer 1987. • United Nations Framework Convention on Climate Change (UNFCCC) 1994.	DAWE
Navigation Act 2012 (& Regulations 2013)	This Act regulates ship-related activities in Commonwealth waters and invokes certain requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) relating to equipment and construction of ships. Several Marine Orders (MO) are enacted under this Act relating to the environmental and social management of offshore petroleum activities, including: • MO 21 - Safety and emergency arrangements. • MO 30 - Prevention of collisions. • MO 50 - Special purpose vessels.	• United Nations Convention on the Law of the Sea 1982 (UNCLOS). • International Convention for the Safety of Life at Sea 1974 (SOLAS). • Convention on the International Regulations for Preventing Collisions at Sea 1972 (COLREG). • International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978 (MARPOL).	AMSA

Legislation/Regulation	Scope	Related International Conventions	Administering Authority
	• MO 70 – Seafarer certification. **Relevance to this activity**: The vessel will adhere to the relevant MOs while operating within Commonwealth waters.	• International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) as amended, 1995.	
Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (POSPOPS Act) Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations 1994	Regulates ship-related operational activities and invokes certain requirements of the MARPOL Convention relating to discharge of noxious liquid substances, sewage, garbage, air pollution etc. It requires that ships >400 gross tonnes have pollution emergency plans. Several MO are enacted under this Act relating to offshore petroleum activities, including: • MO 91: Marine Pollution Prevention – Oil; • MO 93: Marine Pollution Prevention – Noxious liquid substances; • MO 94: Marine Pollution Prevention – Packaged harmful substances; • MO 95: Marine Pollution Prevention – Garbage; • MO 96: Marine Pollution Prevention – Sewage; • MO 97: Marine Pollution Prevention – Air Pollution; and • MO 98: Marine Pollution Prevention – Anti-fouling Systems. **Relevance to this activity:** If >400 gross tonnes, the vessel will adhere to the relevant MOs by having a SMPEP, Oil Record Book and Garbage Management Plan in place and implemented, along with international pollution prevention certificates verifying compliance with oil, air pollution and sewage measures.	Various parts of MARPOL.	AMSA
Protection of the Sea (Shipping Levy) Act 1981	Provides that where, at any time during a quarter when a ship with tonnage length of no less than 24 m was in an Australia port, there was on board the ship a quantity of oil in bulk weighing more than 10 tonnes, a levy is imposed in respect of the ship for the quarter. **Relevance to this activity:** The vessel will adhere to the shipping levy, as required.	Not applicable.	AMSA
Protection of the Sea (Civil Liability for Bunker Oil Pollution Damage) Act 2008	Sets up a compensation scheme for those who suffer damage caused by spills of oil that is carried as fuel in ships' bunkers. There is an obligation on ships >1,000 gross tonnes to carry insurance certificates when leaving/entering Australian ports or leaving/entering an offshore facility within Australian coastal waters.	• International Convention on Civil Liability for Bunker Oil Pollution Damage 2001.	AMSA

Legislation/Regulation	Scope	Related International Conventions	Administering Authority
	Relevance to this activity: The vessel will hold the necessary insurance certificates, as required.		
Protection of the Sea (Harmful Antifouling Systems) Act 2006	Creates an offence for a person to engage in negligent conduct that results in a harmful anti-fouling compound being applied to a ship. Also provides that Australian ships must hold 'anti-fouling certificates', provided they meet certain criteria. **Relevance to this activity:** The vessel will hold valid anti-fouling certificates, as required.	• International Convention on the Control of Harmful Anti-fouling Systems on Ships 2001.	AMSA
Protection of the Sea (Shipping Levy) Act 1981	Provides that where, at any time during a quarter when a ship with tonnage length of no less than 24 m was in an Australia port, there was on board the ship a quantity of oil in bulk weighing more than 10 tonnes, a levy is imposed in respect of the ship for the quarter. **Relevance to this activity:** The vessel will adhere to the shipping levy, as required.	Not applicable.	AMSA
National Greenhouse and Energy Reporting Act 2007 (NGER) (& Regulations 2008)	Establishes the legislative framework for the NGER Scheme, which is a national framework for reporting GHG emissions, GHG projects and energy consumption and production by corporations in Australia. **Relevance to this activity:** Beach is a registered reporter under this Act (ABN 200 076 179 69). Under the NGER Act, a controlling corporation assesses its reporting obligations by reference to the facilities that are under its 'operational control.' As the vessel contractor does not come under Beach's operational control, it will be required to collect and submit its own emissions data under the NGER Act.	• UNFCCC 1994.	Clean Energy Regulator
Biosecurity Act 2015 (& 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. Offshore petroleum installations outside of 12 nm are located outside of Australian territory for the purposes of the Act. While these installations are not subject to biosecurity control, aircraft and vessels (not subject to biosecurity control) that leave Australian territory and are exposed to the installations are subject to biosecurity control when returning to Australian territory.	• International Convention for the Control and Management of Ships Ballast Water & Sediments 2004. • World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures (SPS agreement). • World Organisation for Animal Health and the International Plant Protection Convention.	DAWE

Legislation/Regulation	Scope	Related International Conventions	Administering Authority
	When a vessel or aircraft leaves Australian territory and interacts with an installation or petroleum industry vessel it becomes an 'exposed conveyance' and is subject to biosecurity control when it returns to Australian territory unless exceptions can be met. The person in charge of an exposed conveyance carries the responsibility for pre-arrival reporting under the Act and must arrive at a first point of entry. This Act includes mandatory controls in the use of seawater as ballast in ships and the declaration of sea vessels voyaging into and out of 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. **Relevance to this activity:** If sourced from a foreign port, the vessel will adhere to the DAWE guidelines regarding quarantine clearance to enter Australian waters.		
Fisheries Management Act 1991 *(& Regulations 2009)*	This Act aims to implement efficient and cost-effective fisheries management on behalf of the Commonwealth, ensure that the exploitation of fisheries resources and the carrying on of any related activities are conducted in a manner consistent with the principles of Ecologically Sustainable Development (ESD), maximise the net economic returns to the Australian community from the management of Australian fisheries, ensure accountability to the fishing industry and to the Australian community in the Australian Fisheries Management Authority's (AFMA's) management of fisheries resources, and achieve government targets in relation to the recovery of the costs of AFMA. **Relevance to this activity:** Provides the regulatory and other mechanisms to support any necessary fisheries management decisions in the event of a hydrocarbon spill in Commonwealth waters.	Not applicable.	AFMA

2.3 Government Guidelines

This EP has been developed in accordance with the NOPSEMA Guidance Note for *Environment Plan Content Requirements* (N04750-GN1344, Revision 4, April 2019). This document provides guidance to the petroleum industry on NOPSEMA's interpretation of the OPGGS(E) to assist titleholders in preparing EPs.

Other relevant government guidelines that have been incorporated or taken into consideration during the preparation of this EP include:

EPs

- Environment plan assessment (NOPSEMA Policy N-04750-PL1347, Rev 8, March 2020).
- Reducing marine pest biosecurity risks through good practice biofouling management (NOPSEMA Information Paper N-04750-IP1899, Rev 1, March 2020).
- Environment plan decision making (NOPSEMA Guideline GL1721, Rev 6, November 2019).
- Oil spill modelling (NOPSEMA Environment Bulletin, April 2019).
- Acoustic impact evaluation and management (NOPSEMA Information Paper, N-04750-IP1765, Rev 2, December 2018).
- Petroleum activities and Australian marine parks (NOPSEMA Guidance Note, N-04750-GN1785, Rev 0, July 2018).

Oil Pollution Emergency Plans (OPEPs)

- Oil spill modelling (NOPSEMA Environment Bulletin, April 2019).
- Oil pollution risk management (NOPSEMA Guidance Note GN1488, Rev 2, February 2018).
- Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities (AMSA, January 2015).
- Advisory Note Offshore Petroleum Industry Oil Spill Contingency Planning Consultation (Victorian Department of Transport, Planning and Local Infrastructure, Version 2.0, August 2013).
- Advisory Note for Offshore Petroleum Industry Consultation with Respect of Oil Spill Contingency Plans (AMSA, 2012).

Operational and Scientific Monitoring Programs (OSMPs)

- Operational and scientific monitoring programs (NOPSEMA Information Paper, N-04750-IP1349, October 2020).

EPBC Act

- EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – Matters of National Environmental Significance (DoE, 2013).
- EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales, Industry guidelines (DEWHA, 2008).

2.4 Government Management Plans

The environmental performance standards (EPS) provided throughout Chapter 7 of this EP have taken into account various government management plans, generally under the categories of:

- AMP management plans;

- State coastal park management plans; and
- Recovery Plans, Conservation Plans and Conservation Advice for species threatened at the Commonwealth and/or state levels.

Appendix 1 provides an assessment of the activity against the objectives of marine reserves in the hydrocarbon spill EMBA. Appendix 2 provides an assessment of the activity against the objectives of various Commonwealth-listed threatened species Conservation Advice and Recovery Plans for species that may occur within the hydrocarbon spill EMBA.

2.5 International Industry Codes of Practice and Guidelines

A number of international codes of practice and guidelines are relevant to environmental management of the activity. Those of most relevance are described in this section in chronological order. The Commonwealth legislation described in Table 2.1 lists the conventions and agreements that are enacted by, or whose principles are embodied in, that legislation.

While none of the codes of practice or guidelines described in this section have legislative force in Australia (with the exception of MARPOL), they are considered to represent best practice environmental management (BPEM). Aspects of each code or guideline relevant to the impacts and risks presented by the activity are outlined in the demonstrations of acceptability throughout Chapter 7.

2.5.1 MARPOL

The key international convention relating to marine environmental matters is the International Convention for the Prevention of Pollution from Ships (MARPOL). This convention was adopted in November 1973 by the International Maritime Organisation (IMO), with ongoing additions and amendments. MARPOL aims to prevent and minimise pollution (routine discharges and accidents) from ships generally larger than 400 gross tonnes. It contains six annexes and is in force in 174 countries (as of December 2020).

In Australian Commonwealth waters, MARPOL is given effect through the *Protection of the Sea (Prevention of Pollution from Ships) Act* 1983 and via Marine Orders made under the *Navigation Act* 2012, and is administered by AMSA. Table 2.2 lists the annexes of the Convention and identifies how they are given effect under Commonwealth legislation.

2.5.2 Environmental Management in the Upstream Oil and Gas Industry (2020)

These guidelines were released in August 2020 by the International Association of Oil & Gas Producers (IOGP) and the International Petroleum Industry Environmental Conservation Association (IPIECA). They supersede the United Nations Environment Programme Industry and Environment (UNEP IE) Environmental Management in Oil and Gas Exploration and Production guidelines released in 1997 prepared by the International Exploration and Production Forum (E&P Forum), the precursor to the IOGP. These guidelines provide descriptions of upstream oil and gas activities environmental management practices. Chapter 4 of the guidelines lists the environmental impacts and mitigation measures associated with offshore activities and provide a useful benchmark for BPEM for this activity.

2.5.3 Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (2019)

The *Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production* (European Commission, 2019) aims to identify best available techniques (BAT) and best risk management approaches for key environmental issues associated with onshore and offshore oil and gas exploration and production activities. The BATs included are not prescriptive nor exhaustive but included as a point of comparison with documents such as this EP to ensure the desired environmental outcomes commensurate with BAT can be achieved for the European context.

Table 2.2. Commonwealth legislation enacting the MARPOL Convention

MARPOL Annex (entry into force in Australia)	Commonwealth waters (POSPOPS Act 1983 & *Navigation Act* 2012)	General operating requirements
I Regulations for the Prevention of Pollution by Oil (1988)	AMSA MO 91; Marine Pollution Prevention – Oil.	Addresses measures for preventing pollution by oil from regulated Australian vessels or foreign vessels, and specifies that: • An International Oil Pollution Prevention (IOPP) certificate is required; • A Shipboard Marine Pollution Emergency Plan (SMPEP) is required; • An oil record book must be carried; • Oil discharge monitoring equipment must be in place; and • Incidents involving oil discharges are reported to AMSA.
II Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk (1988)	AMSA MO 93; Marine Pollution Prevention – Noxious Liquid Substances.	Addresses measures for preventing pollution by 250 noxious liquid substances carried in bulk from regulated Australian vessels or foreign vessels, and specifies that: • An International Pollution Prevention (IPP) certificate is required; • A SMPEP is required; • A cargo record book must be carried; • Incidents involving noxious liquid substance discharges are reported to AMSA; • The discharge of residues is allowed only to reception facilities until certain concentrations and conditions (which vary with the category of substances) are complied with; and • No discharge of residues containing noxious substances is permitted within 12 nm of the nearest land.
III Prevention of Pollution by harmful Substances Carried by Sea in Packaged Form (1995)	AMSA MO 94; Marine Pollution Prevention – Packaged Harmful Substances.	Addresses measures for preventing pollution by packaged harmful substances (as defined in the International Marine Dangerous Goods (IMDG) code, which are dangerous goods with properties adverse to the marine environment, in that they are hazardous to marine life, impair the taste of seafood and/or accumulate pollutants in aquatic organisms) from regulated Australian vessels or foreign vessels, and specifies that: • The packing, marking, labelling and stowage of packaged harmful substances complies with Regulations 2 to 5 of MARPOL Annex III; • A copy of the vessel manifest or stowage plan is provided to the port of loading prior to departure; • Substances are only washed overboard if the Vessel Master has considered the physical, chemical and biological properties of the substance; and • Incidents involving discharges of dangerous goods are reported to AMSA.
IV	AMSA MO 96; Marine Pollution Prevention – Sewage.	Addresses measures for preventing pollution by sewage from regulated Australian vessels or foreign vessels, and specifies that: • An International Sewage Pollution Prevention (ISPP) certificate is required;

MARPOL Annex (entry into force in Australia)	**Commonwealth waters (POSPOPS Act 1983 & *Navigation Act* 2012)**	**General operating requirements**
Prevention of Pollution by Sewage from Ships (2004)		• The vessel is equipped with a sewage treatment plant (STP), sewage comminuting and disinfecting system and a holding tank approved by AMSA or a recognised organisation; • The discharge of sewage into the sea is prohibited, except when an approved STP is operating or when discharging comminuted and disinfected sewage using an approved system at a distance of more than 3 nm from the nearest land; and • Sewage that is not comminuted or disinfected has to be discharged at a distance of more than 12 nm from the nearest land.
V Prevention of Pollution by Garbage from Ships (1990)	AMSA MO 95; Marine Pollution Prevention – Garbage. * Not made under the *Navigation Act* 2012.	Addresses measures for preventing pollution by garbage from regulated Australian vessels or foreign vessels, and specifies that: • Prescribed substances (as defined in the IMO 2012 Guidelines for the Implementation of MARPOL Annex V) must not be discharged to the sea; • A Garbage Management Plan must be in place; • A Garbage Record Book must be maintained; • Food waste must be comminuted or ground to particle size <25 mm while en route and no closer than 3 nm from the nearest land (or no closer than 12 nm if waste is not comminuted or ground); and • It is prohibited to discharge wastes including plastics, cooking oil, packing materials, glass and metal.
VI Prevention of Air Pollution from Ships (2007)	AMSA MO 97; Marine Pollution Prevention – Air.	Addresses measures for preventing air pollution from regulated Australian vessels or foreign vessels, and specifies that: • An International Air Pollution Prevention (IAPP) certificate is in place; • An Engine International Air Pollution Prevention (EIAPP) certificate is in place for each marine diesel engine installed; • An International Energy Efficiency (IEE) certificate is in place; • Specifies that incineration of waste is permitted only through a MARPOL-compliant incinerator, with no incineration of Annex I, II and III cargo residues, polychlorinated biphenyls (PCBs), garbage containing traces of heavy metals, refined petroleum products and polyvinyl chlorides (PVCs); • Marine incidents are reported to AMSA; • Sulphur content of fuel oil is no greater than 3.5% m/m; • A bunker delivery note must be provided to the vessel on completion of bunkering operations, with a fuel oil sample retained; and • Emissions of ODS must not take place and an ODS logbook must be maintained.

2.5.4 World Bank Group EHS Guidelines (2015)

The *Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development* (World Bank Group, 2015) is a technical reference document with general and industry-specific examples of good international industry practice. These guidelines are applied when one or more members of the World Bank Group are involved in a project.

The document contains measures considered to be achievable in new facilities, using existing technology, at reasonable costs. The guidelines are designed to be tailored to the applicable hazards and risks established for a given project.

While the World Bank Group is not involved in financing or assessing this activity, control measures adopted for this activity that adhere to these guidelines can be referenced as examples of BPEM.

2.5.5 IOGP Best Practice Guidelines

The International Association of Oil & Gas Producers (IOGP) has a membership including companies that produce more than one-third of the world's oil and gas. The IOGP provides a forum where members identify and share knowledge and good practices to achieve improvements in health, safety, environment, security and social responsibility. The IOGP's aim is to work on behalf of oil and gas exploration and production companies to promote safe, responsible and sustainable operations. The IOGP's work is embodied in publications that are made freely available on its website (www.iogp.org).

The IOGP has developed the 'E&P Sound and Marine Life Programme' under its Joint Industry Program (JIP) (https://www.soundandmarinelife.org). The JIP supports research to help increase understanding of the effects of sound from the oil and gas industry on marine life. Research papers supported by the JIP are referenced throughout this EP as relevant.

At December 2020, IOGP's members comprise 82 members, comprising oil and gas exploration and production companies, associations and contractors. Beach is an IOGP member and the relevant guidelines have been referenced in this EP (and associated OPEP) to support the oil spill response strategies.

The paper *Recommended monitoring and mitigation measures for cetaceans during marine seismic survey geophysical operations* (IOGP & IAGC, March 2017) is referenced through this EP as necessary, and broadly recommends the same controls as those in the EPBC Act Policy Statement 2.1.

2.5.6 IPIECA: Best Practice Guidelines

IPIECA is the International Petroleum Industry Environmental Conservation Association, established in 1974 (since 2002, IPIECA stopped using the full title). At December 2020, IPIECA's members comprise 69 members, comprising oil and gas exploration and production companies, associations and contractors.

IPIECA's vision is for an oil and gas industry whose operations and products meet society's environmental and social performance expectations, with a focus on the key areas of climate and energy, environment, social and reporting. It develops, shares and promotes good practices and knowledge to help the industry improve its environmental and social performance. IPIECA's work is embodied in publications that are made freely available on its website (www.ipieca.org).

Relevant guidelines have been referenced in this EP (and associated OPEP) as relevant, primarily in the areas of atmospheric emissions and oil spill response and preparedness.

Beach has applied IPIECA's *Mapping the Oil and Gas Industry to the Sustainable Development Goals: An Atlas* (July 2017) to the activity. Goal 14 (Conserve and sustainably use the oceans, seas and marine resources for sustainable development) is the most relevant to this survey, and has been met by fulfilling the following:

- Incorporating environmental assessments into management plans – this EP satisfies this sub-goal; and
- Accident prevention, preparedness and response – the OPEP and OSMP demonstrate that Beach takes prevention, preparedness and response seriously and is well prepared to act in the event of an environmental emergency.

2.5.7 ITOPF Oil Spill Response Technical Information Papers

The International Tanker Owners Pollution Federation Limited (ITOPF) was established in 1968 to promote effective response to marine spills of oil, chemicals and other hazardous substances by providing five core services (spill response, claims analysis and damage assessment, information services, contingency planning and advice and training and education). Membership of ITOPF comprises owners or demise charterers of tankers, defined as any ship (whether or not self-propelled) designed, constructed or adapted for the carriage by water in bulk of crude petroleum, hydrocarbon products or other liquid substances.

ITOPF’s series of Technical Information Papers (relating to marine pollution, including the effects of oil pollution, contingency planning for marine oil spills and responding to oil spills assist the upstream petroleum industry in preparing for and responding to oil spills) have been referenced in this EP to support the oil spill response strategies.

2.6 Australian Industry Codes of Practice and Guidelines

There are few Australian industry codes of practice or guidelines regarding environmental management for offshore petroleum exploration. Those that do apply to the survey are briefly discussed in this section in chronological order.

None of these codes of practice or guidelines have legislative force in Australia (other than the EPBC Act Policy Statement 2.1) but are considered to represent BPEM. Aspects of each code or guideline relevant to the impacts and risks presented by the activity are described in the ‘demonstration of acceptability’ throughout Chapter 7.

2.6.1 Australian Ballast Water Management Requirements (2020)

The *Australian Ballast Water Management Requirements* (DAWR, 2020, version 8) detail the mandatory ballast water management requirements and provide information on ballast water pump tests, reporting and exchange calculations. The measures outlined in this EP are designed to minimise the risk of introducing harmful aquatic organisms into Australian waters.

2.6.2 National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (2017)

The *National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna* (DoEE, 2017a) provides a framework for identifying megafauna species (principally whales, dolphins, turtles and whale sharks) most at risk from vessel collision and outlines mitigation measures to reduce this risk.

The measures outlined in this EP are designed to minimise the risk of colliding with megafauna.

2.6.3 Australian National Guidelines for Whale and Dolphin Watching (2017)

The *Australian National Guidelines for Whale and Dolphin Watching* (DoEE, 2017b) principally apply to commercial marine tourism operations involves in whale and dolphin watching, outlining measures to comply with the EPBC Act and minimise disturbance to these cetaceans.

In the context of this activity, Beach applies these guidelines to the support vessels so that approach distances to cetaceans are adhered to.

2.6.4 National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (2009)

The *National Biofouling Management Guidance for the Petroleum Production and Exploration Industry* (DAFF, 2009) provides a generic approach to a biofouling risk assessment and practical information on managing biofouling on hulls and niche areas.

The measures outlined in this EP are designed to minimise the risk of introducing harmful aquatic organisms into Australian waters.

2.6.5 APPEA Code of Environmental Practice (2008)

In Australia, the petroleum exploration and production industry operates within an industry code of practice developed by the Australian Petroleum Production and Exploration Association (APPEA); the *APPEA Code of Environmental Practice* (CoEP) (APPEA, 2008). This code provides guidelines for activities that are not formally regulated and have evolved from the collective knowledge and experience of the oil and gas industry, both nationally and internationally.

The APPEA CoEP covers general environmental objectives for the industry, including planning and design, assessment of environmental risks, emergency response planning, training and inductions, auditing and consultation, and communication. For the offshore sector specifically, it covers issues relating to geophysical surveys, drilling and development and production.

The APPEA CoEP has been used as a reference for the EIA (Chapter 7 of this EP) to ensure that all necessary environmental issues and controls for petroleum exploration have been incorporated into the management of this activity.

2.6.6 National Strategy for Ecologically Sustainable Development (1992)

The National Strategy for Ecologically Sustainable Development (ESDSC, 1992) defines the goal of Ecologically Sustainable Development (ESD) as "*development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends*." Section 3A of the EPBC Act defines the principles of ESD as:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations;
- 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;
- The principle of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;
- The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making; and
- Improved valuation, pricing and incentive mechanisms should be promoted.

Ensuring that any petroleum activity is undertaken in a manner consistent with the ESD principal is a core aim of the OPGGS(E) and it has been taken into consideration in the demonstrations of acceptability in this EP (see Section 6.5.1).

3. Activity Description

This chapter provides a description of the activity in accordance with the requirements of Regulation 13(1) of the OPGGS(E).

3.1 Activity Definition

The White Ibis-1, Trefoil-1 and Yolla-1 wells are suspended, isolated from hydrocarbon zones and managed in accordance with the White Ibis-1, Trefoil-1 and Yolla-1 WOMP (CDN/ID 12348708).

In accordance with Regulation 4(1) of the OPGGS(E), this EP applies to a defined 'petroleum activity.' Beach defines this petroleum activity as the:

> *Continuing non-production (suspended) operations phase of the White Ibis-1, Trefoil-1 and Yolla-1 wells, which is restricted to the physical presence of the wells and the routine monitoring of their integrity.*

In accordance with OPGGS(E) Regulation 19(1), this EP remains valid for 5 years from the date of acceptance.

This EP does not address plug and abandonment (P&A) and decommissioning of the wells (see Section 3.8 for further details).

3.2 Activity Location

Yolla-1 is approximately 1.27 km from the Yolla-A platform. White Ibis-1 and Trefoil-1 are located 50 km and 38 km from the Yolla-A platform, respectively, and approximately 10 km apart (see Figure 1.1). The well locations and water depths are provided in Table 3.1. Approximate distances to nearby key features are provided in Table 3.2.

Table 3.1. Well location coordinates and water depths

Well Name	Permit	Latitude	Longitude	Water depth	Drilled	Drilled by
White Ibis-1	T/LR4	39° 57' 49.60" S	145° 15' 17.23" E	61.9 m	1998	Premier Oil Australasia
Trefoil-1	T/LR2	39 °51' 44.12" S	145° 22' 30.73" E	68.9 m	2004	Origin Energy Ltd
Yolla-1	T/L1	39 °50' 18.89" S	145° 48' 20.55" E	79.0 m	1985	Amoco Australia Petroleum Company

Latitude and longitude are represented as surface coordinates. Water depths are approximate measured from mean sea level (msl) to the seabed.

Table 3.2. Approximate distances between the wells and key features

Feature	Distance and direction from White Ibis-1	Distance and direction from Trefoil-1	Distance and direction from Yolla-1
Towns			
Stanley (Tas)	89 km south	99 km south	111 km southwest
Narracoopa (Tas - King Island)	97 km west	107 km west	144 km west
Cape Paterson (Vic)	146 km north	134 km north	130 km north
Natural Land Features			
Cape Liptrap (Vic)	103 km northeast	116 km northeast	92 km northeast
Wilsons Promontory (Vic)	131 km northeast	116 km northeast	91 km northeast

Feature	Distance and direction from White Ibis-1	Distance and direction from Trefoil-1	Distance and direction from Yolla-1
Nearest Tasmanian mainland	83 km southwest	95 km southwest	108 km southwest
King Island (Tas)	95 km west	106 km west	143 km west
Marine Protected Areas			
Boags Australian Marine Park (AMP)	Overlapped by EMBA	36 km southwest	66 km southwest
Beagle AMP	119 km northeast	106 km northeast	70 km northeast
Franklin AMP	96 km southwest	111 km southwest	142 km southwest
Subsea Infrastructure			
Nearest oil or gas producing well (Yolla-A platform)	50 km east	38 km east	1.21 km south
Subsea telephone cable – Bass Strait 1 (Sandy Point to Boat Harbour)	53 km east	44 km east	7.7 km
Subsea telephone cable – Bass Strait 2 (Inverloch to Stanley)	16.6 km east	8 km east	28 km west

3.3 Activity Area

The activity area is defined as:

A 500-m radius around each of the White Ibis-1, Trefoil-1 and Yolla-1wellheads.

Each of these activity areas equates to an area of 78.55 ha (0.7855 km^2).

3.4 Activity Timing

Well inspection frequencies are provided in the Well Integrity Standard (CDN/ID 7726350). An internal risk review was undertaken by Beach (on 30 July 2020) to assess the frequency of the wellhead inspections. Given the risk of a hydrocarbon leak from the suspended wells is considered as low as reasonably practicable (ALARP), the frequency of inspections was determined to be 3-yearly (as endorsed by the Beach General Manager Victorian Operations on 11 August 2020).

The most recent inspections were undertaken in April 2019, and the next planned routine visual inspection is expected to occur February 2022 in accordance with the planned activity schedule (Q1 2022). Inspections are coordinated through the Computerised Maintenance Management Systems.

It is recognised that subsea well inspections may be conducted in conjunction with other subsea inspections (e.g., Yolla-A sub-structure and pipeline inspections). Under those circumstances, the actual well inspection frequency may be more frequent than 3-yearly.

Each inspection voyage is expected to take 1-3 days to complete, with the duration dependent on a number of factors, including weather conditions.

3.5 Well Designs

Detailed technical specifications of each well are provided in the WOMP (CDN/ID 12348708). This information is summarised in this chapter, including well casing design, well barrier schematics and an overview of well integrity.

3.5.1 Casing Design

Casing data for White Ibis-1, Trefoil-1 and Yolla-1is provided in Table 3.1.

Well casing and completion schematics are provided in Figure 3.1, Figure 3.2 and Figure 3.3.

Table 3.3. Well casing data

Type of Casing	Size (inches)	Weight (ppf)	Grade	Thread	Shoe Depth
White Ibis-1					**(m MDKB)**
Conductor	30	310	X-52	ST2	130.60
Surface casing	13.75	68	L80	New VAM	554.5 (bottom)
Surface casing	13.75	67	L80	BTC	863
Production casing	9.625	53.50	L80	VAM Ac	1,878
Trefoil-1					**(m MDRT)**
Conductor	30/20	310/129	X-52/X-56	Leopard/RL4S	215.05/657.25
Surface casing	13.75	54.5	K55	BTC	657.25
Production casing	9.625	43.5	L80	VAM Top	2,420.94
Production liner	6.625	24	L80	Fox K	3,458.00
Production liner top	-	-	-	-	2,272.15
Yolla-1					**(m MDRT)**
Conductor	30	310	X-52	NS-60	189
Surface casing	20	129/94	X-56	Drill-Quip S-60	399
Intermediate casing	13.375	68/72	N-80	BTC	1,752
Production casing	9.625	47	N-80	BTC	3,339

Hyphen denotes lack of data available.

3.5.2 Cement Plugs

Summary data on cement plugs for White Ibis-1, Trefoil-1 and Yolla-1is provided in Table 3.4.

More detailed information on cement plugs is available in Appendix E of the WOMP (CDN/ID 12348708).

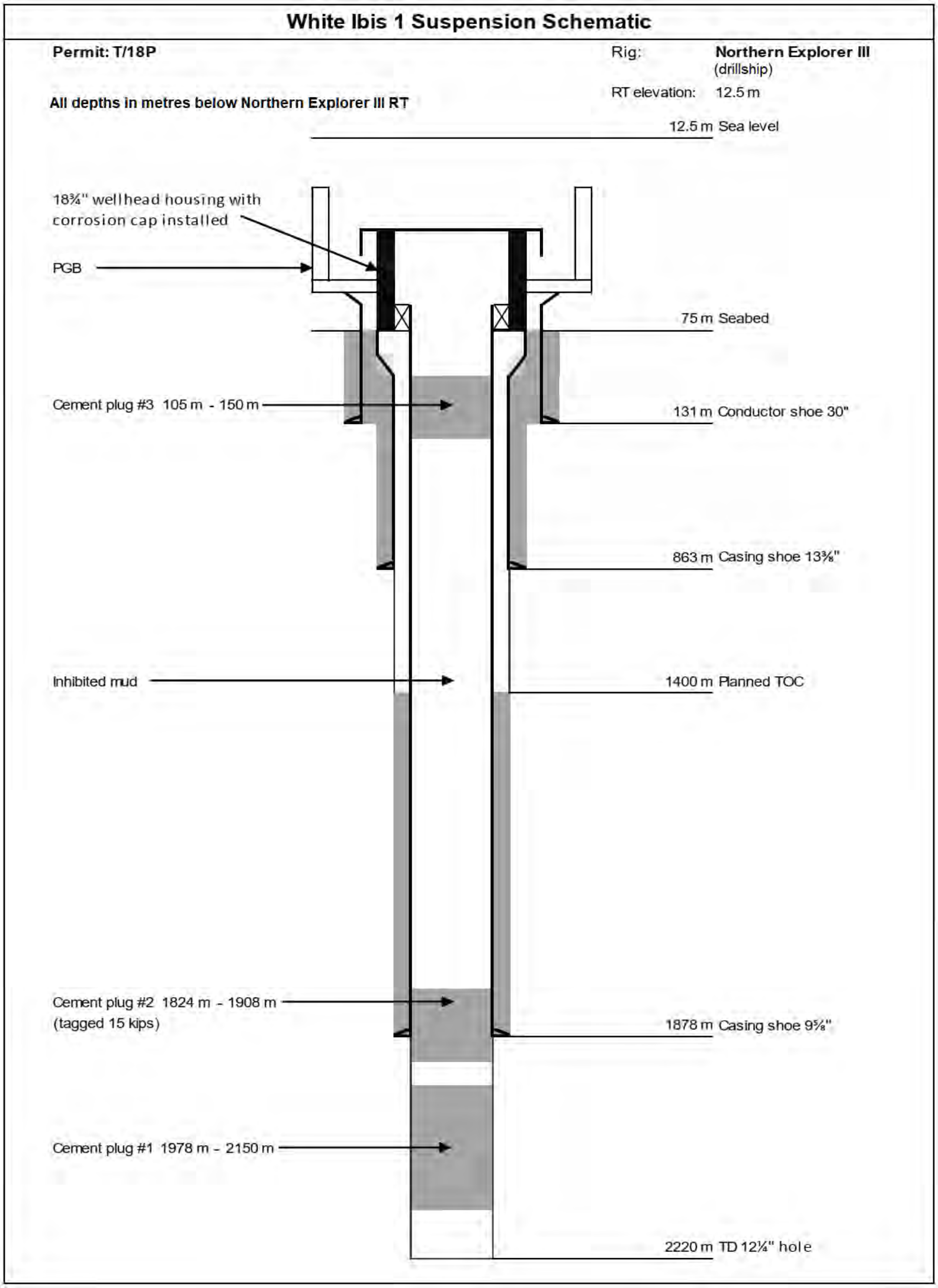


Figure 3.1. White Ibis-1 well completion schematic

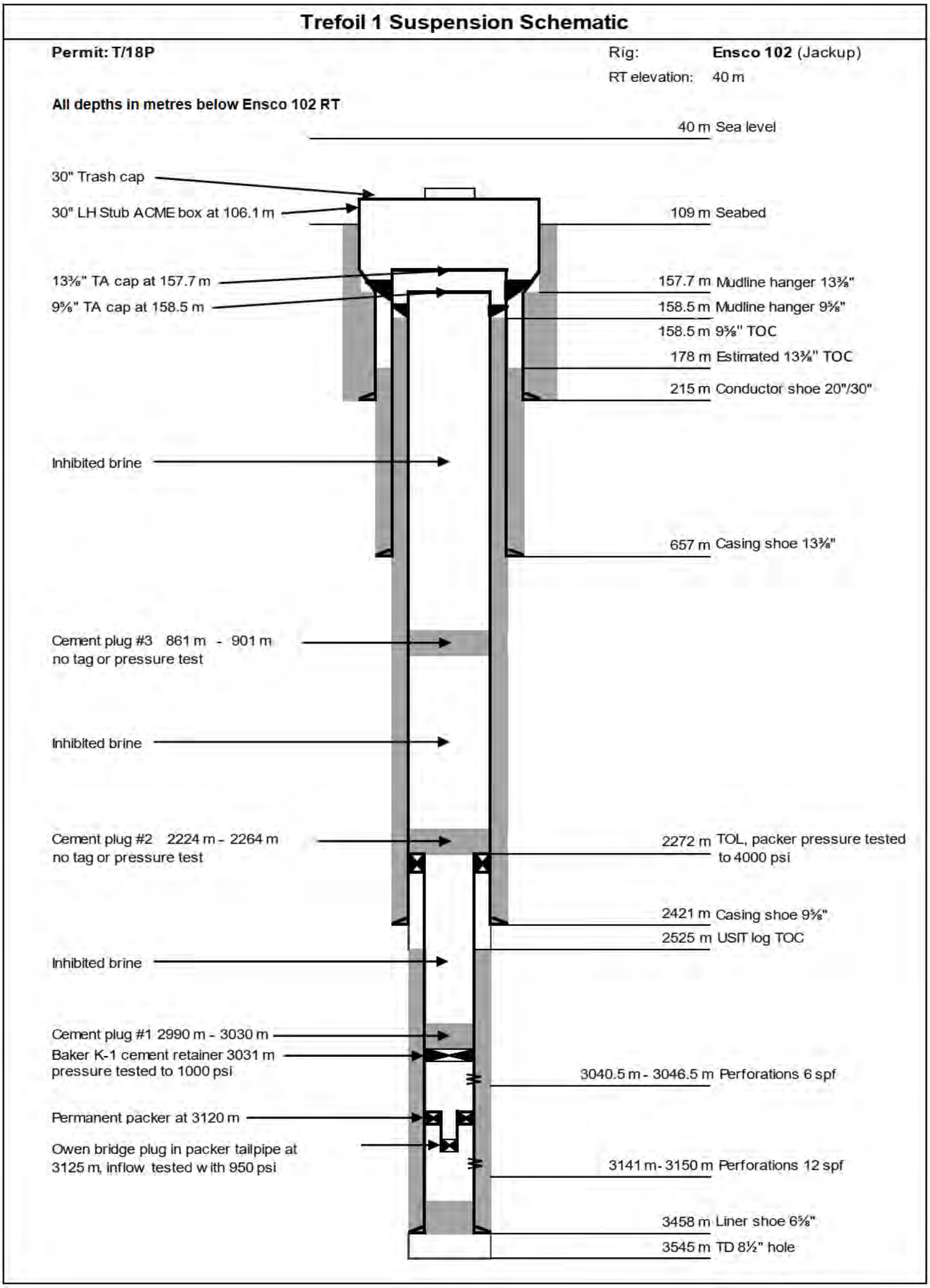


Figure 3.2. Trefoil-1 well completion schematic

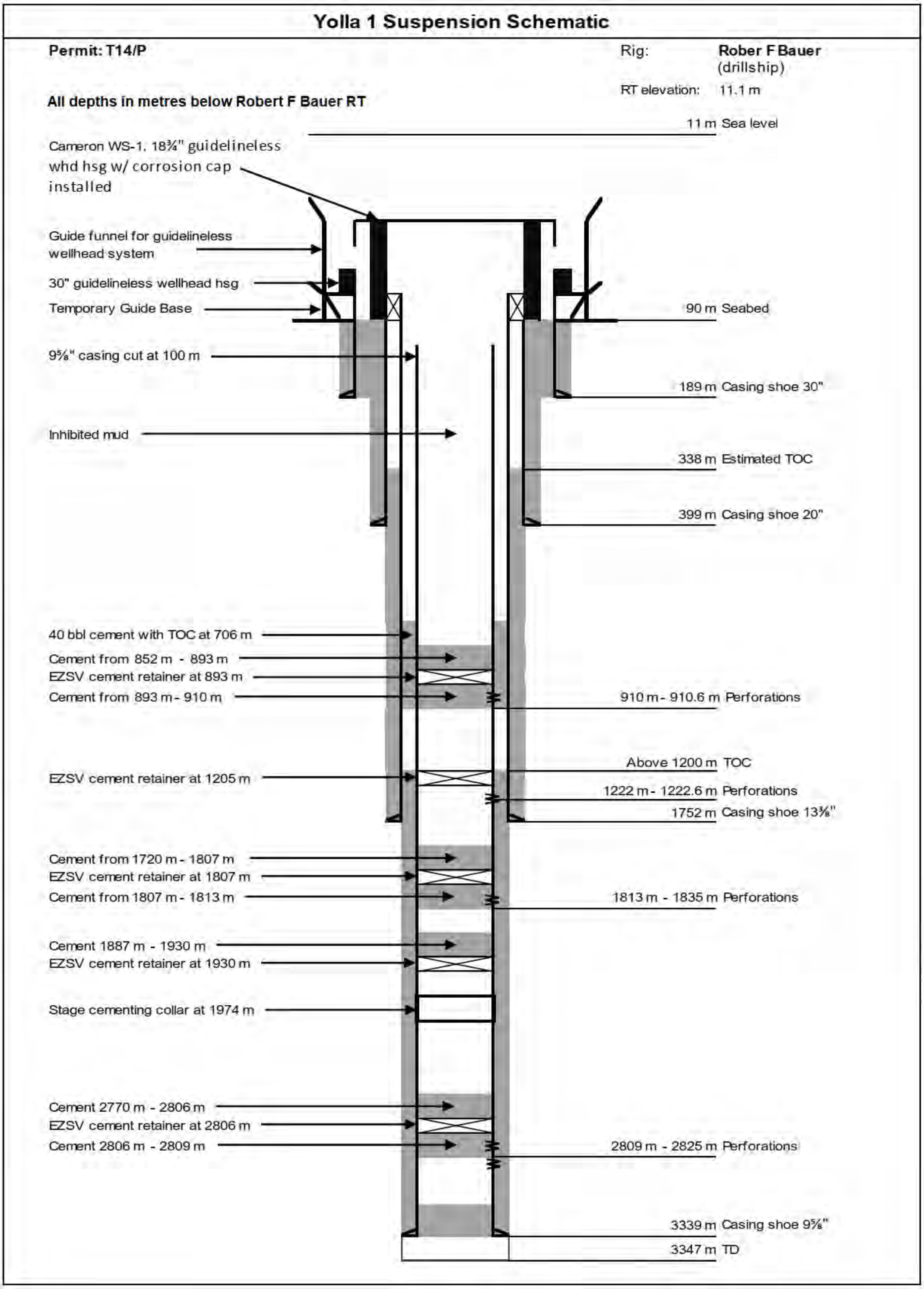


Figure 3.3. Yolla-1 well completion schematic

Table 3.4. Cement plugs data

Plug No.	Cement sacks	Cement			Top Depth (m)	Bottom Depth (m)	Total Plug Depth (m)	Pressure Test	Pressure (psi)	Tag	Weight (lb)
		Barrels	Class	Density							
White Ibis-1											
3	50	10.5	G	15.8	105	150	45	No	-	No	-
2	163	33.5	G	15.8	1,824	1,908	84	No	-	Yes	15,000
1	560	114.8	G	15.8	1,978	2,150	172	No	-	No	-
Trefoil-1											
3	37	10	HTB	15.8	861	901	40	No	300	No	-
2	37	10	HTB	15.8	2,224	2,264	40	No	-	No	-
1	17	4.5	HTB	15.8	2,990	3,030	40	No	-	No	-
Yolla-1											
4	265	54	G	15.8	852	893	41	No	-	No	-
3	200	41	G	15.8	1,720	1,807	87	Yes	2,000	No	-
2	205	42	G	15.8	1,887	1,930	43	No	-	Yes	5,000
1	-	-	-	-	2,770	2,806	36	No	No	-	-

High-Temperature Blend (HTB) is Class G cement plus 35% silica flour by weight of cement.
A hyphen denotes no data available.

3.5.3 Temporary Abandonment Caps

All three wells were TA in accordance with regulations in force at the time of drilling. A summary of the TA caps is in provided in this section. For more detailed information on the TA caps for each well refer to Appendix D of the WOMP (CDN/ID 12348708).

<u>White Ibis-1</u>

The wellhead is set in a depression created by the 36″ (91.4 cm) hole drilling operations. This depression was filled with cuttings and possibly cement during the 3″ (7.6 cm) and 13⅜″ (34 cm) casing cementing operations which at the time buried the wellhead and was subsequently removed to allow the blowout preventer to be landed on the wellhead. Photo 3.3 and Photo 3.4 show that the wellhead has since been buried by sediments over time, with the only components visible above the seabed being the top 1.2 m of the four guide posts (see Photo 3.1) on the permanent guide base and the receptacle for the handling tool (see Photo 3.2) on the corrosion cap.

<u>Trefoil-1</u>

Two 9⅝ inch (24.4 cm) and 13⅜″ TA caps were installed in the respective mud line hangers. The 9⅝″ cap was pressure tested (before disconnecting the drill string) to 300 psi to confirm the caps were mechanically in place.

Prior to the drill rig departing location, a further 41 bbl of cement was pumped into the 36′′ by 30′′ (76.2 cm) annulus at the seabed, after top of cement was tagged at 111 m (2 m below seabed), and a non-sealing trash cap (Photo 3.3) was placed on the 30′′ stump at 106 m, 3 m above the seabed (Photo 3.4).

<u>Yolla-1</u>

The Yolla-1 wellhead consists of a flowbase framework surrounding the wellhead conductor (Photo 3.5). A debris cap is securely installed (Photo 3.6).

Photo 3.1. White Ibis-1 conductor and guide posts

Photo 3.2. Close-up of the White Ibis-1 conductor

Photo 3.3. Trefoil-1 debris cap

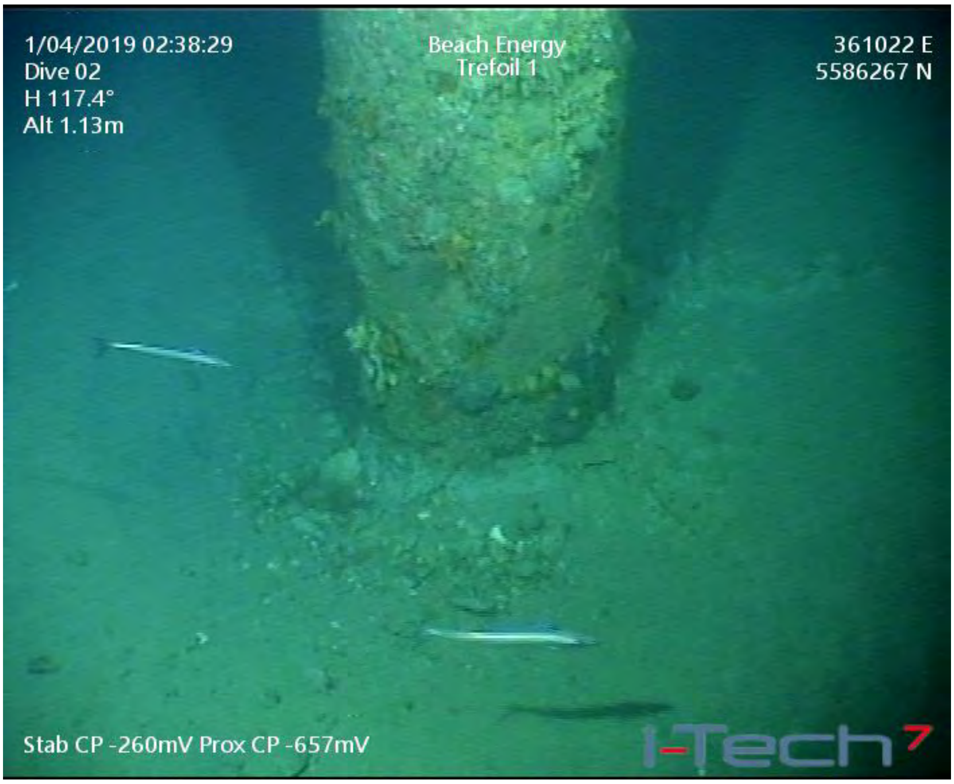


Photo 3.4. Trefoil-1 conductor seabed interface

Photo 3.5. Yolla-1 wellhead overview

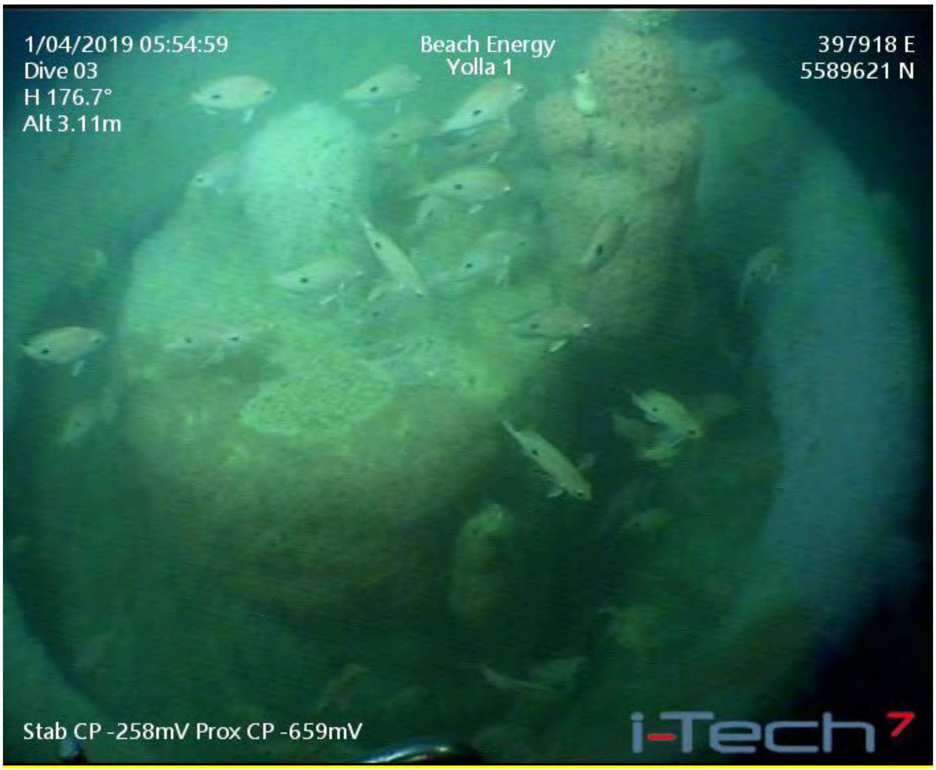


Photo 3.6. Yolla-1 debris cap (with marine growth)

3.6 Well Integrity

3.6.1 Risks to Well Integrity

The risk assessments undertaken by Beach in 2016 and 2017 identified that a loss of well integrity could be caused by well barrier failure or damage to the seabed infrastructure as a result of internal and external corrosion, impacts from ROV during inspections and anchoring and storms, currents or earthquakes.

Damage from commercial fishing is not considered credible given the low fishing effort in the area and the type of fishing methods (see Section 5.7.6).

3.6.2 Status of Wells

Origin Energy commissioned an independent review of the integrity of the wells in May 2015 (which was subsequently updated in March and April 2017 by a third party well examiner) to evaluate the well barrier currently in place. This assessment noted that the risk of a hydrocarbon leak from the White Ibis-1, Trefoil-1 and Yolla-1wells in their suspended state is considered as low as reasonably practicable (ALARP) because:

- Each well contains primary and secondary barriers (cement plugs);
    - Trefoil-1 – the hydrocarbon zones below 2,735 m have been adequately isolated in accordance with regulations at the time. In the wellbore, the bridge plug set at 3,030 m and cement plug #1 provide a verified barrier. In the annulus, the verified 210 m cement column above 2,735 m and the pressure tested liner top packed coupled with the 9⅝" casing provide a verified barrier.
    - White Ibis-1 - the 30" conductor and 13⅜" surface casing were cemented to the seabed, and three plugs were set in the open hole below the 9⅝" casing. The risk of fluids escaping from the uncemented 12¼" hole in the event of wellhead removal is low due to the poor quality of the sandstones in this interval, the absence of hydrocarbons and the reactive nature of the claystones, which prevented the passage of logging tools.
    - Yolla-1 – the interval where hydrocarbons were recorded (Angahook formation) has been adequately isolated by the 13⅜" casing and cement column that extends from 1,752 m to 338 m. Further plugs were set inside the 9⅝" casing. There are no uncemented annuli that extend to the seabed.
- The inspection program is in place;
- The wells are filled with inhibited solutions;
- Well locations have been communicated to the Australian Hydrographic Office (AHO) for inclusion on navigation maps; and
- Beach has a Simultaneous Operations (SIMOPS) process in place for all future overlapping drilling and completions activities.

Subsea inspections using a remotely operated vehicle (ROV) were conducted for all three wells in October 2014, January 2017 and April 2019, with no visible hydrocarbon leaks or well integrity issues identified.

A review of Beach's historical incident records indicated no incidents related to loss of hydrocarbons have occurred, as reported during the 2017 and 2019 routine inspections. Up to the end of 2020, the wells have been in place for between 16 and 36 years without incident. For these reasons, the loss of containment from the wells (i.e., a well blowout) in their suspended state is not considered credible. It is therefore proposed that the wells remain suspended until P&A and decommissioning takes place, which is currently anticipated to be in 2024 (see Section 3.8).

3.7 Operational Details

Well integrity is monitored by either general visual inspection (GVI) or close visual inspection (CVI) in accordance with the WIMP (CDN/ID 7726350). The WIMP requires GVIs to be conducted to detect or observe damage, distortion or deformation or significant debris; and report any evidence of well fluid leaks. The findings of a GVI may lead to the initiation of further investigations such as CVI or more specialised inspections. Monitoring of the suspended wells is integral in ensuring that the wells remain in a suitable condition to allow for successful future P&A and decommissioning (i.e., ensuring the TA caps remain in place and corrosion is kept to a minimum).

The GVI and CVI inspections are undertaken using a remotely operated vehicle (ROV) operated from a vessel using qualified contractors that are managed in accordance with Beach's Operations Excellence Management System (OEMS). All contractors are subject to pre-qualification to ensure that their HSE Management System is adequate for meeting their legal obligations and has identified the significant risks and control measures related to the scope of work being undertaken for Beach.

Activities outside of the activity area (e.g., vessel transiting to/from port and the activity area) is not managed under this EP and is subject to relevant maritime regulations and associated requirements.

3.7.1 Vessel Operations

The activity will be undertaken using an inspection support vessel (ISV) sourced locally or from a foreign port.

The exact type, origin and size of vessel is expected to be similar to the MV *Tek-Ocean Spirit* (Photo 3.7) used as the Yolla-A Platform supply vessel (PSV) and the MV *Sapura Constructor* that was used during Beach's Otway Phase 3 development (Photo 3.8).

The ISV is not likely to anchor on location during the activity; rather it will use dynamic positioning (DP) or similar station keeping systems to maintain position while undertaking the activities. All vessel-based activities will be undertaken on a 24-hour basis.

Photo 3.7. MV *Tek-Ocean Spirit* platform supply vessel

Photo 3.8. MV *Sapura Constructor* offshore construction vessel

The ISV will be fuelled by MDO with refuelling to take place from its home port or suitable port near the activity area (e.g., Port of Hastings, ports within Corner Inlet or Port of Burnie). No vessel refuelling is planned to take place in the activity area.

3.7.2 ROV Operations

A subsea ROV will be deployed from the ISV to perform GVI/CVI and leak testing activities. The type of ROV will either be an observation class or work class ROV.

Specialist ROV contractors will operate the ROV during the inspections. These inspections are undertaken in accordance with ROV contractor procedures, supplemented by project-specific procedures, as required.

A tether containing power and communication cables will physically connect the ROV to the ISV. The ROV will be a light work-class ROV and carry several pieces of survey equipment, including:

- Cameras and LED lights to capture images and video of the wellheads and immediate surrounding environment;
- A water jet and vacuum pump to clear away marine growth that may be present and inhibiting inspection activities; and
- Water sampler to detect gas/hydrocarbons in the water column.

The duration of the inspection and leak testing activities will take between 1 -2 hours per wellhead (a combined total of 6 hours excluding vessel mobilisation, setup, transit and demobilisation) with the combined duration of the inspection program expected to take no longer than 1-3 days.

During leak testing, the ROV will collect water samples if gas bubbles are observed to emerge from the wellheads. Samples will be taken in the water column (above the wellhead) to a horizontal distance of approximately 10 m from the wellhead.

3.7.3 Side Scan Sonar Operations

In the event that visual identification cannot be made of a wellhead location, side scan sonar (SSS) may be used.

SSS is a hydro-acoustic technique used to detect hazards such as pipelines, lost shipping containers, boulders, debris, unmarked wrecks, reefs and craters. It is undertaken by towing a sonar tow-fish over the activity area. The tow-fish is equipped with a liner array of transducers that emit and later receive an acoustic energy pulse in a specific frequency range.

For this activity, the SSS is likely to be a high-resolution single beam sonar head. This will generate underwater noise of short duration (approximately 5 minutes per wellhead) operating at frequencies typically between 100 Hz to 500 Hz.

3.8 Future Activities

A review of the suspension status of the three wells was conducted in 2017 by Petrofac Well Engineering (Petrofac) against the UK Health and Safety Executive and Oil & Gas UK (OGUK) guidelines (as referenced in NOPSEMA guidance notes for well integrity). This review provided a recommendation to permanently plug and abandon (P&A) the wells.

Beach acknowledges that the default position through Section 572 (*Maintenance and removal of property etc. by titleholder*) of the OPGGS Act and NOPSEMA Policy Section 572 Maintenance and Removal of Property (N-00500-PL1903, A720369, November 2020) is for removal of all structures, equipment and property when it is no longer being used for the purposes of petroleum production. Any deviations from this position (i.e., retention of seabed equipment) will need to be evaluated by Beach and approved by NOPSEMA. Beach will incorporate the requirements of this policy into the P&A concept study.

Beach is currently developing a strategy to P&A and decommission the wells to international best practice. It is anticipated that this review will be completed by Q4 2021. Beach is currently planning that the suspended wells will be P&A during a future drilling campaign, likely to be during 2024 (when a drilling rig is available in the region for other Beach projects), either as part of the Trefoil production wells drilling campaign, or combined with the decommissioning of the BassGas Development.

3.8.1 Decommissioning Environmental Approvals

The former Commonwealth Department of Industry, Innovation and Science (DIIS) (now the Department of Industry, Science, Energy and Resources, DISER) released an Offshore Petroleum Decommissioning Guideline (January 2018). This, and future revisions of the guideline, will be taken into account during the P&A planning process.

The timeframe allocated to planning for decommissioning allows for the preparation of a decommissioning EP and to have it assessed by NOPSEMA sufficiently in advance of activities commencing to ensure the EP is accepted prior to activities commencing.

Issues likely to be explored in the decommissioning EP (and addressed through the stakeholder consultation process) include:

- Decommissioning options (leave wellheads and guide posts in situ vs complete removal vs partial removal);
- If equipment is left in situ;
    - Ongoing monitoring requirements.
    - Impacts to commercial fisheries of remaining infrastructure.
- Re-purposing of decommissioned infrastructure to create marine habitat for recreational fishers and divers, either in situ or moved to more accessible location/s; and
- Opportunities for using the wells for carbon sequestration.

4. Stakeholder Consultation

In keeping with Beach's Community and Stakeholder Engagement Policy (Figure 4.1), Beach is committed to open and ongoing engagement with the communities in which it operates and providing information that is clear, timely, relevant and easily understandable. Beach welcomes feedback and is continuously endeavouring to learn from experience in order to manage its environmental and social impacts and risks.

In addition to Beach's Community and Stakeholder Engagement Policy, stakeholder consultation has been undertaken in accordance with the OPGGS(E) requirements and NOPSEMA's stakeholder consultation guidance.

Community and Stakeholder Engagement Policy

1. Policy Introduction

This policy outlines Beach's commitment to engage with its stakeholders to ensure that it develops positive relationships with communities within which it operates. This policy applies in all joint venture operations where Beach is the operator. This policy should be read together with other policies including the Aboriginal Engagement Policy and the Environmental Policy.

2. Scope

This policy applies to all Beach's directors, officers and employees.

3. Position statement

Beach is committed to open and transparent communication with its stakeholders and recognises that its business success is contingent upon building respectful and mutually beneficial relationships while effectively managing its operations. Beach will take the time to listen, understand, give due consideration and respond to the interests and concerns of its stakeholder groups. Beach's aim is to be seen as the operator of choice for its stakeholders, and that its presence in the community is welcomed as a positive experience.

Stakeholders include, but are not limited to, landholders, Aboriginal communities, communities in which Beach operates, interest groups and government.

4. Policy commitment

Beach is committed to:

- Acknowledging that local communities are stakeholders in all operations, that there will be access to reliable and timely information about exploration and development activities and transparent, sincere and respectful consultation with them prior to, during and after operations.
- Clearly communicating the goals and parameters for stakeholder engagement.
- Understanding the social, environmental and economic effects of Beach's activities while delivering business outcomes.
- Seeking to understand stakeholder values, interests and concerns with relevant business operations and in a timely manner address these and deliver on any agreed support or commitments.
- Ensuring its employees and contractors are aware of their obligations toward the protection of local community culture and relationships and the environment.
- Contributing to the community by local employment and engagement of local contractors and suppliers where appropriate and possible.
- Participating in community events where appropriate; and
- Communicating frequently and effectively through a number of means including public meetings, stakeholder forums, its website, annual report, road shows and one-on-one meetings.

Figure 4.1. Beach's Community and Stakeholder Engagement Policy

4.1 Stakeholder consultation objectives

The objectives of Beach's stakeholder consultation in preparation of EPs are to:

- Engage with stakeholders in an open, transparent, timely and responsive manner, building on existing relationships;
- Minimise community and stakeholder concerns where practicable;
- Build and maintain trust with stakeholders; and
- Demonstrate that stakeholders have been appropriately consulted.

These objectives are achieved by:

- Identifying and confirming 'relevant persons' (those whose functions, interests or activities may be affected by the activity);
- Ensuring relevant persons are informed about the survey and its environmental and social impacts and risks;
- Providing informative, accurate and timely information;
- Ensuring affected relevant persons are informed about the process for consultation and that their feedback is considered in the EP; and
- Ensuring that issues raised by relevant persons are adequately assessed, and where requested or relevant, responses to feedback are communicated back to them.

4.2 Regulatory requirements

Section 280 of the OPGGS Act states that a person carrying out activities in an offshore permit area should not interfere with other users of the offshore area to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the first person.

In relation to the content of an EP, more specific requirements are defined in the OPGGS(E) Regulation 11(A). This regulation requires that the Titleholder consult with 'relevant persons' in the preparation of an EP. A 'relevant person' is defined in Regulation 11A(1) as:

1. Each Department or agency of the Commonwealth to which the activities to be carried out under the EP, or the revision of the EP, may be relevant;
2. Each Department or agency of a State or the Northern Territory to which the activities to be carried out under the EP, or the revision of the EP, may be relevant;
3. The Department of the responsible State Minister, or the responsible Northern Territory Minister;
4. A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP, or the revision of the EP; and
5. Any other person or organisation that the titleholder considers relevant.

In this EP, relevant persons may be interchangeably referred to as stakeholders.

Further guidance regarding the definition of functions, interests or activities is provided in NOPSEMA Bulletin #2 *Clarifying statutory requirements and good practice consultation* (November 2019), as follows:

- Functions – a person or organisation's power, duty, authority or responsibilities;

- Activities – a thing or things that a person or group does or has done; and
- Interests – a person or organisation's rights, advantages, duties and liabilities; or a group or organisation having a common concern.

Regulation 14(9) of the OPGGS(E) also defines a requirement for ongoing consultation to be incorporated into the Implementation Strategy defined in the EP. In addition, Regulation 16(b) of the OPGGS(E) requires that the EP contain a summary and full text of this consultation.

Amendments to the OPGGS(E) that took effect on the 25th of April 2019 also specify (in Regulation 9AB) that the complete EP will be published on the NOPSEMA website within five days of submission to NOPSEMA (subject to the EP satisfying a completeness check).

4.3 Stakeholder Identification

Beach has identified and consulted with relevant persons whose functions, interests or activities may be affected by the activity, as well as those who Beach deems necessary to keep up to date with the activities in Bass Strait. Table 4.1 identifies these stakeholders.

Table 4.1. Stakeholders consulted for the non-production well operations EP

Category 1 – Department or agency of the Commonwealth to which the activities to be carried out under the EP may be relevant	
Director of National Parks (DNP)	Australian Fisheries Management Authority (AFMA)
Australian Communications and Media Authority (ACMA)	Australian Hydrographic Office (AHO)
Australian Maritime Safety Authority (AMSA) (Joint Rescue Coordination Centre (JRCC)	Department of Agriculture, Water and the Environment (DAWE)
Category 2 – Each Department or agency of a State to which the activities to be carried out under the EP may be relevant	
Victoria	
Department of Jobs, Precincts and Regions (DJPR): - Earth Resources Regulation (ERR)	Victorian Fisheries Association (VFA)
Tasmania	
Department of Primary Industries, Parks, Water and Environment (DPIPWE)	
Category 3 – The Department of the responsible State Minister	
N/A – Commonwealth waters only.	
Category 4 – A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP	
Fisheries - Commonwealth	
Southern Shark Industry Alliance (SSIA)	Commonwealth Fisheries Association (CFA)
Sustainable Shark Fishing Association (SSFA)	Tuna Australia – ETBF Industry Association
South-east Trawl Fishing Industry Association (SETFIA)	Australian Southern Bluefin Tuna Industry Association (ASBTIA)
Bass Strait Scallop Industry Association (BSSIA)	
Fisheries - Victorian	
Seafood Industry Victoria (SIV)	Victorian Recreational Fishing Peak Body (VR Fish)

Fisheries – Tasmanian	
Tasmanian Association for Recreational Fishing	Tasmanian Rock Lobster Fisherman's Association
Tasmanian Abalone Council Limited	Tasmanian Seafood Industry Council (TSIC)
Southern Rock Lobster Limited (SRL) (SA, VIC, TAS).	T.O.P. Fish Tasmania
Infrastructure asset owners	
Alcatel Submarine Networks UK LTD	Aquasure (Victorian Desalinisation Plant)
Telstra	Toll Group
Spirit of Tasmania	Marinus Link
Other organisations	
Ocean Racing Club of Victoria	SCUBA Divers Federation of Victoria
Category 5 – Any other person or organisation that the Titleholder considered relevant	
Not applicable.	

Note that consultation with contractors to Beach who will assist with undertaking the activity is not addressed in this section of the EP. This includes organisations that Beach has a contract or agreement with for assistance in the event of oil spill response or operational and scientific monitoring. Discussions with these organisations that are not directly linked to the activity are not included in the summary of stakeholder consultation in Section 4.5.

Where discussions with these organisations have assisted in the development or refinement of oil spill response strategies described in the OPEP, then these have been incorporated. The 'functions, interests or activities' of these organisations are only triggered in an emergency response. Consultation with these contractors and organisations is undertaken in accordance with Regulation 14(5) of the OPGGS(E), which requires 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 this EP and has the appropriate competencies and training. This is detailed in Section 8.5.1 of the EP.

Beach recognises that the relevance of stakeholders identified in this EP may change in the event of a non-routine event or emergency. Every effort has been made to identify stakeholders that may be impacted by a non-routine event or emergency, the largest of which is considered a Level 2 or 3 MDO spill from the ISV (see Section 7.13).

4.4 Engagement Approach

Beach applies the approach set out in the International Association for Public Participation (IAP2) spectrum, which is considered best practice for stakeholder engagement. In order of increasing level of public impact, the elements of the spectrum and their goals are:

- Inform – to provide the public with balanced and objective information to assist them in understanding the problems, alternatives and/or solutions.
- Consult – to obtain public feedback on analysis, alternatives and/or decisions.
- Involve – to work directly with stakeholders throughout the process to ensure that public concerns and aspirations are consistently understood and considered.
- Collaborate – to partner with the public in each aspect of the decisions, including the development of alternatives and the identification of the preferred solution.

- Empower – to place final decision-making in the hands of the stakeholders.

The manner in which Beach has informed, consulted and involved stakeholders with the activity are outlined through this section.

Under the regulatory regime for the approval of EPs, the decision maker is the regulator. This being the case, the final step in the IAP2 spectrum, 'Empower', has not been adopted. Given the relatively limited scope of the activities and potential impacts identified in this EP, it is not expected that engagement beyond 'Inform' and 'Consult' would be requested by stakeholders in the preparation of this EP. However, Beach has offered and will remain available to meet with stakeholders and will collaborate to minimise any potential impacts.

Beach has a strategic and systematic approach to stakeholder engagement, which aims to foster an environment where two-way communication and ongoing, open dialogue is encouraged to build positive relationships. Key principles that guide Beach in its stakeholder engagement are outlined in its Community and Stakeholder Engagement Policy (see Figure 4.1).

Beach has a good record of engaging with its stakeholders including regulators, local communities, local councils, community groups and fishing industry associations.

4.5 Engagement Methodology

The tools and methods that have been and will continue to be used for stakeholder engagement are:

- **Project Information Sheet** – this was issued to most relevant persons on the 6thApril 2021 and provided information on the activity, location and timing on inspections (Appendix 3). The information sheet also included questions and answers (Q&As) and contact details to provide the opportunity to provide feedback.
- **One-on-one briefings** – where stakeholders have expressed concerns, one-on-one meetings with Beach's Community Manager, who is supported by project-specific personnel (such as the Environment Advisor) to discuss their concerns and to provide clarifying and targeted information on the activity. The purpose of these briefings is for Beach to provide activity information and updates, listen to issues and concerns, gain feedback on the project and to identify further opportunities for engagement. Information would be itailored to accommodate the different levels of stakeholder understanding. However, this has not been required for this activity so far as stakeholders have not requested meetings.
- **Project hotline and dedicated project email** – A freecall telephone number (1800 797 011) and email address (community@beachenergy.com.au) is provided in the project information sheet and is included in all project information. The phone number and email address are monitored by the Community Manager.
- **Company website** – the project information flyer has been made available on the Beach website (https://www.beachenergy.com.au/bass-basin/) for ease of access.

4.6 Summary of Stakeholder Consultation

Of the 32 stakeholders listed in Table 4.1, only five have responded to Beach thus far (as of 19 April 2021) after receiving the project information sheet. A summary of all key stakeholder consultation undertaken to date, together with Beach's responses and assessment of merit, is included in Table 4.2.

To date, the responses from the AHO, AMSA, BSSIA, DNP and VFA were either seeking further information or simple acknowledgments, with no concerns raised about the ongoing suspension of the wells and the monitoring and inspection of the wells (see Table 4.2)

A complete copy of original communications with relevant persons is provided in Appendix 4 (provided to NOPSEMA separately as sensitive information under Regulation 9(8) of the OPGGS(E).

4.7 Ongoing Consultation

Beach has consulted with key potentially impacted stakeholders, will advise all stakeholders when the EP is published, and in the meantime, will continue to engage with stakeholders who respond and will remain available to consult.

It is envisaged that the only issue that would require additional stakeholder engagement (as distinct from notification of wellhead inspections) would be in the event of a large-scale hydrocarbon release from the ISV.

Activity notification requirements are provided in Chapter 8.

Table 4.2. Summary of stakeholder consultation undertaken (as of 19 April 2021)

Stakeholder	Function, interests and/or activities	Date	Record of consultation	Objections and claims raised	Beach's assessment of merit
Category 1. Department or agency of the Commonwealth to which the activities to be carried out under the EP may be relevant					
AHO	Responsible for the publication and distribution of nautical charts and other information required for safe shipping and navigation in Australian waters.	29/03/2021	Beach emailed AHO requesting updates to well status and nomenclature on next edition of nautical chart (AUS 487) for White Ibis-1, Trefoil-1 and Yolla-1.	N/A	Beach has notified the AHO of well nomenclature, which has resulted in Trefoil-2 being noted as a well rather than an obstruction on nautical charts (AUS 487) (noting that Trefoil-2 is not included in this activity). NTM Edition 8 (2021) notes the update. Beach is satisfied that the wells appear on nautical charts, enclosed by danger circles, so that mariners are aware of the presence of the wellheads.
		06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A.	
		07/04/2021	AHO confirmed updates to paper and electronic copies of AUS 487 (to include updates as proposed by Beach on 29 March 2021 will be updated in future editions.	None.	
		07/04/2021	Beach acknowledged email from AHO and provided water depth of White Ibis-1 as requested.	None.	
		16/04/2021	Beach note that the Notice to Mariners (NTM) (Edition 8) issued by AHO on 16 April 2021 reflects update to Trefoil-2 as a well (rather than an 'obstruction', see **Appendix 5**).	None.	
AFMA	Manager of fisheries in Commonwealth waters.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	Fishing in the activity area is well understood and Beach has working relationship with key fisheries associations in the region. Beach will maintain open lines of communication during the consultation period.
		19/04/2021	No feedback provided to date.	None to date.	
ACMA	Administrator of submarine cable protection zones.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The location of the submarine cable protection zones is mapped and understood.
		19/04/2021	No feedback provided to date.	None to date.	

Stakeholder	Function, interests and/or activities	Date	Record of consultation	Objections and claims raised	Beach's assessment of merit
					Beach will maintain open lines of communication during the consultation period.
AMSA (JRCC)	Commonwealth department responsible for responsible for maritime safety, protection of the marine environment, and maritime aviation search and rescue.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	Beach acknowledges the maritime safety contact information as included in Section 8.12 of the EP.
		6/04/2021	AMSA (JRCC) emailed Beach acknowledging receipt of information flyer and provided a reminder of the maritime safety contact details relevant to the activity.	None.	
		08/04/2021	Beach acknowledged receipt of email and advice provided by AMSA.	N/A	
DNP	Manages the Australian Marine Parks (AMP) network in Commonwealth waters.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	Beach has assessed the routine and non-routine activities associated with the activity against the conservation values of the Boags AMPs in the South East Marine Network (see Appendix 1). Beach has provided the spill notification details for DNP in Section 9.4 of the EP.
		9/04/2021	DNP replied to Beach confirming that the planned activities do not overlap any AMPs, therefore there are no authorisations required from the DNP. DNP confirmed that they do not require further notification of progress made in relation to this activity unless details regarding the activity change and result in an overlap with a marine park or new impact, or for emergency responses. The contacts were provided to Beach.	None.	
		16/04/2021	Beach responded to DNP to confirm that the EP contains an assessment of impacts and risks against the AMP values and contact details in relation to incident reporting are included in the EP.	N/A	
DAWE	Commonwealth department responsible for administration	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	

Stakeholder	Function, interests and/or activities	Date	Record of consultation	Objections and claims raised	Beach's assessment of merit
	of the EPBC Act, AMPs and MNES.	19/04/2021	No feedback provided to date.	None to date.	Beach will maintain open lines of communication during the consultation period.
Category 2. Each Department or agency of a State to which the activities to be carried out under the EP may be relevant					
Victoria					
DJPR – ERR	Regulator of oil and gas activities in Victorian waters.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The activity and EMBA do not extend into Victorian waters, so additional consultation is not required. Beach will maintain open lines of communication during the consultation period.
		19/04/2021	No feedback provided to date.	None to date.	
VFA	Manager of commercial fisheries in Victorian waters.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	There are no Victorian-managed fisheries in the activity area or EMBA (see Section 5.7.6), so additional consultation is not required. Beach will maintain open lines of communication during the consultation period.
		8/04/2021	VFA acknowledged receipt of information sheet and asked whether SIV had been contacted.	None.	
		8/04/2021	Beach confirmed that SIV had been contacted via email with project information sheet on 6 April 2021.	N/A	
		15/04/2021	Beach arranged proactive meeting (via Teams meeting) with VFA and provided an update on all offshore projects, including activities in the Bass and Otway basins.	None.	
Tasmania					
DPIPWE	Tasmania's leading natural resources agency, responsible for the sustainable	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	Tasmanian-managed fisheries in the activity area and EMBA are described in Section 5.7.6.
		19/04/2021	No feedback provided to date.	None to date.	

Stakeholder	Function, interests and/or activities	Date	Record of consultation	Objections and claims raised	Beach's assessment of merit
	management of natural and cultural heritage.				Beach will maintain open lines of communication during the consultation period.
Category 3 – The Department of the responsible State Minister					
N/A – activity in Commonwealth waters only.					
Category 4 – A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP					
Fisheries – Commonwealth					
Associations					
Southern Shark Industry Alliance (SSIA)	Peak representative body for trawl fishing and shark fishing in south-east Australia.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A.	Additional consultation is not required as the extent of Commonwealth fisheries in the activity area and EMBA is well understood (see Section 5.7.6). Beach will maintain open lines of communication during the consultation period.
		19/04/2021	No feedback provided to date.	None to date.	
Sustainable Shark Fishing Association (SSFA)	Industry body representing shark gillnetters.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A.	Additional consultation is not required as the extent of Commonwealth fisheries in the activity area and EMBA is well understood (see Section 5.7.6). Beach will maintain open lines of communication during the consultation period.
		19/04/2021	No feedback provided to date.	None to date.	
SETFIA	Peak representative bodies for trawl fishing and shark fishing in south-east Australia.	01/04/2021	Beach phoned SETFIA to advise an email would be sent next week regarding the EP, gave a summary of the activities, and confirmed Beach would continue to seek their services to provide notice to their members before the inspection activities.	N/A	Additional consultation is not required as the extent of Commonwealth fisheries in the activity area and EMBA is well understood (see Section 5.7.6)

Stakeholder	Function, interests and/or activities	Date	Record of consultation	Objections and claims raised	Beach's assessment of merit
		01/04/2021	SETFIA appreciated the advance notice and activity summary which minimised their 'stakeholder fatigue'. In addition, SETFIA verbally confirmed during the phone call there were no concerns with the activity and no further questions.	None.	Beach will maintain open lines of communication during the consultation period.
		06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	
		19/04/2021	No further feedback provided.	None to date.	
BSSIA	Peak body representing the Bass Strait Central Zone Scallop Fishery.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The extent of scallop fishing in the activity area and EMBA is well understood (see Section 5.7.6). Beach will maintain open lines of communication during the consultation period.
		6/04/2021	BSSIA confirmed by email they have no issues with the proposed activity.	None.	
		08/04/2021	Beach confirmed receipt of email dated 6 April 2021.	N/A	
Tuna Australia – ETBF Industry Association	Peak body representing the Eastern Tuna and Billfish Fishery.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	I It is understood that tuna fishing does not extend to the activity area or EMBA (see Section 5.7.6). Beach will maintain open lines of communication during the consultation period.
		19/04/2021	No feedback provided to date.	None to date.	
Southern Bluefin Tuna Industry Association	Peak body representing the Southern Bluefin Tuna Fishery.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	As above.
		19/04/2021	No feedback provided to date.	None to date.	
CFA	Peak body representing the collective rights, responsibilities and interests of a diverse group of commercial	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The extent of Commonwealth-managed fishing in the activity area and EMBA is well understood (see Section 5.7.6).
		19/04/2021	No feedback provided to date.	None to date.	

Stakeholder	Function, interests and/or activities	Date	Record of consultation	Objections and claims raised	Beach's assessment of merit
	fishers in Commonwealth-regulated fisheries.				Beach will maintain open lines of communication during the consultation period.
Fisheries – Victorian					
Associations					
SIV	Peak industry body for Victorian Fisheries.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The extent of Victorian-managed fishing in the activity area and EMBA is well understood (see Section 5.7.6). Beach will maintain open lines of communication during the consultation period.
		19/04/2021	No feedback provided to date.	None to date.	
VR Fish	Peak body representing recreational fishers in Victoria.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The activity area and EMBA are too far from coastlines to be important recreational fishing areas. Beach will maintain open lines of communication during the consultation period.
		19/04/2021	No feedback provided to date.	None to date.	
Fisheries – Tasmanian					
TSIC	Peak body representing the interests of wild capture fishers, marine farmers and seafood processors in Tasmania.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	Beach has a good working relationship with TSIC and will maintain open lines of communication during the consultation period.
		19/04/2021	No feedback provided to date.	None to date.	
Tasmanian Abalone Council Limited	Peak body representing the interests of the Tasmanian Abalone Fishery.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The activity area and EMBA are too far from abalone fishing areas. Beach will maintain open lines of communication during the consultation period.
		19/04/2021	No feedback provided to date.	None to date.	
Southern Rock Lobster	Peak body representing the interests of the Australian southern rock lobster industry.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The activity area and EMBA do not represent rock lobster fishing areas.
		19/04/2021	No feedback provided to date.	None to date.	

Stakeholder	Function, interests and/or activities	Date	Record of consultation	Objections and claims raised	Beach's assessment of merit
Limited (SRL) (SA, VIC, TAS).					Beach will maintain open lines of communication during the consultation period.
Tasmanian Rock Lobster Fisherman's Association	Peak body representing the Tasmanian rock lobster fishery.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The activity area and EMBA do not represent rock lobster fishing areas. Beach will maintain open lines of communication during the consultation period.
		19/04/2021	No feedback provided to date.	None to date.	
T.O.P. Fish Tasmania	Octopus fishery licensee.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	This fishery operator is already aware of the well locations. Beach will keep this fishing operator notified of ISV activities ahead of time.
		19/04/2021	No feedback provided to date.	None to date.	
Tasmanian Association for Recreational Fishing	Peak body representing recreational fishers in Tasmania.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The activity area and EMBA are too far from coastlines to be important recreational fishing areas, so additional consultation is unlikely to be required. Beach will maintain open lines of communication during the consultation period.
		19/04/2021	No feedback provided to date.	None to date.	
Infrastructure asset owners					
Alcatel Submarine Networks UK LTD	Operator of the two subsea communications cables linking Victoria and Tasmania.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The location of subsea cables in the region is mapped and well understood. Similarly, the wells are marked on nautical charts and can therefore be located by this stakeholder if required. Beach will notify this stakeholder of ISV campaigns ahead of time.
		19/04/2021	No feedback provided to date.	None to date.	
Aquasure (Victorian Desalinisation Plant)	Operator of the Victorian water desalinisation facility on the coast near Wonthaggi.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The Victorian Desalinisation Plant is well outside of the EMBA and activity area. Beach will notify this stakeholder of ISV campaigns ahead of time.
		19/04/2021	No feedback provided to date.	None to date.	

Stakeholder	Function, interests and/or activities	Date	Record of consultation	Objections and claims raised	Beach's assessment of merit
Toll Group	Logistics and transport company.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The wells have no bearing on the stakeholder's activities and they are marked on nautical charts. Beach will notify this stakeholder of ISV campaigns ahead of time.
		19/04/2021	No feedback provided to date.	None to date.	
Spirit of Tasmania	Bass Strait ferry operator.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The wells are marked on navigation charts. Beach has mapped the *Spirit of Tasmania's* summer and winter routes. Beach will notify this stakeholder of ISV campaigns ahead of time.
		19/04/2021	No feedback provided to date.	None to date.	
Telstra	Owner of the two subsea communications cables linking Victoria and Tasmania.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The location of subsea cables in the region is mapped and well understood. Similarly, the wells are marked on nautical charts and can therefore be located by this stakeholder if required. Beach will notify this stakeholder of ISV campaigns ahead of time.
		19/04/2021	No feedback provided to date.	None to date.	
Marinus Link	Proposed electricity interconnector between Victoria and Tasmania.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The lack of feedback is not of material concern as the wells are marked on navigation charts and should therefore be taken into consideration as the project plans the subsea route of this interconnector. Beach will notify this stakeholder of ISV campaigns ahead of time.
		19/04/2021	No feedback provided to date.	None to date.	
Other organisations					
Ocean Racing Club of Victoria	Conducts ocean/offshore and bay yacht races and events in Victoria.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The wells do not present an obstacle to ocean racing and the infrequent and temporary presence of the ISV will not present a major obstacle to any ocean racing activity. Beach will notify this stakeholder of ISV campaigns ahead of time.
		19/04/2021	No feedback provided to date.	None to date.	

Stakeholder	Function, interests and/or activities	Date	Record of consultation	Objections and claims raised	Beach's assessment of merit
SCUBA Divers Federation of Victoria	Supports and represents scuba diving clubs and their members in Victoria.	06/04/2021	Beach emailed the project information sheet and invited return comment.	N/A	The activity area and EMBA are too far from coastlines to be important diving areas. Beach will notify this stakeholder of ISV campaigns ahead of time.
		19/04/2021	No feedback provided to date.	None to date.	
Category 5 – Any person or organisation that the Titleholder considered relevant					
Not applicable.					

5. Description of the Existing Environment

In accordance with OPGGS(E) Regulation 13(2), the environment that may be affected (EMBA) for this activity is described in this chapter, together with its values and sensitivities.

The largest EMBA for the activity, identified as the most credible hydrocarbon spill event, is a full loss of marine diesel oil (MDO) from the largest tank of the ISV from a vessel collision within the activity area. This is based on the spill modelling recently undertaken for the Trefoil Geophysical and Geotechnical Seabed Assessment EP including the Trefoil and Yolla permit areas (accepted by NOPSEMA on 29 April 2020), which was established using Automated Data Inquiry for Oil Spills (ADIOS) modelling.

The hydrocarbon spill EMBA ('spill EMBA' for simplicity) (Figure 5.1) is therefore defined as:

> *The combined extent of low level hydrocarbon exposure to the sea surface (1 g/m^2), entrained in the water column (10 ppb) and dissolved in the water column (10 ppb) as a result of a release of 100 m^3 of MDO (over 12 hours) from the ISV during annualised metocean conditions.*

Details of the spill scenario and modelling results are provided in Section 7.13. Based on the spill modelling, the extent of the spill EMBA is a maximum of 30 km from each well as shown in Figure 5.1. A conservative 30 km (twice the distance of the calculated entrained oil extent) has been used to apply an appropriate level of conservatism considering the limitations of the ADIOS modelling and its application to oil dispersed into the water.

The spill EMBA is entirely within commonwealth waters and does not approach or intersect any shorelines or coastal settlements in state waters. Therefore, this chapter does not describe the shorelines of mainland Victoria, Tasmania and surrounding islands in Bass Strait.

Where appropriate, descriptions of the Bass Strait environment (beyond the spill EMBA) are provided for context. The 'environment' is defined in the OPGGS(E) regulations as:

Ecosystems and their constituent parts, including people and communities;

- Natural and physical resources;
- The qualities and characteristics of locations, places and areas;
- The heritage value of places; and
- The social, economic and cultural features of these matters.

The key sources of information used in developing this chapter include the:

- EPBC Act Protected Matters Search Tool (PMST) database (DAWE, 2021a), conducted for the activity/activity area on 28 January 2021 (Appendix 1) and the EMBA on 29 January 2021 (Appendix 2);
- Species Profile and Threats (SPRAT) Database (DAWE, 2021b);
- South-east Marine Region Profile (DoE, 2015a);
- Marine Natural Areas Values Study Vol 2: Marine Protected Areas of the Flinders and Twofold Shelf Bioregions (Barton *et al*., 2012); and
- National Conservation Values Atlas (NCVA) (DAWE, 2021c).

The relevant values and sensitivities considered in this chapter are inclusive of but not limited to the matters protected under Part 3 of the EPBC Act. Table 5.1 summarises the presence or absence of receptors and sensitivities within the proposed activity area and the EMBA.

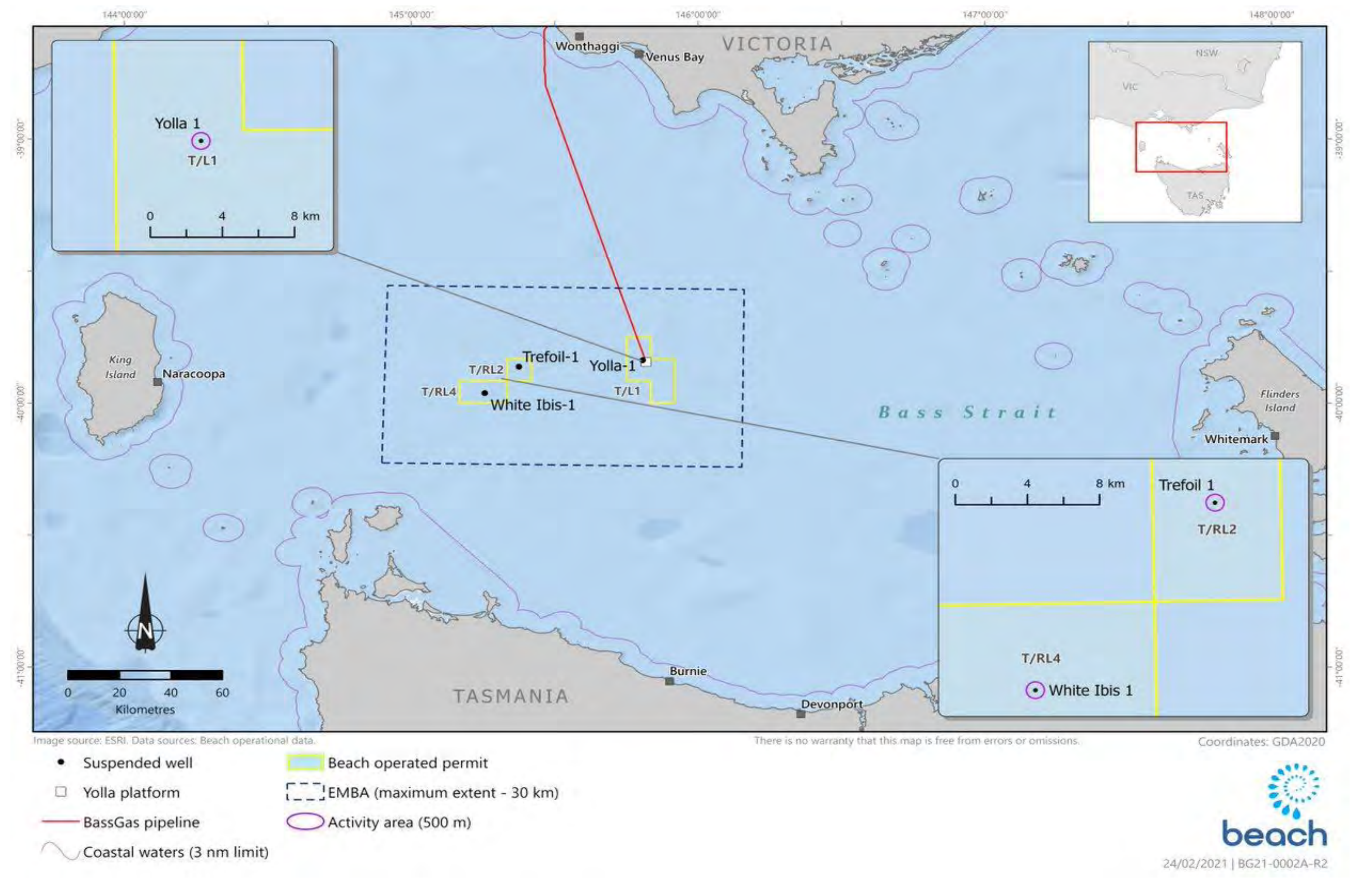


Figure 5.1. The non-production well operations spill EMBA

5.1 Regional Context

Bass Strait separates Tasmania from the southern Australian mainland by approximately 230 km at its narrowest point and contains a number of islands, with the largest being King Island and Flinders Island (see Figure 5.1).

The White Ibis, Trefoil and Yolla gas fields are located within the Bass Strait Provincial Bioregion using the Interim Marine and Coastal Regionalisation for Australia (IMCRA) classification (Figure 5.2) (DEH, 2006). The activity area and spill EMBA are located in the Central Bass Strait (CBS) bioregion, which is approximately 60,000 km^2 in size with water depths between 50 m at the margins and 80 m at the centre and is on the continental shelf (DEH, 2006). The substrate in the central area of the CBS is predominantly mud (DEH, 2006).

Table 5.1. Presence of receptors within the activity area and the EMBA

Receptor	Activity area	EMBA
Physical		
Mud	Seabed is flat and featureless with very soft to soft alternative layers of silty carbonate clay and silty sands containing fragile white shell fragments.	
Sand		
Rocky reef		
Sponge gardens	Possible	
Seagrass communities	Not present within the EMBA and activity area due to water depth >64 m.	
Conservation Values		
Australian Marine Parks (AMPs)		Boags AMP
World Heritage-listed properties		
National Heritage-listed properties		
Threatened Ecological Communities (TECs)		
Key Ecological Features (KEFs)		
Nationally important wetlands		
Victorian marine protected areas		
Tasmanian marine protected area		
Onshore protected areas		
Biological environment		
Plankton		
Benthic species		
Abalone	Beyond depth range of abalone	
Scallops	Possibly	
Rock lobsters	Lack of necessary reef habitat	
Fish		
BIA, great white shark	Distribution	
Cetaceans		
BIA, pygmy blue whale	Possible foraging area	
BIA, southern right whale	Known core range	
BIA, humpback whale		Migration only

Receptor	Activity area	EMBA
Pinnipeds	Foraging only	Foraging only
Reptiles (turtles)	May be present, vagrant only, no nesting grounds	May be present, vagrant only, no nesting grounds
Seabirds	Foraging, flyovers, BIA for many species (particularly albatross)	Foraging, flyovers, BIA for many species (particularly albatross)
Shorebirds	No coastline present, unlikely to forage in CBS	No coastline present, unlikely to forage in CBS
Marine pests	Possible	Possible
Cultural heritage values		
Shipwrecks		
Indigenous heritage	None registered	None registered
Socio-economic environment		
Native title		
Tourism		
Recreational fishing		
Commercial fishing		

Green cells = presence of receptor, red cells = absence of receptor.

5.2 Physical Environment

5.2.1 Climate and Meteorology

Bass Strait is located on the northern-most zone of an area known as the 'Roaring Forties' with its climate determined chiefly by the presence of sub-tropical high-pressure ridges and migratory low-pressure systems (extra-tropical cyclones). Migrating low pressure systems typically bring a westerly wind regime to Bass Strait and are likely to affect the area every three to five days on average during the winter months.

5.2.2 Temperature and Rainfall

Average air temperatures recorded at King Island airport (110 km west of the activity area, but the closest point for a Bureau of Meteorology (BoM) weather station) for 1995-2019 range from a minimum of 10.0°C to a maximum of 17°C (BoM, 2020).

Mean annual rainfall for the period 1974-2019 is 857 mm, with the highest rainfall totals falling in June, July and August (with an average minimum of 30 mm in February and an average maximum of 117 mm in July) (BoM, 2020).

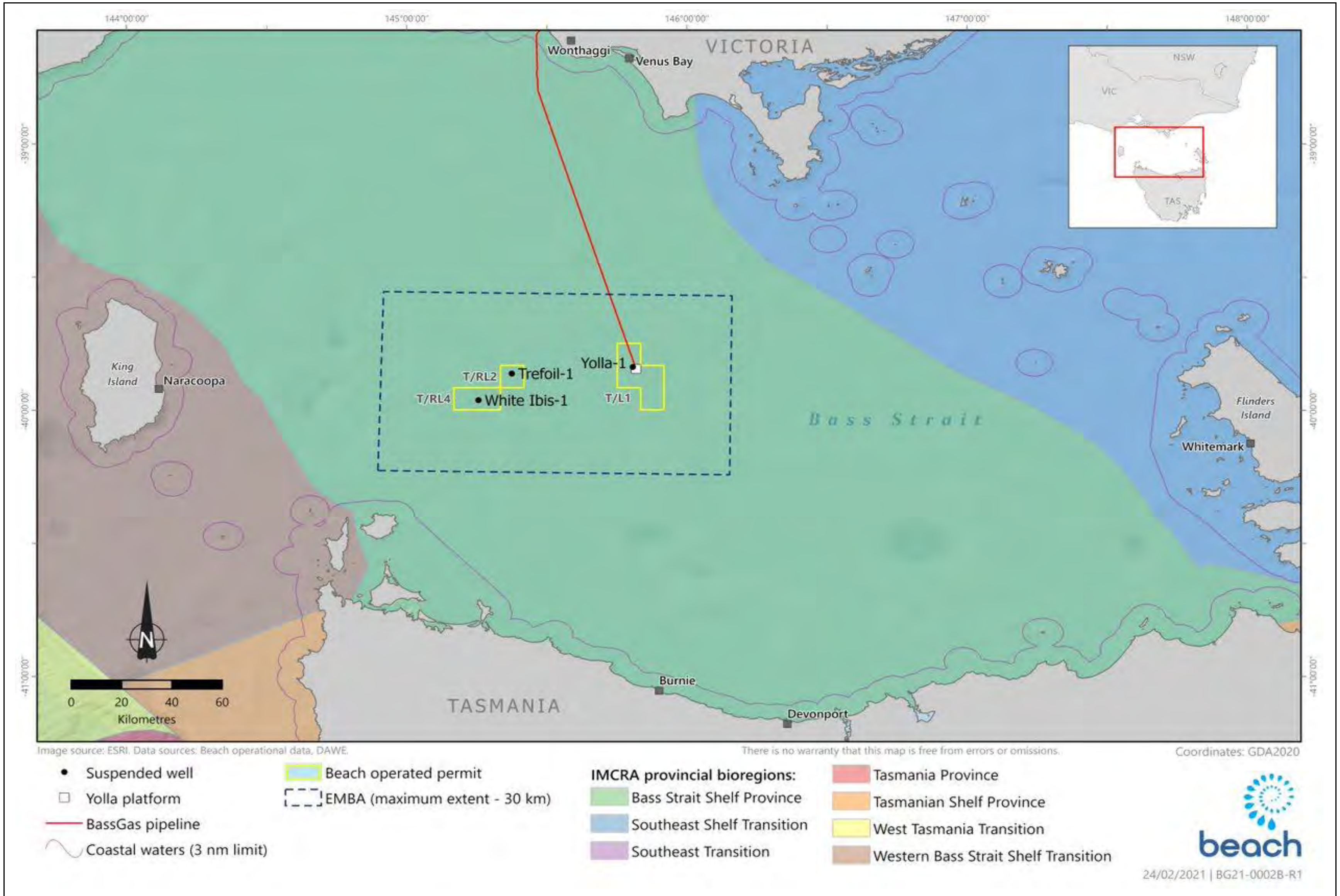


Figure 5.2. IMCRA provincial bioregions

5.2.3 Winds

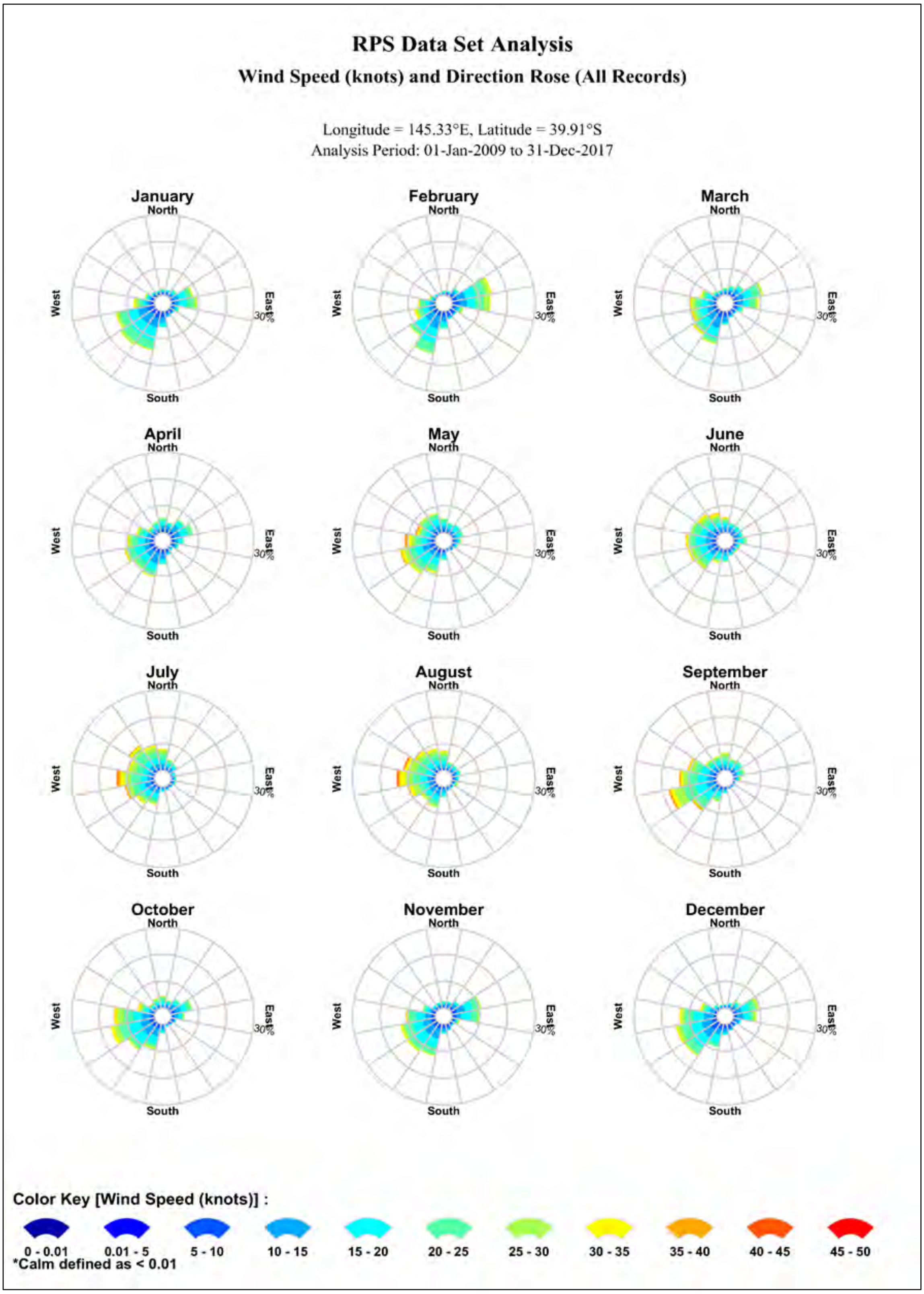
RPS (2020) acquired high-resolution wind data from 2009 to 2017 (inclusive) across their modelling domain from the National Centre for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR). Table 5.2 lists the monthly average and maximum winds derived from the CFSR station located nearest to the activity area.

Figure 5.3 illustrates the monthly wind rose distributions from 2009 to 2017 (inclusive), which clearly indicates that winds from the southwest dominate this region for most of the year.

Table 5.2. Predicted average and maximum wind speeds for the representative wind station nearest the activity area.

Month	Average wind speed (knots)	Maximum wind speed (knots)	General direction (from)
January	15	40	Southwest
February	16	43	South-south-west – East-northeast
March	16	47	South-south-west – East-northeast
April	15	47	West - southwest
May	17	49	West - southwest
June	17	44	Variable
July	19	50	West
August	19	46	West
September	18	46	West - southwest
October	17	42	West - southwest
November	16	40	West–southwest - Southwest
December	16	40	West–southwest - Southwest
Minimum	15	40	
Maximum	19	50	

Source: RPS (2020)



Source: RPS (2020). The convention for defining wind direction is the direction the wind blows from.

Figure 5.3. Modelled monthly wind rose distributions from 2009-2017 (inclusive) for the representative wind station closest to the activity area.

5.3 Oceanography

5.3.1 Tides and Currents

Bass Strait is a relatively shallow area on the continental shelf, connecting the southeast Indian Ocean with the Tasman Sea. The strait has a reputation for strong tidal currents, which are primarily driven by tides, winds and density-driven flows. The tides of central Bass Strait are semi-diurnal with the dominant large-scale water movements due to the astronomical tide (Jones, 1980).

The tidal waves enter Bass Strait from the east and west almost simultaneously and as a result in the centre of the strait there is an area with small tidal currents where the two waves meet. The magnitude of the tidal currents then increases as the distance from the central strait increases with relatively strong tidal currents at either end. The times and magnitudes of the tide within Bass Strait are relatively uniform and predictable. However, the effects of meteorological phenomena may be significant, causing variations in level and also changing the phasing or timing of the tide (Sandery and Kampf, 2005). In winter and spring, waters within the strait are well mixed with no obvious stratification while during summer the central regions of the strait become stratified (Baines and Fandry, 1983; Middleton and Black, 1994).

The region is oceanographically complex, with sub-tropical influences from the north and sub-polar influences from the south (DoE, 2015a). There is a slow easterly flow of waters in Bass Strait and a large anti-clockwise circulation (DoE, 2015a). Three key water currents influence Bass Strait:

1. The Leeuwin Current transports warm, sub-tropical water southward along the Western Australian (WA) coast and then eastward into the Great Australian Bight (GAB), where it mixes with the cool waters from the Zeehan Current running along Tasmania's west coast (DoE, 2015a). The Leeuwin and Zeehan currents are stronger in winter than in summer, with the latter flowing into Bass Strait during winter.

2. The East Australian Current (EAC) is up to 500 m deep and 100 km wide, flows southwards adjacent to the coast of NSW and eastern Victoria, and carries warm equatorial waters (DoE, 2015a). The EAC is strongest in summer when it can flow at a speed of up to 5 knots but flows more slowly (2-3 knots) in winter where it remains at higher latitudes.

3. The Bass Strait Cascade occurs during winter along the shelf break, which brings nutrient-rich waters to the surface as a result of the eastward flushing of the shallow waters of the strait over the continental shelf mixing with cooler, deeper nutrient-rich water (DoE, 2015a).

Figure 5.4 illustrates the major ocean currents in south-eastern Australian waters during summer and winter (DoE, 2015a).

Table 5.3 provides the average and maximum net current speeds from combined HYCOM (Hybrid Coordinate Ocean Model) and tidal currents near the activity area (RPS, 2020).

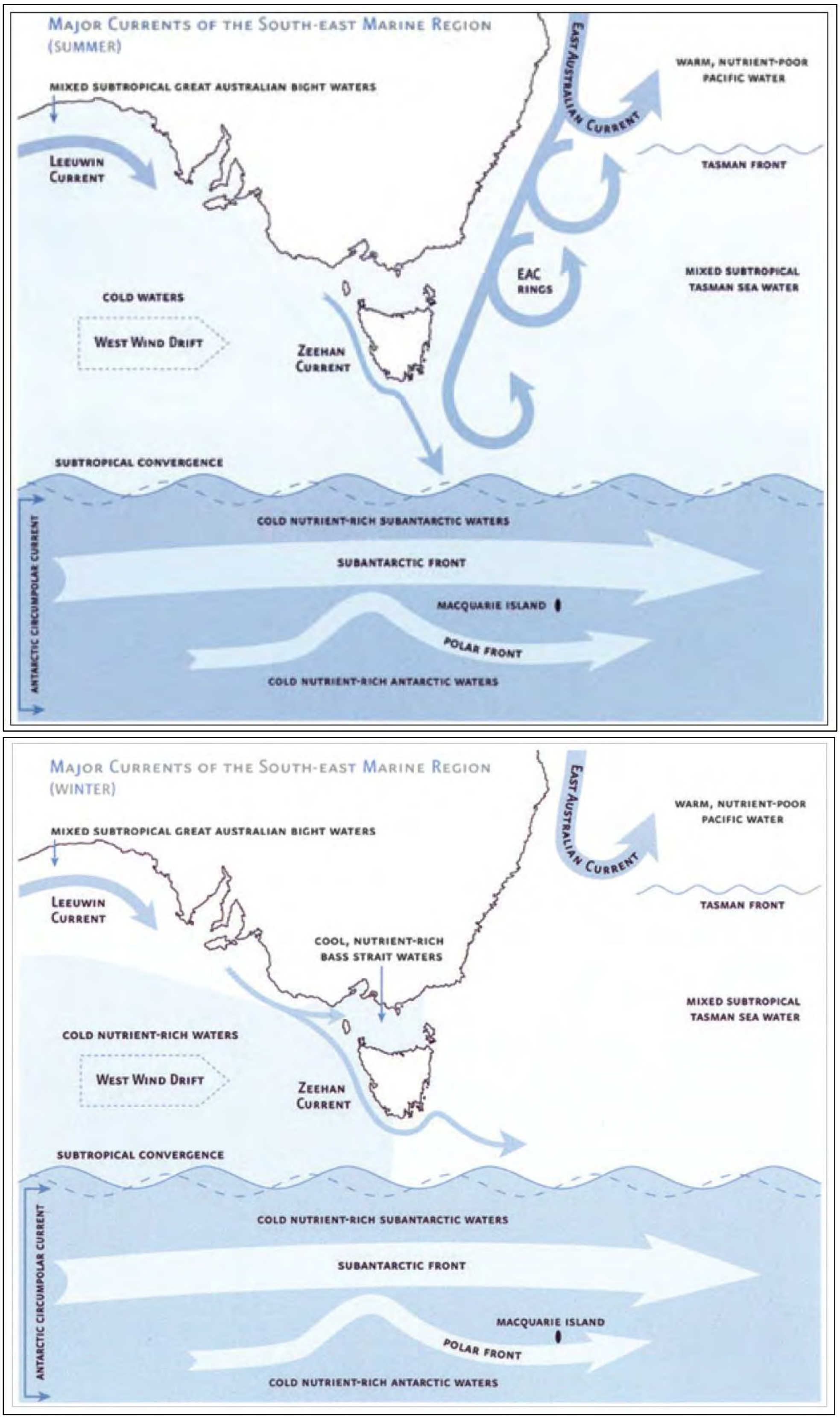
Figure 5.5 illustrates the monthly surface current rose distributions from the combination of HYCOM ocean current data and HYDROMAP tidal data near the activity area from 2009 to 2017 (inclusive) (RPS, 2020). This data indicates that surface currents flow predominantly eastwards.

Semi-diurnal astronomical tides provide the major water level variations in the region with four current reversals each day and a relatively small tidal range of about 1.3 m. The tidal range at the nearby Yolla-A platform (approximately 1 km southeast of Yolla-1) is estimated to be about 2.3 m at spring tides and 1.7 m at neap tides and the combined sea and tidal currents vary in intensity with the time of year, typically reaching speeds of up to 1.0 m/s. The lowest and highest astronomical tides at the platform are -1.47 m and +1.33 m, respectively. Tidal currents at the platform move in an ellipse and tend to flood and ebb to the southeast and northwest respectively.

Table 5.3. Predicted monthly average and maximum surface current speeds close to the activity area.

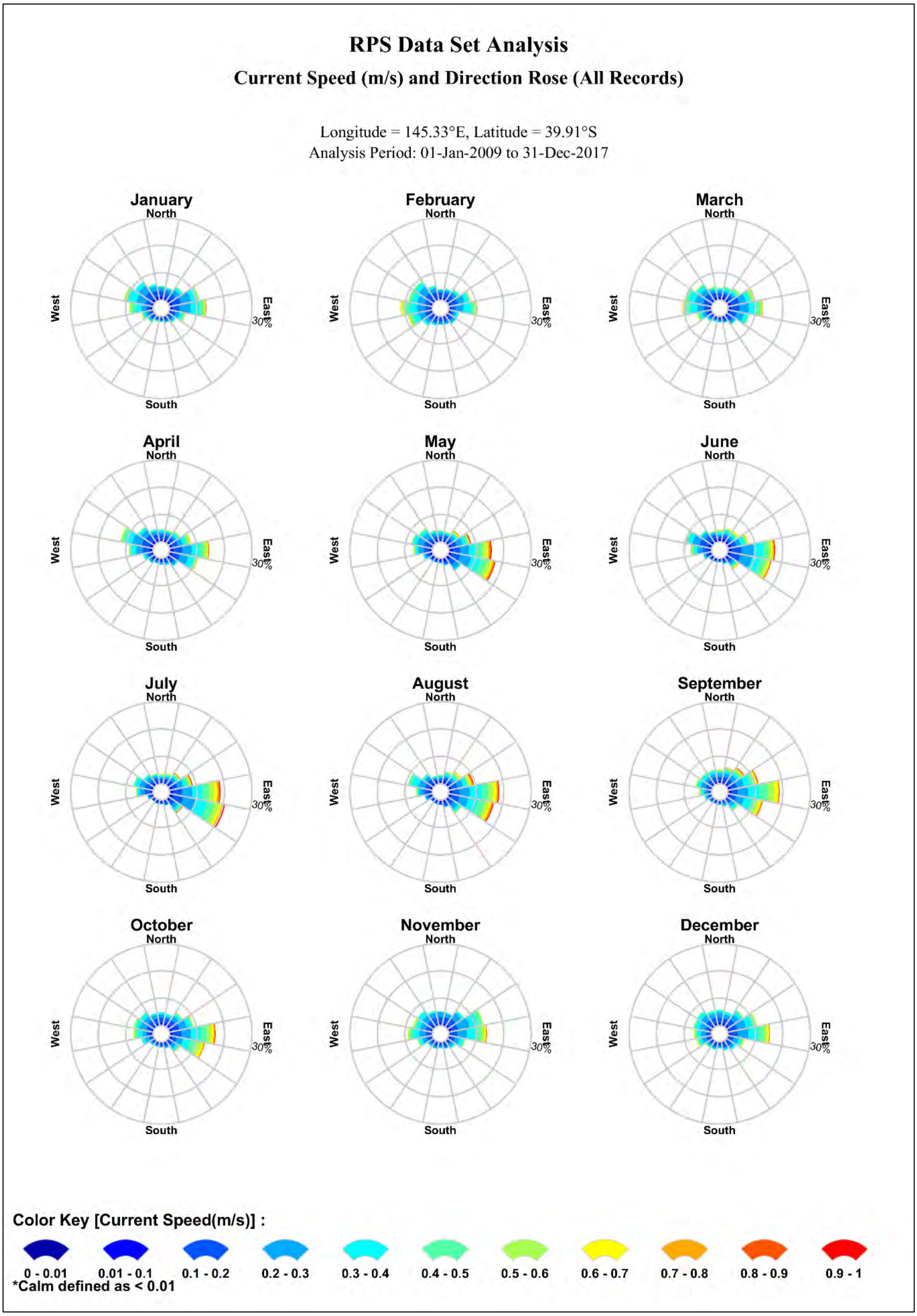
Month	Average wind speed (knots)	Maximum wind speed (knots)	General direction (from)
January	0.24	0.92	East (variable)
February	0.25	0.86	East - West (variable)
March	0.25	1.01	East - West (variable)
April	0.24	1.16	East – West-northwest
May	0.27	1.21	East – East-southeast
June	0.26	1.16	East – East-southeast
July	0.29	1.38	East – East-southeast
August	0.28	1.32	East – East-southeast
September	0.29	1.01	East
October	0.26	1.10	East
November	0.25	0.87	East - East-northeast
December	0.25	0.90	East
Minimum	0.24	0.86	
Maximum	0.29	1.38	

Source: RPS (2020).



Source: DoE (2015a).

Figure 5.4. Major ocean currents in south-eastern Australian waters during summer (top) and winter (bottom)



Source: RPS (2020). The convention for defining current direction is the direction the current flows towards.

Figure 5.5. Monthly surface water current rose plots from 2009-2017 (inclusive) close to the activity area.

5.3.2 Waves

In Bass Strait, the interaction between sea and swell and the resultant wave motion is complicated by the islands and Australian mainland coastline embayments, peninsulas and headlands. This restricts the access of swell from the Southern Ocean into Bass Strait. Some swell is blocked completely and some refracted by the seabed and modified as it passes into shallower waters of Bass Strait. There are also waves generated by wind within Bass Strait and the conditions at any location will be the result of these two wave-energy bands (Falconer and Lindforth, 1972).

The local wave climate is derived principally from locally-generated wind waves mostly from the west and southwest. Wave heights range from 1.5 m to 2 m with periods of 8 s to 13 s, although heights of 5 m to 7 m can occur during storm events.

5.3.3 Water Temperature

The shallowness of Bass Strait means that its waters more rapidly warm in summer and cool in winter than waters of nearby regions (DoE, 2015a). The sea surface temperatures in the area reflect the influence of warmer waters brought into Bass Strait by the EAC (IMCRA, 1998; Barton *et al*., 2012).

Waters of eastern Bass Strait are generally well-mixed, but surface warming sometimes causes weak stratification in calm summer conditions. During these times, mixing and interaction between varying water masses leads to variations in horizontal water temperature and a thermocline (temperature profile) develops. The thermocline acts as a low-friction layer separating the wind-driven motions of the upper well-mixed layer of Bass Strait from the bottom well-mixed layer. RPS (2020) reports that the temperature in the top 40 m of the water column in the region (based on the World Ocean Atlas) varies from 12-18°C across the year.

5.3.4 Water Quality

The nutrient concentrations in CBS are low compared to that of what is seen at its extremities (Gibbs *et al*.,1986; Gibbs, 1992). It is hypothesised that this could be due to the biological demands of the Bass Strait waters consuming much of the nutrients before moving into CBS (Gibbs, 1992).

5.3.5 Salinity

RPS (2020) reports that the average monthly salinity consistently remains in the range of 35.0 to 35.6 practical salinity units (based on the World Ocean Atlas database).

5.3.6 Seabed

The bathymetry of Bass Strait is shown in Figure 5.6 and illustrates that the seafloor is gently sloping with water depths increasing gradually from the shore to reach a maximum of about 80 m. White Ibis-1 and Trefoil-1 are situated in water depths of 60 -65 m and 65 – 70 m respectively.

Sedimentation in Bass Strait is generally low due to the low supply from rivers and the relatively low productivity of carbonate. Origin Energy, as the previous Operator of BassGas, undertook several geotechnical surveys in and around the Yolla-A platform (Thales GeoSolutions, 2001).

These surveys indicate that there are no obstructions or wrecks in the area. The seabed is flat and featureless, with surveys prior to construction indicating the seabed has very soft to soft alternating layers of silty carbonate clay and silty sands containing fragile white shell fragments (Thales GeoSolutions, 2001).

Mainland Tasmania and the Bass Strait islands belong to the same continental landmass as mainland Australia. The continental shelf is narrow along the east coast of Tasmania but broadens in the northwest and northeast, underlying Bass Strait and the Otway and Gippsland basins. The central part of Bass Strait contains a depression that exchanges water with the ocean to the north of King Island. The main seafloor feature of western Bass Strait is a ridge that extends from King Island to northwest Tasmania.

Activity area

Surveys undertaken for the nearby BassGas development (approximately 1 km southeast of Yolla-1) indicate that the seabed has very sort to soft alternating layers of silty carbonate clay and silty sands contained with fragile shell fragments (Thales GeoSolutions, 2001). Given these recent findings are consistent with the scientific literature presented for CBS (Figure 5.7), it is reasonable to assume that the seabed conditions at Yolla-1 are similar.

Surveys undertaken at Trefoil-1 during a recent geotechnical campaign found that the seabed at this location to be silty fine calcareous sand with shell fragments (Neptune, 2020). Given the close proximity of White Ibis-1, it is likely that the seabed conditions at this well are similar to those identified at Trefoil-1.

5.3.7 Shorelines

There are no areas of the mainland Victorian or Tasmanian coastlines, nor offshore islands that are intersected by the spill EMBA. Therefore, shorelines are not described further in this EP.

5.4 Biological Environment

The key sources of information for the species that may be present in the spill EMBA are the results of the EPBC Act PMST undertaken for the activity area and spill EMBA (DAWE, 2021a).

An EPBC Protected Matters Report was generated for both the activity area and spill EMBA (approximately 30 km around the activity area) (see Appendix **6**).

5.4.1 Benthic Assemblages

The Bass Strait region is characterised by a mixture of basins, terraces, plateaus, banks, deep escarpments, areas of continental rise and an eastern ridge (DEH, 2006). Surveys of the seabed near the Yolla-A platform prior to drilling and construction showed sparsely scattered clumps of solitary sponges, sea cucumbers, sea squirts and predatory snails (whelk) (Thales GeoSolutions, 2001). As the EMBA and activity area is within a similar water depth and located close to the Yolla-A platform, the benthic habitat and assemblages are similar at both locations.

Whilst there is little information available on the nature or distribution of epibiota in central Bass Strait, data is available for eastern Bass Strait from the Museum of Victoria biological sampling programs conducted from 1979 to 1984 (Wilson and Poore 1987), from scientific dredging conducted in 1989 (Parry *et al*., 1990), and from targeted investigations for pipeline and power link proposals in the area. This information can be used to extrapolate existing conditions for central Bass Strait. Generally, the epibiota of the region is sparse and characterised by scallops and other large bivalve molluscs, crabs, seasquirts, seapens, sponges and bryozoans. A variety of mobile crabs, prawns and brittle stars are also relatively common. Many of the mobile epibiota appear to occur in aggregations from time to time (scallops, prawns and crabs) while some of the fixed epibiota occur in patches (sponges and bryozoans).

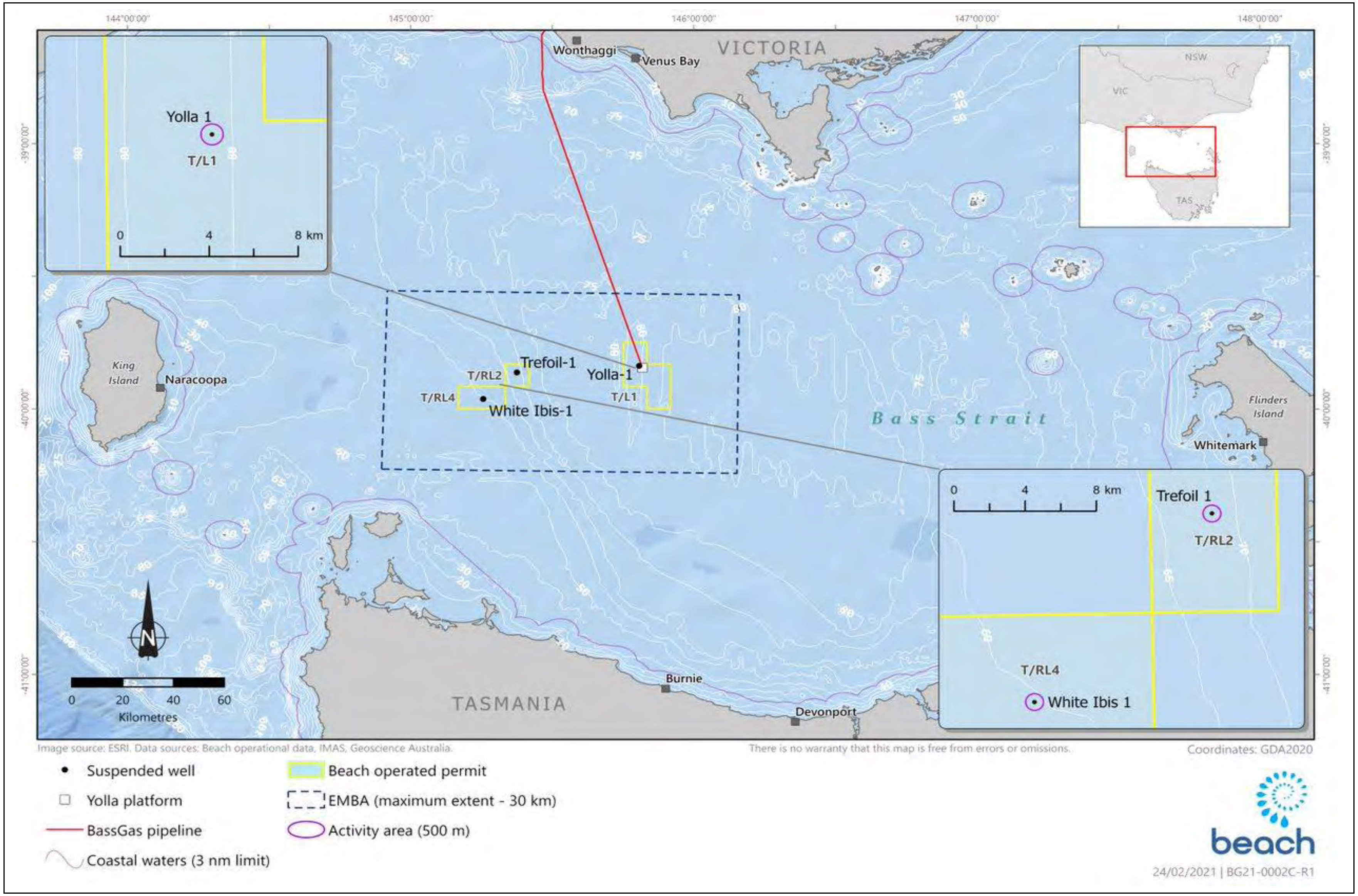


Figure 5.6. Bathymetry of Bass Strait

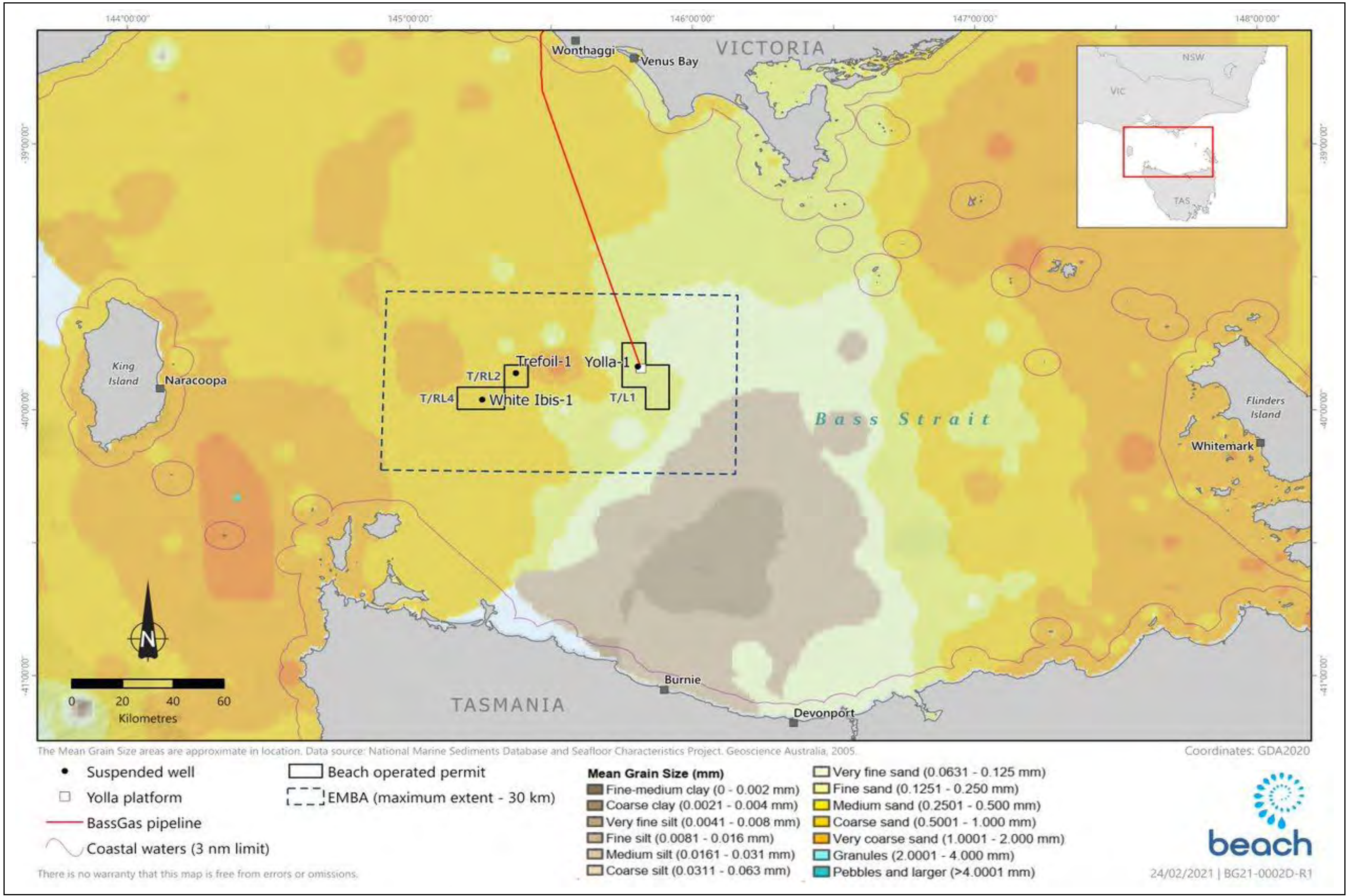


Figure 5.7. Average seabed sediment grain size across Bass Strait

5.4.2 Plankton

Plankton is a key component in oceanic food chains and comprises two elements; phytoplankton and zooplankton, as described herein. Phytoplankton (photosynthetic microalgae) comprise 13 divisions of mainly microscopic algae, including diatoms, dinoflagellates, gold-brown flagellates, green flagellates and cyanobacteria and prochlorophytes (McLeay *et al*., 2003). Phytoplankton drift with the currents, although some species have the ability to migrate short distances through the water column using ciliary hairs. Phytoplankton biomass is greatest at the extremities of Bass Strait (particularly in the northeast) where water is shallow, nutrient levels are high and ocean currents facilitate occasionally planktonic blooms.

Zooplankton is the faunal component of plankton, comprising small crustaceans (such as krill), fish eggs and fish larvae. Zooplankton includes species that drift with the currents and also those that are motile. More than 170 species of zooplankton have been recorded in eastern and central Bass Strait, with copepods making up approximately half of the species encountered (Watson & Chaloupka, 1982). The high diversity may be due to considerable intermingling of distinctive water bodies and may be higher in eastern than in western Bass Strait. Although a high diversity of zooplankton has been recorded, Kimmerer and McKinnon (1984) found that seven dominant species make up 80% of individuals. Phytoplankton is grazed by zooplankton such as small protozoa, copepods, decapods, krill and gelatinous zooplankton.

As part of a marine seismic survey undertaken in early 2018, the CarbonNet Project commissioned plankton sampling across nine sites in shallow waters off Golden Beach, Gippsland (220 km to the northeast of the activity area and outside the spill EMBA). The results of this work (CarbonNet, 2018) found that:

- The composition of zooplankton was a typical healthy example of those expected for temperate coastal waters; and
- Copepods were the dominant group, with varying proportions of appendicularians, cladocerans and doliolids. Numerous other groups occurred in small numbers, including siphonophores, fish larvae, fish eggs, polychaetes, ghost shrimps and cnidarians (jellies).

5.4.3 Marine Flora

Literature searches indicate there is a paucity of public information regarding the distribution and abundance of marine flora in central Bass Strait, particularly in relation to the deeper water of the activity area and spill EMBA.

The subtidal and intertidal rocky reefs of Bass Strait, located closer to the shoreline of Victoria and Tasmania, are understood to have a high diversity of plant species including seagrasses and macroalgae. In sheltered parts of shallow bays, inlets and estuaries, seagrasses establish extensive underwater meadows that are critical in the early life stages of many fish species. Seagrasses trap soil and other material washed from the land by binding them together and stopping it from clouding the water column, which would otherwise prevent sunlight reaching plants on the seabed.

Variation exists among rocky reefs depending on the level of exposure to waves, the rock type, its weathering and the presence of rock pools, crevices and boulders which all in turn determine the composition of marine fauna. In the nearshore environment, seaweed forests are made up of a large brown kelp. In these environments the marine plants attach themselves to solid structures and extend their blades into the waters reaching toward the sunlight. Together the plants form a dense canopy of blades blocking out light and shading the surface of the solid substrate allowing for smaller species of algae to form. The kelp species typically populating these forests include giant kelp (*Macrocystis pyrifera*) and bull kelp (*Durvillea potatorum*).

5.4.4 Birds

The EPBC PMST identifies thirty-four (34) bird species as threatened or migratory whose habitat or migratory pathway may occur within the spill EMBA (listed in Table 5.4). The results of the PMST primarily comprise fifteen albatross, six petrels, one parrot, three shearwaters, one tern, one curlew, one prion, one skua, one red knot and four sandpipers.

Three of these bird species are listed as critically endangered, 5 are endangered and 19 are listed as vulnerable.

Many of the bird species listed in Table 5.4 are protected by international agreements (Bonn Convention, JAMBA, CAMBA and ROKAMBA) and periodically fly through Bass Strait to and from the Bass Strait islands, mainland Victoria and Tasmania (DAWE, 2021b). Species listed as threatened are described in this section. Figure 5.8 illustrates the presence of these bird species throughout the year.

Table 5.4. EPBC Act-listed bird species that may occur within the spill EMBA

Scientific name	Common name	EPBC Act Status			Recorded in EMBA only	BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
True seabirds (26 species)							
Albatross							
Diomedea antipodensis	Antipodean albatross	V	Yes	Yes	-	FFR	
Diomedea antipodensis gibsoni	Gibson's albatross	V	Yes	Yes	-	-	
Diomedea epomophora (sensu stricto)	Southern royal albatross	V	Yes	Yes	-	-	
Diomedea exulans (sensu lato)	Wandering albatross	V	Yes	Yes	-	FFR	Generic RP in place for all albatross in Australia, + AS for all albatross
Diomedea sanfordi	Northern royal albatross	E	Yes	Yes	-	-	
Phoebetria fusca	Sooty albatross	V	Yes	Yes	-	-	
Thalassarche bulleri	Buller's albatross	V	Yes	Yes	-	FFR	
Thalassarche bulleri platei	Northern Buller's albatross	V	-	-	-	-	
Thalassarche cauta	Shy albatross	E	Yes	Yes	-	FFR	
Thalassarche chrysostoma	Grey-headed albatross	E	Yes	Yes	-	-	
Thalassarche impavida	Campbell albatross	V	Yes	Yes	-	FFR	
Thalassarche melanophris	Black-browed albatross	V	Yes	Yes	-	FFR	
Thalassarche salvini	Salvin's albatross	V	Yes	Yes	-	-	

Scientific name	Common name	EPBC Act Status: Listed threatened species	EPBC Act Status: Listed migratory species	EPBC Act Status: Listed marine species	Recorded in EMBA only	BIA within the EMBA?	Recovery Plan in place?
Thalassarche steadi	White-capped albatross	V	Yes	Yes	-	-	
Thalassarche sp. Nov.	Pacific albatross	V	-	Yes	-	-	
Petrels							
Fregetta grallaria grallaria	White-bellied storm-petrel	V	-	-	-	-	-
Halobaena caerulea	Blue petrel	V	-	Yes	-	-	-
Macronectes giganteus	Southern giant petrel	E	Yes	Yes	-	-	Generic RP and AS for giant petrels
Macronectes halli	Northern giant petrel	V	Yes	Yes	-	-	
Pterodroma leucoptera leucoptera	Gould's petrel	E	-	-	-	-	RP
Pterodroma mollis	Soft-plumaged petrel	V	-	Yes	-	FFR	CA
Other seabirds							
Ardenna carneipes	Flesh-footed shearwater	-	Yes	Yes	-	-	-
Ardenna grisea	Sooty Shearwater	-	Yes	Yes	-	-	-
Ardenna tenuirostris	Short-tailed shearwater	-	Yes	Yes	Yes	FFR	-
Catharacta skua	Great skua	-	-	Yes	-	-	-
Pachyptila turtur subantarctica	Fairy prion (southern)	V	-	-	-	-	CA
True shorebirds (8 species)							
Actitis hypoleucos	Common sandpiper	-	Yes	Yes	-	-	-
Calidris acuminata	Sharp-tailed sandpiper	-	Yes	Yes	-	R	-
Calidris canutus	Red knot	E	Yes	Yes	-	-	CA
Calidris ferruginea	Curlew sandpiper	CE	Yes	Yes	-	-	-
Calidris melanotos	Pectoral sandpiper	-	Yes	Yes	-	-	-

Scientific name	Common name	EPBC Act Status			Recorded in EMBA only	BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
Neophema chrysogaster	Orange-bellied parrot	CE	-	Yes	-	-	RP
Numenius madagascariensis	Eastern curlew	CE	Yes	Yes	-	-	CA
Sterna (Sternula) nereis nereis	Australian fairy tern	V	-	-	-	-	CA

Definitions	
Listed threatened species:	A native species listed in Section 178 of the EPBC Act as either extinct, extinct in the wild, critically endangered, endangered, and vulnerable or conservation dependent.
Listed migratory species:	A native species that from time to time is included in the appendices to the Bonn Convention and the annexes of JAMBA, CAMBA and ROKAMBA, as listed in Section 209 of the EPBC Act.
Listed marine species:	As listed in Section 248 of the EPBC Act.

Key		
EPBC Act status (@ February 2021)	V	Vulnerable
	E	Endangered
	CE	Critically endangered
BIA (Biologically Important Area)	A	Aggregation
	B	Breeding
	D	Distribution (i.e., presence only)
	F	Foraging
	FFR	Foraging, feeding or related behaviour
	M	Migration
	R	Roosting
Recovery plans	AS	Action Statement
	CA	Conservation Advice
	CMP	Conservation Management Plan
	RP	Recovery Plan

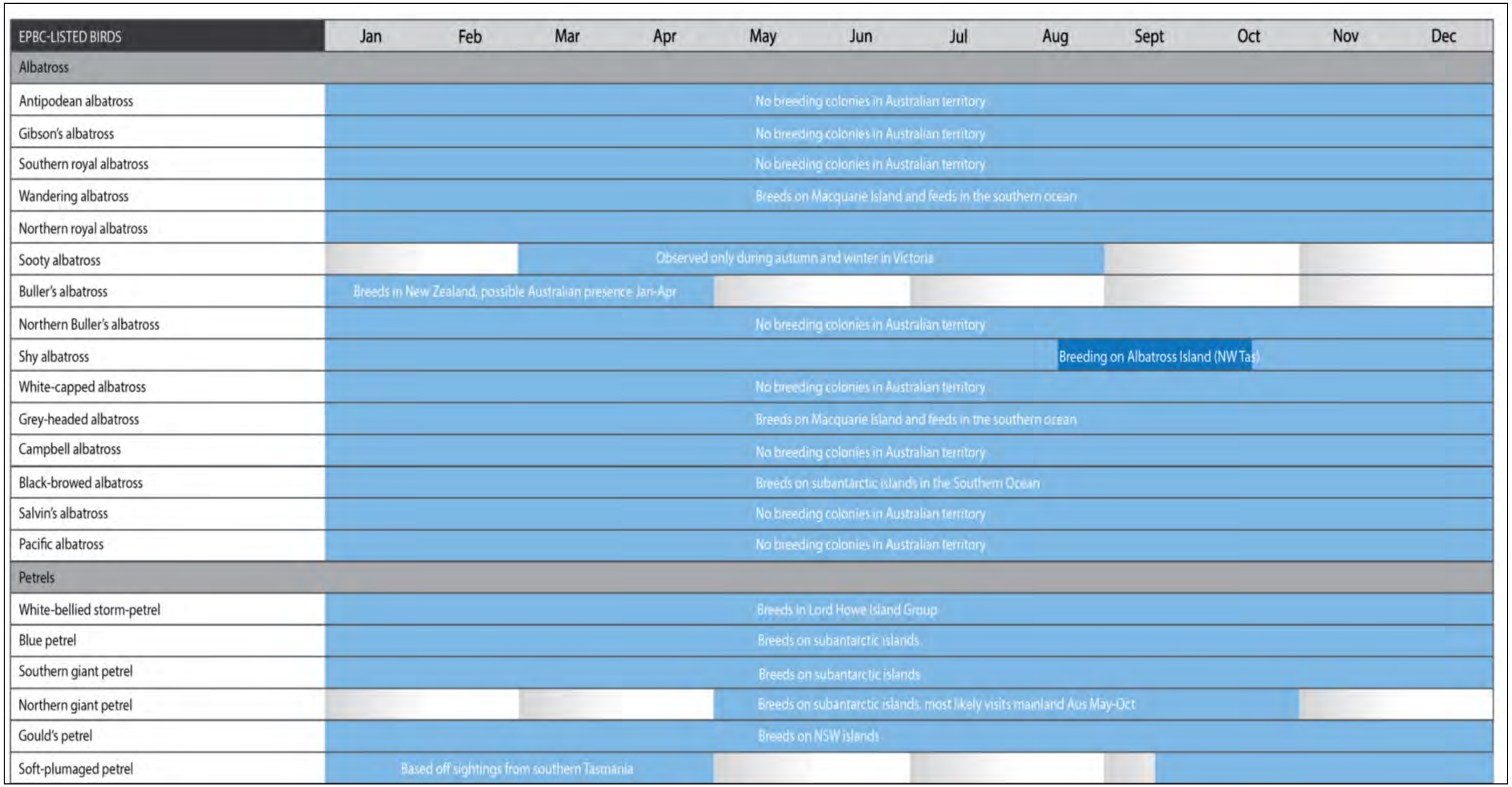


Figure 5.8. The annual presence and absence of seabirds and shorebirds in the spill EMBA

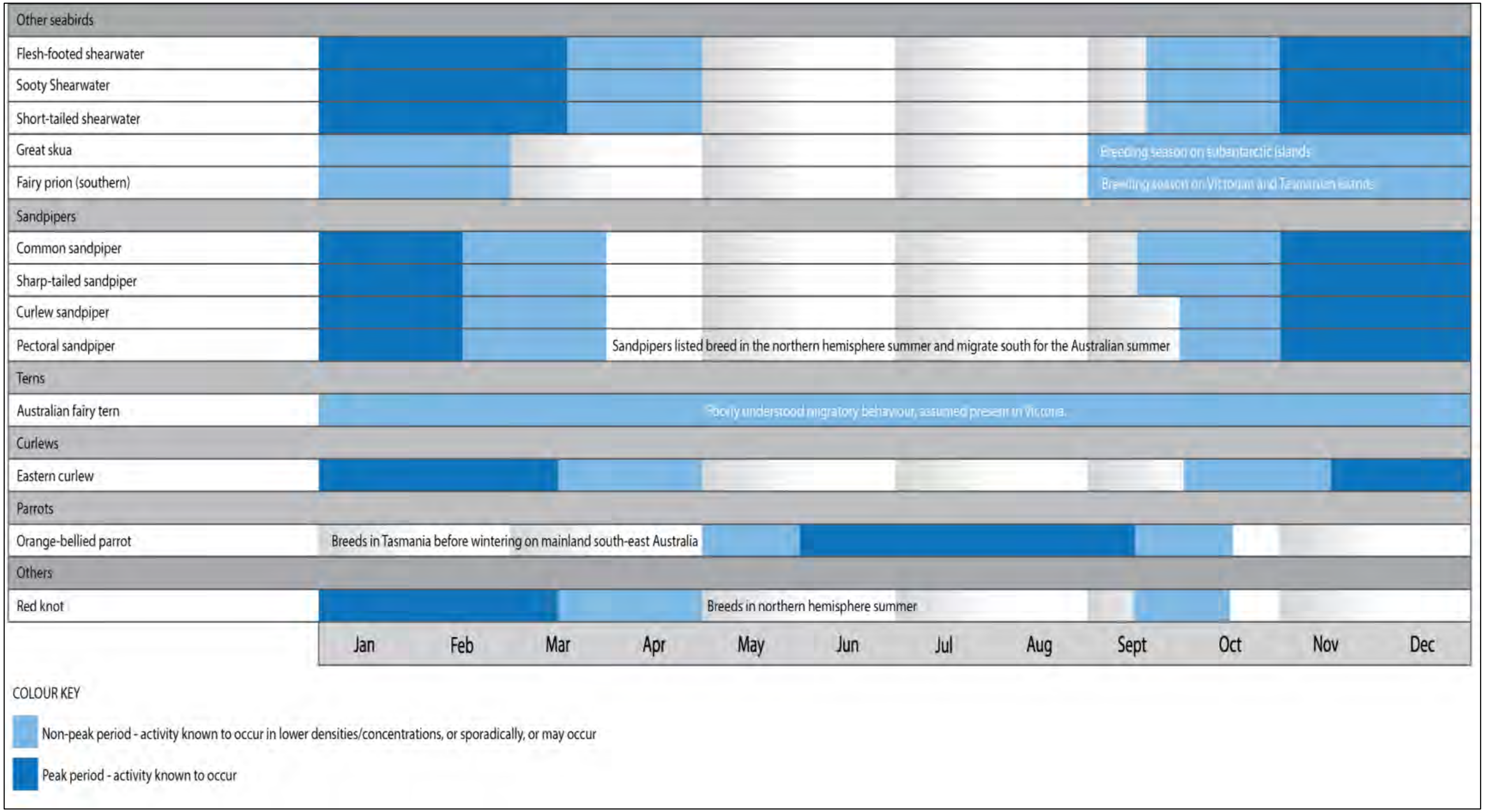


Figure 5.8 (*cont'd*). The annual presence and absence of seabirds and shorebirds in the spill EMBA

Seabirds

Albatross and Petrels

The majority of the EPBC Act listed seabird species are albatrosses and petrels that are considered to be the most dispersive and oceanic of all birds, spending more than 95% of their time foraging the Southern Ocean in search of prey and usually only returning to land to breed (DSEWPC, 2011a). Albatrosses prefer small, remote islands in the Southern Ocean (DSEWPC, 2011a) for breeding. Albatross Island is the closest breeding habitat to the activity area located approximately 69 km to the southwest of White Ibis-1 and outside the spill EMBA. Other albatross and petrel breeding islands located within Australian jurisdiction include Mewstone, Pedra Branca and Macquarie Island, all of which are outside the EMBA. The petrel species listed in Table 5.4 are widely distributed throughout the southern hemisphere. They nest on isolated islands and breed on sub-Antarctic and Antarctic islands. The northern giant-petrel and southern giant-petrel share some of the same breeding areas listed for the albatross (DSEWPC, 2011a). Outside the breeding season (October to February), petrels disperse widely and move north into sub-tropical waters (DSEWPC, 2011a). Most petrel species feed on krill, squid, fish, other small seabirds and marine mammals (DSEWPC, 2011a). Albatross and petrels are threatened by incidental catch resulting from human fishing operations.

Shearwaters

Shearwaters are medium-sized long-winged seabirds most common in temperate and cold waters. They come to islands and coastal cliffs to breed, nesting in burrows and laying a single white egg. Shearwaters feed on small fish, cephalopod molluscs (squid, cuttlefish, nautilus and argonauts), crustaceans (barnacles and shrimp), and other soft-bodied invertebrates and offal. These species forage almost entirely at sea and very rarely on land (TSSC, 2014).

Three of the EPBC Act-listed species recorded in the EMBA by the PMST database (sooty, flesh-footed and short-tailed) are trans-equatorial migrants that cross the Pacific Ocean for the northern hemisphere summer (TSSC, 2014). It is possible these species may overfly the EMBA, however they are unlikely to be encountered in the spill EMBA due to the significant distance of the EMBA to any breeding locations in the Furneaux Group (Flinders Island, etc).

Great Skua

The great skua (*Catharacta skua*) is a large migratory seabird distributed throughout all southern Australian waters (though not listed as migratory under the EPBC Act). This species breeds in summer on nested elevated grasslands or sheltered rocky areas on sub-Antarctic islands, with most adult birds leaving their colonies in winter. Great skuas feed on other seabirds, fish, molluscs and crustaceans, and is likely to be present in the activity area and EMBA (though scarce) during winter (Flegg, 2002).

Southern fairy prion

The southern fairy prion (*Pachyptila turtur subantarctica*) is mainly found offshore. The species diet is comprised mostly of crustaceans (especially krill), but occasionally includes some fish and squid. It feeds mainly by surface-seizing and dipping, but can also catch prey by surface-plunging or pattering (TSSC, 2015a). In Australia, it is known to breed only on Macquarie Island (approximately 1,880 km southeast of the activity area), and on the nearby Bishop and Clerk islands (TSSC, 2015a).

Shorebirds

Sandpipers

There are four sandpiper species (common, sharp-tailed, curlew, pectoral) that may occur within the spill EMBA. They breed in Europe and Asia and migrate to Australia during the southern summer. Sandpipers are small wader species found in coastal and inland wetlands, particularly in muddy estuaries, feeding on small marine invertebrates (Birdlife Australia, 2020; DoE, 2015b). Up to 3,000 sharp-tailed sandpiper and up to 1,800 curlew sandpiper are known to congregate to feed at the Gippsland Lakes. Given the offshore location of the EMBA, it is unlikely that sandpipers would be present in the activity area or spill EMBA.

Red knot

The red knot (*Calidris canutus*) is the only species of knot that may occur within the spill EMBA. This species has a coastal distribution around the entire Australian coastline when they are present during the southern hemisphere summer (breeding in eastern Siberia in the northern hemisphere summer). Knots are a medium-sized wader that prefer sandy beach, tidal mudflats and estuary habitats, where they feed on bivalve molluscs, snails, worms and crustaceans (Birdlife Australia, 2020). Lake Reeve has supported the largest concentration (5,000) of red knot recorded in Victoria. Due to the lack of coastal shorelines, it is unlikely that the red knot would be present in the activity area or spill EMBA.

Orange-bellied parrot

The orange-bellied parrot (*Neophema chrysogaster*) breeds in Tasmania during summer, migrates north across Bass Strait in autumn and over-winters on the mainland. Birds depart the mainland for Tasmania from September to November (Green, 1969). The southward migration is rapid (Stephenson, 1991), so there are few migration records. The northward migration across western Bass Strait is more prolonged (Higgins, 1999).

The parrot's breeding habitat is restricted to southwest Tasmania, where breeding occurs from November to mid-January mainly within 30 km of the coast (DELWP, 2016). The species forage on the ground or in low vegetation (Brown and Wilson, 1980; DEWLP, 2016, Loyn *et al.*, 1986).

During winter, on mainland Australia, orange-bellied parrots are found mostly within 3 km of the coast (DELWP, 2016). In Victoria, they mostly occur in sheltered coastal habitats, such as bays, lagoons and estuaries, or, rarely, saltworks. They are also found in low samphire herbland dominated by beaded glasswort (*Sarcocornia quinqueflora*), sea heath (*Frankenia pauciflora*) or sea-blite (*Suaeda australis*), and in taller shrubland dominated by shrubby glasswort (*Sclerostegia arbuscula*).

Most known breeding activity occurs within 10 km of Melaleuca Lagoon, outside of the spill EMBA, a distant 360 km south of the activity area. Key non-breeding habitat is known to occur around Corner Inlet in Victoria 127 km northeast of the activity area. King Island is known as a key location in the migration route between breeding and non-breeding sites, principally within the Lavinia State Reserve, which is located approximately 98 km west from the activity area, and outside of the EMBA (DELWP, 2016). This species is unlikely to be present in the activity area.

Australian fairy tern

The fairy tern (*Sterna nereis nereis*) occurs in and offshore of the gulfs of South Australia (outside the EMBA). They are also known to breed on the offshore islands and coast of Spencer Gulf (outside the EMBA) (Edyvane, 1999). Flegg (2002) reports that the species is widespread on southern and western Australian coasts, and breeds on coastal beaches and islands (none intersected by the spill EMBA). This species is unlikely to be present in the activity area.

Eastern curlew

The eastern curlew (*Numenius madagascariensis*) is the world's largest shorebird and is widespread in coastal regions in the north-east and south of Australia, including Tasmania. It is commonly found on intertidal mudflats and sandflats where it uses its long beak to pick the surface and probes for crabs. Eastern curlews are also found on sheltered coasts, especially estuaries, mangrove swamps, bays, harbours and lagoons (DoE, 2015c). The species is unlikely to be present in the activity area.

5.4.5 Cetaceans

The EMBA PMST Report identified 14 cetaceans that potentially occur in the EMBA; ten whales species and six dolphins species (DAWE, 2021a). The activity area PMST Report identified 13 cetaceans that potentially occur in the activity area; nine whales and four dolphins. The short-finned pilot whale was the one species identified as potentially occurring within the EMBA but not the activity area.

A description of species listed in Table 5.5 is focused on threatened species.

The EMBA and activity area overlap a foraging BIA (known foraging area) for the pygmy blue whale and a distribution BIA for the southern right whale. The PMST reports identified foraging behaviour likely for the fin and sei whale and foraging behaviour may occur for the pygmy right whale.

Figure 5.9 illustrates the presence and absence of the threatened cetacean species in the EMBA throughout the year.

Table 5.5. EPBC Act-listed cetaceans that may occur within the EMBA

Scientific name	Common name	EPBC Act Status			Recorded in EMBA only	BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
Whales							
Balaenoptera acutorostrata	Minke whale	-	-	Yes	-	-	-
Balaenoptera borealis	Sei whale	V	Yes	Yes	-	-	CA
Balaenoptera musculus	Blue whale	E	Yes	Yes	-	F, D	RP
Balaenoptera physalus	Fin whale	V	Yes	Yes	-	-	CA
Caperea marginata	Pygmy right whale	-	Yes	Yes	-	-	-
Eubalaena australis	Southern right whale	E	Yes	Yes	-	M	CMP
Globicephala macrorhynchus	Short-finned pilot whale	-	-	Yes	-	-	-
Megaptera novaeangliae	Humpback whale	V	Yes	Yes	-	-	CA
Dolphins							
Delphinus delphis	Common dolphin	-	-	Yes	-	-	-
Grampus griseus	Risso's dolphin	-	-	Yes	-	-	-
Lagenorhynchus obscurus	Dusky dolphin	-	Yes	Yes	-	-	-
Orcinus orca	Killer whale	-	Yes	Yes	-	-	-
Pseudorca crassidens	False killer whale	-	-	Yes	-	-	-

Scientific name	Common name	EPBC Act Status			Recorded in EMBA only	BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
Tursiops truncates s. str.	Bottlenose dolphin	-	-	Yes	-	-	-

Definitions and key as per Table 5.4.

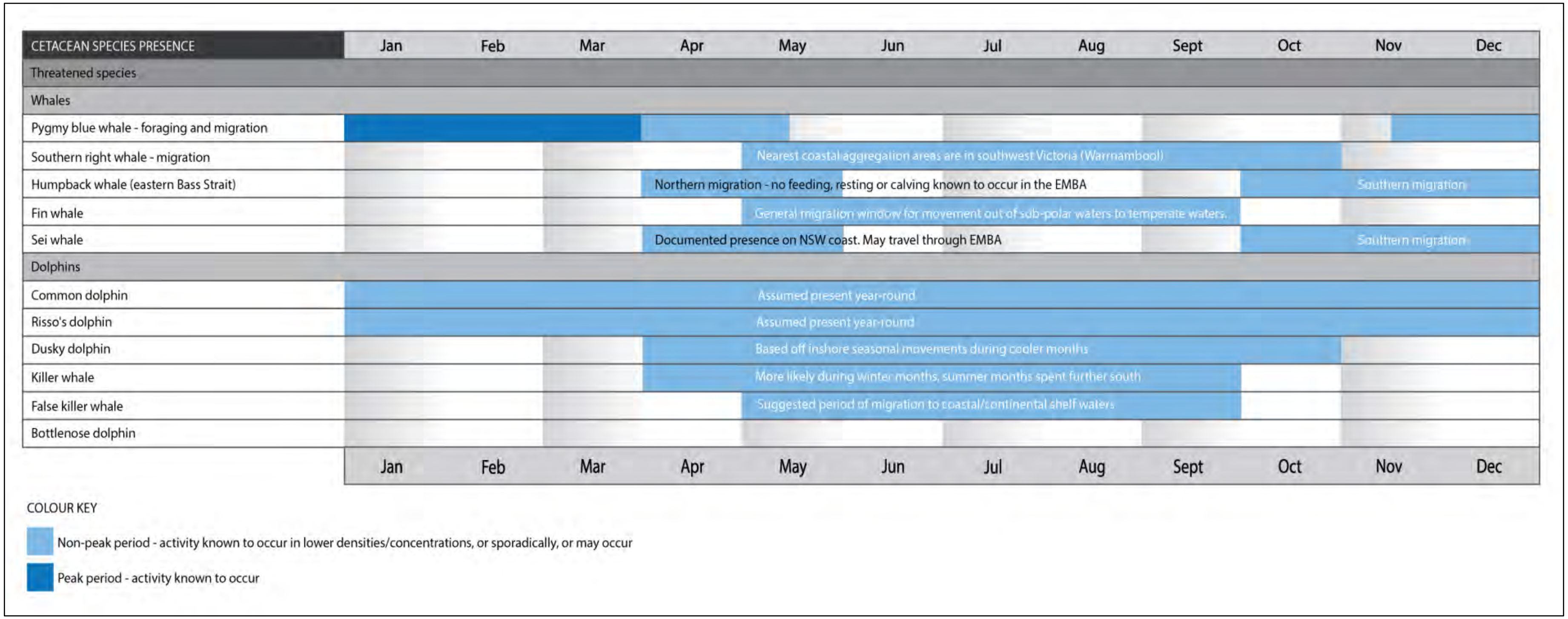


Figure 5.9. The annual presence and absence of cetacean species that may occur in the activity area or spill EMBA

<u>Blue Whale</u>

Blue whales (*Balaenoptera musculus*) are the largest living animals on earth, growing to a length of over 30 m, weighing up to 180 tonnes and living to 90 years (DoE. 2015d). The DoE (2015d) recognises three overlapping populations:

- Antarctic blue whale population (*B. musculus intermedia*) are those blue whales occupying or passing through Australian waters that feed on krill predominantly if not exclusively in Antarctic waters.
- Indo-Australian pygmy blue whales (*B. musculus brevicauda*) are those pygmy blue whales occupying or passing through waters from Indonesia to western and southern Australia and are not generally found in Antarctic waters, and appear to feed in more temperate waters.
- Tasman-Pacific pygmy blue whales (*B. musculus brevicauda*) are those pygmy blue whales generally considered to be occupying or passing through waters in southeast Australia and the Pacific Ocean and are not generally found in Antarctic waters, and appear to feed in more temperate waters.

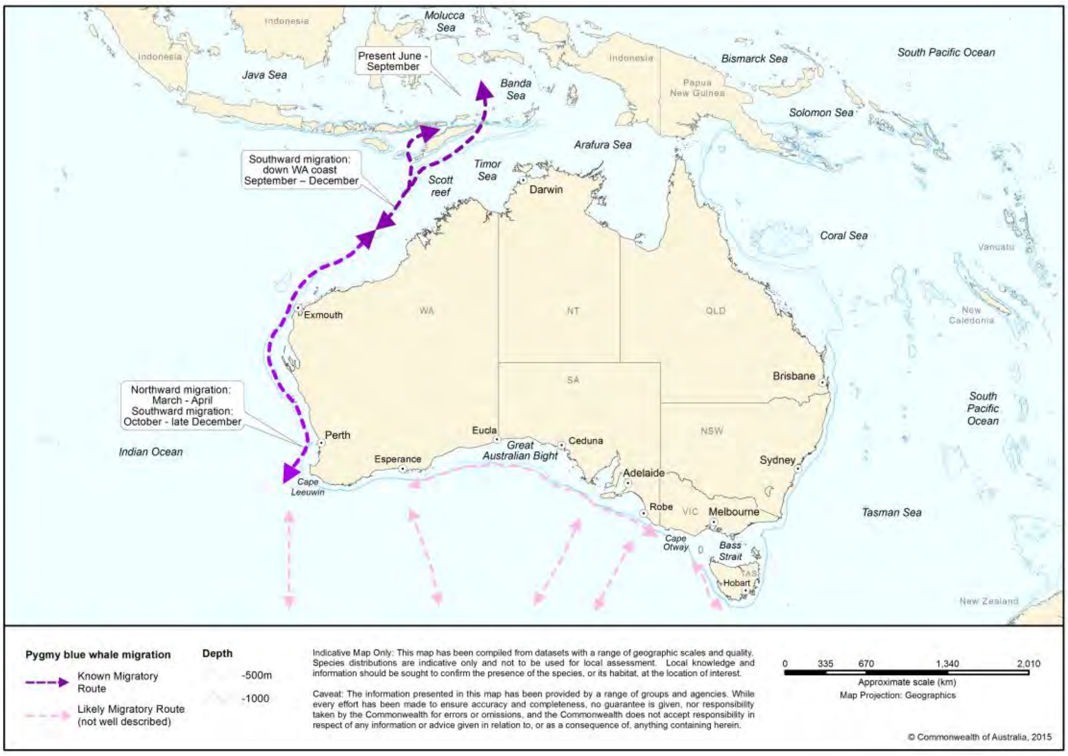
The Antarctic sub-species has been acoustically detected off the west and north coasts of Tasmania predominately from May to December. Based on the seasonality of recordings, these areas possibly form part of their migratory route, breeding habitat or a combination of the two (DoE, 2015d).

Indo-Australian pygmy blue whales inhabit Australian waters as far north as Scott Reef, the Kimberley region and west of the Pilbara and as far south as southwest Australia across to the Great Australian Bight and the Bonney Upwelling, and to waters as far east off Tasmania (Figure 5.10). They have known feeding grounds in the Perth Canyon off Western Australia and the Bonney Upwelling System and adjacent waters off Victoria, South Australia, and Tasmania. These areas are utilised from November to May. They migrate between these feeding aggregation areas, northwards and southwards along the west coast of Australia, to breeding grounds that are likely to include Indonesia.

The Tasman-Pacific pygmy blue whale is the sub-species that migrates through Bass Strait, found in waters north of 55°S (DoE, 2015d). Blue whales are a highly mobile species that feed on krill (euphausids, *Nyctiphane australis*).

A BIA for 'possible foraging area' for the pygmy blue whale covers the activity area and spill EMBA, with high annual use foraging areas (abundant food source) occurring off the southwest Victorian coast, which is not intersected by the activity area or spill EMBA (Figure 5.11).

The time and location of the appearance of blue whales in the South-east Marine Region generally coincides with the upwelling of cold water in summer and autumn along the southeast South Australian and southwest Victoria coast (the Bonney Upwelling) and the associated aggregations of krill that they feed on (DoE, 2015d; Gill and Morrice, 2003). This is a key feeding area for the species. The Bonney Upwelling generally starts in the eastern part of the Great Australian Bight in November or December and spreads eastwards to the Otway Basin around February as southward migration of the sub-tropical high-pressure cell creates favourable winds for upwelling. Pygmy blue whales predominately occupy the western area of the Bonney Upwelling from November to December, and then move southeast during January to April, though the within-season distribution trends in Bass Strait are unknown (DoE, 2015d).



Source: DoE (2015d).

Figure 5.10. Pygmy blue whale migration routes

The DoE (2015d) states that migratory routes for pygmy blue whales off the east coast of Australia are unknown (as seen by the absence of migratory routes in Figure 5.10). However, blue whale migration patterns are thought to be similar to those of the humpback whale, with the species feeding in mid-to high-latitudes (south of Australia) during the summer months and moving to temperate/tropical waters in the winter for breeding and calving. Pygmy blue whale migration is oceanic and no specific migration routes have been identified in the Australasian region (DoE, 2015d).

The Tasman-Pacific pygmy blue whale, which only occupies waters north of 55°S, potentially migrates through Bass Strait although there is little information about this (DoE, 2015d). The DoE (2015d) states that migratory routes for pygmy blue whales off the east coast of Australia are unknown (as seen by the absence of migratory routes in Figure 5.10).

During construction of the Yolla-A platform, a sea noise logger was deployed from April to October 2004. The presence of several whale species was evident in the recordings although the proximity of the whales could not be determined; blue whales were mainly evident in winter and in late autumn pygmy blue whales passed through Bass Strait. There was no obvious evidence of humpback whales, other whale species or fish choruses (McCauley, 2005).

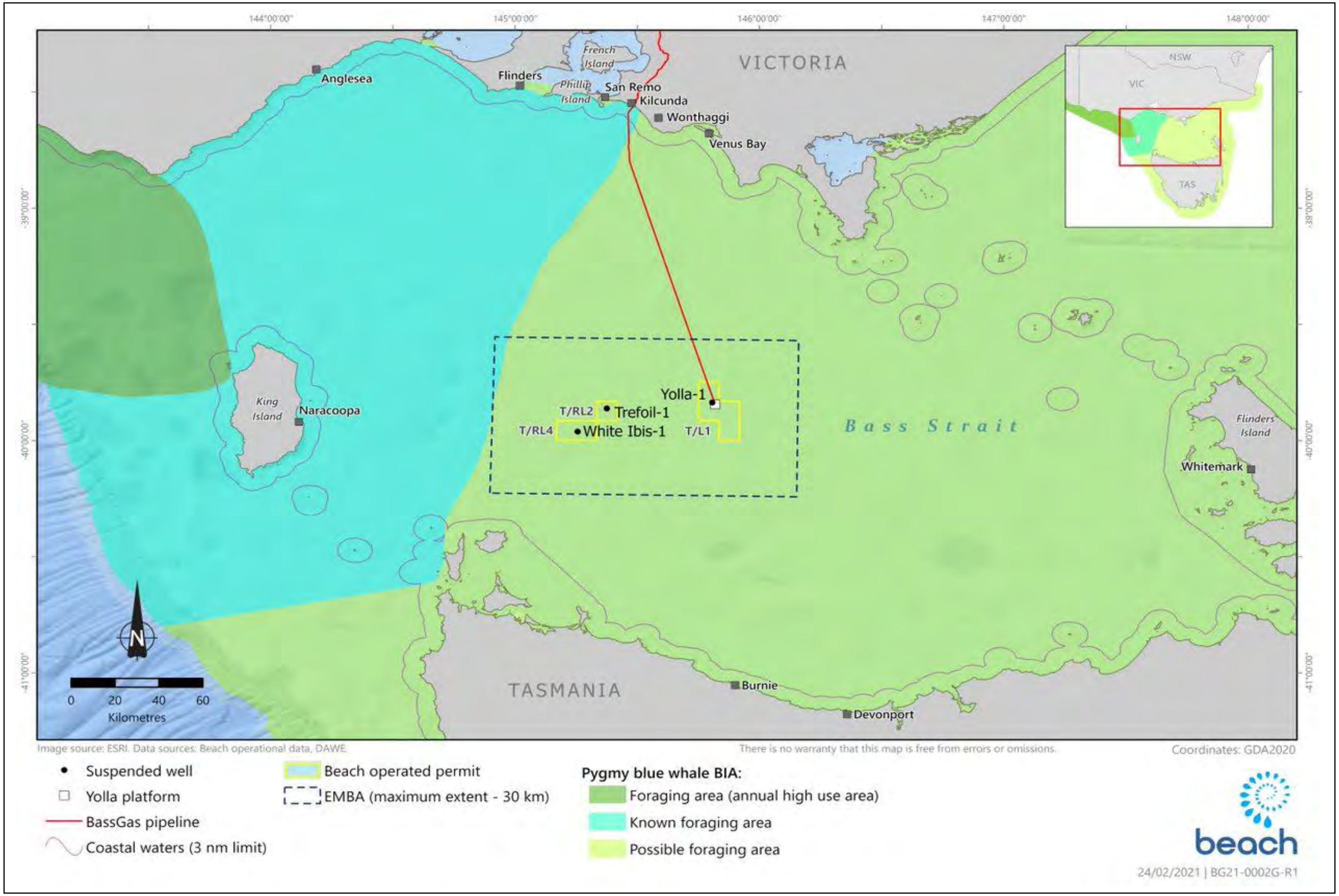


Figure 5.11. Pygmy blue whale BIA intersected by the activity area and spill EMBA

Southern Right Whale

Southern right whales (*Eubalaena australis*) are medium to large black (or less commonly grey-brown) baleen whales (DSEWPC, 2012). They are recognisable by the lack of a dorsal fin, rotund body shape and whitish callosities (patches of keratinised skin colonised by cyamids - small crustaceans) on the head. They have a maximum length of approximately 17.5 m and an approximate weight of 80 tonnes, with mature females slightly larger than males (DSEWPC, 2012).

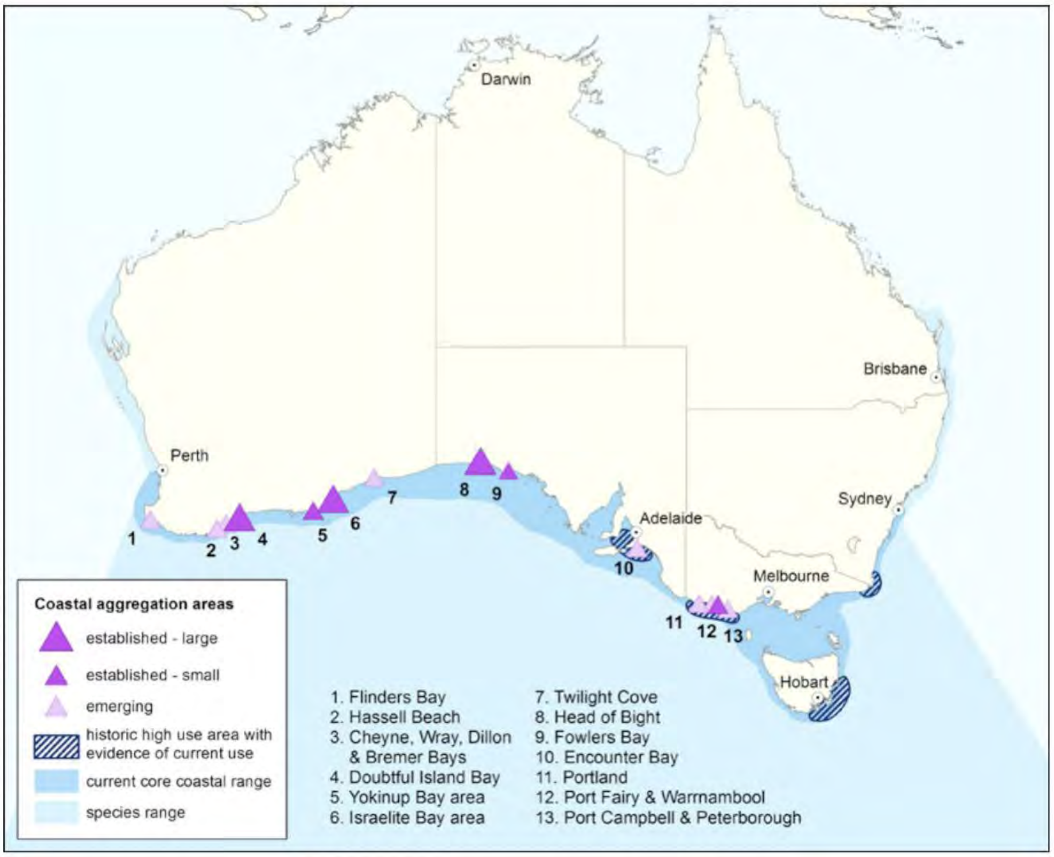
Nineteenth century whaling drastically reduced southern right whale numbers. An estimated 55,000 to 70,000 whales were present in the southern hemisphere in the late 1700s (DSEWPC, 2012). By the 1920s there may have been fewer than 300 individuals remaining throughout the southern hemisphere (DSEWPC, 2012). Other reports suggest the number of individuals in Australia was reduced to 1,500 (Charlton *et al*., 2014). The current Australian population is estimated at 3,500 individuals (Charlton *et al*., 2014). The southern right whale is typically distributed between 16°S and 65°S in the southern hemisphere and is present off the Australian coast between May and October (sometimes as early as April and as late as November) (DSEWPC, 2012).

Southern right whales tend to be distinctly clumped in aggregation areas (DSEWPC, 2012). Aggregation areas are well known with a well-recognised area in Victoria at Warrnambool. The number of whales visiting Victoria is a small fraction of the main population that spends winter along the coasts of South Australia and Western Australia (DSEWPC, 2012).

A number of additional aggregation areas for southern right whales are emerging that might be of importance particularly to the south-eastern population. In these areas small but growing numbers of non-calving whales regularly aggregate for short periods of time. These areas include coastal waters off Peterborough, Port Campbell, Port Fairy and Portland in Victoria located more than 300 km northwest of the activity area, with waters less than 10 m deep preferred (DSEWPC, 2012).

The NCVA identifies a BIA for migration/resting of the southern right whale through all of Bass Strait (Figure 5.12). The closest known aggregation/breeding/calving area to the activity area is at Logan's Beach on the coast near Warrnambool approximately 290 km to the northwest. The area around Wilson's Promontory is a migration/resting area where breeding may occur. The southeast Tasmanian coast is designated as a migration/resting area where breeding is likely to occur (Figure 5.13).

A defined near-shore coastal migration corridor is considered unlikely given the absence of any predictable directional movement for the species (DSEWPC, 2012). Critical habitat for the southern right whale is not defined under the EPBC Act (DSEWPC, 2012) though the BIA shown in Figure 5.12 around Warrnambool, Wilson's Promontory and southeast Tasmania may be considered critical habitat as female southern right whales show calving site fidelity, which combined with their low and slow reproductive rate make calving sites of critical importance to the species recovery (DSEWPC, 2012).



Source: DSEWPC (2012b).

Figure 5.12. Southern right whale aggregation areas

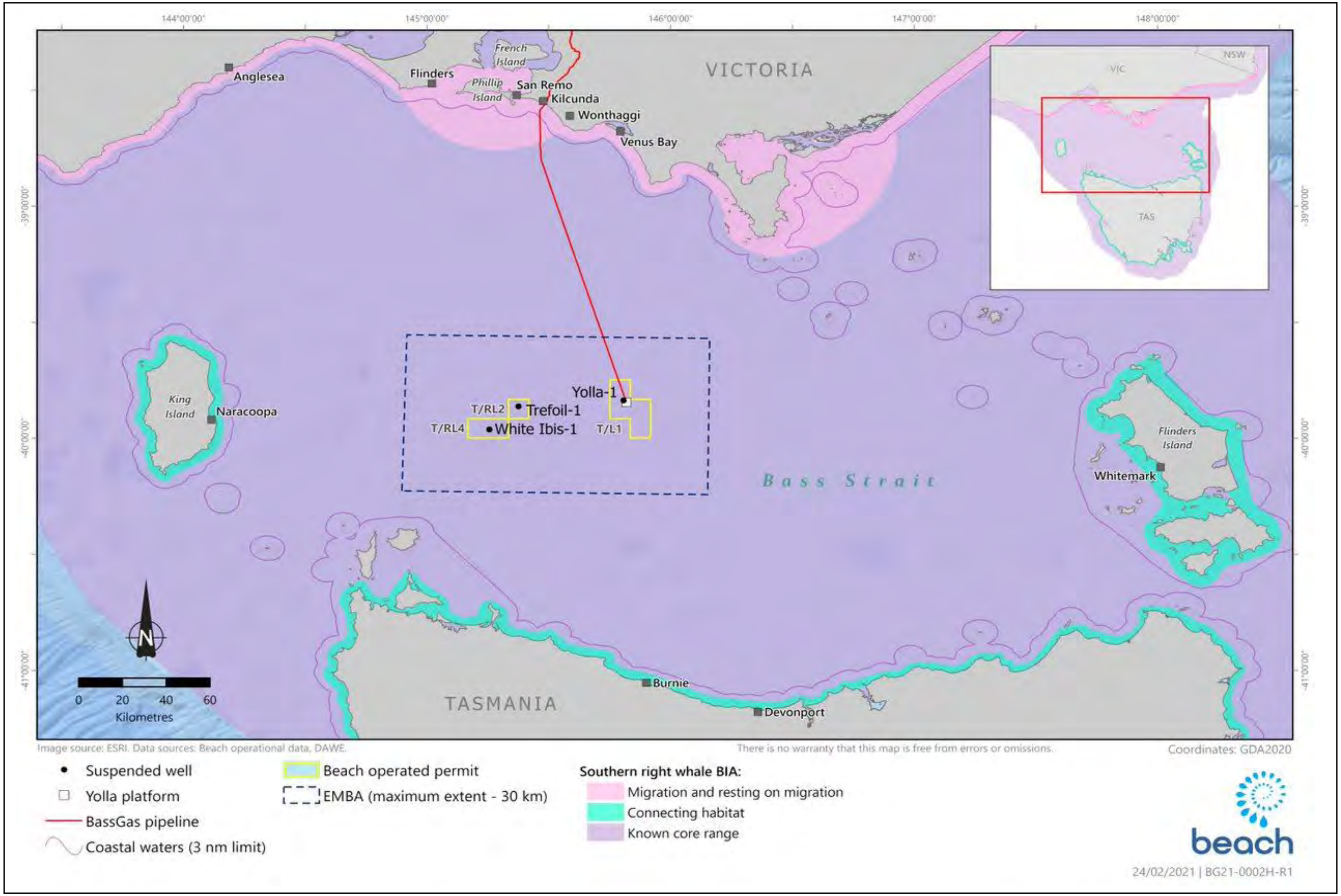


Figure 5.13. Southern right whale BIA intersected by the activity area and EMBA

Humpback Whale

The humpback whale (*Megaptera novaeangliae*) is a moderately large (15 to18 m long) baleen whale that has a worldwide distribution and a geographic segregation. In the 19th and 20th centuries, humpback whales were hunted extensively throughout the world's oceans and as a result it is estimated that 95% of the population was eliminated. Commercial whaling of humpback whales ceased in 1963 in Australia, at which time it is estimated that humpback whales were reduced to between 3.5 and 5% of pre-whaling abundance (TSSC, 2015b).

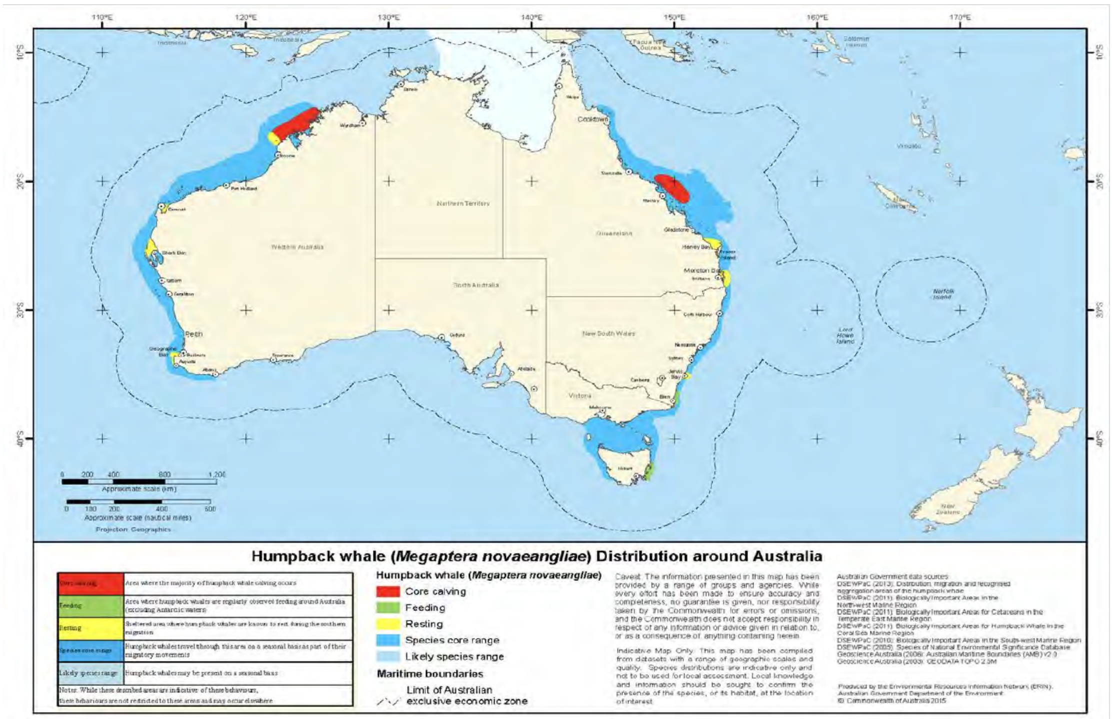
The EPBC Act Threatened Species Scientific Committee (TSSC) states that a 2012 and 2014 review of the conservation status of the species considered that it no longer meets any criteria for listing as threatened under the EPBC Act though it remains listed as vulnerable (TSSC, 2015b).

Humpback whales are found in Australian offshore and Antarctic waters. They primarily feed on krill in Antarctic waters south of 55°S. The eastern Australian population of humpback whales is referred to as Group E1 by the International Whaling Commission, one of seven distinct breeding stocks in the southern hemisphere (TSSC, 2015b).

Bass Strait represents part of the core range of the E1 Group. Feeding, resting or calving is not known to occur in Bass Strait (TSSC, 2015b) though migration through Bass Strait occurs (Figure 5.14). The nearest area that humpback whales are known to congregate and potentially forage is at the southern-most part of NSW near the eastern border of Victoria approximately 550 km northeast of the activity area (Figure 5.15) at Twofold Bay, Eden off the New South Wales south coast.

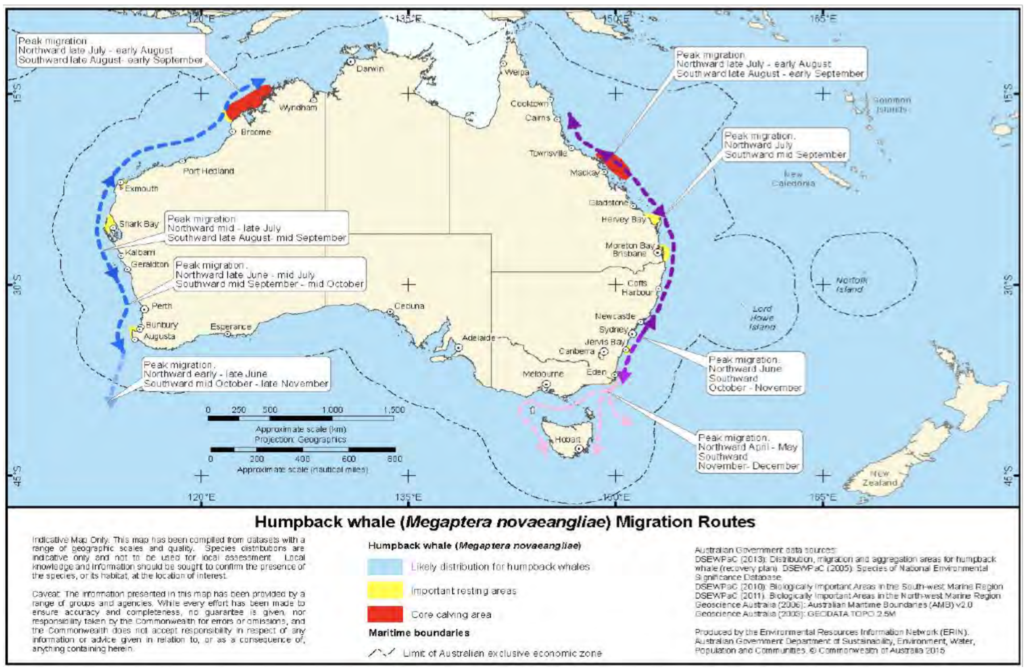
Humpback whales migrate from their summer feeding grounds in Antarctic waters northward up the Australian east coast to their breeding and calving grounds in sub-tropical and tropical inshore waters (TSSC, 2015b). The northern migration off the southeast coast starts in April and May with the southern migration occurring from November to December. This migration tends to occur close to the coast along the continental shelf boundary in waters about 200 m deep (TSSC, 2015b) (Figure 5.15).

The conservation advice for the humpback whale (TSSC, 2015b) identifies vessel strike and anthropogenic noise as threats to the species. The spill EMBA overlaps the core migration range of humpback whales. It is likely that humpback whales migrate through the spill EMBA during April, May, November and December.



Source: TSSC (2015d).

Figure 5.14. Humpback whale distribution around Australia



Source: TSSC (2015d).

Figure 5.15. Humpback whale migration routes around Australia

Fin whale

The fin whale (*B. physalus*) is the second largest whale species after the blue whale, growing up to 27 m long and weighing up to 70 tonnes (TSSC, 2015c). Fin whales are considered a cosmopolitan species and occur from polar to tropical waters, and rarely in inshore waters. The full extent of their distribution in Australian waters is uncertain but they occur within Commonwealth waters and have been recorded in most state waters and from Australian Antarctic Territory waters (TSSC, 2015c).

Fin whales are generally thought to undertake long annual migrations from higher latitude summer feeding grounds to lower latitude winter breeding grounds (TSSC, 2015c). It is likely they migrate between Australian waters and Antarctic feeding areas (the Southern Ocean), sub-Antarctic feeding areas (the Southern Subtropical Front) and tropical breeding areas (Indonesia, the northern Indian Ocean and south-west South Pacific Ocean waters) (TSSC, 2015c).

Fin whales have been sighted inshore in the proximity of the Bonney Upwelling along the continental shelf in summer and autumn months (TSSC, 2015c). The sighting of a cow and calf in the Bonney Upwelling in April 2000 and the stranding of two fin whale calves in South Australia suggest that this area may be important to the species' reproduction, perhaps as a provisioning area for cows with calves (TSSD, 2015c). However, there are no defined mating or calving areas in Australia waters.

The conservation advice (TSSC, 2015c) identifies vessel strike and anthropogenic noise as threats to the species. Based on the fin whale preference for offshore waters, the absence of a BIA in Australian waters and the minimal sightings in Bass Strait, it is considered unlikely that this species occurs within the spill EMBA.

Sei whale

Sei whales (*Balaenoptera borealis*) are primarily found in deep water oceanic habitats and their distribution, abundance and latitudinal migrations are largely determined by seasonal feeding and breeding cycles (TSSC, 2015b).

Sei whale global population is estimated to have declined by 80% over the previous three generation period (TSSC, 2015b). Sei whales were the most commonly observed whales during Australian National Antarctic Research Expedition voyages in the 1960s and 1970s, with the majority recorded south of 60°S in the Southern Ocean (TSSC, 2015b).

These whales are thought to complete long annual seasonal migrations from subpolar summer feeding grounds to lower latitude winter breeding grounds (TSSC, 2015b); details of this migration and whether it involves the entire population are unknown.

In the Australian region, sei whales occur within Australian Antarctic Territory waters and Commonwealth waters, and have been infrequently recorded off Tasmania, New South Wales, Queensland, the Great Australian Bight, Northern Territory and Western Australia (TSSC, 2015b).

Sightings of sei whales within Australian waters includes areas such as the Bonney Upwelling off South Australia (outside the EMBA), where opportunistic feeding has been observed between November and May (TSSC, 2015b).

Based upon the species preference for offshore waters, the absence of a BIA for the species in Australia and the small number of sei whale sightings in southeast Australia, it is considered unlikely that this species occurs within the EMBA.

5.4.6 Pinnipeds

There are two pinniped species recorded under the EPBC Act PMST as potentially occurring within the activity area and the spill EMBA (Table 5.6) (DAWE, 2021a). Figure 5.16 illustrates the fur-seal colonies and haul-out sites in the EMBA.

Table 5.6. EPBC Act-listed pinnipeds that may occur in the EMBA

Scientific name	Common name	EPBC Act Status			Recorded in EMBA only	BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
Arctocephalus forsteri	New Zealand fur-seal	-	-	Yes	-	-	-
Arctocephalus pusillus	Australian fur-seal	-	-	Yes	-	-	-

Definitions and key as per Table 5.4

<u>Australian fur-seal</u>

The Australian fur-seal (*Arctocephalus pusillus*) is common in the spill EMBA and is not listed as a threatened or migratory species under the EPBC Act.

Australian fur seals are endemic to south-eastern Australian waters and have a relatively restricted distribution around the rocky islands of Bass Strait. It is estimated that there are 60,000 Australian fur seals in Bass Strait and the waters around Tasmania. The species has been recorded in the waters off South Australia, Victoria, Tasmania and New South Wales and are the only species of seal known to breed on Victorian and Tasmanian islands in Bass Strait (Kirkwood *et al*., 2009).

There are 10 established breeding colonies of the Australian fur-seal that are restricted to islands in the Bass Strait; six occurring off the coast of Victoria and four off the coast of Tasmania (Kirkwood *et al*., 2009). The largest of the established colonies occur at Lady Julia Percy Island (26% of the breeding population and 329 km northwest of the activity area) and at Seal Rocks adjacent Phillip Island (25% of the breeding population and 149 km north of the activity area), in Victoria. These areas are not located within the spill EMBA.

Other Australian fur-seal breeding colonies in Bass Strait include (none are intersected by the EMBA):

- Rag Island (1,000 fur seal & 270 pups in 2007);
- Kanowna Island (15,000 adults and 3,000 pups);
- Anser Group of Islands;
- The Skerries – 11,500 individuals and 3,000 pups (in 2002); and
- Judgment Rock in the Kent Island Group (~2,500 pups per year) (Kirkwood *et al*., 2009, Shaughnessy, 1999; (Figure 5.17).

Barton et al (2012) and Carlyon et al (2011) list the haul-out sites known in Bass Strait (all of which are located outside the activity area and spill EMBA):

- Beware Reef – a haul-out site where the seals are present most of year;
- Gabo Island – 30-50 individuals; and
- The Hogan Island group – about 300 animals.

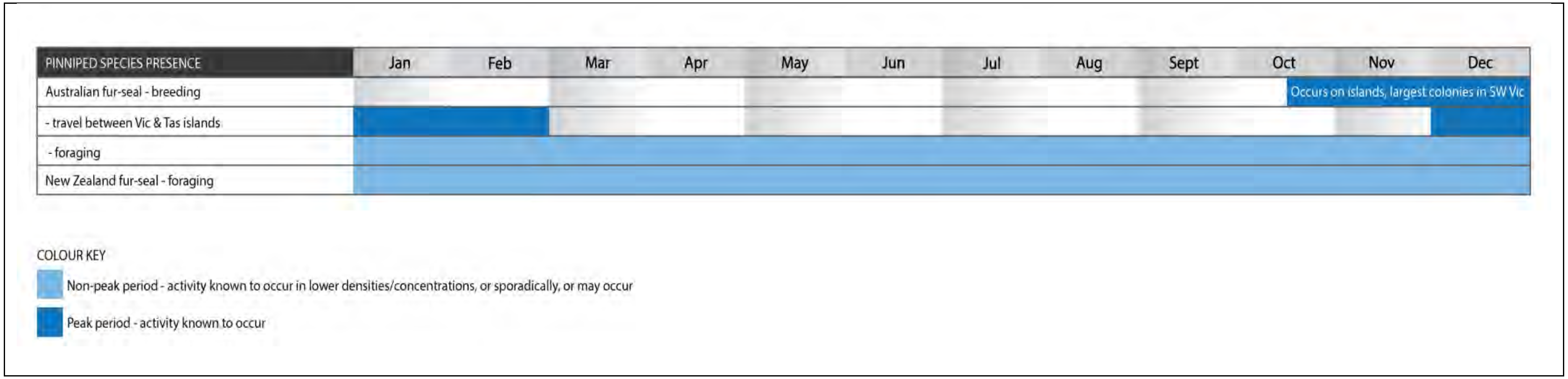


Figure 5.16. Annual activities and presence of EPBC Act-listed pinnipeds in the EMBA

Australian fur seals have a relatively restricted distribution around the islands of Bass Strait where it is the most common seal (Kirkwood *et al*., 2005). Adult tagged seals have shown travel paths from Flinders Island to King Island presumably passing through central Bass Strait. Their preferred habitat, especially for breeding, is a rocky island with boulder or pebble beaches and gradually sloping rocky ledges.

During the summer months Australian fur seals are observed repeatedly travelling between northern Bass Strait islands and southern Tasmania waters following the Tasmanian east coast. Lactating female fur seals and some territorial males are restricted to foraging ranges within Bass Strait waters. Lactating female Australian fur seals forage primarily within the shallow continental shelf of Bass Strait, including off Cape Otway in western Victoria. They forage on benthos at depths of between 60 m and 80 m (Hume *et al*., 2004; Arnould and Kirkwood, 2007; Robinson *et al*., 2008) generally within 100 km to 200 km of the breeding colony for up to five days at a time (Hume *et al*., 2004). The lactation period lasts for between 10 and 11 months and some females may nurse pups for up to three years (Arnould and Hindell, 2001).

Male Australian fur seals are bound to colonies during the breeding season from late October to late December. Outside the breeding season they forage up to several hundred kilometres (Hume *et al*., 2004) and are away for long periods even up to nine days (Kirkwood *et al*., 2005). The sexes generally forage in the same environment (Kirkwood *et al*., 2005); this suggests that males target different prey than females as observed in similar New Zealand fur seals where males prey on larger fish and seabird species compared to females. The activity area is likely to represent foraging grounds for some Australian fur-seals.

<u>New Zealand fur-seal</u>

New Zealand fur-seals (*A. fosteri*, also sometimes referred to as long-nosed fur-seals) are mostly found in central South Australian waters (Kangaroo Island to South Eyre Peninsula) with 77% of their population is found here (outside the EMBA) (Shaughnessy, 1999).

There are 51 known breeding sites for New Zealand fur-seals in Australia, with most of these outside of Victoria (47 in SA and WA) (Kirkwood *et al*., 2009) (see Figure 5.17). Lower density breeding areas occur in Victoria (Shaughnessy, 1999). Breeding locations in Victoria occur at Kanowna Island, off Wilson's Promontory and the Skerries (Kirkwood *et al*., 2009) – both are located outside the spill EMBA. During the non-breeding season (November to January) the breeding sites are occupied by pups/young juveniles, whilst adult females alternate between the breeding sites and foraging at sea (Shaughnessy, 1999).

New Zealand fur-seals feed on small pelagic fish, squid and seabirds, including little penguins (Shaughnessy, 1999). Juvenile seals feed primarily in oceanic waters beyond the continental shelf, lactating females feed in mid-outer shelf waters (50-100 km from the colony) and adult males forage in deeper waters.

The total Australian population of New Zealand fur-seals is 58,000. The population has been slow to recover from the previous intense sealing operations from 1798 to 1820, partially as the species are slow reproducers, producing one pup per year when they reach sexual maturity at four years. Up to 15% of pups die before they reach two months of age, primarily as a result of fishing net and other marine debris entanglements.

Haul-out sites in Bass Strait, as reported by Barton et al (2012), are listed below (none of which are located within the EMBA):

- Beware Reef;
- Kanowna Island – about 300 individuals;
- The Hogan Islands Group; and
- West Moncoeur Island (south of Wilson's Promontory).

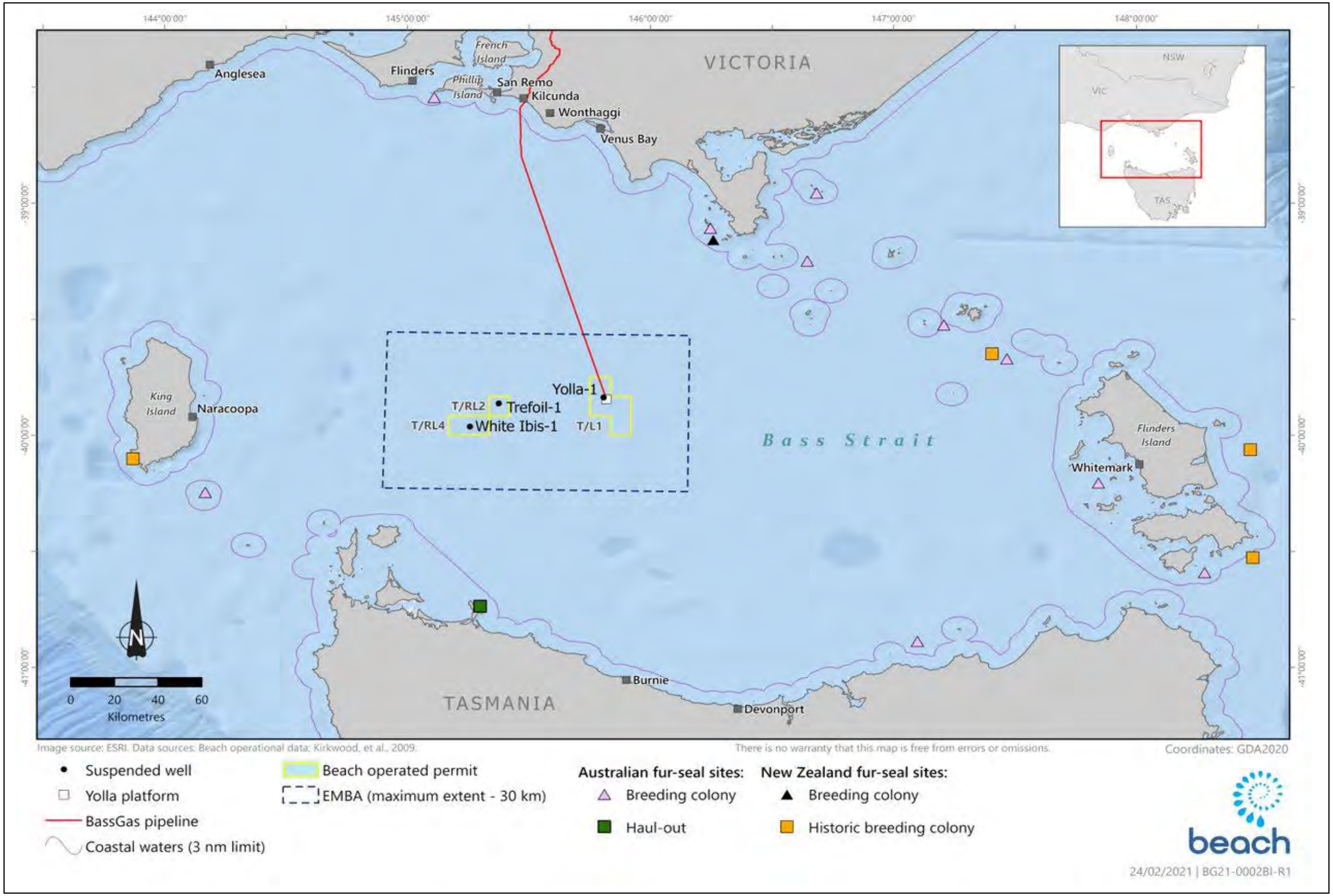


Figure 5.17. Australian and New Zealand fur-seal colonies and haul-out sites in Bass Strait

The species prefers the rocky parts of islands with jumbled terrain and boulders and prefers smoother igneous rocks to rough limestone. Breeding colonies in Bass Strait recorded by Shaughnessy (1999) are listed below (none of which occur in the EMBA):

- Rag Island (1,000 fur seal & 235 pups in 2006);
- Kanowna Island (10,700 adults and 2,700 pups);
- Anser Group of Islands;
- The Skerries – 300 individuals and 78 pups (in 2002); and
- Judgment Rock in the Kent Island Group (about 2,500 pups per year) (Kirkwood *et al.*, 2009)

There is no BIA for the New Zealand fur-seal in Bass Strait. Given the proximity of the activity area to breeding colonies and haul-out sites south of Wilson's Promontory, it is likely that the species feeds around the activity area, and certainly within the spill EMBA. These waters are unlikely to represent important critical feeding or breeding habitat.

5.4.7 Fish

It is estimated that there are over 500 species of fish found in the waters of Bass Strait, including a number of species of importance to commercial and recreational fisheries (LCC, 1993). Fish species commercially fished in and around the EMBA are listed in Section 5.7.6. There are two major groups of fish: pelagic fish that live in the water column and mostly near the surface (i.e., epipelagic, upper 200 m), and demersal or benthic fish that live on or near the seabed. Fish species present in the EMBA and activity area are either pelagic (living in the water column), or demersal (benthic) fish. Fish species inhabiting the region are largely cool temperate species, common within the South Eastern Marine Region.

The PMST Reports identified 14 listed fish species (11 of which are seahorses, seadragons and pipefish) that may potentially occur in the EMBA and activity area. Table 5.7 details the listed fish species identified in the EMBA and activity area PMST Reports.

The threatened and migratory species are described in this section. Table 5.7 lists the fish species known or likely to occur in the EMBA. The EMBA overlaps a distribution BIA for the white shark.

Figure 5.18 illustrates the presence and absence of the oceanic and freshwater fish species throughout the year.

Table 5.7. EPBC Act-listed fish that may occur in the EMBA

Scientific name	Common name	EPBC Act Status			Recorded in EMBA only	BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
Oceanic							
Carcharodon carcharias	Great white shark	V	Yes	-	-	-	RP
*Isurus oxyrinchus**	Shortfin mako	-	Yes	-	-	-	-
Lamna nasus	Porbeagle mackerel shark	-	Yes	-	-	-	-

Scientific name	Common name	EPBC Act Status			Recorded in EMBA only	BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
Syngnathids - Pipefish, seahorses and seadragons							
Hippocampus abdominalis	Big-bellied Seahorse	-	-	Yes	-	-	-
Hippocampus minotaur	Bullneck Seahorse	-	-	Yes	-	-	-
Heraldia nocturna	Eastern Upside-down Pipefish	-	-	Yes	-	-	-
Kimblaeus bassensis	Trawl Pipefish	-	-	Yes	-	-	-
Maroubra perserrata	Sawtooth Pipefish	-	-	Yes	-	-	-
Notiocampus ruber	Red Pipefish	-	-	Yes	-	-	-
Phyllopteryx taeniolatus	Common seadragon	-	-	Yes	-	-	-
Physodurus eques	Leafy seadragon	-	-	Yes	-	-	-
Solegnathus robustus	Robust Pipehorse	-	-	Yes	-	-	-
Solegnathus spinosissimus	Spiny Pipehorse	-	-	Yes	-	-	-
Vanacampus phillipi	Port Phillip Pipefish	-	-	Yes	-	-	-

Definitions and key as per Table 5.4.

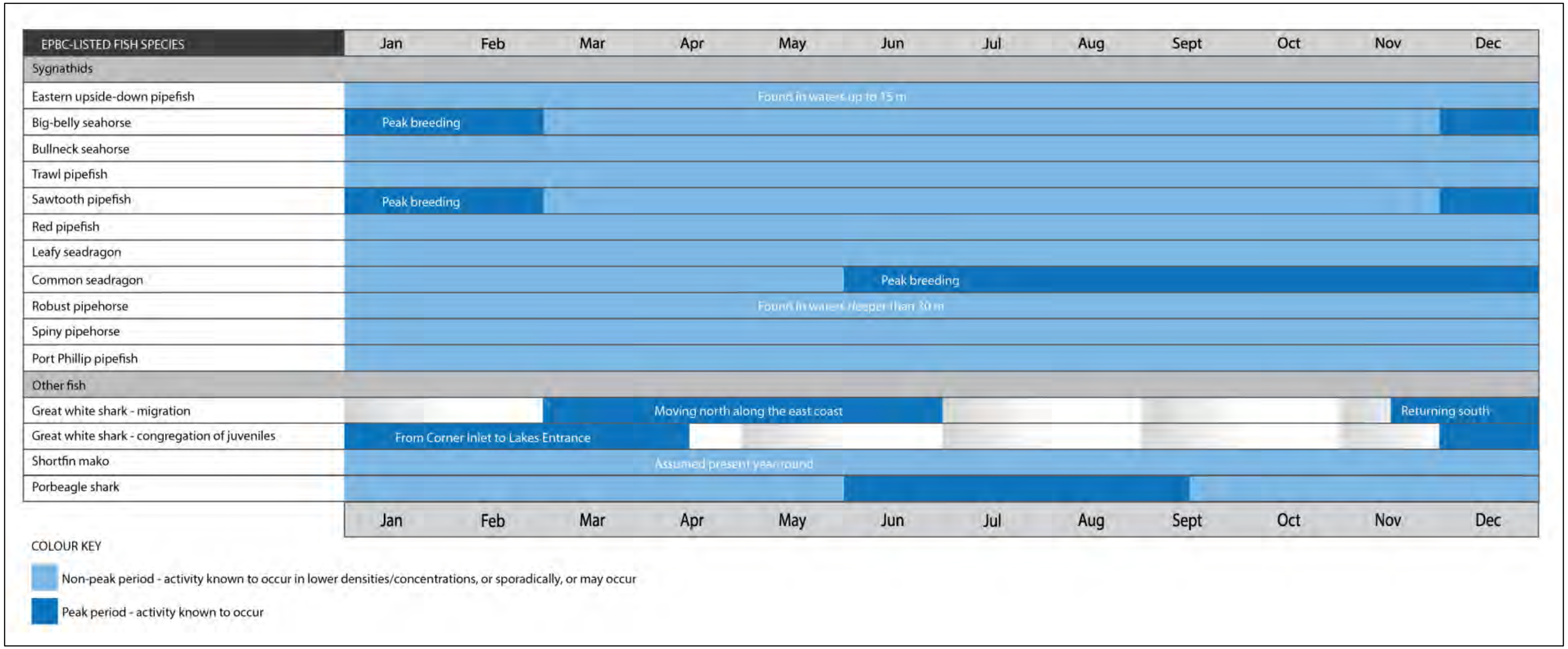


Figure 5.18. The annual presence and absence of key threatened fish species and fish species of fishing value in the spill EMBA

White shark (EPBC Act: Vulnerable, listed migratory)

The white shark (*Carcharodon carcharias*) is widely distributed and located throughout temperate and sub-tropical waters with their known range in Australian waters including all coastal areas except the Northern Territory (DAWE, 2021b). Studies of white sharks indicate that they are largely transient. However, individuals are known to return to feeding grounds on a seasonal basis, with feeding areas located close to the coast and offshore islands (Figure 5.19) (Klimley and Anderson, 1996). The distribution BIA for the white shark intersects the EMBA and activity area, therefore it is likely that white sharks will be present in these areas.

Shortfin mako shark (EPBC Act: Listed migratory)

The shortfin mako shark (*Isurus oxyrinchus*) is a pelagic species with a circum-global oceanic distribution in tropical and temperate seas (Mollet *et al*., 2000). It is widespread in Australian waters, commonly found in water with temperatures greater than 16°C. Populations of the shortfin mako are considered to have undergone a substantial decline globally. These sharks are a common by-catch species of commercial fisheries (Mollet *et al*., 2000). Due to their widespread distribution in Australian waters, shortfin mako sharks are likely to be present in the EMBA and activity area in low numbers.

Porbeagle shark (EPBC Act: Listed migratory)

The porbeagle shark (*Lamna nasus*) is widely distributed in the southern waters of Australia including Victorian and Tasmanian waters. The species preys on bony fishes and cephalopods and is an opportunistic hunter that regularly moves up and down in the water column, catching prey in mid-water as well as at the seafloor. It is most commonly found over food-rich banks on the outer continental shelf. It also conducts long-distance seasonal migrations, generally shifting between shallower and deeper water (Pade *et al*., 2009). The porbeagle shark is likely to be present in the EMBA and activity area in low numbers.

Syngnathids

All the marine ray-finned fish species identified in the PMST Reports are syngnathids, which includes seahorses and their relatives (sea dragon, pipehorse and pipefish). Most of these fish species are found in water depths less than 50 m. Of the 11 species of syngnathids identified, only one (*Hippocampus abdominalis* (big-belly seahorse)) has a documented species and threats profile, indicating how little published information exists in general regarding syngnathids. The PMST Report species profile and threats profiles indicate that the syngnathid species listed in the EMBA and activity area are widely distributed throughout southern, south-eastern and south-western Australian waters. Therefore, it is unlikely that these species will be present in the EMBA as water depths are greater than 50 m and lacking in suitable habitat.

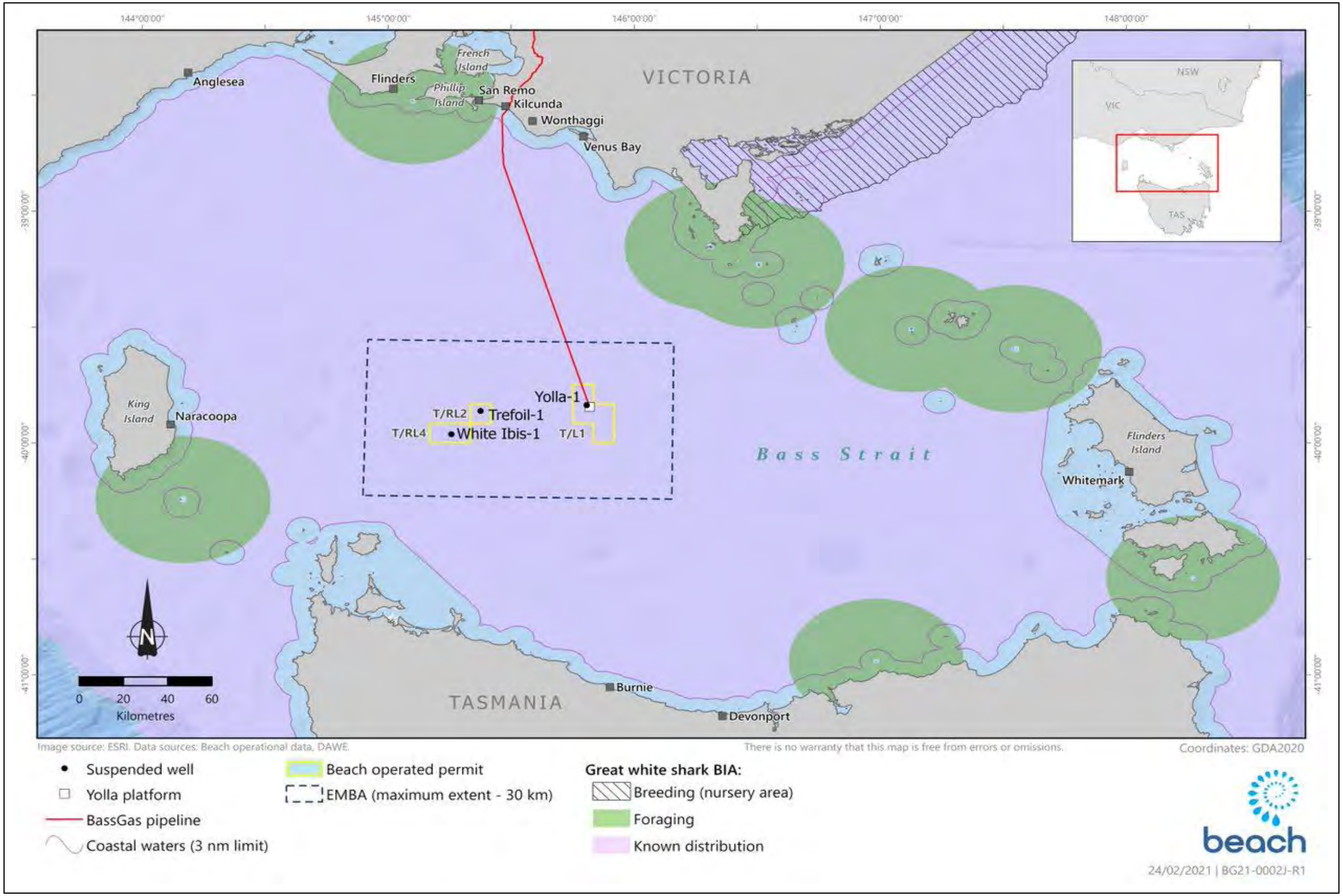


Figure 5.19. Great white shark BIA intersected by the activity area and spill EMBA

5.4.8 Reptiles

Three species of marine turtle are listed under the EPBC Act PMST report as potentially occurring in the spill EMBA, as listed in Table 5.8. No BIAs for turtles occur within Bass Strait.

Additionally, Wilson and Swan (2005) report that 31 species of sea snake and two species of sea kraits occur in Australian waters, though none of these occurs in waters of the southern coast of Australia, with the exception of the yellow-bellied sea snake (*Pelamis platurus*) that extends into waters off the Victorian coast. This species is the world's most widespread sea snake and feeds on fish at the sea surface (Wilson and Swan, 2005). These species are not expected to be encountered within the spill EMBA.

Table 5.8. EPBC Act-listed reptiles that may occur in the spill EMBA

Scientific name	Common name	EPBC Act Status			Recorded in EMBA only	BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
Caretta caretta	Loggerhead turtle	E	Yes	Yes	-	-	Generic RP in place for all marine turtle species, +
Chelonia mydas	Green turtle	V	Yes	Yes	-	-	
Dermochelys coriacea	Leatherback turtle	E	Yes	Yes	-	-	

Definitions and key as per Table 5.4.

Loggerhead turtle (EPBC Act: Endangered, listed migratory)

The loggerhead turtle (*Caretta caretta*) is globally distributed in sub-tropical waters (Limpus, 2008a) including eastern, northern and western Australia (DoEE, 2017), and is rarely sighted off the Victorian coast.

The main Australian breeding areas for loggerhead turtles are generally confined to southern Queensland and Western Australia (DoEE, 2017). Loggerhead turtles will migrate over distances in excess of 1,000 km, and show a strong fidelity to their feeding and breeding areas (Limpus, 2008a). Loggerhead turtles are carnivorous, feeding primarily on benthic invertebrates such as molluscs and crabs in depths ranging from nearshore to 55 m in tidal and sub-tidal habitats, reefs, seagrass beds and bays (DoEE, 2017).

No known loggerhead foraging areas have been identified in Victoria waters (DoEE, 2017). As such, it is unlikely to occur within the spill EMBA.

Green turtle (EPBC Act: Vulnerable, listed migratory)

The green turtle (*Chelonia mydas*) is distributed in sub-tropical and tropical waters around the world (Limpus, 2008b; DoEE, 2017). In Australia, they nest, forage and migrate across tropical northern Australia. Mature turtles settle in tidal and sub-tidal habitat such as reefs, bays and seagrass beds where they feed on seagrass and algae (Limpus, 2008b; DoEE, 2017).

There are no known nesting or foraging grounds for green turtles in Victoria and they occur only as rare vagrants (DoEE, 2017). The DoEE (2017) maps the green turtle as having a 'known' or 'likely' range within Bass Strait and as such, there is a low probability that this species may be encountered in the spill EMBA.

Leatherback turtle (EPBC Act: Endangered, listed migratory)

The leatherback turtle (*Dermochelys coriacea*) is widely distributed throughout tropical, sub-tropical and temperate waters of Australia (DoEE, 2017) including oceanic waters and continental shelf waters along the coast of southern Australia (Limpus, 2009). Unlike other marine turtles the leatherback turtle utilises cold water foraging areas with reported foraging along the coastal waters of central Australia (southern Queensland to central New South Wales), southeast Australia (Tasmania, Victoria and eastern South Australia) and southern Western Australia (Limpus, 2009). This species feeds on soft-bodied invertebrates including jellyfish (Limpus, 2009).

No major nesting has been recorded in Australia, with isolated nesting recorded in the Northern Territory, Queensland and northern New South Wales (DoEE, 2017). This species nests only in the tropics. The DoEE (2017) maps the leatherback turtles as having a known or likely range within Bass Strait and a migration pathway in southern waters. The spill EMBA area is not a critical habitat for the species; it may occur in low numbers during migration.

5.4.9 Marine Pests

It is widely recognised that marine pests can become invasive and cause significant impacts on economic, ecological, social and cultural values of marine environments. Impacts can include the introduction of new diseases, altering ecosystem processes and reducing biodiversity, causing major economic loss and disrupting human activities (Brusati and Grosholz, 2007).

In the South-east Marine Region, 115 marine pest species have been introduced and an additional 84 have been identified as possible introductions, or 'cryptogenic' species (NOO, 2002). Several introduced species have become pests either by displacing native species, dominating habitats or causing algal blooms.

Transport mechanisms of marine pests in the marine environment have largely been associated with commerce and exploration. These include:

- Wooden-hulled vessel boring;
- Biofouling;
- Dry and semidry ballast;
- Steel-hulled vessel biofouling and the transport of planktonic organisms and fragments in ballast water
- Intentional transfer of aquaculture and mariculture organisms;
- Transfer of live, frozen and dried food products and aquarium trade; and
- Explicit transport of species for scientific research.

Marine pests known to occur in Bass Strait, according to Parks Victoria (2020):

- Pacific oyster (*Crassostrea gigas*) – small number of this oyster species are reported to occur in Western Port Bay and at Tidal River in the Wilsons Promontory National Park.
- Northern pacific seastar (*Asterias amurensis*) – prefer soft sediment habitat, but also use artificial structures and rocky reefs, living in water depths usually less than 25 m (but up to 200 m water depths). It is thought to have been introduced through ballast water from Japan.
- New Zealand screw shell (*Maoricolpus roseus*) – lies on or partially buried in sand, mud or gravel in waters up to 130 m deep. It can densely blanket the sea floor with live and dead shells and compete with native scallops and other shellfish for food. This species is known to be present in the Port Phillip and the Western Port region.
- European shore crab (*Carcinus maenas*) – prefers intertidal areas, bays, estuaries, mudflats and subtidal seagrass beds, but occurs in waters up to 60 m deep. It is widespread across Victorian intertidal reef and common in Western Port.
- Dead man's fingers (*Codium fragile ssp. fragile*) – Widespread in Port Phillip and known to inhabit San Remo and Newhaven in Western Port. It grows rapidly to shade out native vegetation and can regenerate

from a broken fragment enabling easy transfer from one area to another. Attaches to subtidal rocky reed and other hard surfaces.

- Asian date mussel (*Musculista senhousia*) – prefers soft sediments in waters up to 20 m deep, forming mats and altering food availability for marine fauna.
- Cord grass (*Spartina anglica* and *Spartina x townsendii* sp) – found at the mouth of Bass River and in drain outlets near Tooradin in Western Port. Widespread in South Gippsland including Anderson's Inlet and Corner Inlet. Invades native saltmarsh, mangroves and mudflats, altering the mud habitat and excluding other species.

5.5 Conservation Values and Sensitivities

The conservation values and sensitivities in and around the activity area and within the spill EMBA are described in this section, with Table 5.9 providing an outline of the conservation categories included.

Table 5.9. Conservation values in the EMBA

Category	Conservation classification	EP Section
MNES	Commonwealth marine areas (principally AMPs)	5.5.1
	World Heritage-listed properties	5.5.2
	National Heritage-listed places	5.5.3
	Wetlands of International Importance	5.5.4
	Nationally threatened species and threatened ecological communities	Throughout Sections 5.4 and 5.5.6.
	Migratory species	Throughout Section 5.4
	Great Barrier Reef Marine Park	Not applicable
	Nuclear actions	Not applicable
	A water resource, in relation to coal seam gas development and large coal mining development	Not applicable
Other areas of national importance	Commonwealth heritage-listed places	5.5.5
	Key Ecological Features (KEFs)	5.5.7
	Nationally important wetlands (NIWs)	5.5.8
Victorian protected areas	MNPs, marine parks and sanctuaries	5.5.9
Tasmanian protected areas	MNPs, marine parks and sanctuaries	5.5.10

5.5.1 Australian Marine Parks

The South-east Marine Parks Network was designed to include examples of each of the provincial bioregions and the different seafloor features in the region (DNP, 2013). Provincial bioregions are large areas of the ocean where the fish species and ocean conditions are broadly similar. Ten provincial bioregions in the South East Marine Region (SEMR) are represented in the network. As there is a lack of detailed information on the biodiversity of the deep ocean environment, seafloor features were used as surrogates for biodiversity to design the Marine Reserves Network. The SEMR network contains representative examples of the 17 seafloor features found in the Commonwealth waters of the region.

There are no Australian Marine Parks (AMPs) that are intersected by the activity area. The Boags AMP is intersected by the spill EMBA (Figure 5.20) and is described herein based on the South-east Marine Reserves Management Plan (DNP, 2013).

Boags AMP

The spill EMBA intersects the Boags AMP but the activity area does not (Figure 5.20). The Boags AMP is assigned as IUCN VI - Multiple Use Zone and covers an area of 537 km^2. It is located off the northwest tip of Tasmania north of Three Hummock Island. Boags AMP is approximately 15 km southwest intersected by the activity area. The AMP represents an area of shallow ecosystems that has a depth range of mostly between 40 m and 80 m. It encompasses the fauna of Bass Strait, which is expected to be especially rich based on studies of several seafloor-dwelling animal groups (DNP, 2013). The Boags AMP contains a rich array of life, particularly benthic animals and animals living in the seafloor sediments and muds including crustaceans, polychaete worms and molluscs, as is common for the Bass Strait seabed. The sandy seabed of the AMP is also likely to host benthic fish such as flathead, skates, rays and latchets but not extensive sponge gardens. The reserve is adjacent to the important seabird colonies of Tasmania's northwest, particularly the Hunter group of islands including three Hummock Island, Hunter Island, Steep Island, Bird Island, Stack Island and Penguin Islet). Bird species present in the Hunter group include shy albatross, fairy prions, black-faced cormorants, common diving petrels, little penguins and Cape Barren geese. It is likely that the rich abundance of benthic fauna facilitates the presence of pelagic fish species within the AMP. The proximity of these two features means that the AMP is an important foraging area for the variety of seabirds that inhabit the Hunter Group (DNP, 2013).

The AMP overlaps the identified BIAs of several seabird species including the black-browed albatross, Buller's albatross, Campbell albatross, Indian yellow-nosed albatross, shy albatross, wandering albatross, white-faced storm petrel, common diving petrel and short-tailed shearwater as well as the southern right and blue whale BIAs. The marine park is also on the migration route for the critically endangered orange-bellied parrots as they across Bass Strait each spring and autumn on their migration to and from Tasmania to the Australian mainland (Parks Australia, 2019).

5.5.2 World Heritage-listed Properties

World Heritage Listed properties are examples of sites that represent the best examples of the world's cultural and heritage values, of which Australia has 19 properties (DAWE, 2021d). In Australia, these properties are protected under Chapter 5, Part 15 of the EPBC Act.

No properties on the World Heritage List occur within the activity area or spill EMBA. The nearest site is the Royal Exhibition Building and Carlton Gardens in Melbourne, an onshore property located 230 km north of the activity area.

5.5.3 National Heritage-listed Places

The National Heritage List is Australia's list of natural, historic and Indigenous places of outstanding significance to the nation (DAWE, 2021e). These places are protected under Chapter 5, Part 15 of the EPBC Act.

There are no national heritage-listed places that are intersected by the activity area or spill EMBA.

5.5.4 Wetlands of International Importance

Australia has 66 wetlands of international importance ('Ramsar wetlands') that cover more than 8.3 million hectares (as of March 2020) (DAWE, 2021c). Ramsar wetlands are those that are representative, rare or unique wetlands, or are important for conserving biological diversity, and are included on the List of Wetlands of International Importance developed under the Ramsar Convention. These wetlands are protected under Chapter 5, Part 15 of the EPBC Act.

There are no wetlands of international importance that are intersected by the activity area or spill EMBA.

5.5.5 Commonwealth Heritage-listed Places

Commonwealth Heritage-listed places are natural, indigenous and historic heritage places owned or controlled by the Commonwealth (DAWE, 2021g). In Australia, these properties are protected under Chapter 5, Part 15 of the EPBC Act.

There are no Commonwealth heritage-listed places that are intersected by the activity area or spill EMBA.

5.5.6 Threatened Ecological Communities

Threatened Ecological Communities (TECs) are protected as MNES under Part 13, Section 181 of the EPBC Act and provide wildlife corridors and/or habitat refuges for many plant and animal species. Listing a TEC provides a form of landscape or systems-level conservation (including threatened species).

There are no TECs that are intersected by the activity area or spill EMBA.

5.5.7 Key Ecological Features

Key Ecological Features (KEFs) are elements of the Commonwealth marine environment that based on current scientific understanding, are considered to be of regional importance for either the region's biodiversity or ecosystem function and integrity. KEFs have no legal status in decision-making under the EPBC Act but may be considered as part of the Commonwealth marine area.

There are no KEFs that are intersected by the activity area or spill EMBA.

5.5.8 Nationally Important Wetlands

Nationally important wetlands (NIW) are considered important for a variety of reasons, including their importance for maintaining ecological and hydrological roles in wetland systems, providing important habitat for animals at a vulnerable stage in their life cycle, supporting 1% or more of the national population of a native plant or animal taxa or for its outstanding historical or cultural significance (DAWE, 2021g).

There are no NIWs that are intersected by the activity area or spill EMBA.

5.5.9 Victorian Protected Areas

Victoria has a large network of onshore and offshore protected areas that are established, protected and managed under the *National Parks Act 1982* (Vic) by Parks Victoria. Offshore, there are 24 Victorian marine national parks and sanctuaries.

There are no Victorian protected areas that are intersected by the activity area or spill EMBA.

5.5.10 Tasmanian Protected Areas

Tasmania has a large network of onshore and offshore protected areas that are established, protected and managed under the *National Parks and Reserves Management Act* 2002 (Tas) and *Nature Conservation Act* 2002 (Tas) by DPIPWE. Offshore, there are seven marine reserves and 14 marine conservation areas (with the latter restricted to waters around Hobart in southern Tasmania).

There are no Tasmanian protected areas that are intersected by the activity area or spill EMBA.

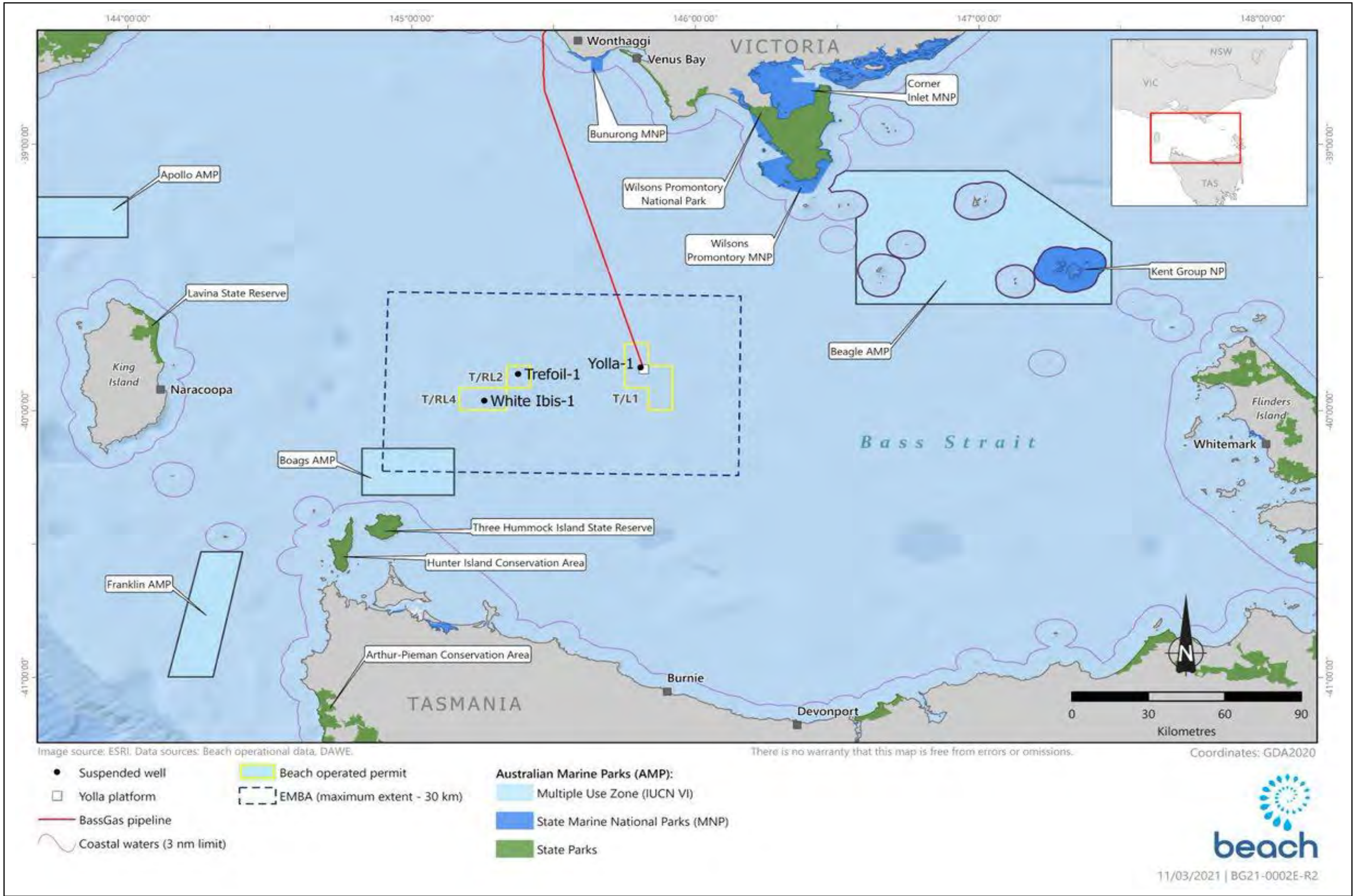


Figure 5.20. Protected areas intersected by the activity area and spill EMBA

5.6 Cultural Heritage

Cultural heritage can be broadly defined as the legacy of physical science artefacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations. Cultural heritage includes tangible culture (such as buildings, monuments, landscapes, books, works of art, and artefacts), intangible culture (such as folklore, traditions, language, and knowledge) and natural heritage (including culturally significant landscapes).

This section describes the cultural heritage values of the activity area, which is broadly categorised as Aboriginal and non-Aboriginal (maritime archaeology).

5.6.1 Aboriginal heritage

Due to the location of the activity area and spill EMBA, they are unlikely to be a site of significant indigenous heritage or native title.

5.6.2 Maritime Archaeological Heritage

Shipwrecks

Shipwrecks over 75 years old are protected within Commonwealth waters under the *Historic Shipwrecks Act 1976* (Cth), in Victorian waters under the *Victorian Heritage Act 1995* (Vic), and in Tasmanian waters under the *Historic Cultural Heritage Act 1995* (Tas).

A search of the Australian National Shipwreck Database indicated there are two shipwrecks - The *Albert* (1850) (shipwreck ID: 6844) and the *Will Watch* (1958) (shipwreck ID: 7929) located within the EMBA, but outside of the activity area (approximately 5.6 km south-east of White Ibis-1) (Figure 5.21).

There are no shipwrecks within the activity area.

The *Albert* was a schooner of 44 imperial tons and was built at the Albert River, Victoria, by John McKenzie in 1849. The schooner sailed from Circular Head in Tasmania for Melbourne on 9 September 1850 under the command of George Brush but failed to arrive. The vessel had previously loaded a cargo of potatoes at the Forth River and had hit the bar while outward bound for Circular Head to obtain a customs clearance, but the master elected to wait till he reached Melbourne before having the schooner surveyed. The damage may well have been more serious than he suspected (DAWE, 2021h).

The *Will Watch* was an auxiliary ketch of 96 imperial tons and was built in New South Wales by Rock Davis in 1895. The ketch sailed from Ulverstone (Tas) for King Island with 75 tons of general cargo on 16 December 1958 under the command of George McCarthy. The vessel failed to arrive at King Island due to taking on a significant amount of water during heavy seas which ultimately resulted in the vessel sinking (DAWE, 2021h).

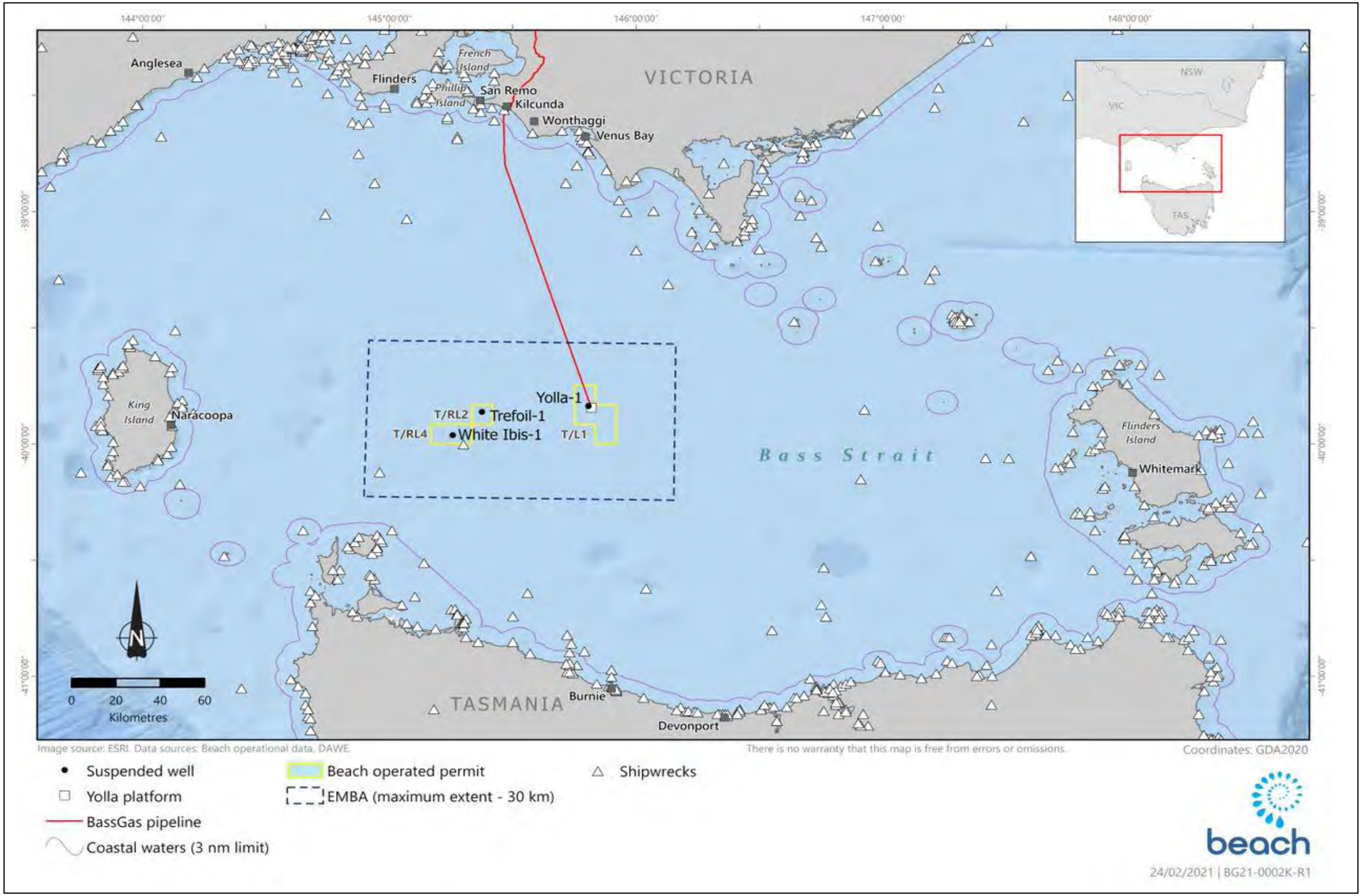


Figure 5.21. Shipwrecks intersected by the activity area and the spill EMBA

5.7 Socio-economic environment

5.7.1 Coastal settlements

The activity area and spill EMBA do not intersect any coastal settlements. The nearest coastal settlements are Three Hummock Island (Tas) approximately 54 km from the activity area (taken from the closest wellhead i.e., White Ibis-1) and 15 km distant from the EMBA (Figure 5.1).

5.7.2 Offshore Energy Exploration and Production

The Beach Yolla-A platform and BassGas pipeline are within the EMBA (Figure 5.22). No other petroleum production activities within the spill EMBA nor the activity area were identified.

5.7.3 Other Infrastructure

There are two Telstra telecommunications cables located in central Bass Strait (Figure 5.22) with one of them located 15 km east of the activity area and both cables are located within the EMBA.

5.7.4 Tourism

Marine-based tourism and recreation in Bass Strait is primarily associated with recreational fishing, boating and ecotourism.

Seaside towns are the primary destinations that attract tourists and holidaymakers to the south coast of Victoria and northwest coast of Tasmania. These coastal communities are popular tourist towns for their boating and fishing activities, along with bushwalking, bird watching and other nature-focused activities. Towns including Inverloch, Venus Bay, Cape Paterson and Cape Woolamai in Victoria are especially popular in summer as well. The George Bass Coastal Walk is one such nature-focused activity that stretches from the outskirts of San Remo to Kilcunda and features a cliff-top trail that follows the route of explorer George Bass and offers spectacular views of the coastline.

The waters of the activity area and spill EMBA are unlikely to represent areas of high tourism value due to their remote nature.

5.7.5 Recreation

Recreational fishing is popular in Victoria and is largely centred within Port Phillip Bay and Western Port, although beach and boat-based fishing occurs along much of the Victorian coastline. Recreational fishing is unlikely to occur in the EMBA and activity area due to the distance offshore.

Recreational diving is a popular activity with a diverse range of sites in around the Victorian and Tasmanian coast. Due to the preferred depth recreational divers use (<60 m) and distance offshore, recreational divers are unlikely to occur in the activity area and spill EMBA.

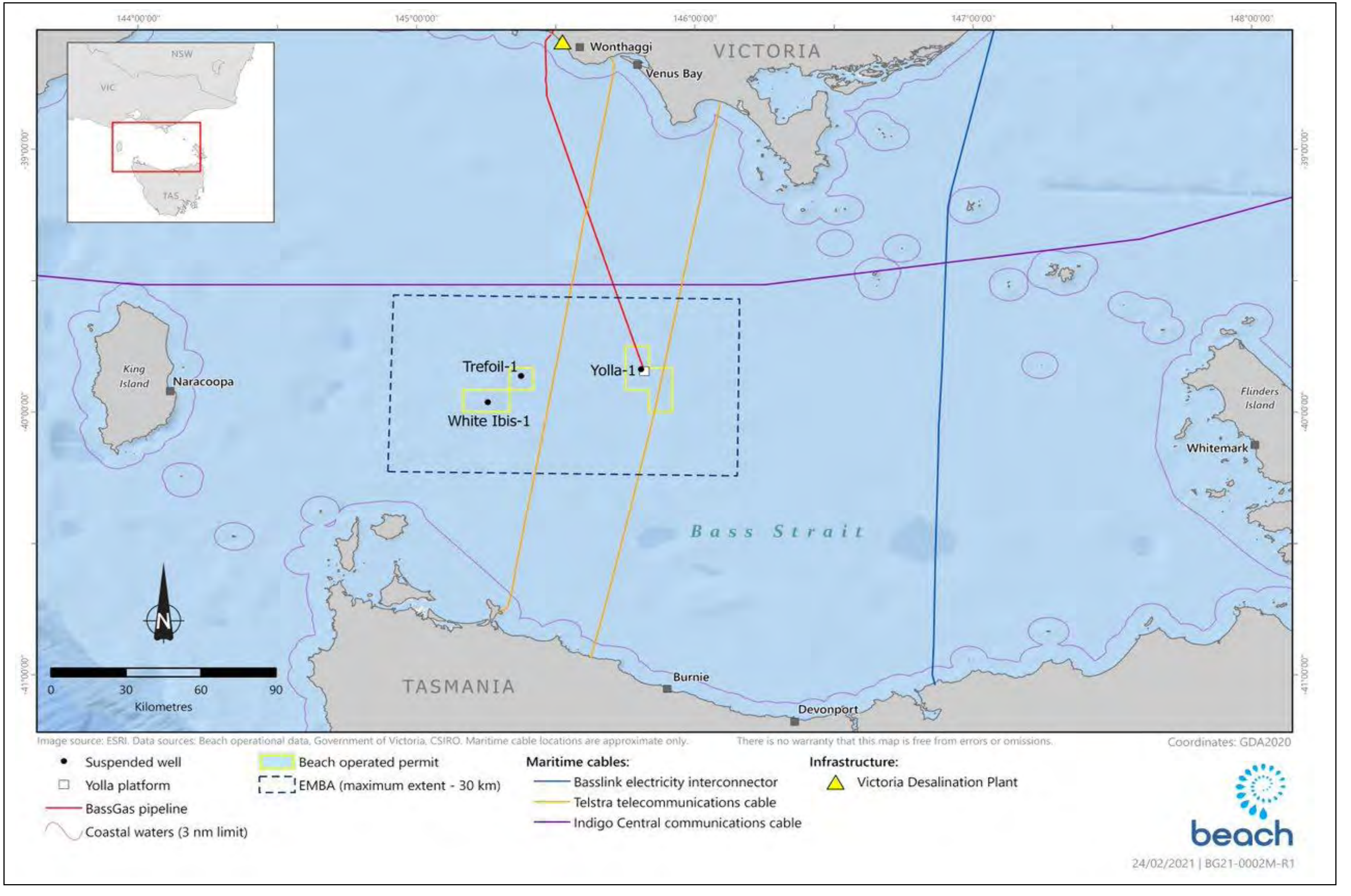


Figure 5.22. Offshore infrastructure in Bass Strait

5.7.6 Commercial Fisheries

Commonwealth-managed fisheries

Commonwealth fisheries are managed by the Australian Fisheries Management Authority (AFMA) under the *Fisheries Management Act 1991* (Cth). AFMA jurisdiction covers the area of ocean from 3 nm from the coast out to the 200 nm limit (the Australian Fishing Zone (AFZ)). Commonwealth-managed commercial fisheries with jurisdictions to fish within the EMBA are the:

- Bass Strait Central Zone Scallop Fishery (BSCZSF) (5% overlap spill EMBA);
- Eastern Tuna and Billfish Fishery (0.24% overlap spill EMBA);
- Eastern Skipjack Tuna Fishery (0.24% overlap spill EMBA);
- Small Pelagic Fishery (0.27% overlap spill EMBA);
- Southern Bluefin Tuna Fishery (0.12% overlap spill EMBA);
- Southern Squid Jig Fishery (SSJF) (0.33% overlap spill EMBA); and
- Southern and Eastern Scalefish and Shark Fishery (SESSF), incorporating.
    - Gillnet and Shark Hook sector (0.6% overlap spill EMBA).
    - Commonwealth Trawl sector (0.72% overlap spill EMBA).
    - Scalefish Hook sector (0.35% overlap spill EMBA).

Based on data from ABARES, the SESSF (shark gillnet sector) potentially has catch and effort within the activity area.

Though certain fisheries possess jurisdiction to actively fish within the activity area and the spill EMBA, analysis of publicly available catch data indicates that not all fisheries have been active within the activity area and/or the EMBA. Table 5.10 summarises the jurisdiction and fishing catch volumes and values for fisheries that have been active in the activity area and/or EMBA in the last five years.

Table 5.10. Commonwealth-managed commercial fisheries in the EMBA

Fishery	Target species	Geographic extent of fishery	Does fishing occur in the activity area or EMBA?	Fishing season	Fishing methods, vessels and licences	Catch data and other information (whole of fishery)
Bass Strait Central Zone Scallop Fishery (Figure 5.23 a, b, c, d, e and f)	Commercial scallop (*Pecten fumatus*)	Central Bass Strait area that lies beyond 20 nm of the Victorian and Tasmanian coasts. Fishery does not operate in state waters. Fishing effort is concentrated east of King Island, off Apollo Bay and north of Flinders Island. Primary landing ports of the fishery are Devonport, Stanley, Apollo Bay, Melbourne, Queenscliff and San Remo.	**Activity area? No.** There is no overlap between the activity area and low, medium or high intensity fishing grounds. **EMBA? Yes.** There is overlap between the EMBA and the King Island scallop fishing grounds. The spill EMBA intersects 5% of the fishery.	1st April to 31st December. Most catch occurs from September-December.	Towed scallop dredges that target dense aggregations ('beds') of scallops. 65 fishing permits are in place. 12 vessels were active in the fishery in 2018, a decrease from 26 active vessels in 2009, reflecting the 'boom or bust' nature of the fishery.	Catch data and economic value available for the last five years: • 2019 – 2,931 tonnes worth $6.3 million. • 2018 – 3,253 tonnes worth $6.7 million. • 2017 – 2,929 tonnes worth $6.7 million. • 2016 – 2,885 tonnes worth $4.6 million. • 2015 – 2,260 tonnes worth $2.8 million. Scallop spawning occurs from winter to spring (June to November), with timing dependent on environmental conditions such as wind and water temperature. Catch is primarily taken during September-December.

Fishery	Target species	Geographic extent of fishery	Does fishing occur in the activity area or EMBA?	Fishing season	Fishing methods, vessels and licences	Catch data and other information (whole of fishery)
Southern Squid Jig Fishery (Figure 5.24)	Arrow squid (*Nototodarus gouldi*)	The fishery extends from the SA/WA border east to southern Queensland. AFMA does not control squid fishing in Victorian or Tasmanian state waters. Primary landing ports of the fishery are Hobart, Portland and Queenscliff.	**Activity area? No.** There is no overlap between the activity area and fishing effort. **EMBA? Yes.** The spill EMBA intersects 0.33% of the fishery, but not in an area of low, medium or high intensity.	12-month season begins 1st January and ends 31 December.	Squid jigging is the fishing method used, mainly at night time and in water depths of 60 to 120 m. High-powered lamps are used to attract squid. In 2018 there were 9 active vessels.	The species' short life span, fast growth and sensitivity to environmental conditions result in strongly fluctuating stock sizes. • 2019 – 722 tonnes worth $2.89 million. • 2018 – 1,649 tonnes worth $5.26 million. • 2017 – 828 tonnes worth $2.24 million. • 2016 – 981 tonnes worth $2.57 million. • 2015 – 824 tonnes worth $2.33 million.
Southern and Eastern Scalefish and Shark Fishery (SESSF)						
Shark Gillnet (Figure 5.25) and Shark Hook (Figure 5.26) Sector	Gummy shark (*Mustelus antarcticus*) is the key target species, with bycatch of elephant fish (*Callorhinchus milii*), sawshark (*Pristiophorus cirratus*, *P. nudipinnis*), and school shark (*Galeorhinus galeus*).	Waters from the NSW/Victorian border westward to the SA/WA border, including the waters around Tasmania, from the low water mark to the extent of the AFZ. Most fishing occurs in waters adjacent to the coastline in Bass Strait. Primary landing ports include Adelaide, Port Lincoln, Robe, Devonport, Hobart, Lakes Entrance, Sen Remo and Port Welshpool.	**Activity area? Yes.** There is overlap between the activity area and low fishing intensity. Activity area intersects 0.00018% of the total fishery area. **EMBA? Yes.** Based on 2018-19 fishing intensity data, the spill EMBA overlaps areas of low and medium intensity fishing.	12-month season begins 1st May. Fishery catch is distributed across the year, with no defined peak periods of catch.	Demersal gillnet and a variety of line methods. Landing ports in Victoria are Lakes Entrance, San Remo and Port Welshpool. 2018-19 – 74 permits and 78 active vessels. 2017-18 – 74 permits and 76 active vessels. 2016-17 – 74 permits and 62 active vessels. 2015-16 – 74 permits and 61 active vessels.	In 2015-16, the SESS Fishery was the largest Commonwealth fishery in terms of volume produced. • 2019-20 – 2,201 tonnes with no value assigned. • 2018-19 – 2,126 tonnes worth $23.6 million. • 2017-18 – 2,216 tonnes worth $19.1 million. • 2016-17 – 2,118 tonnes worth $18.3 million. • 2015-16 – 2,233 tonnes worth $18.4 million.

Fishery	Target species	Geographic extent of fishery	Does fishing occur in the activity area or EMBA?	Fishing season	Fishing methods, vessels and licences	Catch data and other information (whole of fishery)
			The spill EMBA intersects 0.6% of the fishery.			
Commonwealth Trawl Sector (CTS) (Danish Seine) (Figure 5.27)	Key species targeted are eastern school whiting (*Sillago flindersi*), flathead (*Platycephalus richardsoni*) and gummy shark (*Mustelus antarcticus*).	Covers the area of the AFZ extending southward from Barrenjoey Point (north of Sydney) around the New South Wales, Victorian and Tasmanian coastlines to Cape Jervis in South Australia. Primary landing ports of the fishery are Eden, Sydney, Ulladulla, Hobart, Lakes Entrance and Portland.	**Activity area? No.** There is no overlap between the activity area and fishing effort. **EMBA? Yes.** The spill EMBA intersects part of the total area fished but not in an area of low, medium or high intensity. The spill EMBA intersects 0.72% of the fishery.	12-month season begins 1st May. Highest catches from September to April.	Multi gear fishery, but predominantly demersal otter trawl and Danish-seine methods. Primary landing ports in NSW, and Lakes Entrance and Portland in Victoria. For 2018-2019, there were 57 trawl fishing rights with 51 active trawl and Danish-seine vessels.	Logbook catches have been gradually declining since 2001. • 2019-20 – 13,148 tonnes with no value assigned. • 2018-19 – 8,454 tonnes worth $49.47 million. • 2017-18 – 8,631 tonnes worth $41.86 million. • 2016-17 – 8,691 tonnes, worth $46.42 million. • 2015-16 – 9,025 tonnes, worth $41.5 million.

Sources: Patterson et al (2020, 2019, 2018; 2017; 2016).

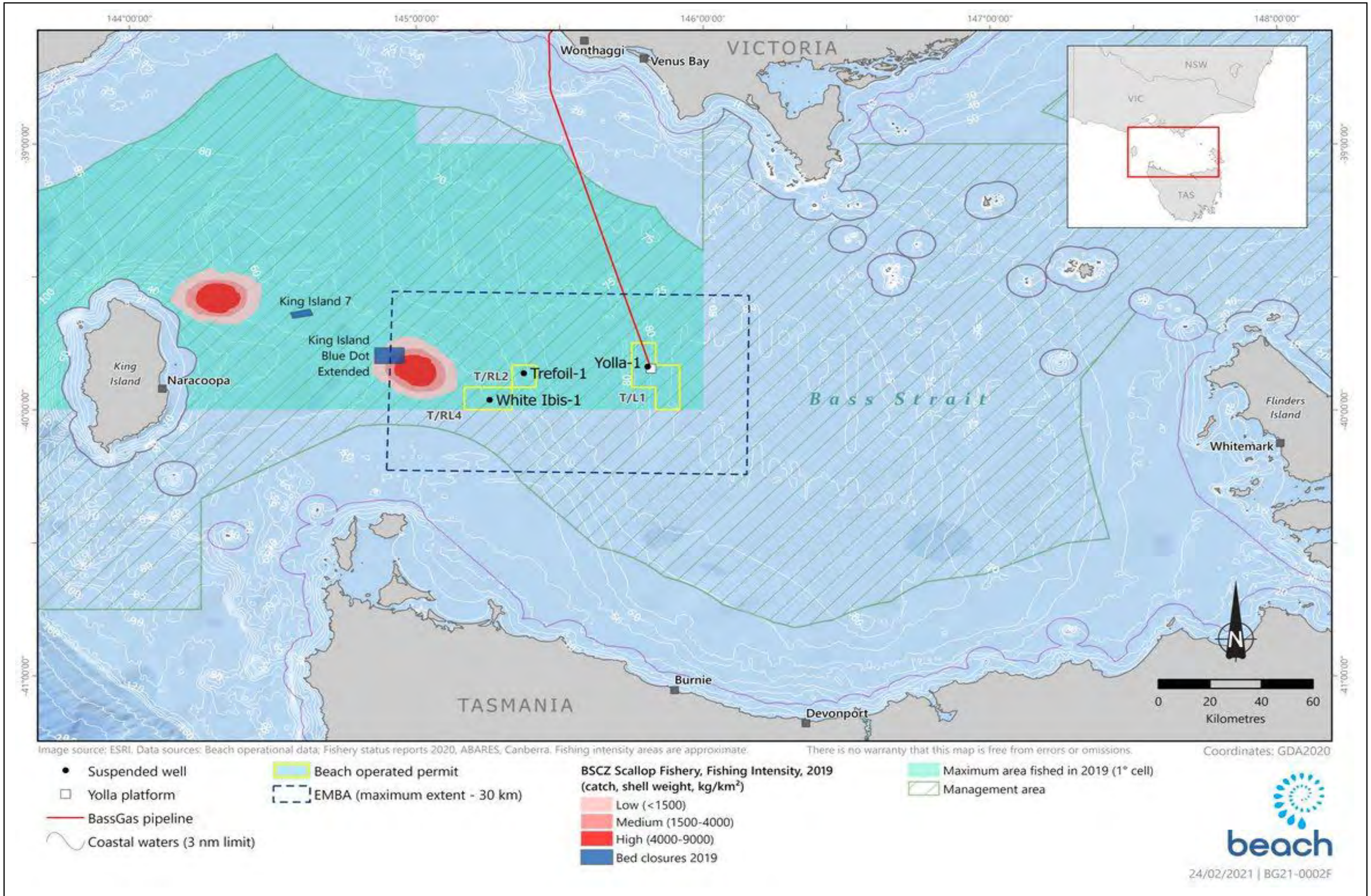


Figure 5.23a. Jurisdiction and fishing intensity in the BSCZSF 2019

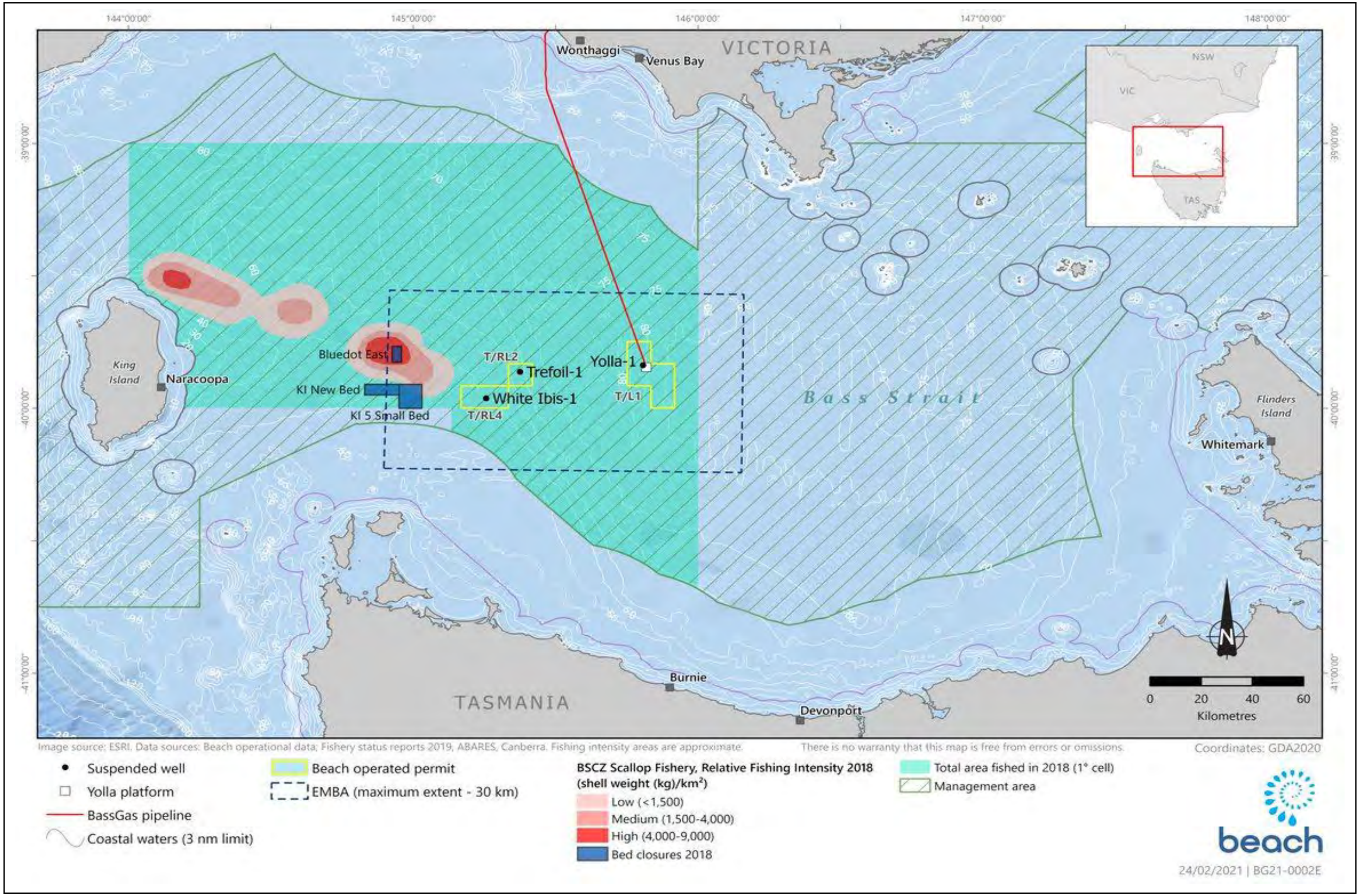


Figure 5.23b. Jurisdiction and fishing intensity in the BSCZSF 2018

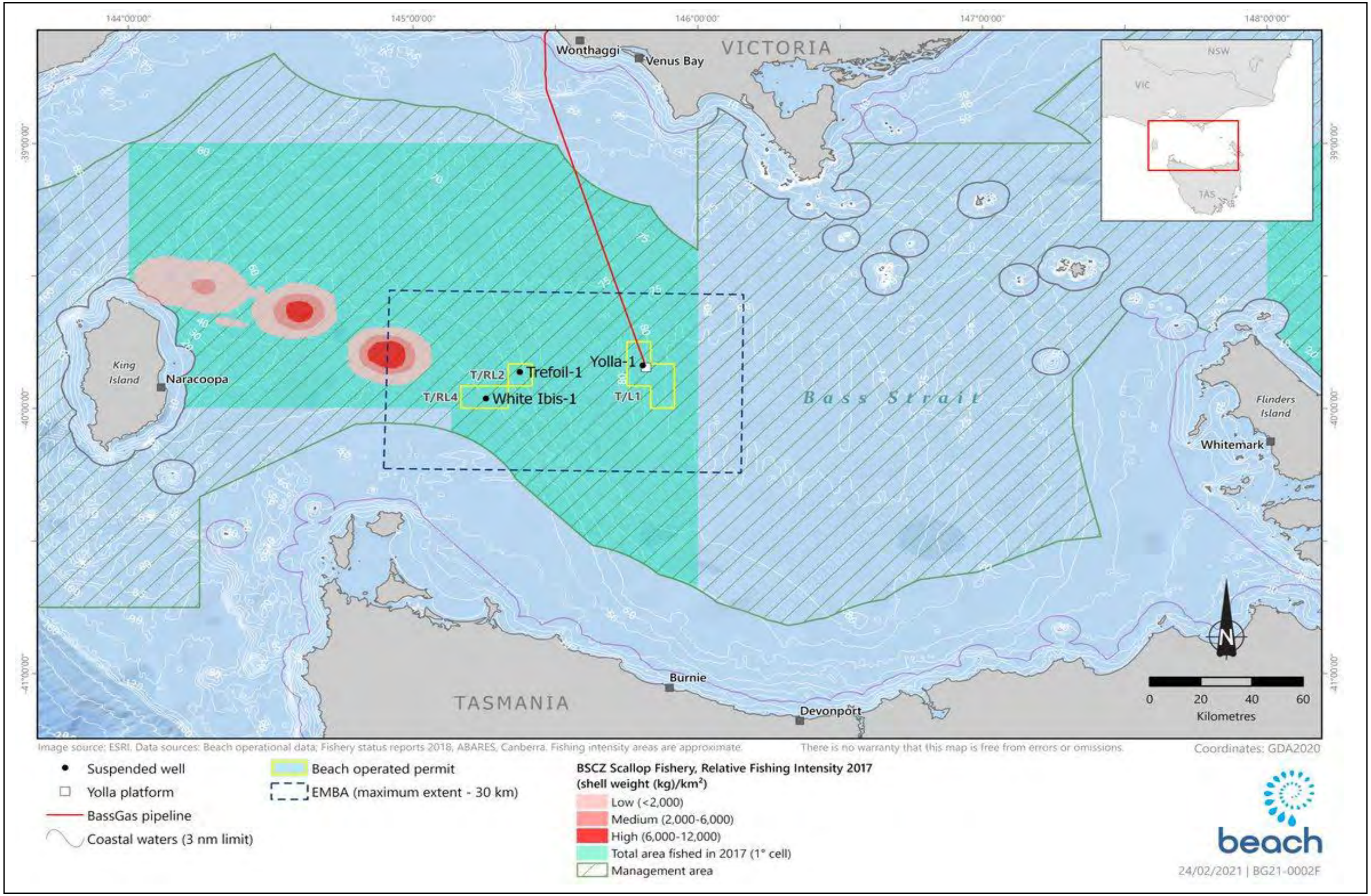


Figure 5.23c. Jurisdiction and fishing intensity in the BSCZSF 2017

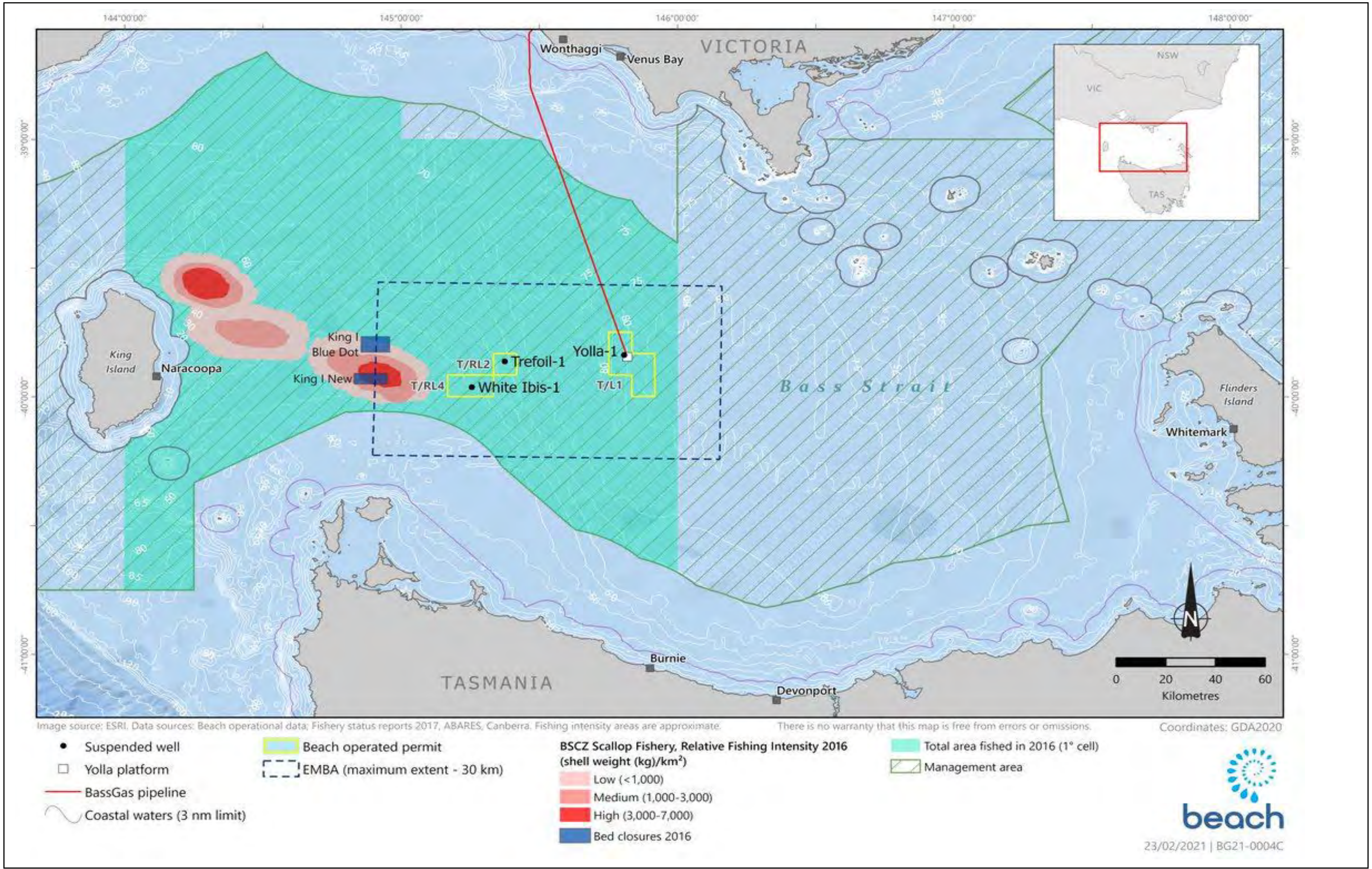


Figure 5.23d. Jurisdiction and fishing intensity in the BSCZSF 2016

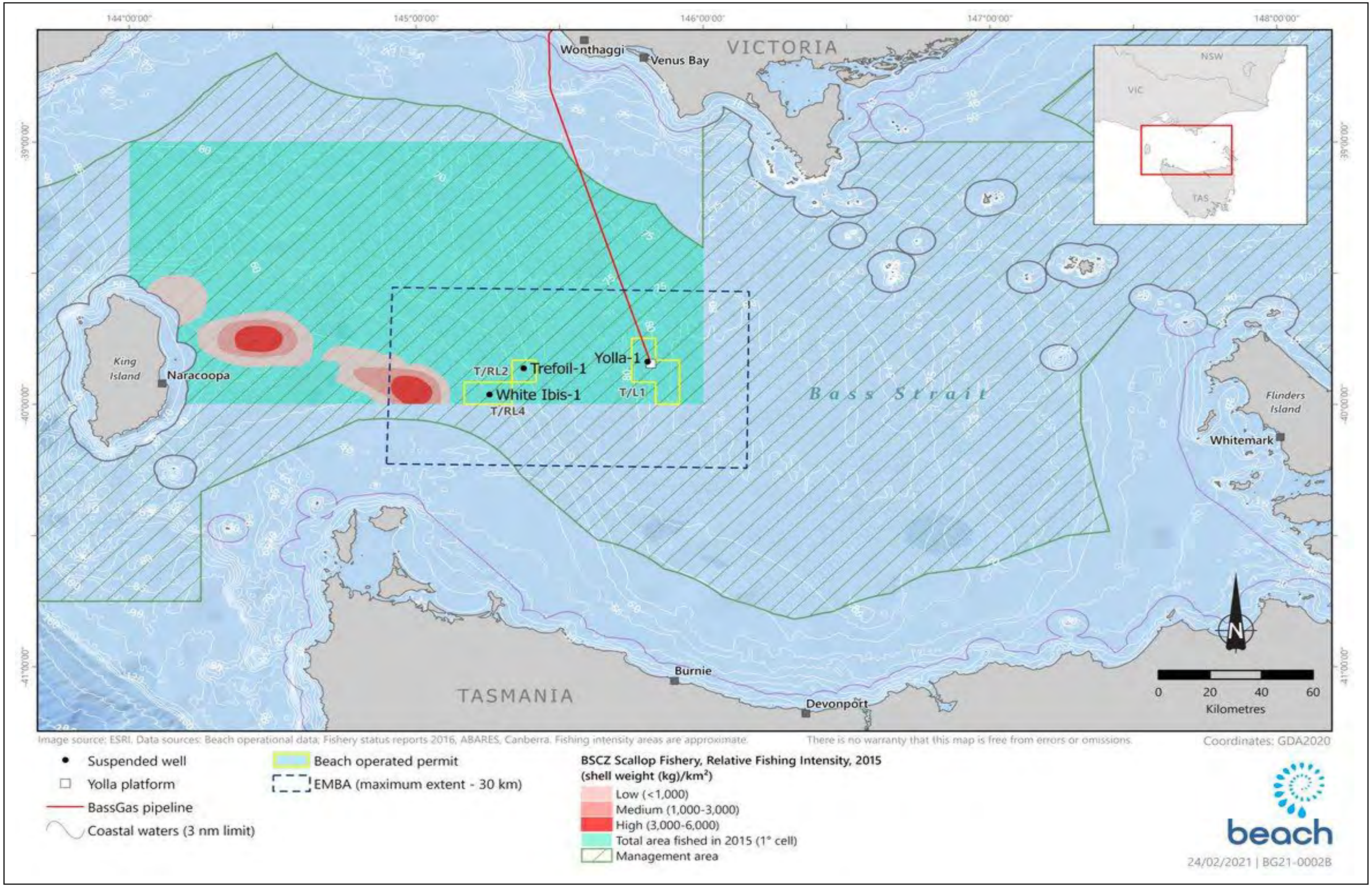


Figure 5.23e. Jurisdiction and fishing intensity in the BSCZSF 2015

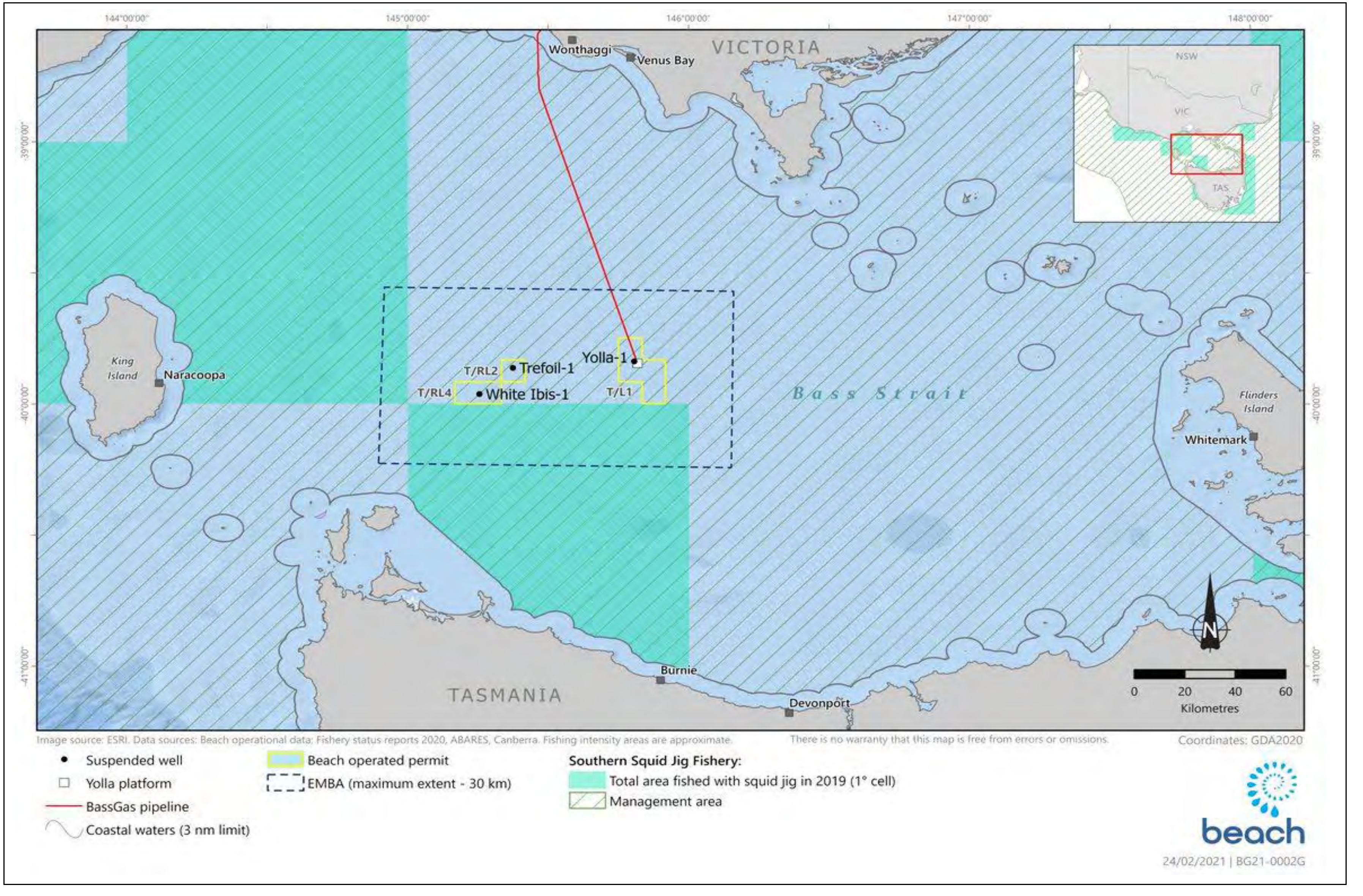


Figure 5.24. Jurisdiction and fishing intensity in the SSJF 2019

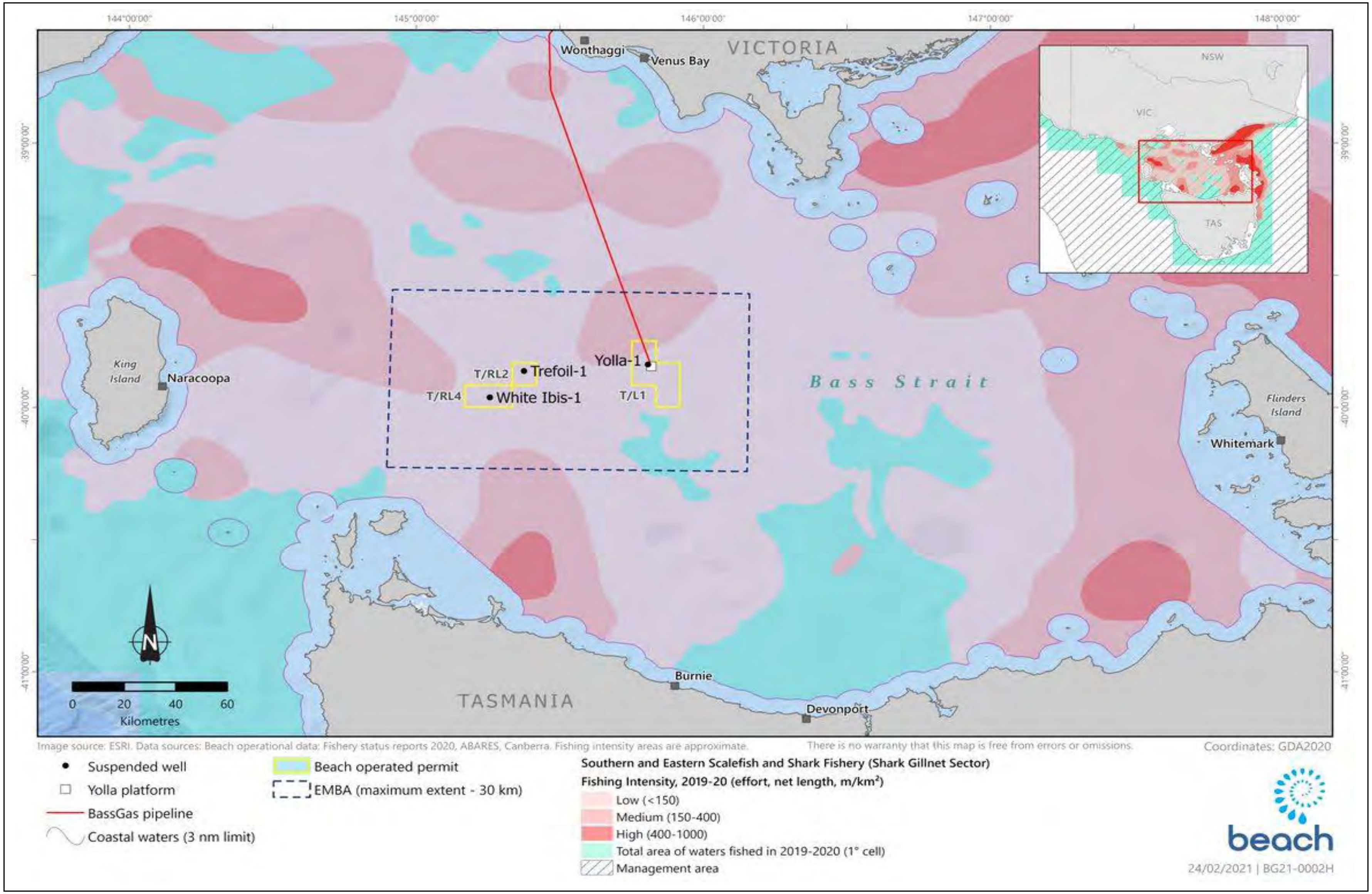


Figure 5.25. Jurisdiction and fishing intensity in the SESSF – Shark Gillnet Sector 2019-20

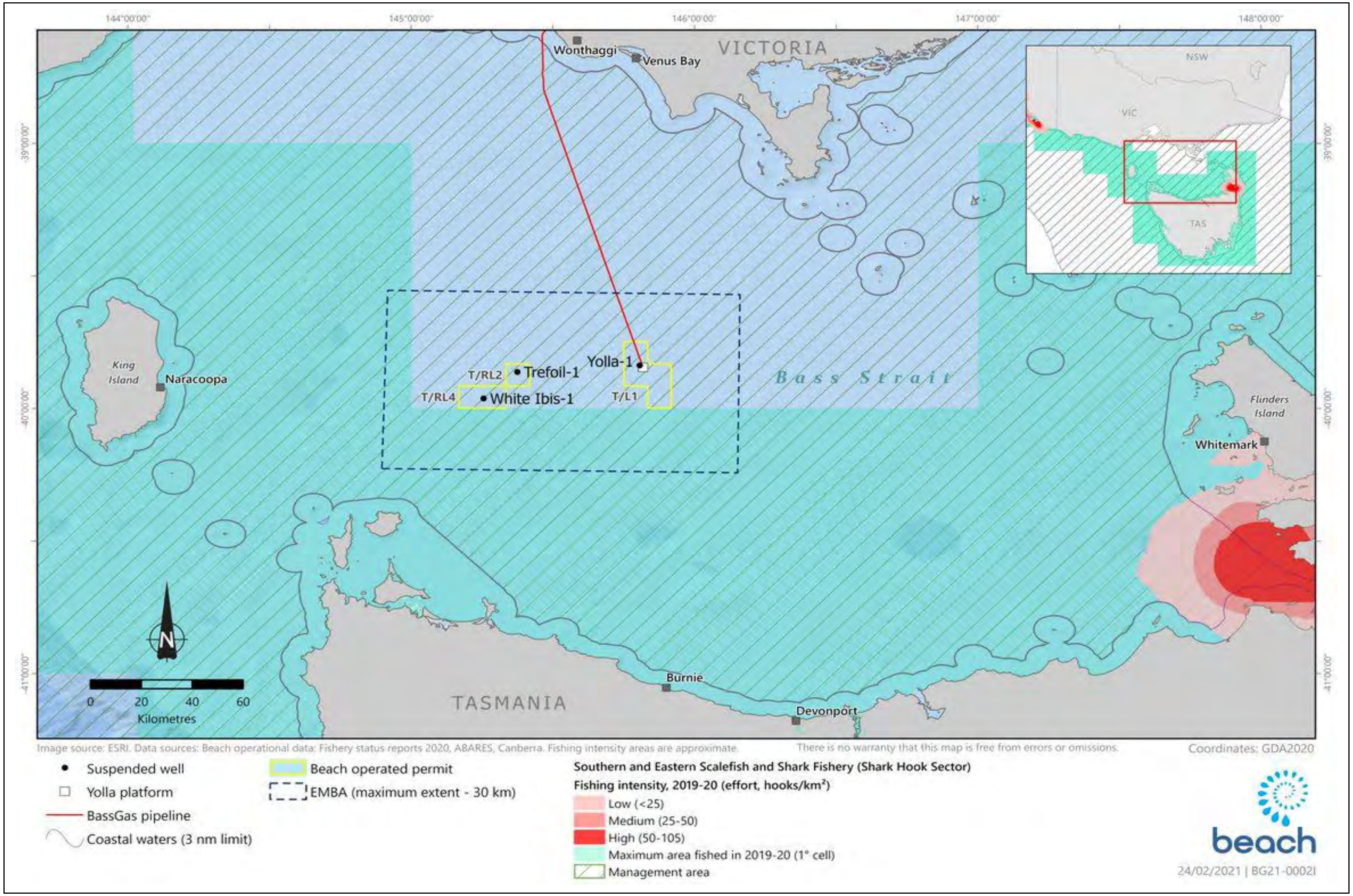


Figure 5.26. Jurisdiction and fishing intensity in the SESSF – Shark Hook Sector 2019-20

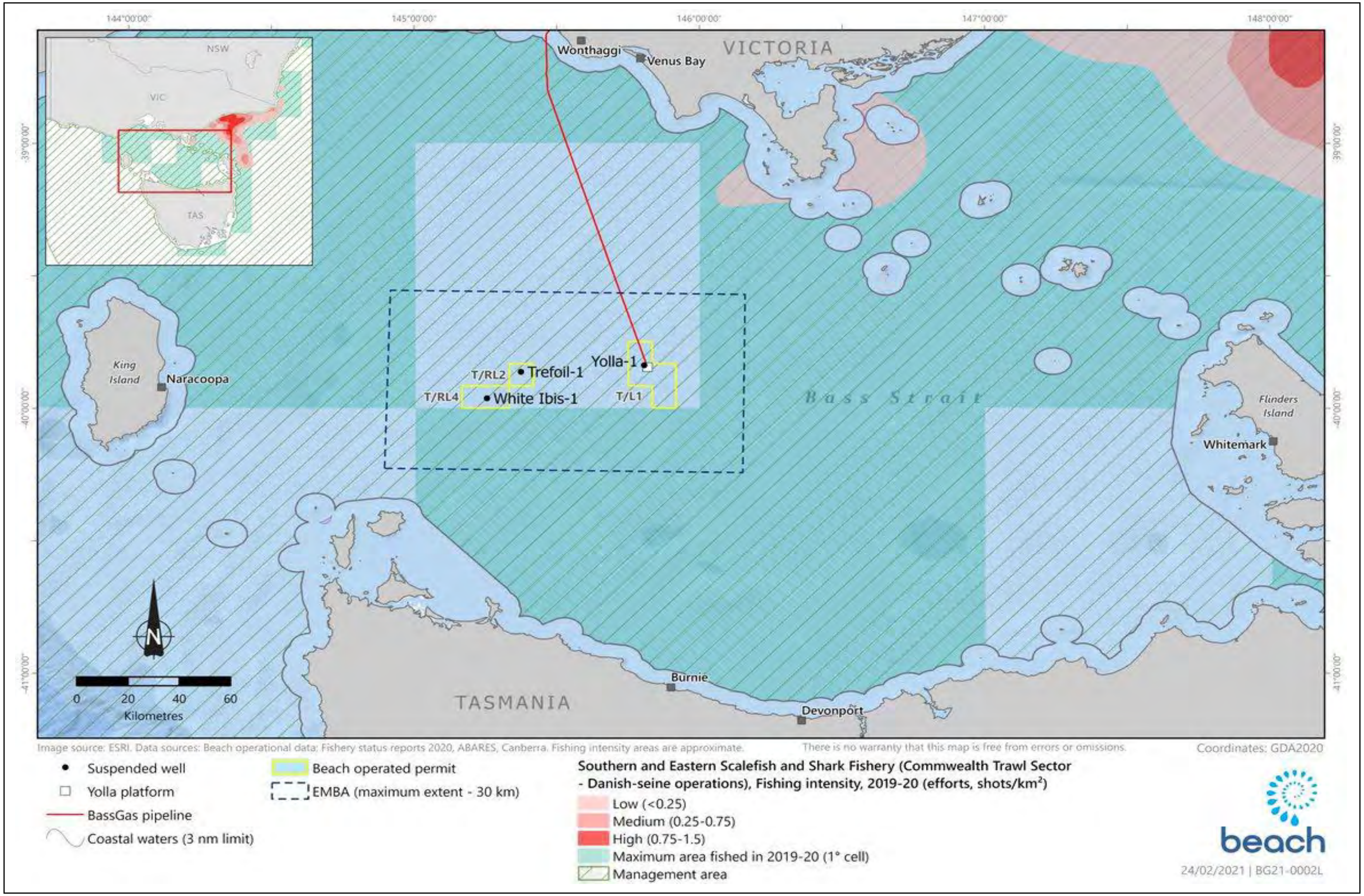


Figure 5.27. Jurisdiction and fishing intensity in the SESSF – CTS (Danish seine) 2019-20

Victorian-managed fisheries

Due to the location of the activity area and spill EMBA, there are no Victorian-managed commercial fisheries with access licences that authorise harvest in these waters (VFA, 2020). As such, Victorian-managed fisheries are not described here.

Tasmanian-managed Fisheries

Tasmanian-managed commercial fisheries with jurisdictions to fish within the activity area and spill EMBA are the:

- Scalefish;
- Octopus;
- Giant crab;
- Rock lobster;
- Shellfish;
- Commercial dive;
- Seaweed; and
- Abalone.

Though certain fisheries possess jurisdiction to actively fish within the activity area and the spill EMBA, analysis of publicly available catch data indicates that not all fisheries have been active within the activity area and/or the EMBA.

Tasmanian-managed commercial fisheries with recent catch and effort within the waters of the activity area and spill EMBA include:

- Scalefish; and
- Octopus.

Table 5.11 summarises the key information for each of these fisheries.

Table 5.11. Tasmanian-managed commercial fisheries in the spill EMBA

Fishery	Target species	Geographic extent of fishery	Does fishing occur in the activity area or spill EMBA?	Fishing season	Fishing methods, vessels and licences	Catch data and other information
Scalefish Fishery (Figure 5.28)	Multi-species fishery including banded morwong (*Cheilodactylus spectabilis*), tiger flathead (*Neoplatycephalus richardsoni*), southern school whiting (*Sillago flindersi*) Australian salmon (*Arripis trutta*), barracouta (*Thyrsites atun*), bastard trumpeter (*Latridopsis forsteri*) and blue warehou (*Seriolella brama*).	Entire Tasmanian coastline.	**Activity area? Yes.** There is overlap between the activity area and reported catch for the fishery. The activity area intersects 0.0013% of the fishery. **EMBA? Yes.** The EMBA intersects areas of reported catch. The spill EMBA intersects 4.27% of the fishery.	Year-round. Some seasonal closures depending on the target species.	The fishery targets multiple species and therefore uses multiple gear-types including drop-line, Danish seine, fish trap, hand-line and spear. There were 259 vessels operating in 2017/18 across the fishery.	Catches of key scalefish species for the last five seasons were: • 2018/19 – 403 t. • 2016/17 – 927 t. • 2015/16 – 679 t. • 2014/15 – 890 t. • 2013/14 – 401 t.
Octopus Fishery (Figure 5.28)	Pale octopus (*Octopus pallidus*).	Entire Tasmanian coastline, the fishery shares the same reporting grid as the scalefish fishery	**Activity area? Yes** Catch data reported in the fishery's 2018/19 assessment indicates that fishing activity occurs in reporting blocks 3E3 and 3E4. The activity area intersects 0.0013% of the fishery. **EMBA? Yes** Catch data reported in the fishery's 2018/19 assessment indicates that catch is reported from the EMBA. The spill EMBA intersects 4.27% of the fishery.	Year round.	There are only two active vessel licences. In 2018/19, the total catch of pale octopus was 129 tonnes, which was well above the long-term annual average catch for the previous decade (85.4 tonnes). Effort decreased slightly from the year before, with 347,000 potlifts recorded in 2018/19. Almost all of this effort and resulting catch occurred in the western portion of the fishery	In the fishing grid with the greatest overlap with the activity area (3E3), 3-12 tonnes of octopus were caught from 2013/14 to 2017/18 and in 2018/19.

Fishery	Target species	Geographic extent of fishery	Does fishing occur in the activity area or spill EMBA?	Fishing season	Fishing methods, vessels and licences	Catch data and other information
					surrounding King Island.	

Source: DPIPWE (2020a-h), Moore & Hartmann (2019), Emery et al (2015), Hill et al (2020).

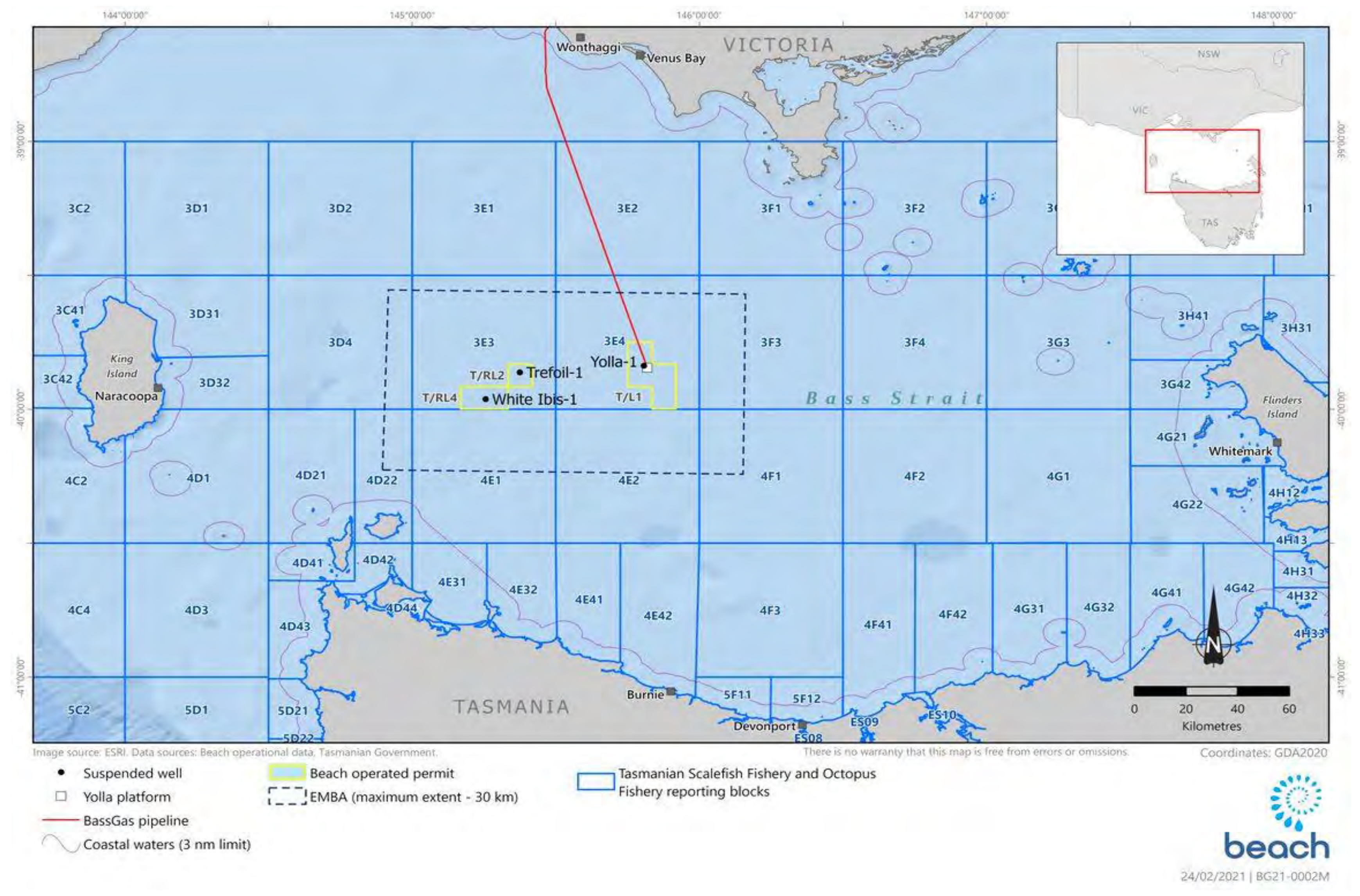


Figure 5.28. Jurisdiction and reporting blocks of the Tasmanian Scalefish and Octopus Fisheries

5.7.7 Commercial Shipping

The South-east Marine Region (which includes Bass Strait) is one of the busiest shipping regions in Australia (DoE, 2015a). Shipping consists of international and coastal cargo trade, passenger services and cargo and vehicular ferry services across Bass Strait (DoE, 2015a).

The 'Spirit of Tasmania' ferry service runs between Melbourne and Devonport (northern Tasmania) on a daily basis. The crossing is 429 km long and during non-peak times (May to August) the ferry departs each port in the evening and during peak times (September to April) day sailings are offered as well. The voyage ferry takes 11 hours on days of single sailings and 9 hours of days of double sailings. The ferry service route is clearly illustrated in Figure 5.29, which intersects the EMBA along with other shipping traffic but not the activity area.

There is a shipping route from Melbourne to Burnie that is clearly indicated in Figure 5.29. This shipping lane passes between White Ibis-1 and Trefoil-1 but does not intersect the activity area.

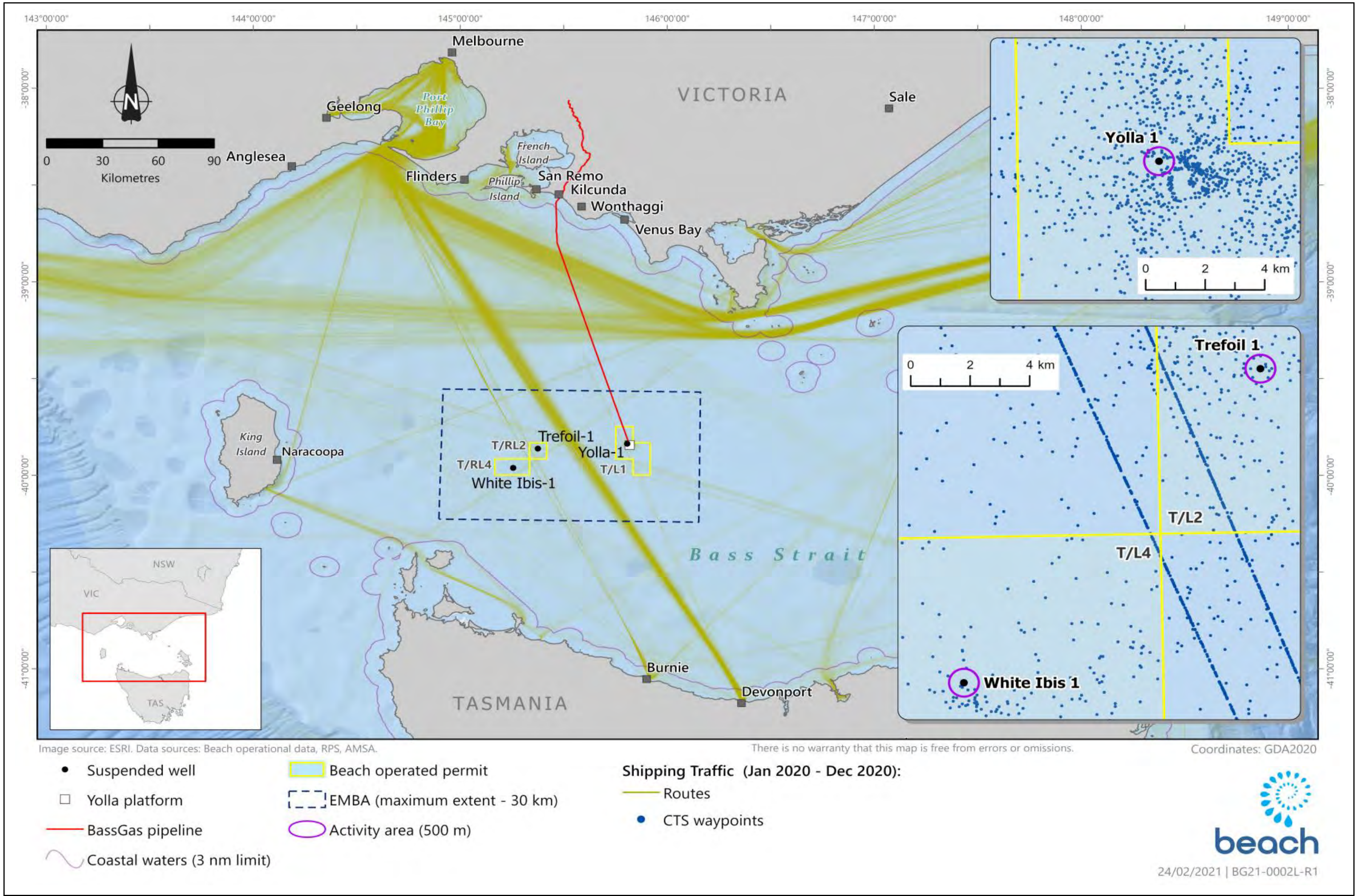


Figure 5.29. Commercial shipping traffic in the EMBA

6. Impact and Risk Assessment Methodology

As required under Regulation 13(5) of the OPGGS(E), this chapter describes the environmental impact and risk assessment methodology used in this EP. Beach uses its Corporate Risk Management Framework as per the Risk Management Standard (CDN/ID 18985348) to mitigate and manage risks for all its activities. The Risk Management Standard is part of Element 8 – Risk Management and Hazard Control, a component of the Beach Operations Excellence Management System (OEMS) (see Chapter 8).

The Corporate Risk Management Framework methodology is consistent with the Australian and New Zealand Standard for Risk Management (AS/NZS ISO 31000:2018, Risk Management – Principles and Guidelines).

Figure 6.1. outlines the Beach risk assessment management process, with each step of this process described in this chapter.

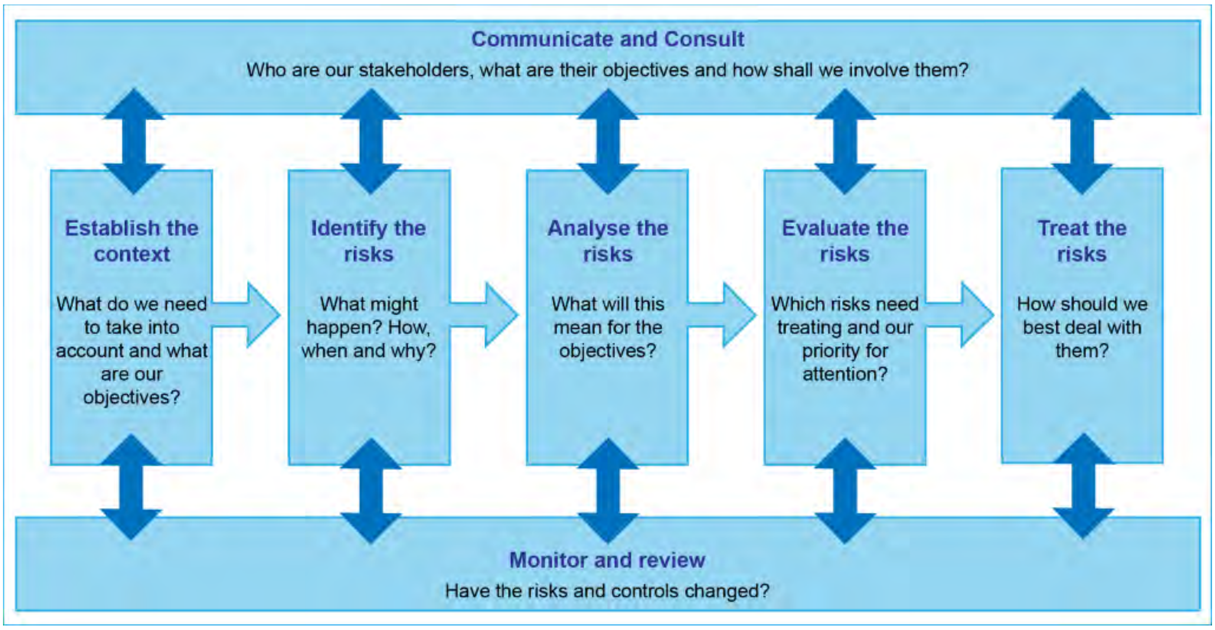


Figure 6.1. Beach risk assessment process

6.1 Step 1 - Communicate and Consult

In accordance with Regulations 11A and 14(9) of the OPGGS(E), Beach has consulted with relevant persons (stakeholders) in the development of this EP to obtain information about their functions, activities and interests and assess how the activity may impact on these. This information has been used to inform the impact and risk assessment in the EP. The stakeholder consultation process is described in detail in Chapter 4.

6.2 Step 2 - Establish the Context

The first step in the risk assessment process (outlined in Figure 6.1) is to establish the context. This involves:

- Understanding the regulatory framework in which the activity takes place (described in the 'Regulatory Framework' in Chapter 2);
- Defining the activities that will cause impacts and create risks (outlined in the 'Activity Description' in Chapter 3);
- Understanding the concerns of stakeholders and incorporating those concerns into the design of the activity where appropriate (outlined in Chapter 4, 'Stakeholder Consultation'); and

- Describing the environment in which the activity takes place (the 'Existing Environment' is described in Chapter 5).

Once the context has been established, the hazards of the activity can be identified, along with the impacts and risks of these hazards. This process is described in the following sections.

6.3 Step 3 - Identify the Risks

Beach's Corporate Risk Management Framework requires the following steps to be implemented:

- Identify the activities and the potential impacts associated with them;
- Identify the sensitive environmental resources at risk within and adjacent to the activity area;
- Identify the environmental consequences of each potential impact, corresponding to the maximum reasonable impact;
- Identify the likelihood (probability) of occurrence of each potential environmental impact (i.e., the probability of the event occurring);
- Identify applicable control measures; and
- Assign a level of risk to each potential environmental impact using a risk matrix.

In accordance with this framework, all risks must be reduced to a level that is considered to be As Low As Reasonably Practicable (ALARP) (see Section 6.5.1).

6.3.1 Definitions

In its Environment plan content requirements guidance note (N-04750-GN1344, Rev 4, April 2019), NOPSEMA distinguishes between environmental impacts and risks. Environmental impact is defined in Table 6.1 in accordance with the OPGGS(E). Table 6.1 also highlights that environmental risk is not defined in both sets of regulations.

Table 6.1. Definitions of impact and risk

Source	Impact	Risk
OPGGS(E)	Any change to the environment, whether adverse or beneficial, that wholly or partially results from an activity.	Not defined.
ISO AS/NZS 31000: 2018 (Risk management – Principles and guidelines)	Not defined.	The effect of uncertainty on objectives.
ISO AS/NZS 14001: 2016 (Environmental management systems – Requirements with guidance for use)	Not defined.	The effect of uncertainty on objectives.
ISO AS/NZS 4360: 2004 (Risk management)	Not defined.	The chance of something happening that will have an impact on objectives.
HB203: 2012 (Managing environment-related risk)	Any change to the environment or a component of the environment, whether adverse or beneficial, wholly or partly resulting from an organisation's environmental aspects.	The effect of uncertainty on objectives. The level of risk can be expressed in terms of a combination of the consequences and the likelihoods of those consequences occurring.

For this activity, Beach has determined that impacts and risks are defined as follows:

- **Impacts** result from **planned events** – there will be consequences (known or unknown) associated with the event occurring. Impacts are an inherent part of the activity. For example, underwater noise will be generated by the ISV during inspection activities and will have consequences for marine life.
  - For impacts, only a consequence is assigned (likelihood is irrelevant given that the event does occur).
- **Risks** result from **unplanned events** – there may be consequences if an unplanned event occurs. Risks are not an inherent part of the activity. For example, a hydrocarbon spill may occur if the ISV collides with another vessel, but this is not a certainty. The risk of this event is determined by multiplying the consequence of the impact (using factors such as the type and volume of hydrocarbons and the nature of the receiving environment) by the likelihood of this event happening (which may be determined objectively or subjectively, qualitatively or quantitatively).
  - For risks, the consequence and likelihood are combined to determine the risk rating (Table 6.2).

6.4 Step 4 - Analyse the Risks

After the impacts and risks have been identified, environmental performance outcomes (EPO) (or objectives) are developed to provide a measurable level of performance for each environmental hazard to ensure that the environmental impacts and risks are managed to be ALARP and acceptable (see Table 6.2).

6.5 Step 5 - Evaluate the Risks

The purpose of impact and risk evaluation (herein referred to simply as risk assessment) is to assist in making decisions, based on the outcomes of analysis, about the sorts of controls required to reduce an impact or risk to ALARP. Planned and unplanned events are subject to risk assessment in the same manner.

Beach's risk assessment process is described below and was followed in the risk identification and assessment workshop described in Section 6.3:

- Identify and describe the risks (see Chapter 7).
- Determine the maximum credible consequence (to the natural environment and community/social/cultural heritage) arising from the impact or risk without introducing additional controls. This determination is provided in the risk assessment tables throughout Chapter 7.
- Adopt controls for each impact or risk.
- Undertake an assessment of the consequence of the impact or risk, corresponding to the maximum credible impact across the consequence categories (see Table 6.2) considering the controls identified and their effectiveness.

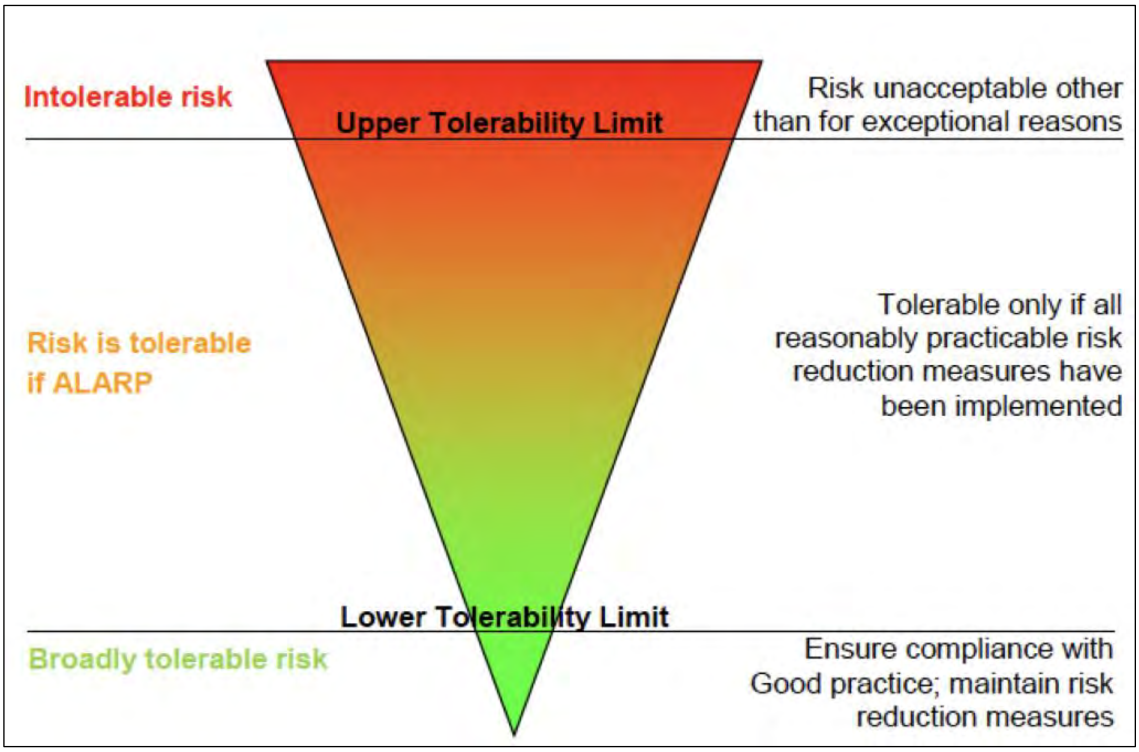
Table 6.2. Beach risk matrix

Risk Matrix

CONSEQUENCE	CONSEQUENCE CATEGORY					LIKELIHOOD					
	PEOPLE	ENVIRONMENT	REPUTATION	FINANCIAL	LEGAL	A. Remote	B. Highly Unlikely	C. Unlikely	D. Possible	E. Likely	F. Almost Certain
	Impact to Beach or contracting personnel	Natural environment	Community safety, reputation/social licence, media, items of cultural significance.	Financial impact (e.g. due to loss of revenue, business interruption, asset loss etc.)	E.G. Breach of law, prosecution, civil action	<1% chance of occurring within the next year. Requires exceptional circumstances, unlikely event in the long-term future. Only occur as a 100-year event	>1% chance of occurring within the next year. May occur but not anticipated. Could occur years to decades	>5% chance of occurring within the next year. May occur but not for a while. Could occur within a few years	>10% chance of occurring within the next year. May occur shortly but a distinct probability it won't. Could occur within months to years	>50% chance of occurring within the next year. Balance of probability will occur. Could occur within weeks to months	99% chance of occurring within the next year. Impact is occurring now. Could occur within days to weeks
6 Catastrophic	Multiple fatalities >4 or severe irreversible disability to large group of people (>10)	Catastrophic offsite or onsite release or spill; long-term destruction of highly significant ecosystems; significant effects on endangered species or habitats; irreversible or very long-term impact	Multiple community fatalities; complete loss of social licence; prolonged negative national media; complete loss of items of cultural significance	> AUD$500m	Prolonged and complex civil and/or regulatory litigation; potential jail terms and/or very high fines and/or damages claim	HIGH	HIGH	SEVERE	SEVERE	EXTREME	EXTREME
5 Critical	1-3 fatalities or serious irreversible disability (>30%) to multiple persons (<10)	Significant offsite or onsite release or spill; eradication or impairment of the ecosystem; significant impact on highly valued species or habitats; widespread long-term impact	Community fatality; significant loss of social licence; negative national media for 2 or more days; significant damage to items of cultural significance	AUD$100m-$500m	Civil and/or regulatory litigation; potential significant fines and/or damages claim	MEDIUM	MEDIUM	HIGH	SEVERE	SEVERE	EXTREME
4 Major	Serious permanent injury/ illness or moderate irreversible disability (<30%) to one or more persons	Major Offsite or onsite release or spill; very serious environmental effects, such as displacement of species and partial impairment of ecosystem; major impact on highly valued species or habitats; widespread medium and some long-term impact	Serious permanent injury to community member; major damage to social licence; negative national media; major damage to items of cultural significance	AUD$10m-$100m	Civil and/or regulatory litigation; potential major fine and damages claim	MEDIUM	MEDIUM	MEDIUM	HIGH	SEVERE	SEVERE
3 Serious	Serious reversible/ temporary injury/illness; Lost Time Injury >5 days or Alternate/Restricted Duties > 1 month	Minor offsite or onsite release or spill; serious short-term effect to ecosystem functions; serious impact on valued species or habitats; moderate effects on biological or physical environment	Serious reversible injury to community member; serious damage to social licence; negative state media; serious damage to items of cultural significance	AUD$1m-$10m	Serious potential breach of law; report and investigation by regulator; possible prosecution or regulatory notice (e.g. improvement notice or equivalent), or possible civil litigation and serious damages claim	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH	SEVERE
2 Moderate	Reversible temporary injury/ illness requiring Medical Treatment; Lost Time Injury ≤5 days or Alternate/Restricted Duties for ≤ 1 month	Event contained within site; short-term effects but not affecting ecosystem functions; some impact on valued species or habitats; minor short-term damage to biological and/or physical environment	Moderate injury to community member; moderate impact to social licence; negative local media; moderate damage to items of cultural significance	AUD$100,000-$1m	Potential Breach of law or non-compliance; inquiry by a regulator leading to Low-level legal issues; possible civil litigation and moderate damages claim	LOW	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH
1 Minor	First Aid Injury/illness	Spill limited to release location; minor effects but not affecting ecosystem functions; no impact on valued species or habitats; low-level impacts on biological and physical environment	Minor injury to community member, public concern restricted to local complaints, minor damage to items of cultural significance	<AUD$100,000	Minor potential breach of law; not reportable to a regulator; on the spot fine or technical non-compliance	LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM

6.5.1 Demonstration of ALARP

The ALARP principle states that it must be possible to demonstrate that the cost involved in reducing the risk further would be grossly disproportionate to the benefit gained. The ALARP principle arises from the fact that infinite time, effort and money could be spent attempting to reduce an impact or risk to zero. This concept is shown diagrammatically in Figure 6.2.



Source: CER (2015).

Figure 6.2. The ALARP Principle

The ALARP principle states that it must be possible to demonstrate that the cost involved in reducing the risk further would be grossly disproportionate to the benefit gained. The ALARP principle arises from the fact that infinite time, effort and money could be spent attempting to reduce an impact or risk to zero. This concept is shown diagrammatically in Figure 6.2.

Beach's approach to demonstrating ALARP includes:

- Systematically identifying and assessing all potential environmental impacts and risks associated with the activity;
- Where relevant, applying industry 'good practice' controls to manage impacts and risks;
- Assessing the effectiveness of the controls in place and determining whether the controls are adequate according to the 'hierarchy of controls' principle; and
- For higher order impacts and risks, implementing further controls if feasible and reasonably practicable to do so.

NOPSEMA's Environment Plan decision making guideline (GL1721, Rev 6, November 2019) states that in order to demonstrate ALARP, a titleholder must be able to implement all available control measures where the cost is not grossly disproportionate to the environmental benefit gained from implementing the control measure.

There is no universally-accepted guidance to applying the ALARP principle to environmental assessments. For this EP, the guidance provided in NOPSEMA's Environment Plan decision making guideline has been applied, and augmented where deemed necessary.

The level of ALARP assessment is dependent upon the:

- Residual impact and risk level (high versus low); and
- The degree of uncertainty associated with the assessed impact or risk.

An iterative risk evaluation process is employed until such time as any further reduction in the residual risk ranking is not reasonably practicable to implement. At this point, the impact or risk is reduced to ALARP. The determination of ALARP is outlined in Table 6.3.

Table 6.3. Alignment of ALARP with impacts (using consequence ranking) and risks (using risk ranking)

Consequence ranking	Minor	Moderate	Serious	Major	Critical	Catastrophic
ALARP level – planned event	Broadly acceptable	Tolerable if ALARP		Intolerable		
Residual impact category	Lower order		Higher order			
Risk ranking	Low	Medium	High	Severe	Extreme	
ALARP level - unplanned event	Broadly acceptable	Tolerable if ALARP		Intolerable		
Residual risk category	Lower order risks			Higher order risks		

Hierarchy of Controls

Beach demonstrates ALARP, in part, by adopting the 'Hierarchy of Controls' philosophy (Figure 6.3). The Hierarchy of Controls is a system used across hazardous industries to minimise or eliminate exposure to hazards. The hierarchy of controls is, in order of effectiveness:

- Elimination;
- Substitution;
- Engineering controls;
- Administrative controls; and
- Personal protective equipment (PPE) – this has not been included here as it is specific to the assessment of safety risks rather than environmental management.

Although commonly used in the evaluation of occupational health and safety hazard control, the Hierarchy of Controls philosophy is also a useful framework to evaluate potential environmental controls to ensure reasonable and practicable solutions have not been overlooked.

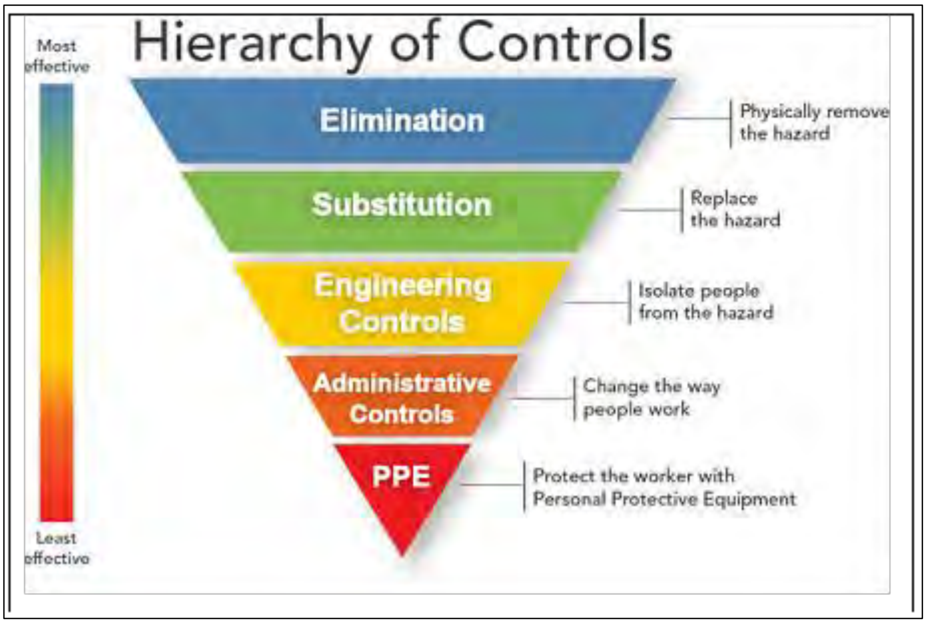


Figure 6.3. The Hierarchy of Controls

When deciding on whether to implement the proposed impact/risk reduction measure, the following issues are considered:

- Does it provide a clear or measurable reduction in risk?
- Is it technically feasible and can it be implemented?
- Will it be supported and utilised by site personnel?
- Is it consistent with national or industry standards and practices?
- Does it introduce additional risk in other operational / activity areas (e.g., will the implementation of an environmental risk reduction measure have an adverse impact on safety)?
  - Will the change be effective, taking into account the:
  - Current level of risk with the existing controls;
  - Amount of additional risk reduction that the control will deliver;
  - Level of confidence that the risk reduction impact will be achieved; and
  - Resources, schedule and cost required to implement the control.

Reducing impacts and risks to ALARP is an ongoing process and new risk reduction measures may be identified at any time, including during operations. Beach actively encourages recording and review of observations through its incident management system (CMO database). Incidents and lessons learned within Beach and from the wider industry are reviewed and utilised to identify hazards and controls.

The following section details how the guidance provided in NOPSEMA's Environment Plan decision making guideline (GL1721, Rev 6, November 2019) is applied.

6.5.2 Residual Impact and Risk Levels

The following section details how the guidance provided in NOPSEMA's Environment Plan decision making guideline (GL1721, Rev 6, November 2019) is applied.

Lower-order Environmental Impacts and Risks

NOPSEMA defines lower-order environmental impacts and risks as those where the environment or receptor is not formally managed, less vulnerable, widely distributed, not protected and/or threatened and there is confidence in the effectiveness of adopted control measures.

Impacts and risks are considered to be lower-order and ALARP when, using the Beach risk matrix (see Table 6.2), the impact consequence is rated as 'minor' or 'moderate' or risks are rated as 'low', 'medium' or 'high' (see also Table 6.3). In these cases, applying 'good industry practice' (see Section 6.5.3) is sufficient to manage the impact or risk to ALARP.

Higher-order Environmental Impacts and Risks

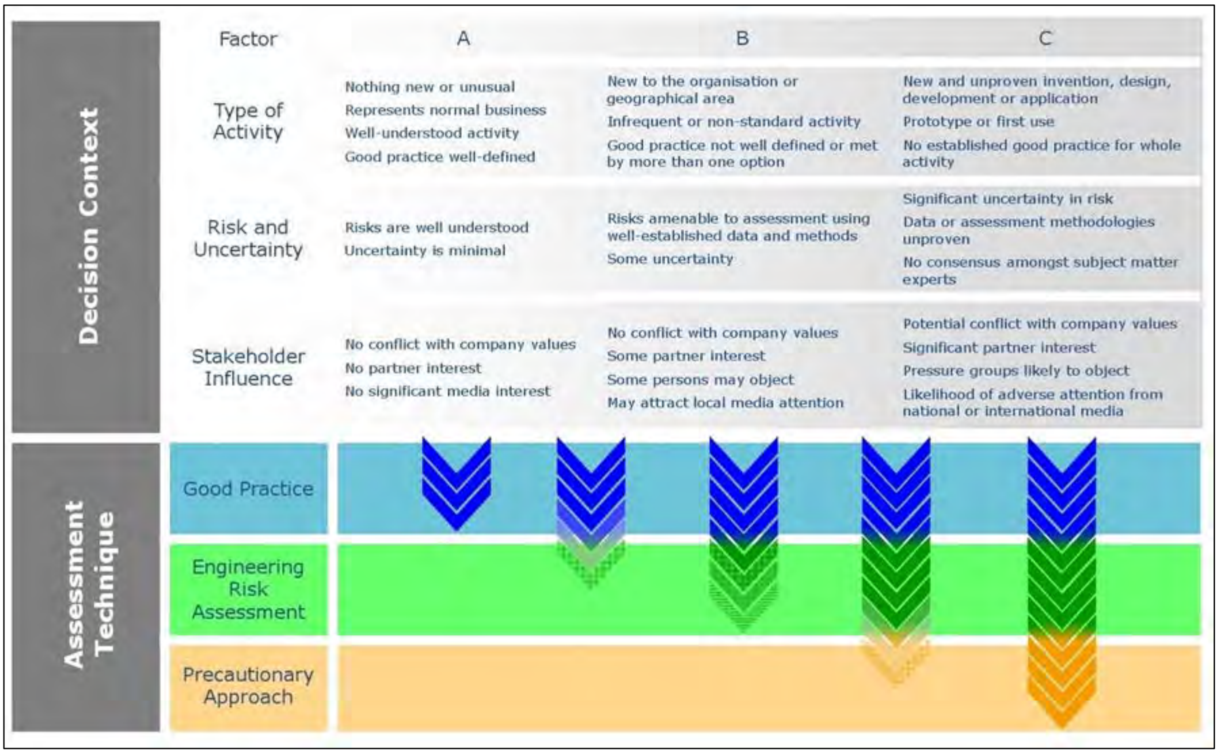
NOPSEMA defines higher-order environmental impacts and risks as those that are not lower order risks or impacts (i.e., where the environment or receptor is formally managed, vulnerable, restricted in distribution, protected or threatened and there is little confidence in the effectiveness of adopted control measures).

Impacts and risks are considered to be higher-order when, using the Beach risk matrix (see Table 6.2), the impact consequence is rated as 'serious', 'major', 'critical' or 'catastrophic', or when the risk is rated as 'severe' or 'extreme' (see also Table 6.3). In these cases, further controls must be considered as per Section 6.5.3.

6.5.3 Uncertainty of Impacts and Risks

Based upon the level of uncertainty associated with the impact or risk, the following framework, adapted by NOPSEMA (2015) from the Guidance on Risk Related Decision Making (Oil & Gas UK, 2014) (Figure 6.4) provides the decision-making framework to establish ALARP.

This framework provides appropriate tools, commensurate to the level of uncertainty or novelty associated with the impact or risk (referred to as the Decision Type A, B or C). The decision type is selected based on an informed decision around the uncertainty of the risk. Decision types and methodologies to establish ALARP are outlined in Table 6.4.



Source: CER (2015).

Figure 6.4. Impact and risk 'uncertainty' decision-making framework

Table 6.4. ALARP decision-making based upon level of uncertainty

Decision type	Decision-making tools
A	Good industry practice Identifies the requirements of legislation, codes and standards that are to be complied with for the activity. Applies the 'Hierarchy of Controls' philosophy, which is a system used in the industry to identify effective controls to minimise or eliminate exposure to impacts or risks. Identifies further engineering control standards and guidelines that may be applied over and above that required to meet the legislation, codes and standards.
B	*In addition to decision type A:* Engineering risk-based tools Engineering risk-based tools to assess the results of probabilistic analyses such as modelling, quantitative risk assessment and/or cost benefit analysis to support the selection of control measures identified during the risk assessment process.
C	*In addition to decision type A and B:* Precautionary Principle Application of the Precautionary Principle is to be applied when good industry practice and engineering risk-based tools fail to address uncertainties.

The decision-making tools outlined in Table 6.4 are explained further below.

Good Practice

In the absence of an Australian definition, the OGUK (2014) and the Irish Commission for Energy Regulation (CER) (2015) define 'Good Practice' as:

The recognised risk management practices and measures that are used by competent organisations to manage well-understood hazards arising from their activities.

NOPSEMA has not endorsed any 'approved codes of practice' or standards to give them a legal status in terms of good practice. Good practice is taken to refer to any well-defined and established standard or codes of practice adopted by an industrial/occupational sector, including 'learnings' from incidents that may yet be incorporated into standards.

Good practice can also be used as the generic term for those standards for controlling risk that have been judged and recognised as satisfying the law when applied to a particular relevant case in an appropriate manner. For this EP, sources of good practice, adapted from CER (2015) are the relevant:

- Commonwealth and state legislation and regulations (outlined in Section 2.2);
- Government policies (outlined in Section 3.5);
- Government guidance (outlined in Section 2.3);
- Industry standards (outlined in Section 2.5 and Section 2.6); and
- International conventions (outlined in Section 2.2.1).

Good practice also requires that hazard management is considered in a hierarchy, with the concept being that it is inherently safer to eliminate a hazard than to reduce its frequency or manage its consequences (CER, 2015). This being the case, the 'Hierarchy of Controls' philosophy is applied to reduce the risks associated with hazards (described in Section 6.5.1).

Engineering Risk Assessment

All impacts and risks that require assessment beyond that of good practice (i.e., decision type A) are subject to an engineering risk assessment.

Engineering risk-based tools can include, but are not limited to, engineering analysis (e.g., structural, fatigue, mooring, process simulation) and consequence modelling (e.g., ship collision, dropped object) (CER, 2015). A cost-benefit analysis to support the selection of control measures identified during the risk assessment process may also be undertaken.

Precautionary Principle

All impacts and risks that do meet decision type A or type B and require assessment beyond that of good practice and engineering risk assessment are subject to the 'Precautionary Principle'. CER (2015) states that if the assessment, taking account of all available engineering and scientific evidence, is insufficient, inconclusive or uncertain, then the precautionary principle should be adopted in the hazard management process. While there is no globally-recognised definition of the Precautionary Principle, it is generally accepted to mean:

> *Uncertain analysis is replaced by conservative assumptions which will increase the likelihood of a risk reduction measure being implemented.*

The degree to which this principle is adopted should be commensurate with the level of uncertainty in the assessment and the level of danger (hazard consequences) believed to be possible.

Under the precautionary principle, environmental considerations are expected to take precedence over economic considerations, meaning that an environmental control measure is more likely to be implemented. In this decision context, the decision could have significant economic consequences to an organisation.

6.5.4 Demonstration of Acceptability

Regulation 13(5)(c) of the OPGGS(E) requires the EP to demonstrate that environmental impacts and risks are acceptable.

NOPSEMA's Environment Plan decision making guideline (GL1721, Rev 6, November 2019) states that stakeholder consultation plays a large part in establishing the context for defining an acceptable level of environmental impact or risk may be.

Beach considers a range of factors to demonstrate the acceptability of the environmental impacts and risks associated with its activities. This evaluation works at several levels, as outlined in Table 6.5. The criteria for demonstrating acceptability were developed based on Beach's interpretation of NOPSEMA's Guidance Note for EP Content Requirements (N04750-GN1344, Rev 0, February 2014, noting that this has since been superseded) and NOPSEMA's Environment Plan decision making guideline (GL1721, Rev 6, November 2019).

Table 6.5. Acceptability criteria

Test	Question	Acceptability demonstrated
Internal context		
Policy compliance	Is the proposed management of the hazard aligned with Beach's Environmental Policy?	The impact or risk must be compliant with the objectives of the company policies.

Management System Compliance	Is the proposed management of the hazard aligned with Beach's Operations Excellence Management System (OEMS)?	Where specific Beach procedures, guidelines, expectations are in place for management of the impact or risk in question, acceptance is demonstrated.
External context		
Stakeholder engagement	Have stakeholders raised any concerns about activity impacts or risks? If so, are measures in place to manage those concerns?	Merits of claims or objections raised by stakeholders must have been adequately assessed and additional controls adopted where appropriate.
Legislation, industry standard and best practice		
Legislative context	Do the management controls meet the expectations of existing Victorian or Commonwealth legislation?	The proposed management controls align with legislative requirements.
Industry practice	Do the management controls align with international and Australian industry guidelines and practices?	The proposed management controls align with relevant industry guidelines and practices.
Environmental context	What are the overall impacts and risks to MNES and other areas of conservation significance? Do environmental controls aligned with the aims and objectives of marine park management plans and species conservation advice, recovery plans or threat abatement plans?	There are no long-term impacts to MNES and the proposed management controls do not conflict with the aims and objectives of marine park management plans and species conservation advice, recovery plans or threat abatement plans.
Ecologically Sustainable Development (ESD) Principles*	Are the management controls aligned with the principles of ESD?	The EIA presented throughout Chapter 7 is consistent with the principles of ESD.

* See Table 6.6 for further information.

6.5.5 Principals of Ecologically Sustainable Development

Based on Australia's National Strategy for Ecologically Sustainable Development (Council of Australian Governments, 1992), Section 3A of the EPBC Act defines ESD as:

> *Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased.*

Table 6.6 outlines the principles of ESD as defined under the EPBC Act and describes how this EP aligns with these principles.

6.6 Treat the Risks

An environmental impact and risk register records the environmental control measures (e.g., measures to prevent, minimise and mitigate impacts and risks) that were determined by an expert team familiar with the activity and the sensitivities of the existing environment.

These controls are listed throughout the EIA and ERA tables in Chapter 7.

6.7 Monitor and Review

Monitoring and review activities are incorporated into the impact and risk management process to ensure that controls are effective and efficient in both design and operation. This is achieved through the environmental performance outcomes (EPO), environmental performance standards (EPS) and measurement criteria that are described for each environmental hazard. Monitoring and review are described in detail in the Implementation Strategy (Chapter 8).

Table 6.6. Assessment of ESD principles

Principle		EP demonstration
A	Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations.	This principle is inherently met through the EP assessment process.
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.	Serious or irreversible environmental damage resulting from the survey activity has been eliminated through the project design (see Chapter 3). None of the residual impacts is rated higher than 'minor' and none of the residual risks is rated higher than 'medium.' Scientific certainty has been maximised by employing a spill EMBA as a risk assessment boundary.
C	The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	The EP assessment methodology ensures that risks from the activity are managed to be ALARP and acceptable.
D	The conservation of biodiversity and ecological integrity should be a fundamental consideration in decision making.	This principle is considered for each hazard in the adoption of environmental controls (i.e., environmental performance outcomes and environmental performance standards) that aim to minimise environmental harm. There is a strong focus in this EP on conserving biodiversity and ecological integrity by understanding the marine environment and commercial fishing activity in and around the survey area (Chapter 5) and implementing controls to minimise impacts and risks (Chapter 7).
E	Improved valuation, pricing and incentive mechanisms should be promoted.	This principle is not relevant to this activity.

7. Impact and Risk Assessment

This chapter presents the EIA and ERA for the environmental impacts and risks identified for the activity using the methodology described in Chapter 6, as required under Regulations 13(5)(6) of the OPGGS(E).

This chapter also presents the EPO, EPS and measurement criteria required to manage the identified impacts and risks. The following definitions are used in this section, as defined in Regulation 4 of the OPPGS(E):

- **EPO** – a measurable level of performance required for the management of environmental aspects of an activity to ensure that environmental impacts and risks will be of an acceptable level (i.e., the environmental objective);
- **EPS** – a statement of the performance required of a control measure; and
- **Measurement criteria** – defines the measure by which environmental performance will be measured to determine whether the EPO has been met.

A summary of the impact consequence rankings and risk ranking for each hazard identified and assessed in this chapter is presented in Table 7.1.

The loss of well containment is not assessed here as the risk of a leak from the wells or well blowout is considered to be ALARP and not a credible risk (see Section 3.6).

Table 7.1. Activity environmental impacts and risk summary

Identifier	Hazard	Inherent	Residual
Impact		Consequence rating	
1	Seabed disturbance	Minor	Minor
2	Putrescible waste discharges	Minor	Minor
3	Sewage and grey water discharges	Minor	Minor
4	Cooling and brine water discharges	Minor	Minor
5	Bilge water and deck drainage discharges	Minor	Minor
6	Light emissions	Minor	Minor
7	Atmospheric emissions	Minor	Minor
8	Underwater noise emissions (all receptors)	Minor	Minor
Risk		Risk rating	
1	Displacement of or interference with third party vessels		
	- Displacement	Medium	Low
	- Interference	Medium	Low
2	Vessel collision with megafauna	Medium	Low
3	Accidental discharge of waste to the ocean	Medium	Low
4	Introduction and establishment of IMS	Medium	Medium
5	MDO release		
	- Benthic fauna	Low	Low
	- Macroalgal communities	Low	Low

Identifier	Hazard	Inherent	Residual
	- Plankton	Low	Low
	- Pelagic fish	Low	Low
	- Cetaceans	Low	Low
	- Pinnipeds	Low	Low
	- Marine reptiles	Low	Low
	- Seabirds	Low	Low
	- Shorebirds	Low	Low
	- Commercial fisheries	Low	Low
6	MDO spill response activities		
	- Fauna disturbance	Medium	Low
	- Fauna injury	Medium	Low
	- Fauna death	Low	Low

7.1 IMPACT 1 – Seabed disturbance

7.1.1 Hazard

The following elements of the activity will result in seabed disturbance:

- Continued presence of the wellheads displaces a total of <3 m^2 of seabed habitat;
- Temporary set-down of equipment on the seabed (e.g., ROV, water jet and vacuum pump);

No anchoring is proposed as part of this activity. The ISV will remain in position using its DP system.

7.1.2 Known and potential environmental impacts

The known and potential environmental impacts of this localised seabed disturbance are:

- Highly localised displacement of seabed habitat;
- Temporary and localised turbidity of water near the seabed during ROV deployment and retrieval, including use of water jetting to clear away marine growth that may be present and inhibiting inspection activities); and
- Creation of new hard substrate habitat.

7.1.3 EMBA

The EMBA for seabed disturbance is 1) the immediate vicinity of each wellhead for physical presence, and 2) immediately around each wellhead during the ROV inspections.

In addition to the quality of the receiving waters, receptors that may occur within this EMBA, either as residents or migrants, are:

- Plankton;
- Demersal fish; and
- Benthic invertebrates.

7.1.4 Evaluation of environmental impacts

Displacement of seabed habitat

The area of seabed that is disturbed is miniscule compared with the overall extent of the sandy seabed habitat in the region and broader Bass Strait environment. Mortality of benthic fauna in areas directly disturbed is considered to be very small compared with the overall extent of similar habitat in the region. Given the miniscule area of seabed affected, there are no long-term impacts on the diversity and abundance of benthic fauna or ecosystem functioning.

The ROV is likely to stir up sediments around the wellheads during the inspection process, resulting in temporary and localised water turbidity. As these sediments settle, they may smother benthic habitat and fauna in very small isolated locations around the well. The thickness of deposition is unlikely to be outside of rates of natural deposition caused by currents and storms.

There are no mapped areas of seabed sensitivity in the activity area (e.g., rocky reefs, sponge gardens, canyons, etc). In this context, benthic fauna will rapidly return to recolonise these disturbed sites, resulting in no long-term impacts.

Water turbidity

Turbidity occurs when seabed sediments are stirred up and is likely to result from use of the ROV and use of water jet and vacuum pump to remove marine growth from the wellhead. The sediments mapped in the activity area are classified as fine, medium, coarse and very coarse sands (see Figure 5.7), so these sediments will rapidly suspend in the water column when disturbed.

Given the small size of the disturbed area the turbidity created will result in a small plume of disturbed sediments that are within the limits of natural variability when considering the turbidity created by ocean bottom currents. Benthic fauna living in sediment (endobenthos) or on sediment (epibenthos) may be temporarily displaced by this turbidity.

Surveys of seabed disturbance from similar activities indicate that recovery of benthic fauna in soft sediment substrates (such as those that dominates the activity area) occurs between 6 to 12 months after the disturbance was created (URS, 2001). The anchor depression acts as a trap for marine detritus and sand, which will quickly fill and be recolonised by benthic organisms (Currie and Isaac, 2005). The area impacted by small anchors that barely penetrate the seabed will not pose a threat to seabed habitats or fauna communities.

7.1.5 Impact Assessment

Table 7.2 presents the impact assessment for seabed disturbance.

Table 7.2. Impact assessment for seabed disturbance

Summary	
Summary of impacts	Localised and temporary water turbidity near the seabed. Localised and temporary seabed habitat smothering.
Extent of impacts	Localised – within a few metres at each wellhead location.
Duration of impacts	Temporary – duration of the survey.
Level of certainty of impacts	HIGH – the impacts of disturbance to seabed sediments are well known.

Impact decision framework context	A – nothing new or unusual, represents business as usual, well understood activity, good practice is well defined.

Impact Consequence (inherent)

Minor

Environmental Controls and Performance Measurement

EPO	EPS	Measurement criteria
Seabed displacement is limited to the area occupied by the wellheads.	ROV is deployed to confirm seabed displacement is limited to the area occupied by the wellheads.	Wellhead imagery confirms displacement is limited to the footprint of the wellheads.
Large objects dropped overboard will be retrieved wherever possible.	An ROV is deployed to search for (and retrieve, where possible), non-buoyant dropped objects so that there is no debris on the seabed at the completion of inspection activities.	ROV operator logs verify that a post-installation survey took place.
	The location of dropped objects left behind at the end of inspection activities (that cannot be retrieved) will be reported to NOPSEMA.	Recordable incident report and transmittal to NOPSEMA is available.

Impact Consequence (residual)

Minor

Demonstration of ALARP

A 'minor' residual impact consequence is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required.

Demonstration of Acceptability

Internal context	Policy compliance	Beach Environmental Policy objectives are met through implementation of this EP.
	OEMS compliance	Chapter 8 describes the EP implementation strategy employed for this activity. It is demonstrated that all the standards in the OEMS have been met during the planning phase of this activity and can be met during the implementation phase of this activity.
Stakeholder engagement (Chapter 4)	Beach will communicate with all relevant stakeholders prior to the activity commencing. It is not anticipated this this hazard will be of material concern to stakeholders.	
Legislative context (see Section 2.2 for description of relevant legislation)	The performance standards outlined in this EP align with the requirements of the: • *OPGGS Act* 2006 (Cth): o Section 280(2) – a person carrying on activities in an offshore area under the permit must carry on those activities in a manner that does not interfere with….the conservation of the resources of the sea and seabed…..to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the first person.	
Industry practice (see Sections 2.5 & 2.6 for descriptions)	The consideration and adoption of the controls outlined in the below-listed codes of practice and guidelines demonstrates that BPEM is being implemented.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS developed for this hazard are in line with the management measures listed for offshore marine use (physical disturbance) in Section 4.3.2 of the guidelines: • Consider sensitive marine habitats. • Reduce footprint.
	Best Available Techniques Guidance	There is no guidance in these guidelines regarding seabed disturbance.

	Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	There is no guidance in these guidelines regarding seabed disturbance.
	APPEA CoEP (2008)	The EPS listed in this table meet the following offshore development and production objectives: • To reduce the impacts to benthic communities to ALARP and to an acceptable level.
Environmental context	MNES	
	AMPs (Section 5.5.1)	This hazard will not impact on the conservation values of nearby AMPs. See **Appendix 1** for additional detail regarding the impacts of non-routine activities on the management aims of these AMPs.
	Ramsar wetlands (Section 5.5.4)	This hazard will not impact any Ramsar wetlands.
	TECs (Section 5.5.6)	This hazard will not impact any TECs.
	NIWs (Section 5.5.4)	This hazard will not impact any NIWs.
	Nationally threatened and migratory species (Section 5.4)	This hazard will not impact any threated or migratory species.
	Other matters	
	State marine parks (Sections 5.5.9 and 5.5.10)	This hazard will not impact any state marine parks.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	None triggered by this hazard. See **Appendix 2** for additional detail regarding the impacts of routine activities on the management aims of threatened species plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	

Environmental Monitoring
• Dropped objects (if required).

Record Keeping
• Geographic coordinates for dropped objects (if required).

7.2 IMPACT 2 – Routine Discharges – Putrescible Waste

7.2.1 Hazard

The generation of food waste (putrescible waste) from the ISV galley will result in the overboard discharge of putrescible waste.

The average volume of putrescible waste discharged overboard depends on the number of POB at any time, and the types of meals prepared. However, some anecdotal reports estimate this volume to be in the order of 1-2 kg per person per day (NERA, 2018).

7.2.2 Known and potential environmental impacts

The known and potential environmental impacts of putrescible waste discharges are:

- Temporary and localised increase in the nutrient content of waters surrounding the discharge point; and
- An associated increase in scavenging behaviour of marine fauna and seabirds (at the sea surface or within the water column).

7.2.3 EMBA

The EMBA for putrescible waste discharges is likely to be the top 10 m of the water column and a 100 m radius from the discharge point. This is based on modelling of continuous wastewater discharges undertaken by Woodside for its Torosa South-1 drilling program (in the Scott Reef complex, Western Australia).

In addition to the quality of the receiving waters, receptors that may occur within this EMBA, either as residents or migrants, are:

- Pelagic fauna (plankton, fish, cetaceans, pinnipeds); and
- Avifauna.

7.2.4 Evaluation of environmental impacts

The overboard discharge of macerated food wastes creates a localised and temporary increase in the nutrient load of near-surface waters. This in turn acts as a food source for scavenging marine fauna and/or seabirds, whose numbers may temporarily increase as a result. The rapid consumption of putrescible waste by scavenging fauna, and its physical and microbial breakdown, ensures that the impacts of such discharges are insignificant.

The impacts of putrescible waste discharges to the physical and biological environment are expected to have insignificant consequences because of the:

- Small discharge volumes;
- Intermittent nature of the discharge;
- Maceration of the waste prior to discharge;
- High dilution and dispersal factor in open waters;
- Long distance from shore;
- Rapid consumption by fauna;
- High biodegradability and low persistence of the waste; and
- The absence of sensitive habitats in the activity area.

7.2.5 Impact Assessment

Table 7.3 presents the impact assessment for putrescible waste discharges.

Table 7.3. Impact assessment for putrescible waste discharges

Summary		
Summary of impacts	Increase in nutrient content of near-surface waters around the discharge point, which may lead to an increase of scavenging behaviour of pelagic fish and seabirds.	
Extent of impacts	Localised – up to 100 m horizontally and 10 m vertically from the discharge point.	
Duration of impacts	Intermittent and temporary – until the discharge is completely diluted (likely to be several hours).	
Level of certainty of impacts	HIGH – the impacts of putrescible waste discharges on marine fauna are well known.	
Impact decision framework context	A – nothing new or unusual, represents business as usual, well understood activity, good practice is well defined.	
Impact Consequence (inherent)		
Minor		
Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
Putrescible waste discharges comply with AMSA Marine Order 95 (Marine pollution prevention – garbage), which enacts MARPOL Annex V.	A MARPOL Annex V-compliant Garbage Management Plan (GMP) is in place (for vessels >100 GRT tonnes or certified to carry 15 persons or more) that sets out the procedures for minimising, collecting, storing, processing and discharging garbage.	A GMP is in place, readily available onboard and kept current.
	A macerator is on board the vessel, functional, in use and set to macerate putrescible waste to a particle size ≤25 mm using to ensure rapid breakdown upon discharge.	PMS records verify that the macerator is functional and regularly maintained or replaced.
	Waste management and housekeeping requirements are communicated to all personnel boarding the vessels to ensure discharges are in accordance with MARPOL Annex V.	Vessel induction includes waste management requirements.
	Records of food waste disposal to be maintained in a Garbage Record Book.	A Garbage Record Book is in place and verifies waste discharge locations and volumes.
	Macerated putrescible waste (≤25 mm) is only discharged overboard when the vessel is >3 nm from the shoreline.	A Garbage Record Book is in place and verifies waste discharge locations and volumes.
	Un-macerated putrescible waste is only discharged overboard when the vessel is >12 nm from the shoreline.	
	For vessels without a macerator and for non-putrescible galley waste, waste is returned to shore for disposal.	
Impact Consequence (residual)		
Minor		
Demonstration of ALARP		

A 'minor' residual impact consequence is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required.

Demonstration of Acceptability		
Internal context	Policy compliance	Beach Environmental Policy objectives are met through implementation of this EP.
	OEMS compliance	Chapter 8 describes the EP implementation strategy employed for this activity. It is demonstrated that all the standards in the OEMS have been met during the planning phase of this activity and can be met during the implementation phase of this activity.
Stakeholder engagement (Chapter 4)	Beach will communicate with all relevant stakeholders prior to the activity commencing. It is not anticipated this this hazard will be of material concern to stakeholders.	

Legislative context
(see Section 2.2 for description of relevant legislation)
	The performance standards outlined in this EP align with the requirements of:
	• *Navigation Act* 2012 (Cth):
	  o Chapter 4 (Prevention of Pollution).
	  o AMSA Marine Order 95 (Marine Pollution Prevention - garbage).
	• *Protection of the Sea (Prevention of Pollution from Ships) Act* 1983 (Cth):
	  o Section 26F (which implements MARPOL Annex V).	

Industry practice (see Sections 2.5 & 2.6 for descriptions)	The consideration and adoption of the controls outlined in the below-listed codes of practice and guidelines demonstrates that BPEM is being implemented.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS listed in this table meet the relevant mitigation measures listed for offshore activities with regard to: • Section 4.5.1 - organic (food) waste from the kitchen should, at a minimum, be macerated to <25 mm prior to discharge to sea, in compliance with MARPOL Annex V requirements.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	The EPS listed in this table meet these guidelines for offshore activities with regard to: • Environmental monitoring (item 26). The BAT are met for the survey with regard to monitoring waste streams.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: • Other waste waters (item 44). Food waste from the kitchen should, at a minimum, be macerated to acceptable levels and discharged to sea, in compliance with MARPOL requirements.
	APPEA CoEP (2008)	The EPS listed in this table meet the following offshore development and production objectives: • To reduce the volume of wastes produced to ALARP and to an acceptable level.
Environmental context	MNES	
	AMPs (Section 5.5.1)	This hazard will not impact on the conservation values of nearby AMPs. See **Appendix 1** for additional detail regarding the impacts of non-routine activities on the management aims of these AMPs.
	Ramsar wetlands (Section 5.5.4)	This hazard will not impact any Ramsar wetlands.
	TECs (Section 5.5.6)	This hazard will not impact any TECs.

	NIWs (Section 5.5.4)	This hazard will not impact any NIWs.
	Nationally threatened and migratory species (Section 5.4)	This hazard will not impact any threatened or migratory species.
	Other matters	
	State marine parks (Sections 5.5.9 and 5.5.10)	This hazard will not impact any state marine parks.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	None triggered by this hazard. See **Appendix 2** for additional detail regarding the impacts of routine activities on the management aims of threatened species plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	
Environmental Monitoring		
• Volume/weight of non-macerated waste sent ashore.		
Record Keeping		
• GMP. • PMS records. • Garbage Record Books • Training matrix. • Induction records.		

7.3 IMPACT 3 - Routine Discharges – Sewage and Grey Water

7.3.1 Hazard

The use of ablution, laundry and galley facilities by the vessel crew will result in the discharge of sewage and grey water. While the number of personnel onboard the vessel at any one point in time is currently unknown, this activity will result in the discharge of several hundred litres of treated sewage and greywater each day. This is based on a maximum approximate discharge of 100 L of sewage/greywater per person per day.

7.3.2 Known and potential environmental impacts

The known and potential environmental impact of treated sewage and grey water discharges is:

- Temporary and localised increase in the nutrient content of surface waters around the vessel.

7.3.3 EMBA

The EMBA for sewage and grey water discharges associated with vessel activities is likely to be the top 10 m of the water column and a 50 m radius from the discharge point. This is based on modelling of continuous wastewater discharges (including treated sewage and greywater) undertaken by Woodside for its Torosa South-1 drilling program (in the Scott Reef complex), which found:

- Rapid horizontal dispersion of discharges occurs due to wind-driven surface water currents;
- Vertical discharge is limited to about the top 10 m of the water column due to the neutrally buoyant nature of the discharge; and

- A concentration of a component within the discharge stream is reduced to 1% of its original concentration at no less than 50 m from the discharge point under any condition (Woodside, 2008).

In addition to the quality of the receiving waters, receptors that may occur within this EMBA, either as residents or migrants, are:

- Pelagic fauna (plankton, fish, cetaceans and pinnipeds); and
- Seabirds.

7.3.4 Evaluation of environmental impacts

Water quality

Nutrients in sewage, such as phosphorus and nitrogen, may contribute to eutrophication of receiving waters (although usually only still, calm, inland waters and not offshore waters), causing algal blooms, which can degrade aquatic habitats by reducing light levels and producing certain toxins, some of which are harmful to marine life and humans. Given the tidal movements and currents in open oceanic waters, eutrophication of receiving waters will not occur. Sewage will be treated through STPs to a tertiary level, so there are no impacts relating to the release of chemicals and pathogens in untreated sewage.

Grey water can contain a wide variety of pollutant substances at different strengths, including oil and some organic compounds, hydrocarbons, detergents and grease, metals, suspended solids, chemical nutrients, food waste, coliform bacteria and some medical waste. Grey water is treated through the STP, so pollutants will be largely removed from the discharge stream.

The effects of sewage and sullage discharges on the water quality at Scott Reef were monitored for a drill rig operating near the edge of the deep-water lagoon area at South Reef. Monitoring at stations 50 m, 100 m and 200 m downstream of the rig and at five different water depths confirmed that the discharges were rapidly diluted in the upper 10 m water layer and no elevations in water quality monitoring parameters (e.g., total nitrogen, total phosphorous and selected metals) were recorded above background levels at any station (Woodside, 2011). Conditions associated with this example at Scott Reef are considered conservative given the high numbers of personnel onboard a drill rig (typically 100-120) compared with vessels undertaking the survey, and the environment much less dispersive than vessels that are in constant movement in Bass Strait.

Treated sewage and grey water discharges will be rapidly diluted in the surface layers of the water column and dispersed by currents. The biological oxygen demand of the treated effluent is unlikely to lead to oxygen depletion of the receiving waters (Black *et al*., 1994), as it will be treated prior to release. On release, surface water currents will assist with oxygenation of the discharge.

Biological receptors

Plankton forms the basis of all marine ecosystems, and plankton communities have a naturally patchy distribution in both space and time (ITOPF, 2011a). They are known to have naturally high mortality rates (primarily through predation), however in favourable conditions (e.g., supply of nutrients), plankton populations can rapidly increase. Once the favourable conditions cease, plankton populations will collapse and/or return to previous conditions. Plankton populations have evolved to respond to these environmental perturbations by copious production within short generation times (ITOPF, 2011a).

Any potential change in plankton diversity, abundance and composition as a result of treated sewage and grey water discharges is expected to be very low (given the waste stream is treated) and localised (as outlined in the EMBA) and is likely to return to background conditions within tens to a few hundred metres of the discharge location (NERA, 2017). Accordingly, impacts higher up the food chain (e.g., fish, reptiles, birds and cetaceans) are expected to be negligible.

Social impacts

Treated sewage and grey water discharges will not have any impacts social activities in or around the activity area due to significant distance to any recreational beaches (swimming and fishing) and the activity area (and most vessel-related activities); and there are no recognised dive sites (e.g., shipwrecks, reefs) in the activity area.

The impacts of treated sewage and grey water discharges to the physical, biological and social environment are expected to have negligible consequences because of the:

- Low discharge volumes;
- Intermittent nature of the discharge;
- Treatment of the waste stream prior to discharge;
- High dilution and dispersal factor in open waters;
- Distance from shore;
- High biodegradability and low persistence of the waste; and
- Absence of sensitive habitats in the activity area.

7.3.5 Impact Assessment

Table 7.4 presents the impact assessment for the discharge of treated sewage and grey water.

Table 7.4. Impact assessment for the discharge of treated sewage and grey water

Summary		
Summary of impacts	Reduction in water quality around the discharge point, increase in nutrients.	
Extent of impacts	Localised – up to 50 m horizontally and 10 m vertically from the discharge point.	
Duration of impacts	Temporary – until the discharge is completely diluted (likely to be minutes to hours).	
Level of certainty of impact	HIGH – the impacts of sewage and grey water discharges water quality are well known.	
Impact decision framework context	A – nothing new or unusual, represents business as usual, well understood activity, good practice is well defined.	
Impact Consequence (inherent)		
Minor		
Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
Sewage and grey water is treated prior to overboard discharge in accordance with Regulation 9 of MARPOL Annex IV.	Where sewage is treated in a STP, the STP meets MARPOL standards.	ISPP certificate is valid and verifies the installation of a MARPOL-approved STP.
	The STP is maintained in accordance with the vessel's PMS.	PMS records confirm that the STP is maintained to schedule.
There is no discharge of treated or untreated sewage and grey water in state waters (<3 nm from shore).	In accordance with Regulation 11 of MARPOL Annex IV (as enacted by Marine Order 96), sewage is comminuted, disinfected and only discharged when: • Vessel is >3 nm from nearest land.	Records verify that treated sewage is only discharged when the vessel is >3 nm from shore.

	• Sewage originating in holding tanks is discharged at a moderate rate while the vessel is proceeding en route at a speed not less than 4 knots.	
Untreated sewage will only be discharged when the vessel is greater than 12 nm from shore.	In the event of a STP malfunction, untreated sewage and grey water is only discharged when the vessel is greater than 12 nm from shore in accordance with Regulation 11 of MARPOL Annex IV (enacted by AMSA Marine Orders Part 96, Sewage).	Activity-specific discharges and emissions register verifies that untreated sewage is only discharged when the vessel is greater than 12 nm from shore.

Impact Consequence (residual)

Minor

Demonstration of ALARP

A 'minor' residual impact consequence is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required.

Demonstration of Acceptability

Internal context	Policy compliance	Beach Environmental Policy objectives are met through implementation of this EP.
	OEMS compliance	Chapter 8 describes the EP implementation strategy employed for this activity. It is demonstrated that all the standards in the OEMS have been met during the planning phase of this activity and can be met during the implementation phase of this activity.
Stakeholder engagement (Chapter 4)	Beach will communicate with all relevant stakeholders prior to the activity commencing. It is not anticipated this this hazard will be of material concern to stakeholders.	
Legislative context (see Section 2.2 for description of relevant legislation)	The performance standards outlined in this EP align with the requirements of: • *Navigation Act* 2012 (Cth): o Chapter 4 (Prevention of Pollution). o AMSA Marine Order 95 (Marine Pollution Prevention - sewage). • *Protection of the Sea (Prevention of Pollution from Ships) Act* 1983 (Cth): o Section 26D (which implements MARPOL Annex IV).	
Industry practice (see Sections 2.5 & 2.6 for descriptions)	The consideration and adoption of the controls outlined in the below-listed codes of practice and guidelines demonstrates that BPEM is being implemented.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS developed for this hazard are in line with the management measures listed in Section 4.5.1 - offshore discharges (sewage and grey water): • Grey and sewage water from showers, toilets, and kitchen facilities should be treated in an appropriate on-site marine sanitary treatment unit. • Sewage units to be in compliance with MARPOL Annex V requirements.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	There are no guidelines for offshore activities with regard to managing sewage and grey water discharges.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: • Other waste waters (item 44). Grey and black water should be treated in an appropriate on-site marine sanitary treatment unit in compliance with MARPOL.

	APPEA CoEP (2008)	The EPS listed in this table meet the following offshore development and production objectives: • To reduce the volume of wastes produced to ALARP and to an acceptable level.
Environmental context	MNES	
	AMPs (Section 5.5.1)	This hazard will not impact on the conservation values of nearby AMPs. See **Appendix 1** for additional detail regarding the impacts of non-routine activities on the management aims of these AMPs.
	Ramsar wetlands (Section 5.5.4)	This hazard will not impact any Ramsar wetlands.
	TECs (Section 5.5.6)	This hazard will not impact any TECs.
	NIWs (Section 5.5.4)	This hazard will not impact any NIWs.
	Nationally threatened and migratory species (Section 5.4)	This hazard will not impact any threated or migratory species.
	Other matters	
	State marine parks (Sections 5.5.9 and 5.5.10)	This hazard will not impact any state marine parks.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	None triggered by this hazard. See **Appendix 2** for additional detail regarding the impacts of routine activities on the management aims of threatened species plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	

Environmental Monitoring
• None required.

Record Keeping
• ISPP certificate. • STP PMS records. • Activity-specific discharges and emissions register.

7.4 IMPACT 4 – Routine Discharges – Cooling and Brine Water

7.4.1 Hazard

Seawater is used as a heat exchange medium for cooling machinery engines on vessels. Brine is created through the desalination processes for potable water generation. Seawater is used as a heat exchange medium for cooling engines and other equipment. Seawater is drawn up from the ocean, where it is de-oxygenated and sterilised by electrolysis (by release of chlorine from the salt solution) and then circulated as coolant for various equipment through the heat exchangers (in the process transferring heat from the machinery) and is then discharged to the ocean at depth (not at surface). Upon discharge, it will be warmer than the ambient water temperature and may contain low concentrations of residual biocide and scale inhibitors if they are used to control biofouling and scale formation.

The maximum cooling water discharge rate for the vessels that may be used is unknown. Also unknown is the temperature at which the heat exchangers are designed to discharge the cooling water at (generally several degrees celsius above ambient sea temperature).

Brine water (hypersaline water) is created through the desalination process that creates freshwater for drinking, showers, cooking etc. This is achieved through reverse osmosis (RO) or distillation resulting in the discharge of seawater with a slightly elevated salinity (~10-15% higher than seawater). The freshwater produced is then stored in tanks on board. Upon discharge, the concentration of the brine is (based on other modern vessels) likely to range from 44-61 ppm, which is 9-26 ppm higher than seawater salt concentration (35 ppm). Brine concentration is dependent on throughput and plant efficiency.

7.4.2 Known and potential environmental impacts

The known and potential environmental impacts of cooling water and brine discharges are:

- Temporary and highly localised increase in sea water temperature, causing thermal stress to marine biota;
- Temporary and highly localised increase in sea surface salinity, potentially causing harm to fauna unable to tolerate higher salinity; and
- Potential toxicity impacts to marine fauna from the ingestion of residual biocide and scale inhibitors.

7.4.3 EMBA

The EMBA for cooling water and brine discharges associated with vessel activities is likely to be the top 10 m of the water column and a 100 m radius from the discharge point. This is based on modelling of continuous wastewater discharges undertaken by Woodside for its Torosa South-1 drilling program (in the Scott Reef complex), which found that discharge water temperature decreases quickly as it mixes with the receiving waters, with the discharge water temperature being less than 1°C above background levels within 100 m (horizontally) of the discharge point, and will be within background levels within 10 m vertically (Woodside, 2008).

In addition to the quality of the receiving waters, receptors that may occur within this EMBA, either as residents or migrants, are:

- Plankton;
- Pelagic fish;
- Cetaceans;
- Pinnipeds; and
- Avifauna.

7.4.4 Evaluation of environmental impacts

<u>Temporary and localised increase in seawater temperature</u>

Once in the water column, cooling water will remain in the surface layer, where turbulent mixing and heat transfer with surrounding waters will occur. Prior to reaching background temperatures, the impact of increased seawater temperatures down current of the discharge may result in changes to the physiological processes of marine organisms, such as attraction or avoidance behaviour, stress or potential mortality.

Modelling of continuous waste water discharges (including cooling water) undertaken by Woodside for its Torosa South-1 drilling program in the Scott Reef complex found that discharge water temperature decreases quickly as it mixes with the receiving waters, with the discharge water temperature being less than 1°C above background levels within 100 m (horizontally) of the discharge point, and will be within background levels within 10 m vertically (Woodside, 2008). As such, impacts to most receptors are expected to be negligible even within this mixing zone.

Temporary and localised increase in sea surface salinity

Brine water will sink through the water column where it will be rapidly mixed with receiving waters and be dispersed by ocean currents. Walker and MacComb (1990) found that most marine species are able to tolerate short-term fluctuations in water salinity in the order of 20-30%, and it is expected that most pelagic species passing through a denser saline plume would not suffer adverse impacts. Other than plankton, pelagic species are mobile and would be subject to slightly elevated salinity levels for a very short time as they swim through the 'plume.' As such, impacts to receptors are expected to be negligible.

Potential toxicity impacts

Scale inhibitors and biocide are likely to be used in the heat exchange and desalination process to avoid fouling of pipework. Scale inhibitors are low molecular weight phosphorous compounds that are water-soluble, and only have acute toxicity to marine organisms about two orders of magnitude higher than typically used in the water phase (Black *et al*., 1994). The biocides typically used in the industry are highly reactive and degrade rapidly and are very soluble in water (Black *et al*., 1994).

These chemicals are inherently safe at the low dosages used, as they are usually 'consumed' in the inhibition process, ensuring there is little or no residual chemical concentration remaining upon discharge.

The impacts of cooling and brine water discharges to the physical and biological environment are expected to have negligible consequences because of the:

- Low discharge volumes;
- Intermittent nature of the discharge;
- 'Consumption' of the chemicals prior to discharge;
- High dilution and dispersal factor in open waters; and
- Absence of sensitive habitats in the activity area.

7.4.5 Impact Assessment

Table 7.5 presents the presents the impact assessment for the discharge of cooling and brine water.

Table 7.5. Impact assessment for the discharge of cooling and brine water

Summary	
Summary of impacts	Increased sea surface temperature and salinity around the discharge point. Potential toxicity impacts to marine fauna from residual biocide and scale inhibitors.
Extent of impacts	Localised – up to 100 m horizontally and 10 m vertically from the discharge point.
Duration of impacts	Temporary during vessel operations.
Level of certainty of impact	HIGH – the impacts of sea surface temperature and salinity increases on marine fauna are well known.
Impact decision framework context	A – nothing new or unusual, represents business as usual, well understood activity, good practice is well defined.
Impact Consequence (inherent)	
Minor	

Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
The RO plant and equipment that requires cooling by water is well maintained.	Plant and equipment that requires cooling by water is maintained in good working order in accordance with the vessels' PMS.	Vessel PMS records verify that equipment that requires cooling is maintained in accordance with OEM requirements.
Only low-toxicity chemicals are used in the cooling and brine water systems.	Only OCNS 'Gold'/'Silver' (CHARM) or 'D'/'E' (non-CHARM)-rated chemicals (i.e., low toxicity) are used in the cooling and brine water systems.	Vessel chemical inventories records verify that biocides and scale inhibitors are of low toxicity.

Impact Consequence (residual)

Minor

Demonstration of ALARP

A 'minor' residual impact consequence is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required.

Demonstration of Acceptability		
Internal context	Policy compliance	Beach Environmental Policy objectives are met through implementation of this EP.
	OEMS compliance	Chapter 8 describes the EP implementation strategy employed for this activity. It is demonstrated that all the standards in the OEMS have been met during the planning phase of this activity and can be met during the implementation phase of this activity.
Stakeholder engagement (Chapter 4)	Beach will communicate with all relevant stakeholders prior to the activity commencing. It is not anticipated this this hazard will be of material concern to stakeholders.	
Legislative context (see Section 2.2 for description of relevant legislation)	There are no legislative controls regarding cooling and brine water discharges.	
Industry practice (see Sections 2.5 & 2.6 for descriptions)	The consideration and adoption of the controls outlined in the below-listed codes of practice and guidelines demonstrates that BPEM is being implemented.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS developed for this hazard are in line with the management measures listed for offshore discharges (cooling water and desalination brine) in Section 4.5.3 of the guidelines: • Biocide dosing kept to a minimum in accordance with the equipment manufacturer's specifications. • Freshwater generation to be limited to volumes necessary for operational requirements.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	There are no guidelines for offshore activities with regard to managing cooling and brine water discharges.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: • Cooling water (items 41 & 42). Antifouling chemical dosing to prevent marine fouling of cooling water systems should be carefully considered and appropriate screens to be fitted to the seawater intake

		to avoid entrainment and impingement of marine flora and fauna. The cooling water discharge depth should be selected to maximise mixing and cooling of the thermal plume to ensure it is within 3°C of ambient seawater temperature within 100 m of the discharge point. • Desalination brine (item 43). Consider mixing desalination brine from the potable water system with cooling water or other effluent streams.
	APPEA CoEP (2008)	The EPS listed in this table meet the following offshore development and production objectives: • To reduce the volume of wastes produced to ALARP and to an acceptable level.
Environmental context	MNES	
	AMPs (Section 5.5.1)	This hazard will not impact on the conservation values of nearby AMPs. See **Appendix 1** for additional detail regarding the impacts of non-routine activities on the management aims of these AMPs.
	Ramsar wetlands (Section 5.5.4)	This hazard will not impact any Ramsar wetlands.
	TECs (Section 5.5.6)	This hazard will not impact any TECs.
	NIWs (Section 5.5.4)	This hazard will not impact any NIWs.
	Nationally threatened and migratory species (Section 5.4)	This hazard will not impact any threated or migratory species.
	Other matters	
	State marine parks (Sections 5.5.9 and 5.5.10)	This hazard will not impact any state marine parks.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	None triggered by this hazard. See **Appendix 2** for additional detail regarding the impacts of routine activities on the management aims of threatened species plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	

Environmental Monitoring

- None required

Record Keeping

- PMS (vessel) records.
- Chemical inventories.

7.5 IMPACT 5 – Routine Discharges – Bilge Water and Deck Drainage

7.5.1 Hazard

Bilge tanks on the ISV receive fluids from closed deck drainage and machinery spaces that may contain contaminants such as oil, detergents, solvents, chemicals and solid waste. An oily water separator (OWS) then treats this water prior to discharge overboard in order to meet the MARPOL requirement that no greater than 15 ppm oil-in-water (OIW) is discharged overboard. The volume of these discharges is small and intermittent (as required, based on bilge tank storage levels). Where no OWS is present, these fluids are retained in tanks for onshore disposal.

Vessel decks that are not bunded and drain directly to the sea may lead to the discharge of contaminated water, caused by ocean spray and rain ('green water') or deck washing activities capturing trace quantities of contaminants such as oil, grease and detergents, or a chemical (e.g., hydraulic fluids, lubricating oils) or hydrocarbon spill or leak washed overboard.

7.5.2 Known and potential environmental impacts

The known and potential environmental impacts of the discharge of bilge water and deck drainage are:

- Temporary and localised reduction of surface water quality around the discharge point; and
- Acute toxicity to marine fauna through ingestion of contaminated water in a small mixing zone.

7.5.3 EMBA

The EMBA for bilge and deck water discharges is likely to be the top 10 m of the water column and less than a 100 m radius from the discharge point. This is based on modelling of continuous wastewater discharges undertaken by Woodside for its Torosa South-1 drilling program in the Scott Reef complex (Woodside, 2008).

In addition to the quality of the receiving waters, receptors that may occur within this EMBA, either as residents or migrants, are:

- Plankton;
- Pelagic fish;
- Cetaceans;
- Pinnipeds; and
- Avifauna.

7.5.4 Evaluation of environmental impacts

<u>Temporary and localised reduction of surface water quality</u>

Small volumes and low concentrations of oily water (<15 ppm) from bilge discharges and traces of chemicals or hydrocarbons discharged to the ocean through open deck drainage may temporarily reduce water quality.

Given the absence of sensitive habitat types in the water column of the EMBA for these discharges, the greatest risk will be to plankton and pelagic fish. These discharges will be rapidly diluted, dispersed and biodegraded to undetectable levels within a very small mixing zone (as per the EMBA).

<u>Potential toxicity impacts</u>

While small volumes and low concentrations of oily water from bilge discharges may temporarily reduce water quality, such discharges are not expected to induce acute or chronic toxicity impacts to marine fauna or plankton through ingestion or absorption through the skin.

In the event a vessel OWS malfunctions and discharges of off specification water, toxicity impacts may occur, though this is only likely in a highly localised mixing zone (meaning that few individuals would be exposed).

In general, the impacts of bilge water and deck drainage to the physical and biological environment are expected to have negligible consequences because of the:

- Low discharge volumes;
- Intermittent nature of the discharge;
- High dilution and dispersal factor in open waters; and
- Absence of sensitive habitats in the activity area and EMBA.

7.5.5 Impact Assessment

Table 7.6 presents the impact assessment for the discharge of bilge water and deck drainage.

Table 7.6. Impact assessment for the discharge of bilge water and deck drainage.

Summary		
Summary of impacts	Increased sea surface temperature and salinity around the discharge point. Potential toxicity impacts to marine fauna from residual biocide and scale inhibitors.	
Extent of impacts	Localised – up to 100 m horizontally and 10 m vertically from the discharge point.	
Duration of impacts	Intermittent during vessel operations.	
Level of certainty of impacts	HIGH – the impacts of oily water discharges to the ocean are well known.	
Impact decision framework context	A – nothing new or unusual, represents business as usual, well understood activity, good practice is well defined.	
Impact Consequence (inherent)		
Minor		
Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
Bilge water discharges comply with MARPOL Annex I requirements.	For vessels >400 gross tonnes, all bilge water passes through a MARPOL-compliant OWS set to limit OIW to <15 ppm prior to overboard discharge.	IOPP certificate is current.
	The OWS is maintained in accordance with the vessel PMS.	PMS records verify that the OWS is maintained to schedule.
	The OWS is calibrated in accordance with the vessel PMS to ensure the 15 ppm OIW limit is met.	PMS records verify that the OWS is calibrated to schedule.
No whole residual bilge oil is discharged overboard.	The residual oil from the OWS is pumped to tanks and disposed of onshore.	The Oil Record Book verifies that waste oil is transferred to shore.
Level 1 spills (<10 m^3) of oil or oily water overboard	The vessel-specific Shipboard Marine Pollution Emergency Plan (SMPEP) is implemented in the	Incident report verifies that the SMPEP was implemented.

are rapidly responded to by the vessel contractor.	event of an overboard spill of hydrocarbons or chemicals.	
Planned open deck discharges are non-toxic.	Deck cleaning detergents are biodegradable.	Safety Data Sheets (SDS) verify that deck cleaning agents are biodegradable.
Hydrocarbon or chemical spills to deck are prevented from being discharged overboard.	Hydrocarbon and chemical storage areas (process areas) are bunded.	Regular inspections (and associated completed checklists) verify that bunding is in place.
	Spills or leaks from equipment are contained within a permanently bunded area (non-process areas).	Regular inspections (and associated completed checklists) verify integrity of bunded area; and to ensure bunds are not filled with rainwater.
Personnel are competent in spill response and have appropriate resources to respond to a spill.	The vessel crews are competent in spill response and have appropriate response resources in order to prevent or minimise hydrocarbon or chemical spills discharging overboard.	Training records verify that vessel crews receive spill response training.
	Fully stocked SMPEP response kits and scupper plugs or equivalent drainage control measures are readily available and used in the event of a spill to deck to prevent or minimise discharge overboard.	Site inspections (and associated completed checklists) verify that fully stocked spill response kits and scupper plugs (or equivalent) are available on deck in high-risk locations.
		Review of incident reports indicate that the spills of hydrocarbons or chemicals to deck are cleaned up.

Impact Consequence (residual)
Minor
Demonstration of ALARP
A 'minor' residual impact consequence is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required.

Demonstration of Acceptability		
Internal context	Policy compliance	Beach Environmental Policy objectives are met through implementation of this EP.
	OEMS compliance	Chapter 8 describes the EP implementation strategy employed for this activity. It is demonstrated that all the standards in the OEMS have been met during the planning phase of this activity and can be met during the implementation phase of this activity.
Stakeholder engagement (Chapter 4)	Beach will communicate with all relevant stakeholders prior to the activity commencing. It is not anticipated this this hazard will be of material concern to stakeholders.	
Legislative context (see Section 2.2 for	The performance standards outlined in this EP align with the requirements of: • *Navigation Act* 2012 (Cth): o Chapter 4 (Prevention of Pollution). o AMSA Marine Order 91 (Marine Pollution Prevention - oil). • *Protection of the Sea (Prevention of Pollution from Ships) Act* 1983 (Cth): o Part II (Prevention of pollution by oil). o Part III (Prevention of pollution by noxious substances).	
Industry practice	The consideration and adoption of the controls outlined in the below-listed codes of practice and guidelines demonstrates that BPEM is being implemented.	

(see Sections 2.5 & 2.6 for descriptions)	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS developed for this hazard are in line with the management measures listed for offshore discharges (deck drainage and bilge water) in Section 4.5.2 of the guidelines: • Vessels must have an IOPP Certificate (for vessels >400 gross tonnes) and equipped with MARPOL/IMO-compliant oil/water treatment system (as appropriate to vessel class). • Hydrocarbon and chemical storage areas are to be bunded with no residues/spills permitted to enter the overboard drainage system unless it first goes through a closed drainage treatment system. • Vessels to maintain an Oil Record Book (applicable to vessels >400 gross tonnes), including the discharge of dirty ballast or cleaning water. • Discharge into the sea of oil or oily mixtures is prohibited except when the OIW of the discharge without dilution does not exceed 15 ppm. • Contaminated deck drainage and bilge water to be contained and treated prior to discharge in accordance with EHS Guidelines for Offshore Oil and Gas Development 2015. If treatment to this standard is not possible, these waters should be contained and shipped to shore for disposal. • Extracted hydrocarbons from oil-in water separator systems to be stored in suitable containers and transported to shore for treatment and/or disposal by a certified waste oil disposal contractor.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	The EPS listed in this table meet these guidelines for offshore activities with regard to: • Management of drain water (item 24). The BAT are met for vessel operations with regard to ensuring deck coaming is in place, maintaining a chemical inventory, implementing an inspection, maintenance and repair schedule and ensuring that personnel are trained in the use of spill kits.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: • Other waste waters (item 44). Bilge waters from machinery spaces should be routed to the closed drain system or contained and treated before discharge to meet MARPOL requirements. Deck drainage water should be routed to separate drainage systems. This includes drainage water from process and non-process areas. All process areas should be bunded to ensure that drainage water flows into the closed drainage system.
	APPEA CoEP (2008)	The EPS listed in this table meet the following offshore development and production objectives: • To reduce the risk of release of substances into the marine environment to ALARP and to an acceptable level.
Environmental context	MNES	
	AMPs (Section 5.5.1)	This hazard will not impact on the conservation values of nearby AMPs. See **Appendix 1** for additional detail regarding the impacts of non-routine activities on the management aims of these AMPs.

	Ramsar wetlands (Section 5.5.4)	This hazard will not impact any Ramsar wetlands.
	TECs (Section 5.5.6)	This hazard will not impact any TECs.
	NIWs (Section 5.5.4)	This hazard will not impact any NIWs.
	Nationally threatened and migratory species (Section 5.4)	This hazard will not impact any threatened or migratory species.
	Other matters	
	State marine parks (Sections 5.5.9 and 5.5.10)	This hazard will not impact any state marine parks.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	None triggered by this hazard. See **Appendix 2** for additional detail regarding the impacts of routine activities on the management aims of threatened species plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	
Environmental Monitoring		
• None required		
Record Keeping		
• PMS records. • IOPP certificate. • Oil Record Book. • Crew training records. • Inspection and checklist records.	• P&IDs. • SDS (for deck cleaning agents). • Incident reports. • SMPEP.	

7.6 IMPACT 6 - Routine Emissions: Light

7.6.1 Hazard

Light emissions will always occur from the ISV. The following activities will result in artificial lighting:

- Vessel navigation lighting will be maintained while vessels are on location for maritime safety purposes and deck lighting for the safety of personnel working on deck.

7.6.2 Known and potential environmental impacts

The known and potential impacts of lighting are:

- Light glow may act as an attractant to light-sensitive species (e.g., seabirds, squid, zooplankton), in turn affecting predator-prey dynamics (due to attraction to or disorientation from light).

7.6.3 EMBA

The EMBA for light emissions associated with vessel activities is likely to be less than a 100 m radius of the vessel. Light-sensitive receptors that may occur within this EMBA, either as residents or migrants, are:

- Plankton;
- Fish (e.g., squid); and
- Seabirds.

7.6.4 Evaluation of environmental impacts

Shipping and fishing activities in Bass Strait (including squid fishing, which uses bright lights directed onto the water surface) are common activities, and the lighting levels associated with the ISV are not considered to be significantly different from these sources or make a significant additional contribution.

There are no turtle nesting beaches in Bass Strait, so impacts of light to turtles are not assessed here.

Light glow at the surface

Seabirds

Seabirds may be attracted to light glow at night time. Bright lighting can disorientate birds, thereby increasing the likelihood of seabird injury or mortality through collision with the vessel, or mortality from starvation due to disrupted foraging at sea (Wiese *et al*., 2001 in DSEWPC, 2011). This disorientation may also result in entrapment, stranding, grounding and interference with navigation (DoEE, 2020). The DoEE (2020) notes that seabird fledglings may be affected by lights up to 15 km away.

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 (Ronconi *et al*., 2015) and that lighting can attract birds from large catchment areas (Wiese *et al*., 2001). The light may provide enhanced capability for seabirds to forage at night.

Migrating seabirds may be attracted by the lights of the ISV, which may result in drawing them off course from their usual migration path (DoEE, 2020). DoEE (2020) reports that petrel species in the Southern Ocean may be unable to take off from a deck. There are no actions within the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-16 (DSEWPC, 2011a) that are compromised by light emissions associated with the activity.

Due to the absence of bird breeding colonies within the activity area (it is 96 km east of little penguin, short-tailed shearwaters and black-faced cormorants on King Island, 54 km northeast of the Important Bird Area (IBA) among the Hunter Island Group, 72 km northeast of the Petrel Island Group off the Tasmanian coastline and 83 km southwest of Curtis Island), light glow from small temporary light sources is unlikely to result in impacts to these breeding colonies at the species population level or ecosystem level. However, given the relative proximity of these breeding colonies to the activity area and the dispersive nature of foraging seabirds, attraction to light sources at night may occur while seabirds are foraging in central Bass Strait. Given the temporary presence of these small light sources for the duration of the activity (1-3 days), impacts at the population or ecosystem level and long-term interference with the natural nocturnal ecology of marine waters is not expected as a result of the wellhead inspection activities.

Fish and plankton

Fish and zooplankton may be directly or indirectly attracted to lights. Experiments using light traps have found that some fish and zooplankton species are attracted to light sources, with traps drawing catches from up to 90 m (Meekan *et al*., 2001). Lindquist et al (2005) concluded from a study of larval fish populations around an oil and gas platform in the Gulf of Mexico that an enhanced abundance of clupeids (herring and sardines) and engraulids (anchovies), both of which are highly photopositive, was caused by the platforms' light fields. The concentration of organisms attracted to light results in an increase in food source for predatory species and marine predators are known to aggregate at the edges of artificial light halos. Shaw et al (2002), in a similar light trap study, noted that juvenile tunas (Scombridae) and jacks (Carangidae), which are highly predatory, may have been preying upon concentrations of zooplankton attracted to the light field of the platforms. This could potentially lead to increased predation rates compared to unlit areas.

Cetaceans

There is no evidence to suggest that artificial light sources adversely affect the migratory, feeding or breeding behaviours of cetaceans. Cetaceans predominantly utilise acoustic senses to monitor their environment rather than visual sources (Simmonds *et al*., 2004), so light is not considered to be a significant factor in cetacean behaviour or survival.

7.6.5 Impact Assessment

Table 7.7 presents the impact assessment for light emissions.

Table 7.7. Impact assessment for light emissions.

Summary		
Summary of impacts	Light glow may act as an attractant to light-sensitive species (e.g., seabirds, fish, zooplankton), in turn affecting predator-prey dynamics (due to attraction to or disorientation from light).	
Extent of impacts	Localised (small radius of light glow around each vessel).	
Duration of impacts	Temporary (duration of activity i.e., 1-3 days).	
Level of certainty of impacts	HIGH – the impacts of light glow on marine fauna are well known.	
Impact decision framework context	A – nothing new or unusual, represents business as usual, well understood activity, good practice is well defined).	
Impact Consequence (inherent)		
Minor		
Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
External vessel lighting conforms to that required by maritime safety standards.	Light glow is minimised by managing external vessel lighting in accordance with: • AMSA Marine Orders Part 30 (Prevention of Collisions). • AMSA Marine Orders Part 59 (Offshore Support Vessel Operations).	Vessel class certifications are current.
Attraction to lights for birds and marine fauna is kept to a minimum.	Lighting is directed to working areas (rather than overboard) to minimise light spill to the ocean.	Completed vessel inspection checklists and photos verify that lights are directed inboard, and where this is not possible, lights are switched off when not in use.
	Lighting directed overboard can be manually over-ridden (with a local switch were possible) such that it is only switched on as required (e.g., man overboard).	
	Blinds will be lowered on all portholes and windows at night.	Completed daily environmental checklists and photos verify that blinds are drawn each night.
Impact Consequence (residual)		
Minor		
Demonstration of ALARP		

A 'minor' residual impact consequence is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required.		
Demonstration of Acceptability		
Internal context	Policy compliance	Beach Environmental Policy objectives are met through implementation of this EP.
	OEMS compliance	Chapter 8 describes the EP implementation strategy employed for this activity. It is demonstrated that all the standards in the OEMS have been met during the planning phase of this activity and can be met during the implementation phase of this activity.
Stakeholder engagement (Chapter 4)	Beach will communicate with all relevant stakeholders prior to the activity commencing. It is not anticipated this this hazard will be of material concern to stakeholders.	
Legislative context (see Section 2.2 for description of relevant legislation)	The EPS outlined in this EP align with the requirements of: • *Navigation Act* 2012 (Cth): o Part 3 (Prevention of Collisions). o AMSA Marine Orders Part 21 (Safety of Navigation and Emergency Procedures). o AMSA Marine Orders Part 27 (Safety of Navigation and Radio Equipment). o AMSA Marine Orders Part 30 (Prevention of Collisions).	
Industry practice (see Sections 2.5 & 2.6 for descriptions)	The consideration and adoption of the controls outlined in the below-listed guidelines and codes of practice demonstrates that BPEM is being implemented.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS listed in this table mee the relevant mitigation measures listed for offshore activities with regard to: • Light emissions - minimise external lighting to that required for navigation and safety of deck operations.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	There are no guidelines specifically regarding lighting for offshore activities.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	The EPS listed in this table are in accordance with these guidelines with regard to: • Ship collision (item 120). To avoid collisions with third-party vessels, offshore facilities should be equipped with navigational aids that meet national and international requirements, including navigational lights on vessels.
	APPEA CoEP (2008)	The EPS listed in this table meet the following offshore development and production objectives: • To reduce the impact on cetaceans and other marine life to ALARP and an acceptable level.
	Light-specific guidance	
	The National Light Pollution Guidelines for Wildlife (DoEE, 2020)	An assessment of the wellhead inspection activities against these guidelines is included in **Appendix 1**. This assessment indicates that many of the measures relating to seabirds in these guidelines are not applicable or not achievable for the survey based on its location being remote from seabird rookeries. Measures relating to turtles and shorebirds are not applicable.
Environmental context	MNES	
	AMPs (Section 5.5.1)	The South-east Commonwealth Marine Reserves Network Management Plan 2013-23 (DNP, 2013) identifies light pollution

		associated with offshore mining operations and other offshore activities as a threat to the AMP network. The EPS listed in this table aimed at minimising light pollution emitted from the activity vessels do not conflict with the strategies outlined in the plan that aim to address this threat. See **Appendix 1** for additional detail regarding the impacts of routine activities on the management aims of these AMPs.
	Ramsar wetlands (Section 5.5.4)	This hazard will not impact any Ramsar wetlands.
	TECs (Section 5.5.6)	This hazard will not impact any TECs.
	NIWs (Section 5.5.4)	This hazard will not impact any NIWs.
	Nationally threatened and migratory species (Section 5.4)	This hazard will not impact any threated or migratory species.
	Other matters	
	State marine parks (Sections 5.5.9 and 5.5.10)	This hazard will not impact any state marine parks.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	The management actions listed for seabirds in The National Light Pollution Guidelines for Wildlife (DoEE, 2020) have been considered. The National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPC, 2011a) does not list artificial lighting as a key threat. The Recovery Plan for Marine Turtles in Australia (DoEE, 2017) is not relevant given the rare sightings of vagrant turtles and absence of turtle BIAs and nesting beaches in Bass Strait. See **Appendix 2** for additional detail regarding the impacts of routine activities on the management aims of threatened species plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	
Environmental Monitoring		
• Fauna interactions with lighting.		
Record Keeping		
• Vessel class certification		

7.7 IMPACT 7 - Routine Emissions: Atmospheric

7.7.1 Hazard

The following activities generate atmospheric emissions:

- Combustion of MDO from the vessel engines, generators and fixed and mobile deck equipment during the activity.

7.7.2 Known and potential environmental impacts

The known and potential environmental impacts of atmospheric emissions are:

- Localised and temporary decrease in air quality due to gaseous emissions and particulates from diesel combustion; and
- Addition of GHG to the atmosphere (influencing climate change).

7.7.3 EMBA

The EMBA for atmospheric emissions associated is the local air shed – likely to be within hundreds of metres of the ISV, both horizontally and vertically.

Receptors that may occur within this EMBA, either as residents or migrants, are seabirds.

7.7.4 Evaluation of environmental impacts

Localised and temporary decrease in air quality from diesel combustion

The combustion of MDO can create continuous or discontinuous plumes of particulate matter (soot or black smoke) and the emission of non-GHG, such as sulphur oxides (SO_X) and nitrous oxides (NO_X). Inhaling this particulate matter can cause or exacerbate health impacts to humans exposed to the particulate matter, such as offshore project personnel or residents of nearby towns (e.g., respiratory illnesses such as asthma) depending on the amount of particles inhaled. Similarly, the inhalation of particulate matter may affect the respiratory systems of fauna. In the proposed acquisition area, this is limited to seabirds overflying the vessel/s.

Particulate matter released from the vessel is not likely to impact on the health or amenity of the nearest human coastal settlements (e.g., Stanley and Naracoopa), as offshore winds will rapidly disperse and dilute particulate matter. This rapid dispersion and dilution will also ensure that seabirds are not exposed to concentrated plumes of particulate matter from vessel exhaust points.

Contribution to the GHG effect

The use of fuel to power engines, generators and any mobile/fixed plant will result in gaseous emissions of GHG such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). While these emissions add to the GHG load in the atmosphere, which adds to global warming potential, they are relatively small on a global scale, representing an insignificant contribution to overall GHG emissions. The activity is similar to other industrial activities contributing to the accumulation of GHG in the atmosphere.

7.7.5 Impact Assessment

Table 7.8 presents the impact assessment for atmospheric emissions.

Table 7.8. Impact assessment for atmospheric emissions

Summary	
Summary of Impacts	Decrease in air quality due to gaseous emissions and particulates from diesel combustion and contribution to the incremental build-up of GHG in the atmosphere (influencing climate change).
Extent of impacts	Localised (local air shed for air quality), widespread (for GHG).
Duration of impacts	Temporary (duration of survey – emissions are rapidly dispersed and diluted).
Level of certainty of impact	HIGH – the impacts of atmospheric emissions are well known.

Impact decision framework context	A – nothing new or unusual, represents business as usual, well understood activity, good practice is well defined.	
Impact Consequence (inherent)		
Minor		
Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
Combustion systems operate in accordance with MARPOL Annex VI (Prevention of Air Pollution from Ships) requirements.	Only low-sulphur (<0.5% m/m) MDO will be used in order to minimise SOx emissions.	Bunker receipts verify the use of low-sulphur marine grade diesel.
	All combustion equipment is maintained in accordance with the PMS (or equivalent).	PMS records verify that combustion equipment is maintained to schedule.
	Vessels with gross tonnage >400 tonnes possess equipment, systems, fittings, arrangements and materials that comply with the applicable requirements of MARPOL Annex VI.	Air Pollution Prevention Certificate (IAPP) is current.
	Vessels >400 gross tonnes and involved in an international voyage implement their Ship Energy Efficiency Management Plan (SEEMP) to monitor and reduce air emissions.	SEEMP records verify energy efficiency records have been adopted.
	Vessels >400 gross tonnes must ensure that firefighting and refrigeration systems are managed to minimise Ozone Depleting Substances (ODS).	ODS record book is available and current.
Solid combustible waste will only be burned within an incinerator, and only if logistics don't allow for the timely removal of waste from the vessel.	Only a MARPOL VI-approved incinerator is used to incinerate solid combustible waste (food waste, paper, cardboard, rags, plastics).	IMO incinerator certificate verifies the incinerator meets MARPOL requirements.
	Incineration is only conducted when the vessel is >12 nm from the shore.	Activity-specific discharges and emissions register indicates no incineration within 12 nm of the shore.
	Oil and other noxious liquid substances will not be incinerated.	The Oil Record Book and Garbage Record Book verify that waste oil and other noxious liquid substances are transferred to shore for disposal.
Fuel use will be measured, recorded and reported.	Fuel use will be measured, recorded and reported for abnormal consumption, and in the event of abnormal fuel use, corrective action is taken to minimise air pollution.	Fuel use is recorded in the daily operations reports.
Impact Consequence (residual)		
Minor		
Demonstration of ALARP		
A 'minor' residual impact consequence is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required.		
Demonstration of Acceptability		
Internal context	Policy compliance	Beach Environmental Policy objectives are met through implementation of this EP.

	OEMS compliance	Chapter 8 describes the EP implementation strategy employed for this activity. It is demonstrated that all the standards in the OEMS have been met during the planning phase of this activity and can be met during the implementation phase of this activity.
Stakeholder engagement (Chapter 4)	Beach will communicate with all relevant stakeholders prior to the activity commencing. It is not anticipated this this hazard will be of material concern to stakeholders.	
Legislative context (see Section 2.2 for description of relevant legislation)	The performance standards outlined in this EP align with the requirements of: • *Navigation Act* 2012 (Cth): o Chapter 4 (Prevention of Pollution). o AMSA Marine Order Part 79 (Marine pollution prevention – air pollution). • *Protection of the Sea (Prevention of Pollution by Ships) Act 1983* (Cth): o Part IIID (Prevention of Air Pollution). o AMSA Marine Orders Part 97 (Air Pollution), enacting MARPOL Annex VI (especially Regulations 6, 14, 16). • *National Greenhouse and Energy Reporting Act* 2007 (Cth).	
Industry practice (see Sections 2.5 & 2.6 for descriptions)	The consideration and adoption of the controls outlined in the below-listed codes of practice and guidelines demonstrates that BPEM is being implemented.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS listed in this table meet the relevant mitigation measures listed for offshore activities with regard to: • Section 4.4.3 - Combustion emissions; o Use of high efficiency equipment to minimise power demand. o Selection of low sulphur diesel. o Regular plant maintenance. o Regular maintenance and emission control devices on vehicles and machinery.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	The EPS listed in this table meet these guidelines for offshore activities with regard to management of fugitive emissions (item 22). The BAT are met for the ISV.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: • Air emissions (item 11). The overall objective to reduce air emissions. • Air emissions (item 12). During equipment selection, air emission specifications should be taken into account, as should the use of very low sulphur content fuels and/or natural gas.
	APPEA CoEP (2008)	The EPS developed for this activity meet the requirements of this guideline with regard to development and production objectives: • To reduce GHG emissions to ALARP and an acceptable level. The performance standards listed in this table meet these objectives.
Environmental context	MNES	
	AMPs (Section 5.5.1)	Atmospheric emissions do not directly affect nearby AMPs.

		See **Appendix 1** for additional detail regarding the impacts of non-routine activities on the management aims of these AMPs.
	Ramsar wetlands (Section 5.5.4)	Atmospheric emissions do not directly affect any Ramsar wetlands.
	TECs (Section 5.5.6)	Atmospheric emissions do not directly affect any TECs.
	NIWs (Section 5.5.4)	Atmospheric emissions do not directly affect any NIWs.
	Nationally threatened and migratory species (Section 5.4)	Atmospheric emissions do not directly affect threated or migratory species.
	Other matters	
	State marine parks (Section 5.5.9 and 5.5.10)	Atmospheric emissions do not directly affect any state marine parks.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	The National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPC, 2011a) lists climate change as a key threat, though the most pervasive threat is accidental mortality and injury from interactions with fishing activities. The Recovery Plans and Conservation Advice for the Blue, Sei, Fin, Southern Right and Humpback Whales lists climate change as a key threat, though the most pervasive threats are whaling, vessel strike and entanglement. The Recovery Plan for Marine Turtles in Australia lists climate change as a key threat. The Recovery Plan for the Orange-bellied parrot lists climate change as a key threat, though the most pervasive threat is loss of habitat. See **Appendix 2** for additional detail regarding the impacts of routine activities on the management aims of threatened species plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	

Environmental Monitoring

- Fuel use.

Record Keeping

- Vessel PMS records.
- Vessel fuel use records.
- Vessel bunkering receipts.
- Waste manifests (for incineration).
- ODS record book.
- Oil record book.
- Garbage record book.
- Activity-specific discharges and emissions register.

7.8 IMPACT 8 – Routine Emissions: Underwater Noise

7.8.1 Hazard

Noise will be generated by the ISV (from vessel engine, propeller rotations and DP thrusters, if using DP systems) and associated equipment.

ROV-mounted sonar may be utilised if the wellheads cannot initially be found using visual methods. The sonar head can operate at a frequency between 675 kHz and 1,350 kHz, well above the hearing range of any marine organism. If required, sonar will be used within approximately 75 m of the seabed and be limited to the amount of time it takes to locate the wellhead.

Noise produced from the ROV during inspections is associated only with its small motors and is considered negligible.

7.8.2 Known and potential environmental impacts

In general, the impacts and risks resulting from underwater sound are generally well understood with regard to potential mortality and/or physiological injury for species in the water column, however, uncertainty lies in understanding the spatial and temporal extents of behavioural disturbances and the potential effects on populations and requires the application of context-specific information.

The potential environmental impacts to marine fauna from noise emissions are:

- Behavioural changes due to disturbance or displacement; and
- Auditory impairment, permanent threshold shift (PTS) and temporary threshold shift (TTS).

7.8.3 EMBA

The EMBA for noise emissions is will be localised (potentially up to 2 km) and temporary (for duration of the activity).

Receptors that are known to occur or may occur within the underwater sound EMBA, either as residents or migrants, are:

- Benthic species;
- Pelagic species (plankton, fin fish);
- Cetaceans; and
- Pinnipeds

7.8.4 Evaluation of environmental impacts

<u>Vessel Noise</u>

Sound emitted from vessels differs strongly, depending mainly on meteorological and oceanographic factors such as sea surface conditions and currents, type and state of propulsion system (including if the vessel is operating under DP), vessel installed power, size, transit speed and load (MacGillivray *et al.* 2018).

It is unlikely that engine sound levels will be greater than that of any other similarly-size vessel normally operating in the area (such as vessels supporting the offshore oil and gas operations in the area, recreational vessels, and merchant vessels travelling in the nearby shipping lane, see Section 5.7.7).

The sound levels and frequency characteristics of underwater sound produced by vessels are related to vessel size and speed. The typical sound levels generated by vessels are:

- Tugboats, crew boats, supply ships, and many research vessels in the 50-100 m size class – 165-180 dB re 1µPa range (Gotz *et al.* 2009);
- Vessels up to 20 m size class – 151-156 dB re 1µPa (Richardson *et al.* 1995);
- Trawlers – peak at around 175 dB re 1µPa (Gotz *et al.* 2009); and

- Large ships – levels exceeding 190 dB re 1µPa (Gotz *et al.* 2009).

Most vessel sounds are broadband (i.e., contain a broad range of frequencies), though, tones are generally associated with the harmonics of the propeller blades (Skjoldal *et al.* 2009). Kent et al. (2016) details that propeller cavitation noise is broadband due to the range of bubble sizes involved, from a few Hz to tens of kHz.

The sound levels and frequency characteristics of underwater noise produced by vessels are related to ship size and speed. Typically, marine vessels produce low frequency sound (i.e., <1 kHz) from the operation of machinery on-board, hydrodynamic flow noise around the hull, engine noise transmitted through the hull and from propeller cavitation (Skjoldal *et al.* 2009).

Noise from vessels acts to increase the sound in the water column above ambient noise levels. For example, noise emissions from idling vessels are low, however noise from thrusters and strong thrusts from the main engines have been recorded at levels of up to 182 dB re 1µPa at 1 m (McCauley, 1998). Under this mode of operation, McCauley (1998) measured underwater broadband noise of approximately 137 dB re 1µPa at 405 m. Levels of 120 dB re 1 µPa extended for a distance of approximately 3-5 km from the source, depending on water depth, seabed composition and other factors.

When idle or moving at slow speed within the activity area, The ISV will generally emit low-level noise that would be detectable over a short distance.

Behavioural responses to noise are highly variable and context-specific; higher received levels are not always associated with stronger behavioural responses (Southall *et al*. 2007; Gomez *et al*. 2016). It is reasonable to expect that significant behavioural responses such as avoidance are more likely to occur in response to higher sound levels. Based on the above and assuming intermediate sound spreading (between spherical and cylindrical sound spreading), cetaceans may display some level of avoidance within approximately 1 or 2 km of the ISV, beyond which, sound levels approach ambient levels. Any significant avoidance response is likely to be limited to within a few hundred metres. Popper et al. (2014), a working group of leading experts, suggested that behavioural responses in turtles and fish, which are less sensitive to noise, are more likely to occur within tens or hundreds of metres from vessels and other continuous noise sources. While fish may show an initial behavioural response, fish are known to quickly habituate to continuous noise sources such as vessel noise (Smith *et al*., 2004; Wysocki *et al*. 2006; Spiga *et al*., 2012; Nichols *et al*., 2015).

The environmental significance of noise arising from the ISV is considered to be minor because:

- The activity will be of very short duration (no more 1 -2 hours any one of the wellhead locations);
- The highly localised extent of disturbance to marine fauna;
- The absence of significant marine fauna habitat or known aggregation sites within the activity area;
- There are no sensitive ecosystems in the activity area (such as reefs or kelp forests); and
- Marine fauna will be transient within the activity area, such disturbances are not of any ecological significance to individual fauna or to any populations.

<u>Sonar Noise</u>

Sonar is a very high-frequency and high-resolution system that produce noise typically operates in the 100 – 500 kHz frequency range (classified as high frequency). The maximum source levels are about 210 -220 dB re 1 µPa @ 1 m. The sound beam width is very narrow, ranging between cones of 1-2° depending on the operating frequency.

While there is a significant volume of published research regarding the effects of offshore seismic and drilling noise on marine fauna (mammals, fish, turtles), there is a paucity of equivalent information relating to the impacts of noise generated of equipment such as side scan sonar.

The very high operating frequencies of single-beam sonar are above the auditory range of all marine fauna, therefore, impacts to species from sonar operation are not expected.

Potential impact from sonar noise is likely to be restricted to temporary avoidance behaviour to individuals transiting through the activity area and are therefore considered localised with no lasting effect.

Given that sonar will only be used in the event that visual identification cannot be made of a wellhead location; and if employed, the noise generated will be of short duration (approximately 5 mins per wellhead), the impact from sonar is considered to be negligible.

7.8.5 Impact Assessment

Table 7.9 presents the impact assessment for noise emissions.

Table 7.9. Impact assessment for noise emissions

Summary		
Summary of Impacts	Physiological or pathological impacts to local populations of marine fauna.	
Extent of impacts	Localised.	
Duration of impacts	Temporary (activity duration is 1-3 days) and infrequent (every 3 years).	
Level of certainty of impact	Moderate – for turtles and seals. High – for fish and cetaceans.	
Impact decision framework context	A – nothing new or unusual, represents business as usual, well understood activity, good practice is well defined.	
Impact Consequence (inherent)		
Minor (all receptors)		
Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
Vessel engines and thrusters are well maintained.	Engines and thrusters are maintained in accordance with manufacturer's instructions via the Planned Maintenance System (PMS) to ensure they are operating efficiently.	PMS records verify that engines and thrusters are maintained to schedule.
Impact Consequence (residual)		
Minor (all receptors)		
Demonstration of ALARP		
A 'minor' residual impact consequence is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required.		
Demonstration of Acceptability		
Internal context	Policy compliance	Beach Environmental Policy objectives are met through implementation of this EP.
	OEMS compliance	Chapter 8 describes the EP implementation strategy employed for this activity. It is demonstrated that all the standards in the OEMS have been met during the planning phase of this activity and can be met during the implementation phase of this activity.

Stakeholder engagement (Chapter 4)	Beach will communicate with all relevant stakeholders prior to the activity commencing. It is not anticipated this this hazard will be of material concern to stakeholders.	
Legislative context (see Section 2.2 for description of relevant legislation)	The performance standards outlined in this EP align with the requirements of: • *Environmental Protection and Biodiversity Conservation Act* 1999 (EPBC Act); and • EPBC Regulations 2000 o Part 8 (Division 8.1) (Vessels)	
Industry practice (see Sections 2.5 & 2.6 for descriptions)	The consideration and adoption of the controls outlined in the below-listed codes of practice and guidelines demonstrates that BPEM is being implemented.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS developed for this activity take into account the management measures listed for construction in Section 4.4.1 of the guidelines, which include: o Considering sensitive locations and times of year for critical activities of species that are present.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	There are no guidelines specifically regarding underwater noise for offshore activities.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	The EPS developed for this activity meet the requirements of these guidelines with regard to: • Noise (item 74) – the preparation of this EP meets the objectives of these guidelines because sensitive areas for marine life are identified.
	APPEA CoEP (2008)	The EPS developed for this activity meet the requirements of this guideline with regard to development and production objectives: • To reduce the impact on cetaceans and other marine life to ALARP and to an acceptable level.
Environmental context	MNES	
	AMPs (Section 5.5.1)	The South-east Commonwealth Marine Reserves Network Management Plan 2013-23 (DNP, 2013) identifies noise pollution associated with shipping, other vessels, seismic survey, offshore mining operations and other offshore construction as a threat to the AMP network. The EPS listed in this table aimed at minimising noise pollution emitted from the activity vessels do not conflict with the strategies outlined in the plan that aim to address this threat. See **Appendix 1** for additional detail regarding the impacts of routine activities on the management aims of these AMPs.
	Ramsar wetlands (Section 5.5.4)	This hazard will not impact on any Ramsar wetlands.
	TECs (Section 5.5.6)	This hazard will not impact on any TECs.
	NIWs (Section 5.5.4)	This hazard will not impact on any NIWs.
	Nationally threatened and migratory species (Section 5.4)	Noise emissions will not have long-term effects on Threatened or migratory species.

	Other matters	
	State marine parks (Sections 5.5.9 and 5.5.10)	Noise emissions do not directly affect any state marine parks.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	Noise emissions will: • Be managed such that any blue whale continues to utilise the area without injury and is not displaced from a foraging area (Commonwealth of Australia, 2015). • Not impact the recovery of the blue whale as per the Conservation Management Plan for the Blue Whale (DoE, 2015). • Not impact the recovery of the southern right whale as per the Conservation Management Plan for the Southern Right Whale (DSEWPaC, 2012). • Not impact the recovery of sei, fin whale or humpback whales, covered by conservation advice. • Not impact the recovery of the white shark as per the Recovery Plan for the White Shark (DSEWPaC, 2013). • Not impact on the recovery of marine turtles as per the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia,2017a). See **Appendix 2** for additional detail regarding the impacts of routine activities on the management aims of threatened species plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	
Environmental Monitoring		
Impacts associated with vessel noise emissions are for a short duration, over small area and not predicted to have long term impacts to marine fauna in the activity area. Therefore, monitoring in relation to underwater noise generation is not proposed.		
Record Keeping		
• Vessel PMS records. • Vessel crew induction and attendance records.		

7.9 RISK 1 – Displacement of or Interference with Third-party Vessels

7.9.1 Hazard

The physical presence of the ISV during the activity may interfere with the navigation paths of third-party vessels, as it will only be on location at each well for several hours. Notification to stakeholders directly from Beach along with the generation of a Notice to Mariners (NTM) will alert third-party vessels to the presence of the ISV during inspection activities.

The wellheads represent a potential hazard to fishing trawling equipment. It may also represent a loss of catch (and thus economic losses) should fishing equipment become snagged on the wellhead and damaged.

Note, this section deals with interference in a socio-economic sense; collision hazards (and subsequent MDO spill impacts) are addressed in Section 7.13.

7.9.2 Known and potential environmental impacts

The known and potential impacts of the displacement of or interference with third-party vessels are:

- Collision potential with third-party vessels (and damage in the case of collision);
- Diversion of third-party vessels from their navigation paths; and
- Damage to or loss of fishing equipment and/or loss of commercial fish catches.

7.9.3 EMBA

Receptors in the EMBA may include:

- Passenger ferries;
- Commercial fishing vessels;
- Recreational vessels (e.g., yachts); and
- Merchant vessels.

7.9.4 Evaluation of environmental risks

Displacement of third-party vessels

The cautionary zones that have been in marked on navigation maps since the wells were first drilled means it is reasonable to assume that they are well known to the established fishing industries that utilise central Bass Strait. As such, the potential impacts to commercial fishers of the inspection activities are considered minor.

The EMBA intersects the 'Spirit of Tasmania' ferry route and merchant shipping routes (see Section 5.7.7), but the activity locations are located outside of this route. The White Ibis-1 well is located approximately 30 km (16 nm) west from this route and Trefoil-1 is located 14 km (7.5 nm) west of this ferry route. Yolla-1 is located 20km (10.7nm) east of the ferry route. As such, the ISV's presence will not result in the need for the Spirit of Tasmania to change course.

For other vessels, the presence of the ISV is unlikely to create a displacement risk because its location will be noted in Notice to Mariners (NTM) so that vessels can alter route ahead of making visual or radar contact with the ISV. As such, there will be a negligible increase in travel time and fuel cost for other vessels (e.g., fishing or merchant vessels), and in the content of an entire journey, this is considered to be of minor consequence. Interactions between the ISV and with third-party vessels is likely to be minimal, mostly because of the stationary nature of the ISV while undertaking inspections and its high visibility (due to size).

Collision with third-party vessels

In the event of a vessel-to-vessel collision, health and safety impacts are more likely than environmental impacts. Should the force of a collision be enough to breach a vessel hull (which is unlikely due to the low speed or stationary nature of the ISV), an MDO spill may eventuate (this is addressed in Section 7.13).

Damage to or loss of fishing equipment and loss of catch

In GVIs undertaken to date, there has been no visual evidence of damage to the wellheads from fishing equipment (e.g., trawl nets). Fishing in this part of Bass Strait mostly uses lines and hooks (SESS), so there is minimal risk of interference from trawling.

If trawl gear was to become entangled in the wellheads, this is more likely to result in damage to or loss of equipment to the fisher rather than damage to the wellhead. In addition to the cost of repairing or replacing this equipment, it could also result in the loss of income from caught fish during that fishing expedition.

Given the short duration of the activity and the low fishing intensity in the activity area, the risk of interference with third-party vessels is low.

7.9.5 Risk Assessment

Table 7.10 presents the risk assessment for displacement or interference with third-party vessels.

Table 7.10. Risk assessment for displacement or interference with third-party vessels.

Summary			
Summary of risks	Presence of ISV resulting in vessel-to-vessel collision, exclusion from fishing grounds, damage to or loss of fishing equipment and loss of commercial fish catches.		
Extent of impacts	Highly localised (immediately around vessels).		
Duration of impacts	Short-term (minutes for a third-party vessel detour) to long-term (vessel collision).		
Level of certainty of impacts	HIGH – the impacts associated with vessel collisions are well known.		
Impact decision framework context	A – nothing new or unusual, represents business as usual, well understood activity, good practice is well defined).		
Impact Consequence (inherent)			
Risk	Likelihood	Consequence	Risk rating
Displacement	Almost certain	Minor	Medium
Interference	Possible	Moderate	Medium

Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
No incidents or complaints of spatial conflict with third-party vessels or fishing equipment.	Beach will issue notifications to stakeholders prior to the activity commencing to ensure that commercial fishers are aware of the timing and locations of the activity.	Consultation records verify that safety exclusion requirements were communicated to commercial fishing stakeholders.
	The wellheads are marked on nautical chart Aus 487.	Communication records verify Beach notified AHO of required amendments for status of suspended wells on nautical chart Aus 487.
		Current edition of navigation chart Aus 487 (paper and electronic version) included the wells enclosed by danger circle.
	The AHO will be notified of survey activities at least 30 days prior to survey commencement to enable the promulgation of NTM and AusCoast navigational warnings.	NTM is available, including vessel details, location and timing.
		Auscoast warnings list the vessel locations.
	The ISV is readily identifiable to third-party vessels.	Visual inspection (and associated completed checklists) verify that the anti-collision monitoring equipment (e.g., 24-hour radar

		watch, GMDSS and Automatic Identification System [AIS]) is functional and in use.
	Visual and radar watch is maintained on the bridge of the ISV at all times. The Vessel Master and deck officers have a valid SCTW certificate in accordance with AMSA Marine Order 70 (seafarer certification) (or equivalent) to operate radio equipment to warn of potential third party spatial conflicts (e.g. International Convention on Standards of Training, Certification and Watch-keeping for Sea-farers [STCW95], GMDSS proficiency).	Appropriate qualifications are available.
	The Vessel Master issues warnings (e.g., radio warning, flares, lights/horns) to third-party vessels approaching the safety exclusion zone in order to prevent a collision with the vessels or equipment.	Radio operations communications log verifies that warnings to third-party vessels approaching the safety exclusion zone have been issued when necessary.
Vessel-to-vessel collisions are managed in accordance with vessel-specific emergency procedures.	The Vessel Master will sound the general alarm, manoeuvre the vessel to minimise the effects of the collision and implement all other measures as outlined in the vessel or structure collision procedure (or equivalent).	Incident report verifies that the relevant safety procedure was implemented.
	Vessel collisions will be reported to AMSA if that collision has or is likely to affect the safety, operation or seaworthiness of the vessel or involves serious injury to personnel.	Incident report verifies that AMSA were notified of a vessel collision.

Risk	Likelihood	Consequence	Risk rating
Displacement	Unlikely	Minor	Low
Interference	Highly unlikely	Moderate	Low

Demonstration of ALARP

A 'minor' residual impact consequence is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required.

Demonstration of Acceptability

Internal context	Policy compliance	Beach Environmental Policy objectives are met through implementation of this EP.
	OEMS compliance	Chapter 8 describes the EP implementation strategy employed for this activity. It is demonstrated that all the standards in the OEMS have been met during the planning phase of this activity and can be met during the implementation phase of this activity.
Stakeholder engagement (Chapter 4)	Beach will communicate with all relevant stakeholders prior to the activity commencing. It is not anticipated this this hazard will be of material concern to stakeholders.	
Legislative context (see Section 2.2 for description of relevant legislation)	The EPS outlined in this table align with the requirements of: • *OPGGS Act* 2006 (Cth). o Section 280 – requires that a 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 navigation or fishing (among others). • *Navigation Act* 2012 (Cth). o Chapter 6 (Safety of navigation), particularly Part 3 (Prevention of collisions).	

	o AMSA Marine Orders Part 21 (Safety of Navigation and Emergency Procedures). o AMSA Marine Orders Part 27 (Safety of Navigation and Radio Equipment). o AMSA Marine Order Part 30 (Prevention of Collisions).	
Industry practice (see Sections 2.5 & 2.6 for descriptions)	The consideration and adoption of the controls outlined in the below-listed guidelines and codes of practice demonstrates that BPEM is being implemented.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS developed for this hazard are in line with the management measures listed for offshore physical presence in Section 4.3.1 of the guidelines, which include: • Develop exclusion zones in consultation with key stakeholders, including local fishing communities; raise awareness of exclusion zones with all stakeholders. • Issue a NTM through the relevant government agencies, detailing the area of operations. • Ensure all vessels adhere to International Regulations for Preventing Collisions at Sea (COLREGS), which set out the navigation rules to be followed to prevent collisions between two or more vessels. • Optimise vessel use to ensure the number of vessels required and length of time that vessels are on site is as low as practicable.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	There are no guidelines specifically regarding physical presence for offshore activities.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	There are no guidelines specifically regarding physical presence for the ISV.
	APPEA CoEP (2008)	The EPS listed in this table meet the following offshore development and production objectives: • To reduce the impact on other marine resource users to ALARP and to an acceptable level. • To reduce risks to public safety to ALARP and an acceptable level.
Environmental context	MNES	
	AMPs (Section 5.5.1)	This hazard will not impact on the conservation values of nearby AMPs. See **Appendix 1** for additional detail regarding the impacts of non-routine activities on the management aims of these AMPs.
	Ramsar wetlands (Section 5.5.4)	This hazard will not impact any Ramsar wetlands.
	TECs (Section 5.5.6)	This hazard will not impact any TECs.
	NIWs (Section 5.5.4)	This hazard will not impact any NIWs.
	Nationally threatened and migratory species (Section 5.4)	This hazard will not impact any threated or migratory species.
	Other matters	

	State marine parks (Sections 5.5.9 and 5.5.10)	This hazard will not impact any state marine parks.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	None triggered by this hazard. See **Appendix 2** for additional detail regarding the impacts of routine activities on the management aims of threatened species plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	
Environmental Monitoring		
• Continuous bridge monitoring.		
Record Keeping		
• Stakeholder consultation communication records. • Notice to Mariners. • Nautical chart (Aus 487). • Auscoast warnings. • Bridge communication logs. • Crew qualifications. • Incident reports.		

7.10 RISK 2 - Vessel Collision with Megafauna

7.10.1 Hazard

The movement of the ISV throughout the activity area has the potential to result in collision or entanglement with megafauna, this being cetaceans and pinnipeds.

7.10.2 Potential environmental impacts

The risks of vessel strike with megafauna are:

- Injury; and
- Death.

7.10.3 EMBA

The EMBA for megafauna vessel strike is the immediate area around the ISV.

Receptors most at risk within this EMBA are:

- Cetaceans (whales and dolphins); and
- Pinnipeds (fur-seals).

7.10.4 Evaluation of environmental risks

Cetaceans and pinnipeds are naturally inquisitive marine mammals that are often attracted to offshore vessels, and dolphins commonly ‘bow ride’ with offshore vessels. The reaction of whales to the approach of a vessel is quite variable. Some species remain motionless when in the vicinity of a vessel 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).

Peel et al (2016) reviewed vessel strike data (2000-2015) for marine species in Australian waters and identified the following:

- Whales including the humpback, pygmy blue, Antarctic blue, southern right, dwarf minke, Antarctic minke, fin, bryde's, pygmy right, sperm, pygmy sperm and pilot species were identified as having interacted with vessels. The humpback whale exhibited the highest incidence of interaction followed by the southern right whale, and these species may migrate through the waters of the activity area (see Section 5.4.5).
- Dolphins including the Australian humpback, common bottlenose, Indo-Pacific bottlenose and Risso's dolphin species were also identified as interacting with vessels. The common bottlenose dolphin exhibited the highest incidence of interaction. A number of these species may reside in or pass through the waters of the activity area (see Section 5.4.5).
- There were no vessel interaction reports during the period for either the Australian or New Zealand fur-seal. There have been incidents of seals being injured by boat propellers, however all indications are rather than 'boat strike' these can be attributed to be the seal interacting/playing with a boat, with a number of experts indicating the incidence of boat strike for seals is very low.
- All turtle species present in Australian waters are identified as interacting with vessels. The green and loggerhead species exhibited the highest incident of interaction. The presence of turtles in the activity area and EMBA is considered remote.

Collisions between vessels and cetaceans occur more frequently where high vessel traffic and cetacean habitat coincide (WDCS, 2006). There have been recorded instances of cetacean deaths in Australian waters (e.g., a Bryde's whale in Bass Strait in 1992), though the data indicates this is more likely to be associated with container ships and fast ferries (WDCS, 2006). Some cetacean species, such as humpback whales, can detect and change course to avoid a vessel (WDCS, 2006). The Australian National Marine Safety Committee (NMSC) reports that during 2009, there was one report of a vessel collision with an animal (species not defined) (NMSC, 2010).

The DoE (2015d) reports that there were two blue whale strandings in the Bonney Upwelling (western Victoria) with suspected ship strike injuries visible. When the vessels are stationary or slow moving, the risk of collision with cetaceans is extremely low, as the vessel sizes and underwater noise 'footprint' will alert cetaceans to its presence and thus elicit avoidance. Laist et al (2001) identifies that larger vessels moving in excess of 10 knots may cause fatal or severe injuries to cetaceans with the most severe injuries caused by vessels travelling faster than 14 knots. When the ISV is operating within the activity area, it will be travelling very slowly or will be stationery, so the risk associated with fast moving vessels is eliminated for this activity.

The DSEWPC (2012) notes that whale entanglement in nets and lines often causes physical damage to skin and blubber. These wounds can then expose the animal to infection. Entanglement can also result in amputation (e.g., of a flipper or tail fluke), and death over a prolonged period. The DoE (2015d) states that entanglement (in the context of fishing nets, lines or ropes) has the potential to cause physical injury that can result in loss of reproductive fitness, and mortality of individuals from drowning, impaired foraging and associated starvation, or infection or physical trauma. There is an almost negligible risk of this occurring to megafauna with tethered ROVs as the tethers are likely to break under the weight of entanglement. The Australian and New Zealand fur-seals are highly agile species that haul themselves onto rocks and platform jackets. As such, it is likely that they will be able to avoid the ROV tether and are unlikely to become entangled within it.

The ISV will remain stationary during inspections at each wellhead, thus minimising the risk of injury to megafauna.

The Australian and New Zealand fur-seals are highly agile species that haul themselves onto rocks and oil and gas platform structures (jackets). As such, it is likely that they will be able to avoid the ISV and the ROV tether.

7.10.5 Risk Assessment

Table 7.11 presents the risk assessment for vessel collision with megafauna.

Table 7.11. Risk assessment for vessel collision with megafauna.

Summary			
Summary of risks	Injury or death of cetaceans and/or pinnipeds.		
Extent of risks	Localised (limited to individuals coming into contact with the ISV).		
Duration of risks	Temporary (if individual animal dies or has a minor injury) to long-term (if there is a serious injury).		
Level of certainty of risk	HIGH – injury may result in the reduced ability to swim and forage. Serious injury may result in death.		
Risk decision framework context	A – nothing new or unusual, represents business as usual, well understood activity, good practice is well defined.		
Risk Assessment (inherent)			
Risk	Likelihood	Consequence	Risk rating
Individual animal	Unlikely	Moderate	Medium
Population level	Unlikely	Minor	Low
Environmental Controls and Performance Measurement			
EPO	EPS	Measurement criteria	
No injury or death of megafauna as a result of vessel strike or entanglement with ROV equipment.	Through constant bridge watch, the ISV complies with the *Australian National Guidelines for Whale and Dolphin Watching for Vessels* (DoEE, 2017) when working within the activity area. This means: • Caution zone (300 m either side of whales and 150 m either side of dolphins) – vessels must operate at no wake speed in this zone. • No approach zone (100 m either side of whales and 50 m either side of dolphins) – vessels should not enter this zone and should not wait in front of the direction of travel or an animal or pod/group. • Do not encourage bow riding. • If animals are bow riding, do not change course or speed suddenly. • If there is a need to stop, reduce speed gradually.	Daily operations reports note when cetaceans and pinnipeds were sighted and what actions were taken to avoid collision or entanglement.	
	Vessel crew has completed an environmental induction covering the above-listed requirements for vessel and megafauna interactions.	Induction and attendance records verify that all crews have completed an environmental induction.	
Vessel strike or entanglement is reported to regulatory authorities.	Vessel strike causing injury to or death of a cetacean is reported to the DAWE via the online National Ship Strike Database (https://data.marinemammals.gov.au/report/shipstrike) within 72 hours of the incident.	Electronic record of report submittal is available.	
		Incident report is available within the OMS.	
	Entanglement of megafauna is reported to the Whale and Dolphin Emergency Hotline on 1300 136 017 (for Victoria) or 0427 942 537 (for Tasmania) as soon as possible. No	Incident report verifies contact was made with the Whale and Dolphin Emergency Hotline.	

	attempts to disentangle megafauna should be made by vessel crew.

Risk Assessment (residual)			
Risk	Likelihood	Consequence	Risk rating
Individual animal	Highly unlikely	Moderate	Low
Population level	Highly unlikely	Minor	Low

Demonstration of ALARP

A 'low' residual risk rating is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required.

Demonstration of Acceptability		
Internal context	Policy compliance	Beach Environmental Policy objectives are met through implementation of this EP.
	OEMS compliance	Chapter 8 describes the EP implementation strategy employed for this activity. It is demonstrated that all the standards in the OEMS have been met during the planning phase of this activity and can be met during the implementation phase of this activity.
Stakeholder engagement (Chapter 4)	Beach will communicate with all relevant stakeholders prior to the activity commencing. It is not anticipated this this hazard will be of material concern to stakeholders.	
Legislative context (see Section 2.2 for description of relevant legislation)	The performance standards outlined in this EP align with the requirements of: • *EPBC Act* 1999 (Cth): o Section 199 (failing to notify taking of listed species or listed ecological community). • EPBC Regulations 2000 (Cth): o Part 8 (Interacting with cetaceans and whale watching). o AMSA Marine Notice 2016/15 – Minimising the risk of collisions with cetaceans.	
Industry practice (see Sections 2.5 & 2.6 for descriptions)	The consideration and adoption of the controls outlined in the below-listed codes of practice and guidelines demonstrates that BPEM is being implemented.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS developed for this activity are in line with the management measures listed for collision with marine fauna in Section 4.7.5 of the guidelines: • Monitoring for the presence and movement of large cetaceans and pinnipeds so that avoidance can be taken when marine fauna is observed to be on a collision course with vessels.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	There are no guidelines for offshore activities with regard to minimising the risk of collisions with megafauna.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	There are no guidelines regarding minimising the risk of vessel strike or entanglement with megafauna.
	APPEA CoEP (2008)	The EPS listed in this table meet the following offshore development and production objectives: • To reduce the risks to the abundance, diversity, geographical spread and productivity of marine species to ALARP and to an acceptable level.
	Megafauna collision-specific	

	The Australian Guidelines for Whale and Dolphin Watching (DoEE, 2017)	The EPS listed in this table are aligned with the requirements of these guidelines, despite the fact that the ISV will not be acting in the capacity of dedicated whale or dolphin watching vessels.
	National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (DoEE, 2017).	The EPS listed in this table are aligned with objective 3 of this strategy, which is to reduce the likelihood and severity of megafauna vessel collisions.
Environmental context	MNES	
	AMPs (Section 5.5.1)	The risk of collisions with megafauna does not have any effect on nearby AMPs. See **Appendix 1** for additional detail regarding the impacts of non-routine activities on the management aims of these AMPs.
	Ramsar wetlands (Section 5.5.4)	The risk of collisions with megafauna does not have any effect on Ramsar wetlands.
	TECs (Section 5.5.6)	The risk of collisions with megafauna does not have any effect on TECs.
	NIWs (Section 5.5.4)	The risk of collisions with megafauna does not have any effect on NIWs.
	Nationally threatened and migratory species (Section 5.4)	The low speed of the ISV, along with the temporary nature of the activity, makes it unlikely that vessel strike or entanglement with megafauna will occur.
	Other matters	
	State marine parks (Sections 5.5.9 and 5.5.10)	There are no state marine parks that are intersected by this hazard.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	Vessel collisions (and/or entanglements) are listed as a threat to cetaceans in the: • Conservation Management Plan for the Southern Right Whale (DSEWPC, 2012); • Conservation Management Plan for the Blue Whale (DoE, 2015a); • Conservation advice for the sei whale (TSSC, 2015d); • Conservation advice for the fin whale (TSSC, 2015c); and • Conservation advice for the humpback whale (TSSC, 2015b). The EPS listed in this table aim to minimise the risk of vessel strike and entanglement with megafauna and do not breach the management actions of the above-listed whale conservation plans. See **Appendix 2** for additional detail regarding the impacts of non-routine activities on the management aims of threatened species plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	
Environmental Monitoring		
• Vessel crew sightings.		

Record Keeping
• Vessel crew induction presentation and attendance records. • Megafauna sighting records. • Incident reports.

7.11 RISK 3 - Accidental Discharge of Waste to Ocean

7.11.1 Hazard

The handling and storage of materials and waste on board a vessel has the potential to result in accidental overboard disposal of hazardous and non-hazardous materials, waste, chemicals and fuel, creating marine debris and pollution.

Small quantities of hazardous and non-hazardous materials are used in routine operations and maintenance and waste is created, and then handled and stored on the vessels. In the normal course of operations, solid and liquid hazardous and non-hazardous materials and wastes will be stored until it is disposed of via port facilities for disposal at licensed onshore facilities. However, accidental releases to sea are a possibility, especially in rough ocean conditions when items may roll off or be blown off the deck.

The following non-hazardous materials and wastes will be disposed of to shore, but have the potential to be accidentally dropped or disposed overboard due to overfull bins or crane operator error:

- Paper and cardboard;
- Wooden pallets;
- Scrap steel, metal and aluminium;
- Glass;
- Foam (e.g., ear plugs); and
- Plastics (e.g., hard hats).

The following hazardous materials (defined as a substance or object that exhibits hazardous characteristics, is no longer fit for its intended use and requires disposal, and as outlined in Annex III to the Basel Convention, may be toxic, flammable, explosive and poisonous) may be used and waste generated through the use of consumable products and will be disposed to shore, but may be accidentally dropped or disposed overboard or could be lost as a result of hose connection failure, overfilling of tanks or emergency disconnection of hoses:

- Hydrocarbons, hydraulic oils and lubricants;
- Hydrocarbon-contaminated materials (e.g., oily rags, pipe dope, oil filters);
- Batteries, empty paint cans, aerosol cans and fluorescent tubes;
- Contaminated personal protective equipment (PPE);
- Laboratory wastes (such as acids and solvents); and
- Larger dropped objects (that may be hazardous or non-hazardous) may be lost to the sea through accidents (e.g., crane operations) include:
  - Sea containers;
  - ROV (and associated survey equipment); and
  - Entire skip bins/crates.

7.11.2 Potential environmental impacts

The risks of the release of hazardous and non-hazardous materials and waste to the ocean are:

- Marine pollution (littler and a temporary and localised reduction in water quality);
- Acute toxicity to marine fauna through ingestion or absorption;
- Injury and entanglement of individual animals (such as seabirds and seals); and
- Localised (and normally temporary) smothering or pollution of benthic habitats.

7.11.3 EMBA

The EMBA for the accidental disposal of hazardous and non-hazardous materials and waste is likely to extend for kilometres from the release site (as buoyant waste drifts with currents) or localised for non-buoyant items that sink to the seabed.

Receptors susceptible to waste that may occur within this EMBA, either as residents or migrants, are:

- Benthic fauna;
- Benthic habitat (sand and reef substrates);
- Pelagic fish;
- Cetaceans;
- Pinnipeds; and
- Avifauna.

The EPBC Act-listed species documented as being negatively impacted by the ingestion of, or entanglement in, harmful marine debris (and known to occur in the EMBA) are (according to DoEE, 2020a):

- The three turtle species (loggerhead, green and leatherback);
- Fifteen albatross species and six petrel species;
- Other birds (flesh-footed shearwater, southern fairy prion);
- Australian fur-seal;
- Bottlenose dolphin; and
- The SRW, PBW, humpback, sei, fin and killer whales.

7.11.4 Evaluation of environmental risks

Non-hazardous Materials and Waste

If discharged overboard, non-hazardous wastes can cause smothering of benthic habitats as well as injury or death to marine fauna or seabirds through ingestion or entanglement (e.g., plastics caught around the necks of seals or ingested by seabirds and fish). For example, the TSSC (2015b) reports that there have been 104 records of cetaceans in Australian waters impacted by plastic debris through entanglement or ingestion since 1998 (humpback whales being the main species).

Marine fauna including cetaceans, turtles and seabirds can be severely injured or die from entanglement in marine debris, causing restricted mobility, starvation, infection, amputation, drowning and smothering (DoEE, 2018b). Seabirds entangled in plastic packing straps or other marine debris may lose their ability to move quickly through the water, reducing their ability to catch prey and avoid predators, or they may suffer constricted circulation, leading to asphyxiation and death. In marine mammals and turtles, this debris may lead to infection or the amputation of flippers, tails or flukes (DoEE, 2018b). Plastics have been implicated in the deaths of a number of marine species including marine mammals and turtles, due to ingestion.

If dropped objects such as skip bins are not retrievable (e.g., by crane), these items may permanently smother very small areas of seabed, resulting in the loss of benthic habitat. However, as with most subsea infrastructure, the items themselves are likely to become colonised by benthic fauna over time (e.g., sponges) and become a focal area for sea life, so the net environmental impact is likely to be neutral. The benthic habitats in the activity area are broadly similar to those elsewhere in the region (e.g., extensive sandy seabed), so impacts to very localised areas of seabed will not result in the long-term loss of benthic habitat or species diversity or abundance. Seabed substrates can rapidly recover from temporary and localised impacts.

Hazardous Materials and Waste

Hazardous materials and wastes released to the sea cause pollution and contamination, with either direct or indirect effects on marine organisms. For example, chemical or hydrocarbon spills can (depending on the volume released) impact on marine life from plankton to pelagic fish communities, causing physiological damage through ingestion or absorption through the skin. Impacts from an accidental release would be limited to the immediate area surrounding the release, prior to the dilution of the chemical with the surrounding seawater. In an open ocean environment such as Bass Strait, it is expected that any minor release would be rapidly diluted and dispersed, and thus temporary and localised. The absence of particularly sensitive seabed habitats and the widespread nature of the sandy seabed present in the activity area further limits the extent of potential impacts.

Solid hazardous materials, such as paint cans containing paint residue, batteries and so forth, would settle on the seabed if dropped overboard. Over time, this may result in the leaching of hazardous materials to the seabed, which is likely to result in a small area of substrate becoming toxic and unsuitable for colonisation by benthic fauna. The benthic habitats of the activity area are broadly similar to those elsewhere in the region (e.g., extensive sandy seabed), so impacts to very localised areas of seabed will not result in the long-term loss of benthic habitat or species diversity or abundance.

All hazardous waste is disposed of at appropriately licensed facilities, by licenced contractors, so impacts such as illegal dumping or disposal to an unauthorised onshore landfill that is not lined are highly unlikely to result from the survey.

7.11.5 Risk Assessment

Table 7.12 presents the risk assessment for the accidental disposal of hazardous and non-hazardous materials and waste.

Table 7.12. Risk assessment for the unplanned discharge of solid or hazardous waste to the marine environment.

Summary	
Summary of risk	Marine pollution (litter and a temporary and localised reduction in water quality), injury and entanglement of individual animals (such as seabirds and seals) and smothering or pollution of benthic habitats.
Extent of risks	Non-buoyant waste may sink to the seabed near where it was lost. Buoyant waste may float long distances with ocean currents and winds.
Duration of risks	Short-term to long-term, depending on the type of waste and location.
Level of certainty of risk	HIGH – the effects of inappropriate waste discharges are well known.
Risk decision framework context	A – nothing new or unusual, represents business as usual, well understood activity, good practice is well defined.

Risk Assessment (inherent)		
Likelihood	Consequence	Risk rating
Possible	Moderate	Medium

Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
No unplanned release of hazardous or non-hazardous solid wastes or materials.	A MARPOL Annex V-compliant Garbage Management Plan (GMP) is in place for the ISV (if >100 gross tonnes or certified to carry 15 persons or more) that sets out the procedures for minimising, collecting, storing, processing and discharging garbage.	A GMP is in place, readily available on board and kept current.
	Waste is stored, handled and disposed of in accordance with the GMP. This includes measures including: • No discharge of general operational or maintenance wastes or plastics or plastic products of any kind. • Waste containers are covered with secure lids to prevent solid wastes from blowing overboard. • All solid wastes are stored in designated areas before being sent ashore for recycling, disposal or treatment. • Any liquid waste storage on deck must have at least one barrier to minimise the risk of spills to deck entering the ocean. This can include containment lips on deck (primary bunding) and/or secondary containment measures (bunding, containment pallet, transport packs, absorbent pad barriers) in place. • Correct segregation of solid and hazardous wastes.	GMP is available and current. Inspections verify that waste is stored and handled according to its waste classification. Inspections verify that waste receptacles are properly located, sized, labelled, covered and secured for the waste they hold. A licensed shore-based waste contract is in place for the management of onshore waste transport and disposal.
	Vessel crews and visitors are inducted into waste management procedures to ensure they understand how to implement the GMP.	Induction and attendance records verify that all crew members are inducted.
	Waste types and volumes are tracked and logged.	Waste tracker is available and current.
	Solid waste that is accidentally discharged overboard is recovered if reasonably practicable.	Incident records are available to verify that credible and realistic attempts to retrieve the materials lost overboard were made.
	A chemical locker is available, bunded and used for the storage of all greases and non-bulk chemicals (i.e., those not in tote tanks) so as to prevent discharge overboard.	Site inspection verifies that greases and chemicals are stored in a chemical locker.
Avoid objects being dropped overboard	Large bulky items are securely fastened to or stored on the deck to prevent loss to sea.	A completed pre-departure inspection checklist verifies that bulky goods are securely sea-fastened.
	The vessel PMS is implemented to ensure that lifting equipment remains in certification and fit for use at all times to minimise the risk of dropped objects.	PMS records verify that lifting equipment is maintained to schedule and in accordance with OEM requirements.
	The crane handling and transfer procedure is in place and implemented by crane operators (and others, such as dogmen) to prevent dropped objects.	Completed handling and transfer procedure checklist, permit to work (PTW) and/or risk assessments verify that the

		procedure is implemented prior to each transfer.
	The crane operators are trained to be competent in the handling and transfer procedure to prevent dropped objects.	Training records verify that crane operators are trained in the loading and unloading procedure.
	Visual inspection of lifting gear is undertaken every quarter by a qualified competent person (e.g., maritime officer) and lifting gear is tested regularly in line with the vessel PMS.	Inspection of PMS records and Lifting Register verifies that inspections and testing have been conducted to schedule.
Chemicals and hydrocarbons are stored and transferred in a manner that prevents bulk release.	All hydrocarbons and chemicals are stored within secure receptacles within bunded areas or dedicated chemical lockers that drain to bilge tanks.	Visual inspection verifies that hydrocarbons and chemicals are stored within secure receptacles within bunded areas or dedicated chemical lockers that drain to bilge tanks.
	The PMS is implemented to ensure the integrity of chemical and hydrocarbon storage areas and transfer systems are maintained in good order.	Vessel PMS records verify that chemical and hydrocarbon storage areas and transfer systems (e.g., bunds, tanks, pumps and hydraulic hoses) are maintained to schedule and in accordance with OEM requirements.
	Where hydrocarbons and chemicals are stored within open draining decks, receptacles are stored on/in temporary bunds.	Visual inspection verifies that where hydrocarbons and chemicals are stored within open draining decks, receptacles are stored on/in temporary bunds.
	Crane transfers of bulk chemicals and hydrocarbons are undertaken in accordance with the vessel contractor lifting and loading procedure, or equivalent, and under a PTW.	PTW records verify that crane transfers of bulk chemicals and hydrocarbons are undertaken in accordance with the procedure.

Risk Assessment (residual)		
Likelihood	Consequence	Risk rating
Highly unlikely	Moderate	Low

Demonstration of ALARP

A 'low' residual risk rating is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required.

Demonstration of Acceptability		
Internal context	Policy compliance	Beach Environmental Policy objectives are met through implementation of this EP.
	OEMS compliance	Chapter 8 describes the EP implementation strategy employed for this activity. It is demonstrated that all the standards in the OEMS have been met during the planning phase of this activity and can be met during the implementation phase of this activity.
Stakeholder engagement (Chapter 4)	Beach will communicate with all relevant stakeholders prior to the activity commencing. It is not anticipated this this hazard will be of material concern to stakeholders.	
Legislative context	The performance standards outlined in this EP align with the requirements of: • *Navigation Act* 2012 (Cth): o Chapter 4 (Prevention of Pollution).	

(see Section 2.2 for description of relevant legislation)	o Marine Orders Part 47. o Marine Orders Part 94 (Marine pollution prevention – packaged harmful substances). o Marine Orders Part 95 (Marine pollution prevention – garbage). • *Protection of the Sea (Prevention of Pollution from Ships) Act* 1983 (Cth): o Part III (Prevention of pollution by noxious substances). o Part IIIA (Prevention of pollution by packaged harmful substances). o Part IIIC (Prevention of pollution by garbage).	
Industry practice (see Sections 2.5 & 2.6 for descriptions)	The consideration and adoption of the controls outlined in the below-listed codes of practice and guidelines demonstrates that BPEM is being implemented.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS developed for this activity are in line with the management measures listed for hazardous waste and non-hazardous waste discharges in Sections 4.6.2 and 4.6.3 of the guidelines, which include: • Segregating hazardous and non-hazardous wastes prior to disposal. • Managing hazardous waste in accordance with their SDS and tracking it to final destination. • Not deliberately discharging waste overboard.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	The EPS listed in this table meet these guidelines for offshore activities with regard to: • Risk management for handling and storage of chemicals (item 19). The BAT are met for the survey with regard to implementing chemical transfer procedures and ensuring chemicals are stored in separate, labelled containers.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: • Waste management (items 46). Materials should be segregated offshore and shipped to shore for reuse, recycling or disposal. A waste management plan should be developed and contain a mechanism allowing waste consignments to be tracked. • Hazardous materials management (item 72). Principles relate to the selection of chemicals with the lowest environmental and health risks.
	APPEA CoEP (2008)	The EPS listed in this table meet the following offshore development and production objectives: • To reduce the risk of any unplanned release of material into the marine environment to as low as reasonably practical and to an acceptable level.
	Waste management-specific	
	Guidelines for the Development of GMPs (IMO, 2012)	The GMP is developed in accordance with these guidelines.
	International Dangerous Goods Maritime Code (IMO, 2016)	The storage and handling of dangerous goods on the ISV is managed in accordance with this code.
Environmental context	MNES	
	AMPs (Section 5.5.1)	The unplanned discharge of solid or hazardous waste is highly unlikely to intersect nearby AMPs. The South-east Commonwealth Marine Reserves Network Management Plan 2013-23 (DNP, 2013) identifies marine debris as a threat to the AMP network. The EPS listed in this

		table aim to minimise the generation of marine debris and are aligned with the strategies outlined in the plan. See **Appendix 1** for additional detail regarding the impacts of non-routine activities on the management aims of these AMPs.
	Ramsar wetlands (Section 5.5.4)	The unplanned discharge of solid or hazardous waste poses no risk to Ramsar wetlands.
	TECs (Section 5.5.6)	The unplanned discharge of solid or hazardous waste is highly unlikely to have any impact on TECs.
	NIWs (Section 5.5.4)	The unplanned discharge of solid or hazardous waste is poses no risk to any NIWs.
	Nationally threatened and migratory species (Section 5.4)	The unplanned discharge of solid or hazardous waste is highly unlikely to have any impacts on threated or migratory species.
	Other matters	
	State marine parks (Sections 5.5.9 and 5.5.10)	It is highly unlikely that the unplanned discharge of hazardous or non-hazardous waste will intersect any state marine parks.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	Marine pollution is a threat identified in the National recovery plan for threatened albatross and giant petrels 2011-2016 (DSEWPC, 2011a). Population monitoring is the suggested action to deal with marine pollution. The risks posed by this hazard do not impact this action. The conservation advice for humpback whales (TSSC, 2015b) and the Conservation Management Plan for the Blue Whale (DoE, 2015d) identify marine debris as a threat, but there are no conservation management actions to counter this. The EPS listed in this table aim to minimise the generation of marine debris. The EPS listed in this table meet objective one of the Threat Abatement Plan for the Impacts of Marine Debris on Vertebrate Wildlife of Australia's coasts and oceans (DoEE, 2018b), which is to contribute to the long-term prevention of the incidence of harmful marine debris. See **Appendix 2** for additional detail regarding the impacts of non-routine activities on the management aims of threatened species plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	

Environmental Monitoring

- Waste tracking.

Record Keeping

- Vessel contractor pre-qualification report/s.
- GMP.
- Garbage Record Book.
- Crew induction and attendance records.
- Inspection records/checklists.
- Shore-based waste contract.
- Incident reports.

7.12 RISK 4 - Introduction and Establishment of Invasive Marine Species

7.12.1 Hazard

The DAWR (2018) defines marine pests (referred to in this EP as invasive marine species, IMS) as:

> *Non-native marine plants or animals that harm Australia's marine environment, social amenity or industries that use the marine environment, or have the potential to do so if they were to be introduced, established (that is, forming self-sustaining populations) or spread in Australia's marine environment.*

The following activities have the potential to result in the introduction of IMS in the activity area:

- Discharge of vessel ballast water containing foreign species; and
- Translocation of foreign species through biofouling on vessel hulls, niches (e.g., thruster tunnels, sea chests) or in-water equipment (e.g., ROV).

The ISV may ballast and de-ballast to improve stability, even out vessel stresses and adjust vessel draft, list and trim, with regard to the weight of equipment on board at any one time.

Biofouling is the accumulation of aquatic microorganisms, algae, plants and animals on vessel hulls and submerged surfaces. More than 250 non-indigenous marine species have established in Australian waters, with research indicating that biofouling has been responsible for more foreign marine introductions than ballast water (DAWE, 2020).

The DAWR estimates that ballast water is responsible for 30% of all marine pest incursions into Australian waters (DAWR, 2018). The DAWR declares that all saltwater from ports or coastal waters outside Australia's territorial seas presents a high risk of introducing foreign marine pests into Australia (AQIS, 2011), while DAWR (2018) notes that the movement of vessels and marine infrastructure is the primary pathway for the introduction of IMS.

7.12.2 Potential environmental impacts

The risks of IMS introduction (assuming their survival, colonisation and spread) include:

- Reduction in native marine species diversity and abundance;
- Displacement of native marine species;
- Depletion of commercial fish stocks (and associated socio-economic effects); and
- Changes to conservation values of protected areas.

7.12.3 EMBA

The EMBA for IMS introduction is anywhere within the activity area, though if IMS survive the introduction and go on to colonise and spread, this EMBA could extend to other parts of Bass Strait.

Receptors most at risk within this EMBA, either as residents or migrants, are:

- Benthic fauna (because of their limited ability to move to other suitable areas);
- Benthic habitat; and
- Pelagic fish.

7.12.4 Evaluation of environmental risks

Successful IMS invasion requires the following three steps:

1. Colonisation and establishment of the marine pest on a vector (e.g., vessel hull) in a donor region (e.g., home port).
2. Survival of the settled marine species on the vector during the voyage from the donor to the recipient region (e.g., activity area).
3. Colonisation (e.g., dislodgement or reproduction) of the marine species in the recipient region, followed by successful establishment of a viable new local population.

If successful invasion takes place, the IMS is likely to have little or no natural competition or predation, thus potentially outcompeting native species for food or space, preying on native species or changing the nature of the environment. It is estimated that approximately one in six introduced marine species becomes pests (AMSA, n.d).

Marine pest species can also deplete fishing grounds and aquaculture stock, with between 10% and 40% of Australia's fishing industry being potentially vulnerable to marine pest incursion (AMSA, n.d). For example, the introduction of the Northern Pacific seastar (*Asterias amurensis*) in Victorian and Tasmanian waters was linked to a decline in scallop fisheries. Similarly, the ability of the New Zealand screw shell (*Maoricolpus roseus*) to reach densities of thousands of shells per square metre has presented problems for commercial scallop fishers (MESA, 2017). The ABC (2000) reported that the New Zealand screw shell is likely to displace similar related species of screw shells, several of which occupy the same depth range and sediment profile.

Marine pests can also damage marine and industrial infrastructure, such as encrusting jetties and marinas or blocking industrial water intake pipes. By building up on vessel hulls, they can slow the vessels down and increase fuel consumption.

7.12.5 Risk Assessment

Table 7.13 presents the risk assessment for the introduction of IMS.

Table 7.13. Risk assessment for the introduction of IMS

Summary		
Summary of risks	Reduction in native marine species diversity and abundance, displacement of native marine species, socio-economic impacts on commercial fisheries and changes to conservation values of protected areas.	
Extent of risk	Localised (isolated locations if there is no spread) to widespread (if colonisation and spread occurs).	
Duration of risk	Short-term (IMS is detected and eradicated, or IMS does not survive long enough to colonise and spread) to long-term (IMS colonises and spreads).	
Level of certainty of risk	HIGH – the impacts associated with IMS introduction are well known and the vectors of introduction are known. Regulatory guidelines controlling these vectors have been established.	
Risk decision framework context	A – nothing new or unusual, represents business as usual, well understood activity, good practice is well defined.	
Risk Assessment (inherent)		
Likelihood	Consequence	Risk rating
Unlikely	Major	Medium
Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
Vessels used to undertake the inspection activities do not introduce IMS.	A pre-qualification is undertaken for the vessel against Beach's IMS Management Plan ((IMSMP) S4000AH719916) prior to charter to ensure biofouling and ballast water controls meet these EP	Vessel contractor pre-qualification audit report verifies the vessel meets the requirements outlined in the IMSMP.

	requirements. The requirements of the IMSMP are outlined herein.	
Biofouling		
Vessels do not introduce IMS to the activity area	The vessel is managed in accordance with the *National Biofouling Management Guidance for the Petroleum Production and Exploration Industry* (AQIS, 2009) and the to ensure they present a low biofouling risk. This means: • Biofouling risk is assessed. • Conducting in-water inspection by divers or inspection in drydock if deemed necessary (based on risk assessment). • Cleaning of hull and internal seawater systems, if deemed necessary. • Anti-fouling coating status taken into account, with antifouling renewal undertaken if deemed necessary.	Biofouling assessment report prior to mobilising to site confirms acceptability to enter the activity area
	If the ISV is >400 gross tonnes, it will carry a current International Anti-fouling System (IAFS) Certificate that is complaint with Marine Order Part 98 (Anti-fouling Systems).	IAFS Certificate is available and current.
	The ISV is managed in accordance with the *Guidelines for the Control and Management of Ships' Biofouling to Minimise the Transfer of Invasive Aquatic Species* (IMO, 2011), which involves ensuring that vessels: • Maintain a Biofouling Management Plan; • Maintain a Biofouling Record Book; • Install and maintain an anti-fouling system; • Undertake in-water inspections (and in-water hull cleaning, if appropriate); and • Instruct crews on the application of biofouling management procedures.	Vessel contractor Biofouling Management Plan and Biofouling Record Book are available and current.
	An IMS risk assessment is undertaken based on the following: • Inspecting the IAFS certificate to ensure currency. • Reviewing recent vessel inspection/audit reports to ensure that the risk of IMS introduction is low. • Reviewing recent ports of call to determine the IMS risk of those ports. • Determining the need for in-water cleaning and/or re-application of anti-fouling paint if neither has been done recently in line with anti-fouling and in-water cleaning guidelines (DoA/DoE, 2015).	IMS risk assessment document verifies that the biofouling risk evaluation took place and that the IMS risk is 'low.'

	• Implementing the biofouling guidance provided in Part 5 of the Offshore Installation Biosecurity Guideline (DAWR, 2019, v1.3).	
Immersible equipment does not introduce IMS to the activity area.	Immersible equipment is cleaned (e.g., biofouling is removed from subsea infrastructure, crane chains, etc) prior to initial use in the activity area.	Records are available to verify that immersible equipment was cleaned prior to use.
Ballast water		
Internationally-sourced vessels discharge only low risk ballast water.	If sourced internationally, the ISV fulfils the requirements of the *Australian Ballast Water Management Requirements* (DAWR, 2020, v8). This includes requirements to: • Carry a valid Ballast Water Management Plan (BWMP). • Submit a Ballast Water Report (BWR) through the Maritime Arrivals Reporting System (MARS). o If intending to discharge internationally-sourced ballast water, submit BWR through MARS at least 12 hours prior to arrival. o If intending to discharge Australian-sourced ballast water, seek a low-risk exemption through MARS. • Hold a Ballast Water Management Certificate (BWMC). • Ensure all ballast water exchange operations are recorded in a Ballast Water Record System (BWRS).	BWMP is available and current. BWR (or exemption) is submitted prior to entry to the activity area. A valid BWMC is in place. An up-to-date BWRS is in place. An ePAR is available and signed off by DAWR.
Vessels only discharge low risk ballast water.	As above, except a BWR is not required for domestic journeys (i.e., when moving between Australian ports and 200 nm of the coastline). *Note: ballast water management is not required between Australian ports if:* • *Ballast water is taken up and discharged in the same place.* • *Potable water is used as ballast.* • *Ballast water was taken up on the high seas only.* • *The vessel receives a risk-based exemption from ballast water management.*	As above, except for the BWR.
Reporting		
Known or suspected non-compliance with biosecurity measures are reported to regulatory agencies.	Non-compliant discharges of domestic ballast water are to be reported to the DAWR immediately (contact details in Section 8.9).	Incident report notes that contact was made with the DAWR regarding non-compliant ballast water discharges.

Risk Assessment (residual)		
Likelihood	Consequence	Risk rating
Highly unlikely	Major	Medium

Demonstration of ALARP		
A 'medium' residual risk rating is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required.		

Demonstration of Acceptability		
Internal context	Policy compliance	Beach Environmental Policy objectives are met through implementation of this EP.
	Management system compliance	Chapter 8 describes the EP implementation strategy employed for this activity.
Stakeholder engagement (Chapter 4)	Beach will communicate with all relevant stakeholders prior to the activity commencing.	
Legislative context (see Section 2.2 for description of relevant legislation)	The performance standards outlined in this EP align with the requirements of: • *Biosecurity Act* 2015 (Cth): o Chapter 4 (Managing biosecurity risk). o Chapter 5, Part 3 (Management of discharge of ballast water). • *Protection of the Sea (Harmful Anti-fouling Systems) Act* 2006 (Cth): o Part 2 (Application or use of harmful anti-fouling systems). o Part 3 (Anti-fouling certificates and anti-fouling declarations). o Marine Order 98 (Marine pollution – anti-fouling systems).	
Industry practice (see Sections 2.5 & 2.6 for descriptions)	The consideration and adoption of the controls outlined in the below-listed codes of practice and guidelines demonstrates that BPEM is being implemented.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS developed for this activity are in line with the management measures listed for the introduction of IMS in Section 4.7.6 of the guidelines: • Developing an IMS Management Plan (where applicable). • Complying with the International Convention on the Control of Harmful Anti-fouling Systems on Ships. • Ensuring vessels of appropriate class have IFAS certificates. • Ensuring compliance with local regulatory guidelines.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	There are no guidelines for offshore activities with regard to minimising the risk of introducing IMS.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	There are no guidelines regarding preventing the introduction of IMS.
	APPEA CoEP (2008)	The EPS listed in this table meet the following offshore development and production objectives: • To reduce the risk of introduction of marine pests to ALARP and to an acceptable level. • To reduce the impacts to benthic communities to ALARP and to an acceptable level.
	IMS-specific	

	Offshore Installations - Quarantine Guide (DAWR, 2019, v1.3)	The EPS in this table reflect the guidance regarding ballast water and biofouling management in the DAWR guide.
	Australian Ballast Water Management Requirements (DAWR, 2020, v8)	The EPS in this table reflect the guidance regarding ballast water management in the DAWR guide.
	Anti-Fouling and In-Water Cleaning Guidelines (DoA/DoE, 2015).	The EPS in this table reflect the general guidance regarding managing fouling in the DoA/DoE guidelines, which have since been updated in the aforementioned DAWR (2019) quarantine guide.
	Guidelines for the Control and Management of Ships' Biofouling to Minimise the Transfer of Invasive Aquatic Species (IMO, 2011)	The EPS in this table reflect the guidance regarding minimising the transfer of IMS from biofouling.
	National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (DAFF, 2009)	The EPS in this table reflect the guidance regarding biofouling management in the DAFF guide.
Environmental context	MNES	
	AMPs (Section 5.5.1)	The South-east Commonwealth Marine Reserves Network Management Plan 2013-23 (DNP, 2013) identifies IMS and diseases translocated by shipping, fishing vessels and other vessels as a threat to the AMP network. The implementation of the EPS listed here make it unlikely that IMS will be introduced to the activity area and spread to nearby AMPs.
	Ramsar wetlands (Section 5.5.4)	The risk of introducing IMS is highly unlikely to affect Ramsar wetlands.
	TECs (Section 5.5.6)	The risk of introducing IMS is highly unlikely to affect TECs.
	NIWs (Section 5.5.4)	The risk of introducing IMS is highly unlikely to affect NIWs.
	Nationally threatened and migratory species (Section 5.4)	The threatened and migratory species within the EMBA are all highly mobile species. There are no EPBC Act-listed benthic species listed in the activity area; these are generally more susceptible to the effects of IMS than mobile fauna.
	Other matters	
	State marine parks (Sections 5.5.9 and 5.5.10)	This hazard does not intersect any state marine parks. See Appendix 1 for additional detail regarding the impacts of routine activities on the management aims of state marine parks.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	The National Strategic Plan for Marine Pest Biosecurity (2018-2023) (DAWR, 2018) has five objectives. The EPS listed in this table are aligned with the plan's objective to minimise the risk of marine pest introductions, establishment and spread (noting that the other four objectives do not apply to the activity).

		See Appendix 2 for additional detail regarding the impacts of non-routine activities on the management aims of threatened species plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	
	Is there a threat of serious or irreversible environmental damage?	Possibly. But the EPS aim to avoid this.
	Is there scientific uncertainty as to the environmental damage?	Yes. Individual species fill different ecological niches and understanding how one or more species are likely to behave outside their native habitat is generally unknown until it occurs.

Environmental Monitoring

- None required.

Record Keeping

- Vessel contractor pre-qualification reports.
- Biofouling risk assessment.
- Ballast water risk assessments.
- BWMP.
- BWR.
- BWMC.
- BWRS.
- IAFS Certificates.
- DAWR-signed ePARs.

7.13 RISK 5 – Marine Diesel Oil Spill

7.13.1 Hazard

A release of MDO may occur from the ISV. An MDO release may occur as a result of:

- A collision between the ISV and a third-party vessel.

MDO properties

The following points summarise the nature and behaviour of MDO, based on and APASA (2012):

- MDO is dominated by n-alkane hydrocarbons that give diesel its unique compression ignition characteristics and usually consist of carbon chain C11-C28 but may vary depending upon specifications (e.g., winter vs. summer grades).
- While MDOs are generally considered to be non-persistent oils, many can contain a small percentage (approximately 3-7%) by volume of hydrocarbons that are classified as 'persistent' under IOPC Fund definition (i.e., greater than 5% boiling above 370°C) (Table 7.14).
- Diesel fuels are light, refined petroleum products with a relatively narrow boiling range, meaning that when spilled on water, most of the oil evaporates or naturally disperses quickly (hours to days).
- Diesel fuels are much lighter than water, so it is not possible for diesel oil to sink and accumulate on the seabed as pooled or free oil.
- Dispersion into the sea by the action of wind and waves can result in 25–50% of the loss of hydrocarbons from surface slicks and dissolution (solubility of hydrocarbons) can account for 1-10% loss from the surface. While the majority of the MDO evaporates quickly, it is common for the residues of MDO spills after weathering to contain n-alkanes, iso-alkanes and naphthenic hydrocarbons.
- Minor quantities of PAHs will be present.

- When spilled on water, MDO spreads very quickly to a thin film and generally has a low viscosity that can result in hydrocarbons becoming physically dispersed as fine droplets into the water column when winds exceed 10 knots.
- Droplets of MDO that are naturally or chemically dispersed sub-surface behave quite differently to oil on the sea surface. Diesel droplets will move 100% with the currents under water but on the surface are affected by both wind and currents.
- Natural dispersion of MDOs will reduce the hydrocarbons available to evaporate into the air. Although this reduces the volume of hydrocarbons on the water surface, it increases the level of hydrocarbons able to be inhaled.
- This increased hydrocarbon vapour exposure can affect any air breathing animal including whales, dolphins, seals and turtles.
- The environmental effects of MDO spills are not as visually obvious as those of heavy fuel oils (HFO) or crude oils. Diesel oil is considered to have a higher aquatic toxicity in comparison to many other crude oils due to the:
    - High percentage of toxic, water-soluble components (such as BTEX and PAH);
    - Higher potential to naturally entrain in the water column (compared to HFO);
    - Higher solubility in water; and
    - Higher potential to bioaccumulate in organisms.
- Diesel fuel oils are not very sticky or viscous compared to black oils. When diesel oil strands on a shoreline, it generally penetrates porous sediments quickly, but is also washed off quickly by waves.
- In open water, diesel oil spills are so rapidly diluted that fish kills are rarely observed (this is more likely in confined, shallow waters).

Table 7.14. Physical characteristics of MDO

	Volatiles	**Semi-volatiles**	**Low Volatiles**	**Residual Oil**
Boiling Point (°C)	< 180	180-265	265-380	> 380
MDO (%)	6.0	34.6	54.4	5.0
Persistence	Non-persistent			Persistent

<u>Oil Spill Trajectory Modelling</u>

In order to determine the environment that may be affected in the unlikely event of a hydrocarbon spill from a vessel collision the Automated Data Inquiry for Oil Spills (ADIOS) was used. Tables 7.14, 7.15 and 7.16 outline the modelling parameters used in the ADIOS model.

Table 7.15. Modelling parameters used in the ADIOS model

	Volume	**Current (direction towards)**	**Wind (direction from)**	**Water Temperature**	**Salinity**
Details	100 m³	0.18 m/s	17 knots (8.7 m/s)	14.0 °C	35 ppt

	Volume	Current (direction towards)	Wind (direction from)	Water Temperature	Salinity
Direction		East	South-west		

Table 7.16. Modelling parameters used in the ADIOS model

Characteristic	Details
Density (kg/m^3)	829 at 15°C
API	37.6
Dynamic viscosity (cP)	4.0 at 25°C
Pour point (°C)	-14
Oil property category	Group II
Oil persistence classification	Light persistent oil

Metocean conditions used in the ADIOS model are shown in Table 7.15. As it is unknown exactly when wellhead inspections will take place, an average of the wind data was used (17 knots = 8.7 m/s) and the prominent direction from the south-west. As the activity may be undertaken at any time, an annual average of the water current data for the region was used (0.18 m/s), with the predominant current direction towards the east.

Spill volume

AMSA's *Technical Guidelines for preparing Contingency Plans for Marine and Coastal Facilities* (AMSA, 2015, pg. 24) indicates that an appropriate spill size for a vessel collision (a non-oil tanker) should be based on the volume of the largest tank. Beach has used this guidance in determining the volume to be modelled for this study. Given that the vessel for this survey has yet to be contracted, the exact volume of MDO to be carried cannot be provided. The spill volume of 100 m^3 was used based on the complete loss of inventory from the largest fuel tank on the largest potential vessel typically used for survey work (such as geotechnical and geophysical).

Table 7.17. Summary of the MDO spill ADIOS inputs.

Parameter	Details
Oil Type	MDO
Total spill volume	100 m^3
Release type	Sea surface
Release duration	12 hours
Simulation duration	Five days
Surface oil concentration thresholds (g/m^2)	1 g/m^2 – low exposure 10 g/m^2 – moderate exposure 50 g/m^2 – high exposure
Shoreline load threshold (g/m^2)	10 g/m^2 – low exposure 100 g/m^2 – moderate exposure 1,000 g/m^2 – high exposure

Parameter	Details
Dissolved aromatic dosages to assess potential exposure (ppb)	10 ppb – low exposure 50 ppb – moderate exposure 400 ppb – high exposure
Entrained oil dosages to assess potential exposure (ppb)	10 ppb – low exposure 100 ppb – high exposure

Exposure values

The outputs of the OSTM are used to assess the environmental risk if a credible hydrocarbon spill scenario occurred, by defining which areas of the marine environment could be exposed to hydrocarbon concentrations that exceed exposure values that may result in impact to sensitive receptors. The degree of impact will depend on the sensitivity of the biota contacted, the duration of the exposure and the toxicity of the hydrocarbon mixture making the contact. The toxicity of a hydrocarbon will change over time, due to weathering processes altering the composition of the hydrocarbon.

The modelling considered four key physical or chemical phases of hydrocarbons that pose differing environmental and socioeconomic risks:

- Surface hydrocarbons;
- Entrained hydrocarbons;
- Dissolved hydrocarbons;
- Evaporated; and
- Decayed.

The modelling used defined hydrocarbon exposure values, as relevant for risk assessment and oil spill planning, for the various hydrocarbon phases. To ensure conservatism in the environmental assessment process, the exposure values applied to the model are selected to adopt the most sensitive receptors that may be exposed, the longest likely exposure times and the more toxic hydrocarbons.

Exposure values applied for surface, entrained, dissolved and shoreline accumulated hydrocarbons used in the modelling study are summarised in Table 7.17. The adopted exposure values are based primarily on the exposure values defined in NOPSEMA Bulletin #1 Oil Spill Modelling (April 2019). NOPSEMA recommend that the low thresholds should be used to define the environment that may be affected (EMBA). These low thresholds may not be ecologically significant but should be used as a predictive tool to set the outer boundaries of the EMBA.

Spatial extent of the MDO spill

Based on the calculations below the following spatial extent and durations have been determined for a 100 m^3 diesel spill:

- Surface oil will evaporate or disperse below the low exposure threshold by 12 hours and will travel 21.3 km in this time.
- Dissolved oil above the low exposure threshold is unlikely as the volatile components of the diesel spill will evaporate within 12 hours and are unlikely to become dissolved.
- Entrained oil will dissipate below the low exposure within 30 km of the spill point over a period of 46 hours.

Based on this information an EMBA of 30 km is used to identify receptors that might be contacted by surface and subsurface hydrocarbons in the highly unlikely event of a diesel spill from a vessel collision. A conservative 30 km (twice the distance of the calculated entrained oil extent) has been used to apply an appropriate level of conservatism considering the limitations of the ADIOS modelling and its application to oil dispersed into the water.

Results

The key outcomes from the ADIOS modelling are:

- The surface life for an instantaneous diesel spill of 100 m^3 from a worst-case vessel collision incident is estimated at 12 hours.
- After 12 hours approximately 19 m^3 of the 100 m^3 spill has evaporated and 81 m^3 has been dispersed into the water column.

The ADIOS model does not model further weathering of oil once it is dispersed into the water column, as the model does not change after the initial processes of evaporation and dispersion have occurred during the first 12 hours of the spill occurring.

7.13.2 Known and potential environmental impacts

The known and potential impacts of an MDO spill are:

- A temporary and localised reduction in water quality;
- Injury or death of exposed marine fauna and seabirds;
- Habitat damage where the spill reaches shorelines; and
- Changes to the functions, interests or activities of other users (e.g., commercial fisheries).

7.13.3 EMBA

The EMBA for a 100 m^3 spill of MDO is entirely within commonwealth offshore waters as illustrated in Figure 5.1. Receptors most at risk within this EMBA, whether resident or migratory, are:

- Plankton;
- Fish;
- Cetaceans;
- Pinnipeds; and
- Avifauna.

7.13.4 Evaluation of environmental risks

Vessel collisions are a low probability event in open ocean areas without restricted navigation, and shipping traffic around the activity area is low. Higher commercial and recreational vessel traffic occurs in and around ports and harbours, which is therefore where the greatest risk of collision occurs. While undertaking the inspection of the wellheads, the ISV will be idle (other than moving in between wells), reducing the risk of collision with third-party vessels.

Criteria for the sensitivity of receptors that may be affected by an MDO spill are presented earlier in Table 7.18. The impacts of the MDO spill scenario on key environmental receptors in the spill EMBA are described in Table 7.18 to Table 7.27.

Table 7.18. Criteria used to determine receptor sensitivity in the EMBA

Sensitivity	Protected areas	Species status	BIA	Coastal sensitivity	Receptors in the EMBA
Low	State - no marine protected areas. Cth - multiple use zones are the dominant component of the protected area.	Species not threatened (or limited to only a few species of a particular faunal grouping). Present in the EMBA only occasionally or as vagrants. Populations known to recover rapidly from disturbance.	No BIA (or limited to only a few species of a particular faunal grouping).	Low sensitivity habitat, such as fine-grained beaches, exposed wave-cut platform and exposed rocky shores, with rapid recovery from oiling (~ 1 year or less). Public recreation beaches not present or not widely used. No harbours or marinas.	• Benthic assemblages. • Plankton. • Pelagic fish. • Macroalgae. • Sandy beaches. • Rocky shores.
Medium	State – no marine protected area. Cth - little to no special purpose zonation.	Species may be threatened (or some species of a particular faunal grouping). Species may or may not be present at time of activity. Some susceptibility to oiling. Populations may take a moderate time to recover from oiling.	Some intersection with one or more BIAs, generally for distribution or foraging rather than breeding.	Moderately sensitive habitat present, such as sheltered rocky rubble coasts, exposed tidal flats, gravel beaches, mixed sand and gravel beaches, with a medium recovery period from oiling (~2-5 years). Public recreation beaches present but not often used. No harbours or marinas.	• Marine reptiles. • Seabirds.
High	State - marine protected area present. Cth - special purposes zones are the dominant component of the protected area.	Species are threatened (or most species of a particular faunal grouping). Species known to be present at time of activity. Known to be susceptible to oiling. Populations may take a long time to recover from oiling.	Significant intersection with one or more BIAs, particularly with regard to breeding or migration.	Sensitive habitat present, such as mangrove, salt marshes, and sheltered tidal flats, with long recovery periods from oiling (> 5 years). Public recreation beaches present that are widely used. Busy harbours or marinas.	• Cetaceans. • Pinnipeds. • Shorebirds. • Commercial fishing. • Marine parks.

Table 7.19. Potential risk of MDO release on benthic assemblages

General sensitivity to oiling – benthic assemblages	
Sensitivity rating of benthic species and communities:	Low
A description of benthic fauna in the EMBA is provided in:	Section 5.4.1

Surface hydrocarbons

Benthic species are generally protected from exposure to surface hydrocarbon. The primary modes of exposure for benthic communities in oil spills include:

- Direct exposure to dispersed oil (e.g., physical smothering) where bottom discharges stay at the ocean bottom;
- Direct exposure to dispersed and non-dispersed oil (e.g., physical smothering) where oil sinks down from higher depths of the ocean;
- Direct exposure to dispersed and non-dispersed oil dissolved in sea water and/or partitioned onto sediment particles; and
- Indirect exposure to dispersed and non-dispersed oil through the food web (e.g., uptake of oiled plankton, detritus, prey, etc.) (NRDA, 2012).

Adult marine invertebrates and larvae usually reside within benthic substrates and pelagic waters, rarely reaching the water's surface in their life cycle (to breed, breathe and feed). Therefore, surface hydrocarbons are not considered to pose a high risk to marine invertebrates except at locations where surface oil reaches shorelines.

Acute or chronic exposure, through surface contact, and/or ingestion can result in toxicological risks. However, the presence of an exoskeleton (e.g., crustaceans) will reduce the impact of hydrocarbon absorption through the surface membrane. Other invertebrates with no exoskeleton and larval forms may be more prone to impacts from pelagic hydrocarbons.

Water column/seabed hydrocarbons

Entrained and dissolved hydrocarbons can have negative impacts on marine invertebrates and associated larval forms, while impacts to adult species is reduced as a result of the presence of an exoskeleton. Localised impacts to larval stages may occur which could impact on population recruitment that year. If invertebrates are contaminated by hydrocarbons, tissue taint can remain for several months, although taint may eventually be lost. For example, it has been demonstrated that it took 2-5 months for lobsters to lose their taint when exposed to a light hydrocarbon (NOAA, 2002).

Exposure to microscopic oil droplets may also impact aquatic biota either mechanically (especially filter feeders) or act as a conduit for exposure to semi-soluble hydrocarbons (that might be taken up by the gills or digestive tract) (McCay-French, 2009). Toxicity is primarily attributed to water soluble PAHs, specifically the substituted naphthalene (C_2 and C_3) as the higher C-ring compounds become insoluble and are not bioavailable. ANZECC/ARMCANZ (2000) identifies the following 96-hr LC50 concentrations for naphthalene (a key primary PAH dissolved phase toxicant in crude oils):

- For the bivalve mollusc, *Katelysia opima*, a concentration of 57,000 ppb; and
- For six species of marine crustaceans, a concentration between 850 and 5,700 ppb.

Other possible impacts from the presence of dispersed and non-dispersed oil include effects of oxygen depletion in bottom waters due to bacterial metabolism of oil (and/or dispersants), and light deprivation under surface oil (NRDA, 2012).

Surveys undertaken after the Montara well blowout in the Timor Sea in 2009 found no obvious visual signs of major disturbance at Barracouta and Vulcan shoals (Heyward *et al*., 2010), which occur about 20-30 m below the water line in otherwise deep waters (generally >150 m water depth). Later sampling indicated the presence of low-level severely degraded oil at some shoals, though in the absence of pre-impact data, this could not be directly linked to the Montara spill. Levels of hydrocarbons in the sediments were, in any case, several orders of magnitude lower than levels at which biological effects become possible (Heyward *et al*., 2010; Gagnon & Rawson, 2011).

Studies undertaken since the Macondo well blowout in the Gulf of Mexico (GoM) in 2010 have shown that fewer than 2% of the more than 8,000 sediment samples collected exceeded the EPA sediment toxicity benchmark for aquatic life, and these were largely limited to the area close to the wellhead (BP, 2015). Studies of offshore benthic seaweeds in the northwest GoM prior to and after the Macondo well blowout at Sackett and Ewing banks (in water depths of 55-75 m) found a dramatic die-off of seaweeds after the spill (60 species pre-spill compared with 10 species post-spill) (Felder *et al*., 2014). Benthic decapod assemblages (crabs, lobsters, prawns) associated with the seaweeds and benthic substrate also showed a strong decline in abundance at both banks post-spill (species richness on Ewing Bank reduced by 42% and on Sackett Bank by 29%), though it is noted that these banks are exposed to influences from Mississippi River discharges that vary year to year, so definitive links to the oil spill are not possible. It is noted, however, that petroleum residues were observed on Ewing Bank and it is possible that this may have caused localized mortalities, reduced the fecundity of surviving female decapods or reduced recruitment (Felder *et al*., 2014). Felder *et al* (2014) also notes that freshly caught soft-sediment decapod samples caught in early and mid-2011 near the spill site exhibited lesions that were severe enough to cause appendage loss and mortality. Recovery of benthic habitats exposed to entrained hydrocarbons would be expected to return to background water quality conditions within weeks to months of contact. Several studies have indicated that rapid recovery rates may occur even in cases of heavy oiling (Committee on Oil in the Sea, 2003).
Potential consequence from an MDO spill
Due to the spill location and the extent of the EMBA (entirely within in Commonwealth marine waters), given that MDO is not expected to sink to the seabed and that the EMBA does not contact any shoreline, the consequences for benthic assemblages are expected to be **minor**.

Table 7.20. Potential risk of MDO release from vessel on macroalgal communities

General sensitivity to oiling – macroalgal communities	
Sensitivity rating of macroalgal species and communities:	Low
A description of macroalgal species and communities in the EMBA is provided in:	Section 5.4.3
Macroalgae are generally limited to growing on intertidal and subtidal rocky substrata in shallow waters to 10 m depth. As such, they may be exposed to subsurface entrained and dissolved hydrocarbons, as well as to surface hydrocarbons if present in intertidal habitats as opposed to subtidal habitats. Smothering, fouling and asphyxiation are some of the physical effects that have been documented from oil contamination in marine plants (Blumer, 1971; Cintron *et al*., 1981). In macroalgae, oil can act as a physical barrier for the diffusion of CO_2 across cell walls (O'Brian & Dixon, 1976). The effect of hydrocarbons however is largely dependent on the degree of direct exposure and how much of the hydrocarbon adheres to algae, which will vary depending on the oils physical state and relative 'stickiness'. The morphological features of macroalgae, such as the presence of a mucilage layer or the presence of fine 'hairs' will influence the amount of hydrocarbon that will adhere to the algae. A review of field studies conducted after spill events by Connell et al (1981) indicated a high degree of variability in the level of impact, but in all instances, the algae appeared to be able to recover rapidly from even very heavy oiling. The rapid recovery of algae was attributed to the fact that for most algae, new growth is produced from near the base of the plant while the distal parts (which would be exposed to the oil contamination) are continually lost. Other studies have indicated that oiled kelp beds had a 90% recovery within 3-4 years of impact, however full recovery to pre-spill diversity may not occur for long periods after the spill (French-McCay, 2004). Intertidal macroalgal beds are more prone to oil spills than subtidal beds because although the mucous coating prevents oil adherence, oil that is trapped in the upper canopy can increase the persistence of the oil, which impacts upon site-attached species. Additionally, when oil sticks to dry fronds on the shore, they can become overweight and break as a result of wave action (IPIECA, 2002). The toxicity of macroalgae to hydrocarbons varies for the different macroalgal life stages, with water-soluble hydrocarbons more toxic to macroalgae (Van Overbeek & Blondeau, 1954; Kauss *et al*., 1973; cited in O'Brien and Dixon, 1976). Toxic effect concentrations for hydrocarbons and algae have varied greatly among species and studies, ranging 0.002–10,000 ppm (Lewis & Pryor, 2013). The sensitivity of gametes, larva and zygote stages however have all proven more responsive to petroleum oil exposure than adult growth stages (Thursby & Steele, 2003; Lewis & Pryor, 2013). Macrophytes, including seagrasses and macroalgae, require light to photosynthesise. So, in addition to the potential impacts from direct smothering or exposure to entrained and dissolved hydrocarbons, the presence of entrained hydrocarbons within the water column can affect light qualities and the ability of macrophytes to photosynthesise.	
Potential consequence from an MDO spill	
Floating vegetation in central Bass Strait may be exposed to limited areas of hydrocarbons at the sea surface. There are no areas of hydrocarbon exposure in the nearshore environment, which is where marine flora is more abundant. The nature of the spill scenario and the fact that the spill EMBA does not intersect the nearest giant kelp forests (located on the north western coast of Tasmania and the west coast of Flinders Island.), the consequence to macroalgal communities is considered **minor.**	

Table 7.21. Potential risk of MDO release on plankton

General sensitivity to oiling – plankton	
Sensitivity rating of plankton:	Low
A description of plankton communities in the EMBA is provided in:	Section 5.4.2
Plankton is found in nearshore and open waters beneath the surface in the water column. These organisms migrate vertically through the water column to feed in surface waters at night (NRDA, 2012). As they move close to the sea surface it is possible that they may be exposed to both surface hydrocarbons but to a greater extent, hydrocarbons dissolved or entrained in the water column. Phytoplankton is typically not sensitive to the impacts of oil, though they do accumulate it rapidly due to their small size and high surface area to volume ratio (Hook *et al*., 2016). If phytoplankton is exposed to hydrocarbons at the sea surface, this may directly affect their ability to photosynthesize and would have implications for the next trophic level in the food chain (e.g., small fish) (Hook *et al*., 2016). In addition, the presence of surface hydrocarbons may result in a reduction of light penetrating the water column, which could affect the rate of photosynthesis for phytoplankton in instances where there is prolonged presence of surface hydrocarbons over an extensive area such that the phytoplankton was restricted from exposure to light. Oil can affect the rate of photosynthesis and inhibit growth in phytoplankton, depending on the concentration range. For example, photosynthesis is stimulated by low concentrations of oil in the water column (10-30 ppb), but become progressively inhibited above 50 ppb. Conversely, photosynthesis can be stimulated below 100 ppb for exposure to weathered oil (Volkman *et al*., 2004). Zooplankton (microscopic animals such as rotifers, copepods and krill that feed on phytoplankton) are vulnerable to hydrocarbons due to their small size and high surface area to volume ratio, along with (in many cases) their high lipid content (that facilitates hydrocarbon uptake) (Hook *et al*., 2016). Water column organisms that come into contact with oil risk exposure through ingestion, inhalation and dermal contact (NRDA, 2012), which can cause immediate mortality or declines in egg production and hatching rates along with a decline in swimming speeds (Hook *et al*., 2016). Plankton is generally abundant in the upper layers of the water column and acts as the basis for the marine food web, meaning that a MDO spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Variations in the temporal scale of oceanographic processes typical of the ecosystem have a greater influence on plankton communities than the direct effect of spilt hydrocarbons. This is because reproduction by survivors or migration from unaffected areas would be likely to rapidly replenish any losses from permanent zooplankton (Volkman *et al*., 2004). Field observations from oil spills show minimal or transient effects on marine plankton (Volkman *et al*., 2004). Once background water quality conditions have re-established, the plankton community will take weeks to months to recover (ITOPF, 2011a), allowing for seasonal influences on the assemblage characteristics.	
Potential consequence from an MDO spill	
Plankton found in open water of the EMBA is expected to be widely represented in wider Bass Strait. Plankton in the upper water column is likely to be directly affected (e.g., through smothering and ingestion) and indirectly affected (e.g., toxicity from decrease in water quality and bioaccumulation) by surface, dissolved and entrained hydrocarbons. Once background water quality conditions are re-established following the natural weathering and dispersion of the hydrocarbons (~24 hours at the sea surface), plankton populations are expected to recover rapidly due to recruitment of plankton from surrounding waters. The consequence of an MDO spill on plankton populations is therefore assessed as **minor**.	

Table 7.22. Potential risk of MDO release on pelagic fish

General sensitivity to oiling – pelagic fish	
Sensitivity rating of pelagic fish	Low
A description of pelagic fish in the EMBA is provided in:	Section 5.4.7

The behaviours and habitat preferences of fish species determine their potential for exposure to hydrocarbons and the resulting impacts. Demersal species may be susceptible to oiled sediments, particularly species that are site-restricted. Pelagic species that occupy the water column are more susceptible to entrained and dissolved hydrocarbons, however generally these species are highly mobile and as such are not likely to suffer extended exposure due to their patterns of movement. The exception would be in areas such as reefs and other seabed features where species are less likely to move away into open waters (i.e., they area site-attached).

Fish are exposed to hydrocarbon droplets through a variety of pathways, including:

- Direct dermal contact (e.g., swimming through oil or waters with elevated dissolved hydrocarbon concentrations and other constituents, with diffusion across their gills (Hook *et al*., 2016));
- Ingestion (e.g., directly or via food base, fish that have recently ingested contaminated prey may themselves be a source of contamination for their predators); and
- Inhalation (e.g., elevated dissolved contaminant concentrations in water passing over the gills).

Exposure to hydrocarbons at the surface or entrained or dissolved in the water column can be toxic to fish. Studies have shown a range of impacts including changes in abundance, decreased size, inhibited swimming ability, changes to oxygen consumption and respiration, changes to reproduction, immune system responses, DNA damage, visible skin and organ lesions, and increased parasitism. However, many fish species can metabolise toxic hydrocarbons, which reduces the risk of bioaccumulation of contaminants in the food web (and human exposure to contaminants through the consumption of seafood) (NRDA, 2012).

Sub-lethal impacts in adult fish include altered heart and respiratory rates, gill hyperplasia, enlarged liver, reduced growth, fin erosion, impaired endocrine systems, behavioural modifications and alterations in feeding, migration, reproduction, swimming, schooling and burrowing behaviour (Kennish, 1996). However, fish are high mobile and unlikely to remain in the area of a spill for long enough to be exposed to sub-lethal doses of hydrocarbons.

Fish are most vulnerable to hydrocarbon discharges during their embryonic, larval and juvenile life stages. Eggs and larvae of many fish species are highly sensitive to oil exposure, resulting in decreased spawning success and abnormal larval development (see Table 7.21 'Plankton').

Since fish and sharks do not generally break the sea surface, the impacts of surface hydrocarbons to fish and shark species are unlikely to occur. Near the sea surface, fish are able to detect and avoid contact with surface slicks meaning fish mortalities rarely occur in the event of a hydrocarbon spill in open waters (Volkman *et al*., 2004). As a result, wide-ranging pelagic fish of the open ocean generally are not highly susceptible to impacts from surface hydrocarbons. Adult fish kills reported after oil spills occur mainly to shallow water, near-shore benthic species (Volkman *et al*., 2004).

Hydrocarbon in the water column can physically affect reef fish (that have high site fidelity and cannot move out of harm's way) exposed for an extended duration (weeks to months) by coating of gills, leading to lethal and sub-lethal effects from reduced oxygen exchange and coating of body surfaces that may lead to increased incidence of irritation and infection. Fish may also ingest hydrocarbon droplets or contaminated food, leading to reduced growth (Volkman *et al*., 2004).

The threshold value for species toxicity in the water column is based on global data from French et al. (1999) and French-McCay (2002, 2003), which showed that species sensitivity (fish and invertebrates) to dissolved aromatics exposure >4 days (96-hour LC50) under different environmental conditions varied from 6 to 400 µg/L (ppb), with an average of 50 ppb. This range covered 95% of aquatic organisms tested, which included species during sensitive life stages (eggs and larvae). Based on scientific literature, a minimum threshold of 6 ppb over 96 hours or equivalent was used to assess in-water low exposure zones, respectively (Engelhardt, 1983; Clark, 1984; Geraci and St Aubin, 1988; Jenssen, 1994; Tsvetnenko, 1998). French-McCay (2002) indicates that an average 96-hour LC50 of 50 ppb and 400 ppb could serve as an acute lethal threshold to 50% and 97.5% to biota, respectively.

Studies of oil impacts on bony fishes report that light, volatile oils are likely to be more toxic to fish. Many studies conclude that exposure to PAHs and soluble compounds are responsible for the majority of toxic impacts observed in fish (e.g., Carls *et al*., 2008; Ramachandran *et al*., 2004). A range of lethal and sub-lethal effects to fish in the larval stage has been reported at water-accommodated fraction (WAF) hydrocarbon concentrations (48–hour and 96-hour exposures) of 0.001 to 0.018 ppm during laboratory exposures (Carls *et al*., 2008; Gala, 2001). In contrast, wave tank exposures reported much higher lethal concentrations (14-day LC50) up to 1.9 ppm for herring embryos and up to 4.3 ppm for juvenile cod (Lee *et al*., 2011).

Toxicity in adult fish has been reported in response to crude oils, HFO and diesel (Holdway, 2002; Shigenaka, 2011). Uptake of hydrocarbons has been demonstrated in bony fish after exposure to WAF of between 24 and 48 hours. Danion et al (2011) observed PAH uptake of 148 µg/kg-1 after 48-hour exposures to PAH from Arabian Crude at high concentrations of 770 ppm. Davis et al (2002) report detectable tainting of fish flesh after a 24-hour exposure at crude concentrations of 0.1 ppm, marine fuel oil concentrations of 0.33 ppm and diesel concentrations of 0.25 ppm. The majority of studies, either from laboratory trials or of fish collected after spill events (including the Hebei Spirit, Macondo, and Sea Empress spills) find evidence of elimination of PAHs in fish tissues returning to reference levels within two months of exposure (Challenger and Mauseth, 2011; Davis *et al*., 2002; Gagnon & Rawson, 2011; Gohlke *et al*., 2011; Jung, 2011; Law, 1997; Rawson *et al*., 2011).

During most of their lives, squid are widely distributed, however, when squid reach maturity at 1-2 years, they move inshore to spawn in large numbers and then die after spawning. Where large numbers of squid spawn in small areas, the population could be impacted by the reduction in successful spawn. As squid are generally abundant and reach sexual maturity rapidly, recovery is expected to be rapid (1-2 years) (Minerals Management Service, 1983).

The toxicity of dissolved hydrocarbons and dispersed oil to fish species has been the subject of a number of laboratory studies (AMSA, 1998). Generally, concentrations in the range of 0.1–0.4 mg/L dispersed oil have been shown to cause fish deaths in laboratory experiments (96-hour LC50). No reported studies of the impacts of oil spills on cartilaginous fish (including sharks, rays and sawfish) were found in the literature. It is not known how the data on the sensitivity of bony fishes would relate to toxicity in cartilaginous fishes.

The assessment of effects on fish species in the Timor Sea as a result of the Montara well blowout (a light gas condensate), conducted from November 2009 to November 2010 undertaken by Gagnon & Rawson (2011), found that of the species studied (mostly goldband snapper *Pristipomoides multidens*, red emperor *Lutjanus sebae*, rainbow runner *Elegatis bipinnulata* and Spanish mackerel *Scomberomorus commerson*), all 781 specimens were in good physical health at all sites. Results show that:

- Phase 1 study (November 2009, immediately after the blowout ceased) - indicated that in the short-term, fish were exposed to and metabolised petroleum hydrocarbons, however no consistent adverse effects on fish health or their reproductive activity were detected.
- Phase 2 study (March 2010, 5 months after the blowout ceased) – indicated continuing exposure to petroleum hydrocarbons, as detected by elevated liver detoxification enzymes and PAH biliary metabolites in three out of four species collected close to the MODU, and elevated oxidative DNA damage.
- Phase 3 study (November 2010, 12 months after the blowout ceased) – showed a trend towards a return to reference levels with often, but not always, comparable biomarker levels in fish collected from reference and impacted sites. This evidence of exposure to petroleum hydrocarbons at sites close to the spill location suggest an ongoing trend toward a return to normal biochemistry/physiology (Gagnon & Rawson, 2011).

The main finding of the Gagnon & Rawson (2011) study concluded that there were no detectable petroleum hydrocarbons found in the fish muscle samples, limited ill effects were detected in a small number of individual fish, and no consistent adverse effects of exposure on fish health could be detected within two weeks following the end of the well release. Notwithstanding, fishes from close to the Montara well, collected seven months after the discharge began, showed continuing exposure to hydrocarbons in terms of biomarker responses. Two years after the discharge, biomarker levels in fishes had mostly returned to reference levels, except for liver size. However this was potentially attributed to local nutrient enrichment, or to past exposure to hydrocarbons. Fishes near Heyward Shoal, approximately 100 km southwest of the Montara well, had elevated biomarker responses indicating exposure to hydrocarbons, but were collected close to the Cornea natural hydrocarbon seep. Studies on the Montara discharge have shown recovery in terms of the abundance and composition of fishes, and toxicological and physiological responses of fishes.

Sampling from January 2010 to June 2011 by the University of South Alabama and Dauphin Island Sea Lab found no significant evidence of diseased fish in reef populations off Alabama or the western Florida Panhandle as a result of the Macondo well blowout in the GoM (BP, 2014).

No reports of oil spills in open waters have been reported to cause fish kills (though mortality in aquaculture pens has), which is likely to be because vertebrates can rapidly metabolise and excrete hydrocarbons (Hook *et al*., 2016). Recovery of fish assemblages depends on the intensity and duration of an unplanned discharge, the composition of the discharge and whether dispersants are used, as each of these factors influences the level of exposure to potential toxicants. Recovery would also depend on the life cycle attributes of fishes. Species that are abundant, short-lived and highly fecund may recover rapidly. However less abundant, long-lived species may take longer to recover. The range of movement of fishes will also influence recovery. The nature of the receiving environment would influence the level of impact on fishes.
Potential consequence from an MDO spill
The majority of fish tend to remain in the mid-pelagic zone, they are not likely to come into contact with surface hydrocarbons, so the consequence of an MDO spill is **minor**. Due to Bass Strait’s generally well-mixed waters, and the high and rapid rate of MDO weathering, the consequence of an MDO spill on for fish is restricted to the top 10 m of water and is assessed as **minor** at a population level.

Table 7.23. Potential risk of MDO release on cetaceans

General sensitivity to oiling – cetaceans	
Sensitivity rating of cetaceans:	High
A description of cetaceans in the EMBA is provided in:	Section 5.4.5

Whales and dolphins can be exposed to the chemicals in oil through:

- Internal exposure by consuming oil or contaminated prey;
- Inhaling volatile oil compounds when surfacing to breathe;
- Dermal contact, by swimming in oil and having oil directly on the skin and body; and
- Maternal transfer of contaminants to embryos (NRDA, 2012; Hook *et al*., 2016).

The effects of this exposure include:

- Hypothermia due to conductance changes in skin, resulting in metabolic shock (expected to be more problematic for non-cetaceans in colder waters);
- Toxic effects and secondary organ dysfunction due to ingestion of oil;
- Congested lungs;
- Damaged airways;
- Interstitial emphysema due to inhalation of oil droplets and vapour;
- Gastrointestinal ulceration and haemorrhaging due to ingestion of oil during grooming and feeding;
- Eye and skin lesions from continuous exposure to oil;
- Decreased body mass due to restricted diet; and
- Stress due to oil exposure and behavioural changes.

French-McCay (2009) identifies that a 10-25 µm oil thickness threshold has the potential to impart a lethal dose on marine species, however also estimates a probability of 0.1% mortality to cetaceans if they encounter these thresholds based on the proportion of the time spent at surface. Direct surface oil contact with hydrocarbons is considered to have little deleterious effect on whales, possibly due to the skin's effectiveness as a barrier to toxicity, and effect of oil on cetacean skin is probably minor and temporary (Geraci & St Aubin, 1988). Cetaceans in particular have mostly smooth skins with limited areas of pelage (hair covered skin) or rough surfaces such as barnacled skin. Oil tends to adhere to rough surfaces, hair or calluses of animals, so contact with hydrocarbons by whales and dolphins may cause only minor hydrocarbon adherence.

The physical impacts from ingested hydrocarbon with subsequent lethal or sub-lethal impacts are both applicable to entrained oil. However, the susceptibility of cetaceans varies with feeding habits. Baleen whales (such as blue, southern right and humpback whales) are not particularly susceptible to ingestion of oil in the water column, but are susceptible to oil at the sea surface as they feed by skimming the surface. Oil may stick to the baleen while they 'filter feed' near slicks. Sticky, tar-like residues are particularly likely to foul the baleen plates.

The inhalation of oil droplets, vapours and fumes is a distinct possibility if whales surface in slicks to breathe. Exposure to hydrocarbons in this way could damage mucous membranes, damage airways or even cause death.

Toothed whales and dolphins may be susceptible to ingestion of dissolved and entrained oil as they gulp feed at depth. There are reports of declines in the health of individual pods of killer whales (a toothed whale species), though not the population as a whole, in Prince William Sound after the Exxon Valdez vessel spill (heavy oil) (Hook *et al*., 2016).

It has been stated that pelagic species will avoid hydrocarbons, mainly because of its noxious odours, but this has not been proven. The strong attraction to specific areas for breeding or feeding (e.g., use of the Warrnambool coastline as a nursery area for southern right whales) may override any tendency for cetaceans to avoid the noxious presence of hydrocarbons. So weathered or tar-like oil residues can still present a problem by fouling baleen whale feeding systems.

Dolphin populations from Barataria Bay, Louisianna, USA, which were exposed to prolonged and continuous oiling from the Macondo oil spill in 2010, had higher incidences of lung and kidney disease than those in the other urbanised environments (Hook *et al.*, 2016). The spill may have also contributed to unusually high perinatal mortality in bottlenose dolphins (Hook *et al.*, 2016).

As highly mobile species, in general it is very unlikely that cetaceans will be constantly exposed to concentrations of hydrocarbons in the water column for continuous durations (e.g., >96 hours) that would lead to chronic toxicity effects.

Potential consequence from an MDO spill	
The potential for impacts to cetaceans and dolphins would be limited to a relatively short period following the spill release. The consequence to cetacean populations from an MDO spill is **minor**.	
This hydrocarbon spill scenario will not have a 'significant' impact on threatened cetacean species (see Section 5.4.5) when assessed against the EPBC Act *Significant Impact Guidelines 1.1* (DoE, 2013), which are:	
• Lead to a long-term decrease in the size of a population.	A spill would not lead to a long-term decrease in the size of a population given the small area of 'swept ocean' from a single spill, the rapid weathering of MDO and the low likelihood of a large portion of a cetacean population being present in the spill area at any one time.
• Reduce the area of occupancy of the species.	Given the small area of 'swept ocean' from a single spill, the rapid weathering of MDO, the area of occupancy may be temporarily reduced (noting that cetaceans may not necessarily avoid a spill at the surface or in the water column), but there will be no long-term reduction in the area of occupancy.
• Fragment an existing population into two or more populations.	In the event of an MDO spill, cetaceans have access to an expansive area of unpolluted waters. A spill would not be expected to split up a single population into two or more populations. A spill does not move quickly enough to result in a migrating population splitting to avoid a spill.
• Adversely affect habitat critical to the survival of a species.	The water quality of the activity area and EMBA would be temporarily reduced in the event of an MDO spill. However, only a small portion of the MDO entrains or dissolves in the water column where cetaceans spend the majority of their time (apart from surfacing to breath). The activity area and EMBA form only a small portion of cetacean migration routes, so this habitat is not critical to their survival; they would be exposed to MDO for a very short period of time if a spill occurred during migration (minutes to hours).
• Disrupt the breeding cycle of a population.	Most of the cetacean species known to occur in the activity area and EMBA are not known to breed within the activity area or the EMBA. Given the small area of 'swept ocean' from a single spill and the rapid weathering of MDO, it is highly unlikely that the breeding cycle of a cetacean population will be disrupted.

• Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The water quality of the activity area and EMBA would be temporarily reduced in the event of an MDO spill. Given the small area of 'swept ocean' from a single spill and the rapid weathering of MDO, the duration of reduced water quality will be temporarily. Marine habitat will not be modified, destroyed, removed, isolated or decreased to the extent that one or more cetacean species will decline.
• Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	The endangered cetaceans that may migrate through the activity area and EMBA are the pygmy blue whale and southern right whale (there are no critically endangered cetaceans listed on the databases informing this assessment). An MDO spill is highly unlikely to result in the introduction and spread of IMS that are harmful to these species. Vessels that may be involved in the 'monitor and evaluate' spill response strategy will be subject to strict IMS controls to ensure that ballast water is of 'low risk' and that hulls are free of IMS.
• Introduce disease that may cause the species to decline.	The risks of toxic impacts to individual cetaceans or populations is minor due to the rapid weathering of MDO. The small extent of a single spill further reduces the risk to a small area. As such, it is unlikely that there would be a large number of 'oiled' cetaceans that may then become susceptible to disease.
• Interfere with the recovery of the species.	For all the reasons outlined above, an MDO spill will not interfere with the recovery of a cetacean species.

Table 7.24. Potential risk of MDO release on pinnipeds

General sensitivity to oiling – pinnipeds	
Sensitivity rating of pinnipeds:	High
A description of pinnipeds in the EMBA is provided in:	Section 5.4.6

Pinnipeds (Australian fur-seal and New Zealand fur-seal) are potentially impacted by hydrocarbons at the sea surface, water column and shoreline.

Sea surface oil

Pinnipeds are vulnerable to sea surface exposures given they spend much of their time on or near the surface of the water, as they need to surface every few minutes to breathe and regularly haul out on to beaches. Pinnipeds are also sensitive as they will stay near established colonies and haul-out areas, meaning they are less likely to practice avoidance behaviours. This is corroborated by Geraci and St. Aubins (1988) who suggest seals, sea-lions and fur-seals have been observed swimming in oil slicks during a number of documented spills.

Exposure to surface oil can result in skin and eye irritations and disruptions to thermal regulation. As a result of exposure to surface oils, pinnipeds, with their relatively large, protruding eyes are particularly vulnerable to effects such as irritation to mucous membranes that surround the eyes and line the oral cavity, respiratory surfaces, and anal and urogenital orifices. Hook *et al* (2016) reports that seals appear not to be very sensitive to contact with oil, but instead to the toxic impacts from the inhalation of volatile components.

For some pinnipeds, fur is an effective thermal barrier because it traps air and repels water. Petroleum stuck to fur reduces its insulative value by removing natural oils that waterproof the pelage. Consequently, the rate of heat transfer through fur seal pelts can double after oiling (Geraci & St. Aubin, 1988), adding an energetic burden to the animal. Kooyman et al (1976) suggest that in fact, fouling of approximately one-third of the body surface resulted in 50% greater heat loss in fur seals immersed in water at various temperatures. Fur-seals are particularly vulnerable due to the likelihood of oil adhering to fur. Heavy oil coating and tar deposits on fur-seals may result in reduced swimming ability and lack of mobility out of the water. Davis and Anderson (1976) observed two gray seal pups drowning, their "flippers stuck to the sides of their bodies such that they were unable to swim".

However, pinnipeds other than fur-seals are less threatened by thermal effects of fouling, if at all. Oil has no effect on the relatively poor insulative capacity of sea-lion and bearded and ringed seal pelts; oiled Weddell seal samples show some increase in conductance (Oritsland, 1975; Kooyman *et al*., 1976; 1977).

In-water oil

Ingested hydrocarbons can irritate or destroy epithelial cells that line the stomach and intestine, thereby affecting motility, digestion and absorption. However, pinnipeds have been found to have the enzyme systems necessary to convert absorbed hydrocarbons into polar metabolites, which can be excreted in urine (Engelhardt, 1982; Addison & Brodie, 1984; Addison *et al*., 1986). Geraci & St. Aubin (1988) suggest that a small phocid weighing 50 kg might have to ingest approximately 1 litre of oil to be at risk.

Volkman et al (1994) report that benzene and naphthalene ingested by seals is quickly absorbed into the blood through the gut, causing acute stress, with damage to the liver considered likely. If ingested in large volumes, hydrocarbons may not be completely metabolised, which may result in death.

Shoreline oil

Breeding colonies (used to birth and nurse until pups are weaned) are particularly sensitive to hydrocarbon spills (Higgins & Gass, 1993). Pinnipeds are further at risk because of their tendency to stay near established colonies and haul-out areas and consequently are unlikely to practice oil avoidance behaviours.

ITOPF (2011a) report that species that rely on fur to regulate their body temperature (such as fur-seals) are the most vulnerable to oil as the animals may die from hypothermia or overheating, depending on the season, if the fur becomes matted with oil.

It is reported that most pinnipeds scratch themselves vigorously with their flippers and do not lick or groom themselves, so are less likely to ingest oil from skin surfaces (Geraci & St. Aubin, 1988). However, mothers trying to clean an oiled pup may ingest oil. All pinnipeds examined to date have the enzyme systems necessary to convert absorbed hydrocarbons into polar metabolites, which can be excreted in urine (Engelhardt, 1982; Addison and Brodie, 1984; Addison *et al*., 1986).

The long-term Environmental Impact and Recovery report for the Iron Barren oil spill (in Tasmania, 1995) concluded that "The number of seal pups born at Tenth Island in 1995 was reduced when compared to previous years. There was a strong relationship between the productivity of the seal colonies and the proximity of the islands to the oil spill wherein the islands close to the spill showed reduced pup production and those islands more distant to the oil spill did not" (Tasmanian SMPC, 1999).

Pinnipeds are further at risk because they appear to rely on scent to establish a mother-pup bond (Sandegren, 1970; Fogden, 1971), and consequently oil-coated pups may not be recognisable to their mothers. This is only theorised, with studies and research indicating interaction between mothers and oiled pups were normal (Davis and Anderson, 1976; Davies, 1949; Shaughnessy & Chapman, 1984).

Due to the extreme philopatry of females and limited dispersal of males between breeding colonies, the removal of only a few individuals annually may increase the likelihood of decline and potentially lead to the extinction of some of the smaller colonies. Extinction of breeding colonies has the potential to further reduce genetic diversity and the already limited genetic flow between colonies. This, in turn, may weaken the genetic resilience of the species and impact on its ability to cope with other natural or anthropogenic impacts. In addition, the extreme philopatry of females suggests that extinction of breeding colonies may lead to a contraction of the range of the species as re-colonisation of breeding sites via immigration is limited.

For the reasons outlined above, small breeding colonies are under particular pressure of survival from even low levels of anthropogenic mortality.

Potential consequence from an MDO spill

Given the proximity of the activity area to breeding colonies and haul-out sites south of Wilson's Promontory (43 km northeast of the EMBA), it is likely that the species forage within the activity area and the spill EMBA. However, given the vast area available for feeding and the short duration of hydrocarbons present on the sea suface, the impact consequence is therefore assessed as **minor**.

Table 7.25. Potential risk of MDO release on marine reptiles

General sensitivity to oiling – marine reptiles	
Sensitivity rating of marine reptiles:	Medium
A description of marine reptiles in the EMBA is provided in:	Section 5.4.8

Marine reptiles can be exposed to hydrocarbon through ingestion of contaminated prey, inhalation or dermal exposure (Hook *et al*., 2016).

Sea turtles are vulnerable to the effects of oil at all life stages—eggs, post-hatchlings, juveniles, and adults in nearshore waters. Several aspects of sea turtle biology and behaviour place them at particular risk, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large pre-dive inhalations. Effects of oil on turtles include increased egg mortality and developmental defects, direct mortality due to oiling in hatchlings, juveniles, and adults; and negative impacts to the skin, blood, digestive and immune systems, and salt glands. Oil exposure affects different turtle life stages in different ways. Each turtle life stage frequents a habitat with notable potential to be impacted during an oil spill. Thus, information on oil toxicity needs to be organized by life stage. Turtles may be exposed to chemicals in oil in two ways:

1. Internally – eating or swallowing oil, consuming prey containing oil-based chemicals, or inhaling of volatile oil related compounds; and
2. Externally – swimming in oil or dispersants, or oil or dispersants on skin and body.

Records of oiled wildlife during spills rarely include marine turtles, even from areas where they are known to be relatively abundant (Short, 2011). An exception to this was the large number of marine turtles collected (613 dead and 536 live) during the Macondo spill in the GoM, although many of these animals did not show any sign of oil exposure (NOAA, 2013). Of the dead turtles found, 3.4% were visibly oiled and 85% of the live turtles found were oiled (NOAA, 2013). Of the captured animals, 88% of the live turtles were later released, suggesting that oiling does not inevitably lead to mortality.

Impacts to sea snakes during marine hydrocarbon spills are known from limited assessments, undertaken following the Montara spill in the Timor Sea in 2009. Two dead sea snakes were collected during the incident, one of which was concluded to have died as a result of exposure to the oil, with evidence of inhaled and ingested oil and elevated concentrations of PAHs in muscle tissues. The second snake showed evidence of ingestion by oil but no accumulation in tissues or damage to internal organs and it was concluded that the oil was unlikely to be the cause of death (Curtin University, 2009; 2010).

There is potential for contamination of turtle eggs to result in similar toxic impacts to developing embryos as has been observed in birds. Studies on freshwater snapping turtles showed uptake of PAHs from contaminated nest sediments, but no impacts on hatching success or juvenile health following exposure of eggs to dispersed weathered light crude (Rowe *et al*., 2009). However, other studies found evidence that exposure of freshwater turtle embryos to PAHs results in deformities (Bell *et al*., 2006, Van Meter *et al*., 2006).

Turtles may experience oiling impacts on nesting beaches and eggs through chemical exposure, resulting in decreased survival to hatching and developmental defects in hatchlings. Turtle hatchlings may be more vulnerable to smothering as they emerge from the nests and make their way over the intertidal area to the open water (AMSA, 2015). Hatchlings that contact oil residues while crossing a beach can exhibit a range of effects including impaired movement and bodily functions (Shigenaka, 2003). Hatchlings sticky with oily residues may also have more difficulty crawling and swimming, rendering them more vulnerable to predation.

Ingested oil may cause harm to the internal organs of turtles. Oil covering their bodies may interfere with breathing because they inhale large volumes of air to dive. Oil can enter cavities such as the eyes, nostrils, or mouth. Turtles may experience oiling impacts on nesting beaches when they come ashore to lay their eggs, and their eggs may be exposed during incubation, potentially resulting in increased egg mortality and/or possibly developmental defects in hatchlings.

Potential consequence from an MDO spill

Some individual marine reptiles may come into contact with hydrocarbon exposure on the sea surface. At moderate and high concentrations, toxicity impacts may occur, including sub-lethal impacts including irritation of skin or cavities. However, due to the absence of turtle BIAs in Bass Strait and the low number of turtles foraging or migrating through Bass Strait in general, and given shorelines (potential nesting sites) are not intersected by the EMBA, the consequence of an MDO spill to threatened turtle individuals and populations is **minor.**

Table 7.26. Potential risk of MDO release on seabirds

General sensitivity to oiling – seabirds	
Sensitivity rating of seabirds:	High
A description of seabirds and shorebirds in the EMBA is provided in:	Section 5.4.4
Seabirds and shorebirds are sensitive to the impacts of oiling, with their vulnerability arising from the fact that they cross the air-water interface to feed, while their shoreline habitats may also be oiled (Hook *et al*., 2016). Species that raft together in large flocks on the sea surface are particularly at risk (ITOPF, 2011a). Birds foraging at sea have the potential to directly interact with oil on the sea surface some considerable distance from breeding sites in the course of normal foraging activities. Species most at risk include those that readily rest on the sea surface (such as shearwaters) and surface plunging species such as terns and boobies. As seabirds are top order predators, any impact on other marine life (e.g., pelagic fish) may disrupt and limit food supply both for the maintenance of adults and the provisioning of young. In the case of seabirds, direct contact with hydrocarbons is likely to foul plumage, which may result in hypothermia due to a reduction in the ability of the bird to thermo-regulate and impair water-proofing (ITOPF, 2011a). A bird suffering from cold, exhaustion and a loss of buoyancy (resulting from fouling of plumage) may dehydrate, drown or starve (ITOPF, 2011a; DSEWPC, 2011; AMSA, 2013). It may also result in impaired navigation and flight performance (Hook *et al*., 2016). Increased heat loss as a result of a loss of water-proofing results in an increased metabolism of food reserves in the body, which is not countered by a corresponding increase in food intake, and may lead to emaciation (DSEPWC, 2011). The greatest vulnerability in this case occurs when birds are feeding or resting at the sea surface (Peakall *et al*., 1987). In a review of 45 marine hydrocarbon spills, there was no correlation between the numbers of bird deaths and the volume of the spill (Burger, 1993). Toxic effects of hydrocarbons on birds may result where the oil is ingested as the bird attempts to preen its feathers, and the preening process may spread the oil over otherwise clean areas of the body (ITOPF, 2011a). Whether this toxicity ultimately results in mortality will depend on the amount of hydrocarbons consumed and other factors relating to the health and sensitivity of the bird. Birds that are coated in oil also suffer from damage to external tissues including skin and eyes, as well as internal tissue irritation in their lungs and stomachs. Studies of contamination of duck eggs by small quantities of crude oil, mimicking the effect of oil transfer by parent birds, have been shown to result in mortality of developing embryos. Engelhardt (1983), Clark (1984), Geraci & St Aubin (1988) and Jenssen (1994) indicated that the threshold thickness of oil that could impart a lethal dose to some intersecting wildlife individual is 10 µm (~10 g/m^2).	
Potential consequence from an MDO spill	
Given the extensive ocean foraging habitat available to species such as albatross and petrel, the small area and temporary nature of the hydrocarbon release on the sea surface makes it unlikely that a spill will limit their ability to forage for unaffected prey, nor will the unlikely event of exposure at the sea surface result in permanent injury or mortality. Therefore, the consequence on seabirds from an MDO spill is considered **minor**.	
This hydrocarbon spill scenario will not have a 'significant' impact on migratory shorebird species (see Section 5.4.4) when assessed against the EPBC Act *Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act-listed migratory shorebird species Policy Statement 3.21* (DoEE, 2017b), which are:	
• Loss of habitat.	The sandy beaches of the EMBA will not be lost in the event of an MDO spill.
• Degradation of habitat leading to a substantial reduction in migratory shorebird numbers.	Shoreline quality will temporarily decrease but given the behaviour of MDO and nature of the shoreline, there will be no long-term degradation.

• Increased disturbance leading to a substantial reduction in migratory shorebird numbers.	MDO will rapidly percolate through sandy beach sediments, resulting in only short-term disturbance. The most likely shoreline response option will be to monitor and evaluate (rather than actively undertake a clean-up), further reducing the potential for disturbance to shorebirds.
• Direct mortality of birds leading to a substantial reduction in migratory shorebird numbers.	Depending on the nature of the spill, how it weathers and the location of shoreline loading, there is a low risk of direct mortality of birds. No one area of the EMBA, particularly the shoreline closest to the activity area, has high concentrations or a high percentage of a population of any migratory shorebird species. As such, a substantial reduction in migratory shorebird numbers is highly unlikely to occur.
This hydrocarbon spill scenario will not have a 'significant' impact on threatened seabird species (see Section 5.4.4) when assessed against the EPBC Act *Significant Impact Guidelines 1.1* (DoE, 2013), which are:	
• Lead to a long-term decrease in the size of a population.	A spill would not lead to a long-term decrease in the size of a population given the small area of 'swept ocean' from a single spill, the rapid weathering of MDO and the low likelihood of a large portion of a seabird population being present in the spill area at any one time.
• Reduce the area of occupancy of the species.	Given the small area of 'swept ocean' from a single spill, the rapid weathering of MDO and the abundance of suitable nearby habitat, sea surface water quality will temporarily decrease and therefore the area of occupancy will be temporarily reduced but there will be no long-term reduction in the area of occupancy.
• Fragment an existing population into two or more populations.	In the event of an MDO spill, seabirds have access to an expansive area of unpolluted waters. A spill would not fragment an existing population given the small area of 'swept ocean' from a single spill.
• Adversely affect habitat critical to the survival of a species.	The marine waters of the activity area and EMBA are not critical to the survival or any seabirds. Similar marine habitat occurs all through Bass Strait and the Southern Ocean.
• Disrupt the breeding cycle of a population.	Most of the seabird species known to occur in the activity area and EMBA (e.g., albatross, petrels, shearwaters) breed outside of Australia or well beyond the EMBA. Given the small area of 'swept ocean' from a single spill and the rapid weathering of MDO, it is highly unlikely that the breeding cycle of a seabird population will be disrupted.
• Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Given the small area of 'swept ocean' from a single spill and the rapid weathering of MDO, the quality of marine waters in the area of the spill will be temporarily reduced. However, marine habitat will not be modified, destroyed, removed, isolated or decreased to the extent that one or more seabird species will decline. Most of the seabird species known to occur in the activity area and EMBA (e.g., albatross, petrels, shearwaters) breed outside of Australia or well beyond the EMBA. This being the case, it is unlikely for adults to bring contaminated prey back to nests to feed chicks. For the species that do breed in Australian waters and parts of the EMBA, it is unlikely that MDO or MDO-affected prey would be brought back to the nest in quantities significant enough to result in mortality of chicks and the loss of a generation.
• Result in invasive species that are harmful to a critically endangered or endangered species	There are several EPBC Act-listed endangered and critically endangered seabirds that may occur in the activity area and/or EMBA. An MDO spill is highly unlikely to result in the introduction and spread of IMS that are harmful to these species. Vessels that may be

becoming established in the endangered or critically endangered species' habitat.	involved in the 'monitor and evaluate' spill response strategy will be subject to strict IMS controls to ensure that ballast water is of 'low risk' and that hulls are free of IMS.
• Introduce disease that may cause the species to decline.	The risks of toxic impacts to individual birds or populations is minor due to the rapid weathering of MDO. The small extent of a single spill further reduces the risk to a small area. As such, it is unlikely that there would be a large number of 'oiled' birds that may then become susceptible to disease.
• Interfere with the recovery of the species.	For all the reasons outlined above, an MDO spill will not interfere with the recovery of a seabird species.

The activity will not impact on the objectives of the Draft Wildlife Conservation Plan for Seabirds (DAWE, 2019), which are:

1. International cooperation and collaboration occur to support the survival of seabirds and their habitats outside Australian jurisdiction.
2. Seabirds and their habitats are protected and managed in Australia.
3. The long-term survival of seabirds and their habitats is achieved through supporting priority research programs, coordinating monitoring, on-ground management and conservation.
4. Awareness of the importance of conserving seabirds and their habitats is increased through a strategic approach to community education and capacity building to support monitoring and on-ground management.

Table 7.27. Potential risk of MDO spill on commercial fisheries

General sensitivity to oiling – commercial fishing	
Sensitivity rating of commercial fisheries:	High
A description of commercial fisheries operating in the EMBA is provided in:	Section 5.7.6

Commercial fishing has the potential to be impacted through exclusion zones associated with the spill, the spill response and subsequent reduction in fishing effort. Exclusion zones may impede access to commercial fishing areas, for a short period of time, and nets and lines may become oiled. The impacts to commercial fishing from a public perception perspective however, may be much more significant and longer term than the spill itself.

Fishing areas may be closed for fishing for shorter or longer periods because of the risks of the catch being tainted by oil. Concentrations of petroleum contaminants in fish, crustacean and mollusc tissues could pose a significant potential for adverse human health effects, and until these products from nearshore fisheries have been cleared by the health authorities, they could be restricted for sale and human consumption. Indirectly, the fisheries sector will suffer a heavy loss if consumers are either stopped from using or unwilling to buy fish and shellfish from the region affected by the spill.

Impacts to fish stocks have the potential for reduction in profits for commercial fisheries, and exclusion zones exclude fishing effort. Davis et al (2002) report detectable tainting of fish flesh after a 24-hour exposure at crude concentrations of 0.1 ppm, marine fuel oil concentrations of 0.33 ppm and diesel concentrations of 0.25 ppm.

The Montara spill (as the most recent [2009] example of a large hydrocarbon spill in Australian waters) occurred over an area fished by the Northern Demersal Scalefish Managed Fishery (with 11 licences held by 7 operators), with goldband snapper, red emperor, saddletail snapper and yellow spotted rockcod being the key species fished (PTTEP, 2013). As a precautionary measure, the WA Department of Fisheries advised the commercial fishing fleet to avoid fishing in oil-affected waters. Testing of fish caught in areas of visible oil slick (November 2009) found that there were no detectable petroleum hydrocarbons in fish muscle samples, suggesting fish were safe for human consumption. In the short-term, fish had metabolised petroleum hydrocarbons. Limited ill effects were detected in a small number of individual fish only (PTTEP, 2013). No consistent effects of exposure on fish health could be detected within two weeks following the end of the well release. Follow up sampling in areas affected by the spill during 2010 and 2011 (PTTEP, 2013) found negligible ongoing environmental impacts from the spill.

Since testing began in the month after the Macondo well blowout in the Gulf of Mexico (GoM) (2010), levels of oil contamination residue in seafood consistently tested 100 to 1,000 times lower than safety thresholds established by the USA FDA, and every sample tested was found to be far below the FDA's safety threshold for dispersant compounds (BP, 2015). FDA testing of oysters found oil contamination residues to be 10 to 100 times below safety thresholds (BP, 2014). Sampling data shows that post-spill fish populations in the GoM since 2011 were generally consistent with pre-spill ranges and for many shellfish species, commercial landings in the GoM in 2011 were comparable to pre-spill levels. In 2012, shrimp (prawn) and blue crab landings were within 2.0% of 2007-09 landings. Recreational fishing harvests in 2011, 2012 and 2013 exceeded landings from 2007-09 (BP, 2014).

In the event of a MDO spill, a temporary fisheries closure may be put in place by AFMA, the VFA and/or DPIPWE (or voluntarily by the fishers themselves). Oil may foul the hulls of fishing vessels and associated equipment, such as gill nets. A temporary fisheries closure, combined with oil tainting of target species (actual or perceived), may lead to financial losses to fisheries and economic losses for individual licence holders. Fisheries closures and the flow on losses from the lack of income derived from these fisheries are likely to have short-term but widespread socio-economic consequences, such as reduced employment (in fisheries service industries, such as tackle and bait supplies, fuel, marine mechanical services, accommodation and so forth).

Potential consequence from MDO release			
Fishery	**Surface oiling**	**Water column**	**Shoreline**
General	A short-term fishing exclusion zone may be implemented by AFMA, the VFA and/or DPIPWE. Given the temporary nature of any surface slick and the low fishing intensity in the EMBA, there are unlikely to be any significant impact on fisheries in terms of lost catches (and associated income).	A short-term fishing exclusion zone may be implemented by AFMA or the Victorian or Tasmanian fishing authorities. The hydrocarbons are predicted to weather quickly and the area would return to pre-spill conditions rapidly.	Vessels use local ports, which are located outside the EMBA.
Tasmanian fisheries			
Scalefish	No impacts due to their pelagic habitat.	A temporary closure of the area affected by hydrocarbons may be implemented. This is not expected to have an impact on the overall function of the fishery or its catch species and the consequence of the MDO spill is therefore **minor**.	As per 'general.'
Octopus	No impacts due to their benthic and pelagic habitat. There is a low risk of octopus pot buoys accumulating hydrocarbons if they are set at the time of a spill. The oiled surfaces may themselves be a source of secondary contamination until they are cleaned. This is expected to be of **minor** consequence to the fishery.	A temporary closure of the area affected by hydrocarbons may be implemented. This is not expected to have an impact on the overall function of the fishery or its catch species as pots are laid on the seabed. The consequence of the MDO spill is therefore **minor**.	As per 'general.'
Commonwealth fisheries (those known to fish within the EMBA)			
Scallop	No impact due to their benthic habitat.	Hydrocarbons are not expected to accumulate among benthic sediments in the EMBA due to the significant mixing of waters and dilution of the high and low concentration of hydrocarbons in the water column. The most intensely fished areas of the fishery, off the east coast of King Island in Commonwealth waters, are not exposed to dissolved or entrained hydrocarbons in the benthic layer. However, a temporary closure of the area affected by hydrocarbons may be implemented until background water quality levels return to pre-spill conditions.	Not applicable.

		Given the proximity of recent fishing effort to the activity area, the consequence of a hydrocarbon spill and potential closure of grounds adjacent the spill would be of **moderate** consequence to the fishery.	
Southern squid jig	The most heavily fished areas of the fishery are located off the west coast of Victoria and east coast of Tasmania, which are outside the EMBA. A temporary closure of the fishery is therefore unlikely and as such, the consequence of the MDO spill is **minor**.		Not applicable.
SESS – gillnet and shark hook sector	The most heavily fished areas of the fishery are located off the east coast of Victoria and north coast of Flinders Island, outside the EMBA. A temporary closure of the fishery is therefore unlikely and as such, the consequence of the MDO spill is **minor**.		Not applicable.
SESS – Commonwealth trawl sector	The most heavily fished areas of the fishery are located on the continental slope off the east coast of Victoria, southwest Victoria and the west and east coasts of Tasmania. These areas are outside the EMBA. A temporary closure of the fishery is therefore unlikely and as such, the consequence of the MDO spill is **minor**.		Not applicable.

7.13.5 Risk Assessment

Table 7.28 presents the risk assessment for an MDO spill.

Table 7.28. Risk assessment for an MDO spill

Summary			
Summary of risks	Localised and temporary reduction in water quality. Potential toxicity impacts to marine life. Temporary fisheries closures.		
Extent of risks	EMBA is defined conservatively as a 30 km buffer from the activity area.		
Duration of risks	Short-term (several days, depending on level of contact, location and receptor).		
Level of certainty of risks	HIGH – the environmental impacts of spilled hydrocarbons are well understood.		
Risk decision framework context	B – new to the organisation or geographical area, infrequent or non-standard activity, some uncertainty, some partner interest, may attract media attention.		
Risk Assessment (inherent)			
Receptor	Consequence	Likelihood	Risk rating
Benthic fauna	Minor	Highly unlikely	Low
Macroalgal communities	Minor	Highly unlikely	Low
Plankton	Minor	Highly unlikely	Low
Pelagic fish	Minor	Highly unlikely	Low
Cetaceans	Minor	Highly unlikely	Low
Pinnipeds	Minor	Highly unlikely	Low
Marine reptiles	Minor	Highly unlikely	Low
Seabirds	Minor	Highly unlikely	Low
Commercial fisheries	Minor	Highly unlikely	Low
Environmental Controls and Performance Measurement			
EPO	EPS	Measurement criteria	
Preventative controls as per 'displacement of or interference with third-party vessels' and 'routine emissions – light.' Additional controls are provided here.			
Preparedness			
No MDO is spilled at sea during refuelling activities.	No vessel refuelling is undertaken at sea (this will be done in port).	Bunker log verifies that refuelling was undertaken in port.	
No MDO is spilled at sea as a result of vessel-to-vessel collision.	In order to minimise the risk of vessel-to-vessel collisions, the ISV will: • Comply with the requirements of: o *Navigation Act* 2012 (Cth), Chapter 3, Part 3 (Seaworthiness of vessels). o Marine Order 21 (Safety and emergency arrangements).	Vessel audit/assurance reports (prepared or commissioned by Beach) verify that vessels contracted to Beach meet legislative safety requirements.	

	o Marine Order 30 (Prevention of Collisions). o Marine Order 91 (Marine pollution prevention - oil). • Operate navigational lights and communication systems. • Maintain navigational lights and communication systems in accordance with the PMS. • Have trained and competent crew maintaining 24-hour visual, radar and radio watch for other vessels.	
	Beach notifies relevant stakeholders ahead of the activity so that third-party marine users are aware of vessel location and timing.	Stakeholder correspondence and the stakeholder register verify that Beach made contact with relevant stakeholders about the timing and location of the activity.
Vessel crews are prepared to respond to a spill.	Vessel has approved SMPEP (or equivalent appropriate to class) that is implemented in the event of a large MDO spill.	Current SMPEP is available.
		Spill incident report verifies that the actions were taken in accordance with the SMPEP.
	Vessel crew is trained in spill response techniques in accordance with the SMPEP.	Training records verify that crews are trained in spill response.
	In accordance with the SMPEP, oil spill response kits are available in relevant locations around the vessel, are fully stocked and are used in the event of hydrocarbon or chemical spills to deck.	Inspection/audit confirms that SMPEP kits are readily available on deck.
		Incident reports for hydrocarbon spills to deck record that the spill is cleaned up using SMPEP resources.
Emergency response		
Vessel crews promptly respond to a spill.	A Beach OPEP and ERP are in place and tested annually in desktop exercises by those nominated in the plans to be part of the response strategies.	The OPEP and ERP are current.
		OPEP and ERP training schedule is available and remains live.
		The training matrix is maintained as a live document and verifies that personnel nominated to assist in emergency response are up to date with their training.
		OPEP and ERP exercise reports verify that exercises have been undertaken.
	The Vessel Master will authorise actions in accordance with the vessel-specific SMPEP (or equivalent according to class).	Daily operations reports verify that the SMPEP was implemented.
	The OPEP is implemented to limit the release of a Level 2 or 3 MDO spill.	Daily operations reports verify that the OPEP was implemented.
Recording and reporting		
Beach and regulatory authorities are promptly	All incidents of spatial conflict with other marine users will be reported in the Beach incident register (CMO).	The CMO is current.

made of aware of near-misses and spills.	Beach will report the spill to regulatory authorities within 2 hours of the spill or becoming aware of the spill.	Incident report verifies that contact with regulatory agencies was made within 2 hours.
Monitoring		
Characterise environmental impacts of a Level 2 or 3 spill.	Beach will undertake operational and scientific monitoring in accordance with the OSMP.	Daily operations reports and overall study reports verify that the OSMP was implemented.

Risk Assessment (residual)			
Receptor	Consequence	Likelihood	Risk rating
Benthic fauna	Minor	Remote	Low
Macroalgal communities	Minor	Remote	Low
Plankton	Minor	Remote	Low
Pelagic fish	Minor	Remote	Low
Cetaceans	Minor	Remote	Low
Pinnipeds	Minor	Remote	Low
Marine reptiles	Minor	Remote	Low
Seabirds	Minor	Remote	Low
Commercial fisheries	Minor	Remote	Low

Demonstration of ALARP

A 'low' residual risk rating is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required. However, because this hazard has a Decision Context of 'B', an ALARP analysis is presented below.

Good practice	
Avoid/Eliminate	The potential for a vessel collision leading to a MDO spill cannot be eliminated completely. However, eliminating the need to refuel on location removes one of the more credible sources of an MDO spill.
Change the likelihood Change the consequence	Power that could be used as a substitute to MDO, such as solar or wind power or biofuels, are not commercially proven in vessels. MDO is a substitute for HFO, which would have greater environmental impacts if spilled. Other measures in place to reduce the likelihood and consequence of an MDO spill are that vessels are equipped with navigation aids, are equipped with dynamic positioning and are manned by qualified and experienced personnel.
Reduce the risk	Vessel specific SMPEPs are in place and are implemented. The Beach ERP and OPEP are implemented in the event of a Level 2 or 3 spill.

Engineering risk assessment

The spill modelling undertaken for the MDO spill scenario is an engineering risk assessment and supports the development of the EPS listed in this table.

Cost benefit analysis

Not applicable for an impact decision framework context of 'B'.

Demonstration of Acceptability

<table>
<tr><td rowspan="2">Internal context</td><td>Policy compliance</td><td>Beach Environmental Policy objectives are met through implementation of this EP.</td></tr>
<tr><td>OEMS compliance</td><td>Chapter 8 describes the EP implementation strategy employed for this activity. It is demonstrated that all the standards in the OEMS have been met during the planning phase of this activity and can be met during the implementation phase of this activity.</td></tr>
<tr><td>Stakeholder engagement (Chapter 4)</td><td colspan="2">Beach will communicate with all relevant stakeholders prior to inspection activities.</td></tr>
<tr><td>Legislative context
(see Section 2.2 for descriptions of relevant legislation)</td><td colspan="2">The performance standards outlined in this EP align with the requirements of:
• Navigation Act 2012 (Cth):
o Chapter 4 (Prevention of Pollution).
• OPGGS Act 2006 (Cth):
o Section 572A-F (Polluter pays for escape of petroleum).
• OPGGS(E):
o Part 3 (Incidents, reports and records).
• Protection of the Sea (Prevention of Pollution by Ships) Act 1983 (Cth):
o Section 11A (SOPEP).</td></tr>
<tr><td rowspan="5">Industry practice
(see Sections 2.5 & 2.6 for descriptions)</td><td colspan="2">The consideration and adoption of the controls outlined in the below-listed codes of practice and guidelines demonstrates that BPEM is being implemented.</td></tr>
<tr><td>Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)</td><td>The EPS developed for this activity are in line with the management measures listed for spills from vessels in Section 4.7.2 of the guidelines:
• Vessels having a SMPEP.
• Vessels having radar fitted and maintaining appropriate lighting and navigation systems.
• Having safety exclusion zones around facilities.</td></tr>
<tr><td>Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)</td><td>No guidance is provided regarding preventing or managing an offshore MDO spill, other than having a spill contingency plan in place. An OPEP is in place.</td></tr>
<tr><td>Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)</td><td>Guidelines met with regard to:
• Section 75 (Spills): Conducting a spill risk assessment, implementing personnel training and field exercises, ensuring spill response equipment is available.
• Sections 76-79 (Spill response planning): A spill response plan should be prepared.</td></tr>
<tr><td>APPEA CoEP (2008)</td><td>The EPS listed in this table meet the following offshore development and production objectives:
• To reduce the risk of any unplanned release of material into the marine environment to ALARP and an acceptable level.</td></tr>
<tr><td rowspan="2">Environmental context</td><td colspan="2">MNES</td></tr>
<tr><td>AMPs
(Section 5.5.1)</td><td>The MDO spill EMBA overlaps the Boags AMP.
These AMPs have the following relevant conservation values:
- Benthic assemblages
- Cetaceans
- Seabirds
- Pinnipeds</td></tr>
</table>

		- White shark As addressed in Tables 7.19 to 7.27, the consequence of an MDO spill on these conservation values is minor and unlikely to result in long-term ecological impacts. See **Appendix 1** for additional detail regarding the impacts of non-routine activities on the management aims of these AMPs.
	Ramsar wetlands (Section 5.5.4)	The MDO spill EMBA is not predicted to intersect or contact any Ramsar sites.
	TECs (Section 5.5.6)	The MDO spill EMBA is not predicted to intersect or contact any TECs.
	NIWs (Section 5.5.4)	The MDO spill EMBA is not predicted to intersect or contact any NIWs.
	Nationally threatened and migratory species (Section 5.4)	Some nationally threatened species and migratory species have the potential to be present in the MDO spill EMBA, particularly within their BIAs, but as evaluated in the previous tables in this section, the consequence to individuals or populations of threatened and migratory species are minor.
	Other matters	
	State marine parks (Sections 5.5.9 and 5.5.10)	There are no state marine parks that will be intersected by the spill EMBA.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	Marine pollution is a threat identified for albatross and giant-petrels in the National recovery plan for threatened albatross and giant petrels 2011-2016 (DSEWPC, 2011a). Population monitoring is the suggested action to deal with marine pollution. The conservation advice and management plans for blue, humpback, sei and fin whales identify hydrocarbon spill as threats, though there are no specific aims to address this. See **Appendix 2** for additional detail regarding the impacts of non-routine activities on the management aims of threatened species plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	

Environmental Monitoring

- As per the OPEP and OSMP.

Record Keeping

- Vessel assurance reports.
- Notices to Mariners.
- Stakeholder consultation correspondence and register.
- SMPEPs.
- OPEP.
- ERP.
- Crew training records.
- Bunkering procedure.
- Bunkering PTWs, JSAs, inspection checklists.
- Oil spill response exercise records.
- Inspection/audit reports.
- Incident reports.

7.14 RISK 6 - Hydrocarbon Spill Response Activities

This section assesses the environmental and socio-economic risks associated with the MDO spill response strategies. Not all spill response options are appropriate for every spill type – responses vary based on key factors such as hydrocarbon type (light oil, heavy oil, refined oil), volume, location, sea state and trajectory.

Table 7.29 summarises the feasibility and effectiveness of the strategies available to respond to a Level 2 or 3 MDO spill, and whether they will be adopted. Only those that will be adopted are risk assessed in this section.

Table 7.29. MDO spill response options

Response option	Feasibility and effectiveness analysis	Adopt?
Source control	**Effectiveness** Implementing the vessel-specific SMPEP is the preferred manner in which to control an MDO release (e.g., transfer MDO from the ruptured tank to an intact tank, where possible). **Feasibility** This response strategy is effective based on the assumption that the vessel is not damaged to the point where electronic and hydraulic systems fail.	Yes
Monitor and Evaluate	**Effectiveness** MDO evaporates and disperses rapidly. MDO will be visible on the sea surface using satellite monitoring, vessel and aerial-based observations. **Feasibility** Monitoring is a fundamental part of any hydrocarbon spill response to gain situational awareness of the nature and scale of the spill and the direction of movement. Trained personnel at AMSA and within the oil and gas industry (via AMOSC) are readily available to undertake this monitoring.	Yes
Assisted Natural Dispersion	**Effectiveness** The use of motorised vessels to break up slicks using propeller wash creates an inherent safety risk because of the presence of an ignition source (MDO is highly volatile). **Feasibility** Mechanical dispersion could be undertaken in slightly weathered MDO once the volatiles have flashed off to disperse the MDO into the water column to create smaller droplets and enhance biodegradation (only if monitoring indicates the slick is moving to sensitive shorelines).	Yes
Chemical Dispersants	**Effectiveness** Although the use of dispersants is 'conditional' for Group II oil such as MDO, the potential spill volume and the natural tendency of spreading into very thin films is evidence that dispersant application will be an ineffective response. Dispersant droplets will penetrate through the thin oil layer and cause 'herding' of the oil, which creates areas of clear water and could be mistaken for successful dispersion. **Feasibility** Dispersant use will have a net negative effect on the environment. Dispersants push the MDO into the water column, creating longer lasting impacts in the water column than allowing the MDO to weather naturally from the sea surface.	No
Offshore Containment and Recovery	**Effectiveness** The high volatility of MDO creates inherent safety risks when attempting to contain and recover it mechanically.	No

Response option	Feasibility and effectiveness analysis	Adopt?
	This response technique is dependent on adequate MDO thickness (generally >10 g/m²), calm seas and significant areas of unbroken surface slicks. Due to the low viscosity of MDO, the ability to contain and recover it is extremely limited. MDO evaporates faster than the collection rate of a thin surface film present. It spreads in less time than is required to deploy this equipment. **Feasibility** It is unlikely to be effective because the areas of high MDO concentration would weather in less time than is required to deploy response equipment.	
Protection and Deflection	**Effectiveness** The high volatility of MDO creates inherent safety risks when attempting to use protection and deflection booms. Oceanic environments such as Bass Strait and the Otway region often do not present suitable conditions for the use of booming material (i.e., swell and waves deem this strategy ineffective). **Feasibility** There is no shoreline loading predicted, therefore this response measure is not required.	No
Shoreline clean-up	**Effectiveness** MDO is highly volatile and will evaporate rapidly even after making shoreline contact. MDO also quickly infiltrates sand, where it is then remobilised by wave action (reworking) until it has naturally degraded. This quick infiltration through sediments makes it very difficult to recover without also recovering vast amounts of shoreline sediments. **Feasibility** There is no shoreline loading predicted, therefore this response measure is not required.	No
Oiled Wildlife Response (OWR)	**Effectiveness** Because MDO evaporates and disperses rapidly, most fauna are unlikely to be exposed to sub-lethal or lethal hydrocarbon concentrations that warrant wildlife capture and treatment, especially at the sea surface. **Feasibility** No shoreline loading is predicted in the OSTM. Therefore, oiled wildlife on the shoreline is unlikely. Wildlife may become oiled in the offshore environment. Hazing may be considered to disperse animals away from a slick (such as seabirds, shorebird, seals and dolphins) or any shoreline areas where MDO has not infiltrated beach sediments. Only DELWP, DPIPWE or AMSA officers (or those authorised by these agencies) are permitted to handle and treat oiled wildlife. This may limit the effectiveness and feasibility of this response in terms of the number of responders and therefore the number of affected fauna that could be treated.	No

Table 7.29 indicates that only the following responses may be used to respond to a hydrocarbon spill:

- Source control;
- Monitor and evaluate; and

- Assisted natural dispersion.

The risks associated with these response techniques is discussed in this section.

7.14.1 Scope of Activity

Source Control

In the event of an MDO release, the key method of source control is outlined in the vessel-specific SMPEP (or equivalent based on class). The key response measures typically involve:

- Moving further out to sea (away from shoreline sensitivities) if the vessel is still able to navigate; and
- Transferring MDO from the affected tank/s to non-affected tanks.

Monitor and Evaluate

Ongoing monitoring and evaluation of a hydrocarbon spill is critical for maintaining situational awareness and to complement and support the other response activities. In some situations, monitoring may be the primary response strategy if natural dispersion and weathering processes are effective in reducing the volume of hydrocarbons reaching sensitive receptors (as is likely to be the case in this scenario).

Operational monitoring includes the following:

- Aerial observation (primarily by helicopter);
- Vessel-based observation;
- OSTM (computer-based and/or manual vector analysis); and

Assisted Natural Dispersion

Assisted natural dispersion involves the use of motorised vessels to break up hydrocarbon slicks using propeller wash; essentially navigating a vessel in whatever pattern maximises travel through the slick to create smaller droplets and enhance biodegradation in the water column.

This activity is generally only necessary if monitoring indicates the slick is moving to sensitive shorelines.

7.14.2 Availability

Monitor and Evaluate

Beach (through its membership with AMOSC) maintain operational monitoring capability as outlined in Table 7.30.

Table 7.30. Resources available for monitoring and evaluation

Resource required	Beach resources
Aviation	Beach will activate its contract with AMOSC to access helicopter and/or fixed aircraft to assist in spill monitoring.
Trained observers	Beach can request the assistance of AMOSC's Core Group personnel (>120 oil and gas industry personnel nation-wide) who are available 24/7 to respond to marine oil spills.
Vessel based observations	Vessels of opportunity (VoO) based in ports nearest to the activity area, such as Stanley or Geelong would be engaged as required. VoO from ports slightly further afield, such as Port of Melbourne or Barry Beach (in Corner Inlet) would also be considered.

Resource required	Beach resources
OSTM	Beach will activate its contract with AMOSC to access 24/7 emergency OSTM. OSTM results can generally be provided within 4 hours of request.

Assisted Natural Dispersion

The same VoO outlined under 'monitor and evaluate' would be used to implement assisted natural dispersion.

7.14.3 Hazards

The hazards associated with each of these response options are:

- Additional vessel activity (over a greater area than the activity area), resulting in additional routine emissions (air, noise) and routine discharges (sewage, putrescible waste, cooling water, etc); and
- Sound generated by helicopters.

7.14.4 Impacts and Risks of the Response Activities

The impacts and risks associated with these response options are:

- Routine and non-routine impacts and risks associated with vessel operations (as outlined throughout this chapter); and
- Noise disturbance to marine fauna and shoreline species by aerial flights.

7.14.5 Evaluation of Environmental Impacts and Risks

Monitor and Evaluate

The impacts and risks associated with routine and non-routine vessel and helicopter activities are described and assessed throughout this chapter and are not repeated here. Foot access to beaches is not addressed in the EP and is therefore evaluated below.

Damage to shoreline habitat (such as sand dunes providing shorebird nesting habitat) may be caused if personnel veer from formed tracks. The noise, light and general disturbance created by shoreline monitoring activities (likely to involve foot traffic only, rather than vehicle traffic), may disturb the feeding, breeding, nesting or resting activities of resident and migratory fauna species that may be present. This is particularly the case for beach-nesting shorebirds, which may be present in some shorelines of the EMBA. As an example, the eggs of hooded plovers (that nest only on sandy beaches) have small eggs that are very well camouflaged, so they are easily trodden on by accident. If the incubating adult is scared off the nest by passers-by, the eggs may literally bake in the sun, or become too cold in the cool weather. Either way, it kills the chick developing in the egg, and the egg will not hatch. Similarly, when people disturb a chick, it quickly runs into the sand dunes and hides. While it is running, the chick uses up valuable energy, and while it is hiding it is unable to feed (they usually forage at the water's edge), so that a chick that is forced to run and hide throughout the day could easily starve. Any erosion caused by responder access to sandy beaches, may also bury nests. In isolated instances, this is unlikely to have impacts at the population level.

The presence of hydrocarbons in nearshore waters may necessitate temporary beach closures (likely to be in the order of days, depending on the degree of oiling). This means recreational activities (such as swimming, walking, fishing) in affected areas will be excluded until access is again granted by the local government authority. However, given shoreline loading above the minimum reporting threshold is not predicted in the OSTM, beach closure is unlikely to be required.

Assisted Natural Dispersion

The impacts and risks associated with routine and non-routine vessel activities are described and assessed throughout this chapter and are not repeated here.

7.14.6 Environmental Impact and Risk Assessment

Table 7.31 presents the risk assessment for hydrocarbon spill response activities.

Table 7.31. Risk assessment for hydrocarbon spill response activities

Summary			
Summary of risks	Disturbance to marine and shoreline fauna.		
Extent of risk	Localised – area immediately around vessel or aircraft		
Duration of risk	Short-term (days to a week).		
Level of certainty of risk	HIGH – the impacts associated with vessel discharges and noise disturbance to fauna from vessels and helicopters are well understood, and controls are documented in legislation.		
Risk decision framework context	B – new to the organisation or geographical area, infrequent or non-standard activity, some uncertainty, some partner interest, may attract media attention.		
Risk Assessment (inherent)			
Receptor	Likelihood	Consequence	Risk rating
Fauna disturbance	Possible	Minor	Medium
Fauna injury	Possible	Minor	Medium
Fauna death	Unlikely	Minor	Low

Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
Preparedness		
Source control Beach and its vessel contractors are operationally ready to respond to a spill.	The vessel has a current SMPEP in place.	Inspection/audit records verify a current SMPEP is in place.
Monitor and evaluate Beach maintains capability to implement hydrocarbon spill monitoring and response in a Level 2 or 3 spill event.	Access to operational response capabilities is maintained through the vessel paying the required shipping levy and Beach maintaining a current contract with AMOSC.	Vessel pays required shipping levy. Contract with AMOSC is available and current.
	AMSA undertakes regular testing of response arrangements and equipment to ensure it is always ready to respond rapidly.	AMSA response capabilities are maintained in a manner that permits them to respond to spills rapidly (noted in annual reports).
	Beach undertakes a desktop review of oil spill preparedness and response arrangements prior to the activity commencing.	Review is current.
Response		
Source control The source of the release is stopped in the shortest	MDO loss is managed through implementation of the vessel SMPEP (or equivalent according to class).	Incident logs verify that the SMPEP is implemented.

time possible in accordance with established procedures.		
Monitor and evaluate Undertake visual observations to monitor spill behaviour and determine whether it is likely to reach sensitive receptors.	Visual observations from the vessel are initiated immediately.	Incident report verifies that visual observations commenced immediately following a spill.
	The NatPlan is activated so that AMSA can commence undertaking monitoring activities.	Incident communications log verifies that AMSA was contacted and asked to activate the NatPlan.
The trajectory of the spill is predicted based on the spill location in order to inform response strategies.	OSTM is undertaken in accordance with NatPlan requirements.	Incident records verify OSTM was undertaken.
Activity controls		
Monitor and evaluate, protection and deflection Monitoring activities are undertaken in a manner that protects sensitive fauna and habitat.	Helicopters will maintain a buffer distances of 500 m around cetaceans in accordance with EPBC Regulations 2000 (Part 8).	Flight instructions document these constraints.
	Vessels will maintain buffer distances around whales and dolphins in accordance with The Australian National Guidelines for Whale and Dolphin Watching (DoEE, 2017) for those individuals not visibly affected by hydrocarbons (closer approaches may be necessary to determine impacts).	Incident reports note when cetaceans were sighted and what actions were undertaken.

Risk Assessment (residual)

Receptor	Likelihood	Consequence	Risk rating
Fauna disturbance	Unlikely	Minor	Low
Fauna injury	Unlikely	Minor	Low
Fauna death	Highly unlikely	Minor	Low

Demonstration of ALARP

A 'low' residual risk rating is considered to be ALARP and a 'lower order' impact. An ALARP analysis is therefore not required. However, because this hazard has a Decision Context of 'B', an ALARP analysis is presented below.

Table 7.29 provides a guide as to the suitability of response techniques for an MDO spill, including in the context of the OSTM undertaken for the activity. This should be taken into account into this demonstration of ALARP.

Good practice	
Avoid/Eliminate	Oil spill response activities will only be undertaken if the operational NEBA demonstrates that the net benefit of the response is greater than allowing the hydrocarbons to weather naturally.
Change the likelihood Change the consequence	The NatPlan will be used to guide the spill response activities. The use of trained AMSA, AMOSC and Beach personnel to monitor and respond to the spill reduces the likelihood and consequence of a poor response being implemented and creating more environmental damage than it prevents. This reduces the likelihood and consequence of additional environmental damage resulting from the response activities.
Reduce the risk	A pre-activity desktop exercise will be undertaken to ensure Beach and vessel contractors are aware of spill response risks and the measures in place to respond to a spill. This exercise reduces the risks associated with poor preparedness. Beach's contract with AMOSC reduces the risk of delays in instigating response measures (over and beyond those of AMSA).

Engineering risk assessment		
The OSTM undertaken for the MDO spill scenario is an engineering risk assessment (consequence modelling) and supports the development of the EPS listed in this table. The engineering control measures considered but not adopted because of the negative cost/benefit analysis are described below: • Use of autonomous underwater vehicles (AUV) – AUVs may be able to provide additional detail on hydrocarbons in the water column, but this does not assist with spill response options on the sea surface or at the shoreline. There are no practical means for removing hydrocarbons in the water column. • Night-time infrared monitoring – side looking airborne radar systems are required to be installed on specific aircraft or vessels. The costs of sourcing such vessels/aircraft is approximately $20,000 per day. Infrared may be used to provide aerial monitoring at night, however the benefit is minimal given trajectory monitoring (and infield monitoring during daylight hours) will provide good operational awareness. In addition to this, satellite imagery may be used at night to provide additional operational awareness.		
Cost benefit analysis		
Not applicable for an impact decision framework context of 'B'.		
Demonstration of Acceptability		
Internal context	Policy compliance	Beach Environmental Policy objectives are met through implementation of this EP.
	OEMS compliance	Chapter 8 describes the EP implementation strategy employed for this activity. It is demonstrated that all the standards in the OEMS have been met during the planning phase of this activity and can be met during the implementation phase of this activity.
Stakeholder engagement (Chapter 4)	Beach will communicate with all relevant stakeholders prior to inspection activities.	
Legislative context (see Section 2.2 for descriptions of relevant legislation)	The performance standards outlined in this EP align with the requirements of: • *OPGGS Act* 2006 (Cth) and OPGGS(E) (Cth): o Part 6.2 – directs the polluter to take actions in response to an incident and to clean up and monitor impacts. o Regulation 13(5) (Risk assessment undertaken to demonstrate ALARP). • EPBC Regulations 2000 (Cth): o Part 8 (Interacting with cetaceans and whale watching).	
Industry practice (see Sections 2.5 & 2.6 for descriptions)	The consideration and adoption of the controls outlined in the below-listed codes of practice and guidelines demonstrates that BPEM is being implemented.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS listed in this table meet the relevant mitigation measures listed for offshore activities with regard to: • Emergency preparedness and response – spill preparedness and emergency response measures are in place.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	No guidance is provided regarding oil spill response activities, other than having a spill contingency plan in place. An OPEP is in place for the activity.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: • Sections 76-79 (Spill response planning): A spill response plan should be prepared.

	APPEA CoEP (2008)	The EPS listed in this table meet the following offshore development and production objectives: • To reduce the risk of any unplanned release of material into the marine environment to ALARP and to an acceptable level.
	Hydrocarbon spill-specific guidelines	
	NatPlan (AMSA, 2020).	AMSA will implement this plan in the event their resources are deployed. The EPS listed in this table complement the NatPlan.
	AMOSPlan (2017)	AMOSC will implement this plan in the event their resources are deployed. The EPS listed in this table complement AMOSPlan.
	Contingency planning for oil spills on water – Good practice guidelines for incident management and emergency response personnel (IPIECA/IOGP, 2015).	The EPS listed in this table are prepared cognisant of these guidelines, which discuss oil spill scenarios, various response techniques and the requirements for contingency plan preparation.
	Oil spill training - Good practice guidelines on the development of training programmes for incident management and emergency response personnel (IPIECA/IOGP, 2014).	The EPS listed in this table are prepared cognisant of these guidelines, in so far as training of Beach and contractor personnel in oil spill preparedness and response takes place and is overseen by an emergency response specialist.
	Aerial Observations of Marine Oil Spills (ITOPF, 2011a). Aerial Observations of Oil Spills at Sea (IPIECA/OGP, 2015).	The EPS listed in this table related to monitoring were prepared cognisant of these guidelines, which describe monitoring techniques and outline the importance of monitoring in guiding on-water and shoreline response activities.
Environmental context	MNES	
	AMPs (Section 5.5.1)	Oil and chemical spills are a threat identified in the South-east Commonwealth Marine Reserve Network Management Plan 2013-2023. Spill response will not be undertaken in AMPs given that actionable surface oiling is not predicted. Vessel or aircraft-based monitoring activities will have no impacts on AMPs. See **Appendix 1** for additional detail regarding the impacts of non-routine activities on the management aims of these AMPs.
	Ramsar wetlands (Section 5.5.4)	Spill response will not be undertaken in Ramsar wetlands given that surface oiling is not predicted. Vessel or aircraft-based monitoring activities will have no impacts on Ramsar wetlands.
	TECs (Section 5.5.6)	Spill response will not be undertaken in areas where TECs exist. Vessel or aircraft-based monitoring activities will have no impacts on TECs.
	NIWs (Section 5.5.4)	Spill response will not be undertaken in NIWs given that surface oiling is not predicted. Vessel or aircraft-based monitoring activities will have no impacts on NIWs.

	Nationally threatened and migratory species (Section 5.4)	Some threatened and migratory species have the potential to be present in spill response areas but given that the key response strategy is centred on monitoring and surveillance because of the volatile nature of the hydrocarbons, vessel or aircraft-based monitoring activities will have no impacts on threatened and migratory species.
	Other matters	
	State marine parks (Sections 5.5.9 and 5.5.10)	Many of the Victorian marine and coastal reserve management plans list the protection of marine and terrestrial ecological communities and indigenous flora and fauna, particularly threatened species, as a management aim. Spill response may be undertaken in coastal marine parks given that shoreline loading is predicted to contact some parks. Land, vessel or aircraft-based monitoring activities will have no significant impacts on these marine parks or the management objectives of the parks' management plans. See **Appendix 1** for additional detail regarding the impacts of routine activities on the management aims of state marine parks.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	Marine pollution is a threat identified for albatross and giant-petrels in the National recovery plan for threatened albatross and giant petrels 2011-2016 (DSEWPC, 2011a). Population monitoring is the suggested action to deal with marine pollution. The risks posed by response operations do not impact this action. The conservation advice and management plans for blue, humpback, sei and fin whales identify hydrocarbon spill as threats, though there are no specific aims to address this. See **Appendix 2** for additional detail regarding the impacts of non-routine activities on the management aims of threatened species plans. Land, aerial or vessel-based observations will not conflict with the management objectives of these plans.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	

Environmental Monitoring

- As per NatPlan requirements.

Record Keeping

- Contracts and agreements with third parties.
- Equipment and service provider register.
- Exercise drill reports.
- Inspection/audit reports.
- Incident and daily operations reports.
- Operational NEBA.
- Briefing records.
- Photos.
- OSMP implementation records and reports.
- IAP.

8. Implementation Strategy

Regulation 14 of the OPGGS(E)R requires that the EP must contain an implementation strategy for the activity.

The Beach Operations Excellence Management System (OEMS) will be used to govern the White Ibis-1, Trefoil-1 and Yolla-1 non-production operations EP. The OEMS provides guidance on how Beach will meet the requirements of its Environmental Policy (see Figure 2.1). The Beach OEMS has been developed considering Australian/New Zealand Standard ISO 14001:2016 Environmental Management Systems. The OEMS is an integrated management system and includes all HSE management elements and procedures.

The Implementation Strategy described in this section provides a summary of the OEMS elements and how they will be applied to effectively implement the control measures detailed in this EP. Specifically, it describes:

- The OEMS;
- Environment-specific roles and responsibilities;
- Arrangements for monitoring, review and reporting of environmental performance;
- Preparedness for emergencies; and
- Arrangements for ongoing consultation.

8.1 Operations Excellence Management Strategy

This EP will be undertaken in accordance with the Beach OEMS. The OEMS documents the Environmental Policy, 11 OEMS Elements, HSE Procedures and the key HSE processes and requirements for activities where Beach is the titleholder. It provides a management framework for achieving the requirements in a systematic way but allows flexibility to achieve this in a manner that best suits the business. The OEMS has been developed based on the IOGP Operating Management System Framework and is aligned with the requirements of recognised international and national standards including:

- ISO 14001 (Environmental Management);
- ISO 31000 (Risk Management); and
- ISO 45001 (Occupational Health and Safety Management Systems).

At the core of the OEMS are 11 elements and associated standards that detail specific performance requirements that incorporate all the requirements for the implementation of the Environmental Policy (provided in Figure 2.1) and management of potential HSE impacts and risks (Table 8.1 and Figure 8.1). The Elements, via the nominated expectations, sponsor 30 Beach OEMS Standards, which provide more granular minimum compliance rule sets under which the company operates. At the business level, the system is complemented by asset and site procedures and plans such as this EP.

Whilst Beach is the titleholder for the activity, the inspection contractor maintains operational control of the vessel as per the requirements of their management system. The application of OEMS Elements and Standards relevant to the activity are described in the following sections.

Table 8.1. Beach OEMS Elements and Standards

Element		Standard
1	Partners, Leadership and Authority	Leadership Standard
		Technical Authority Standard
		Joint Venture Management Standard
2	Financial Management and Business Planning	Integrated Planning Standard
		Phase Gate Standard
		Hydrocarbon Resource Estimation and Reporting Standard
		Finance Management Standard
3	Information Management and Legal Requirements	Regulatory Compliance Standard
		Document Management Standard
		Information Management Standard
4	People, Capability and Health	Training and Competency Standard
		Health Management Standard
5	Contracts and Procurement	Contracts and Procurement Standard
		Transport and Logistics Standard
6	Asset Management	Asset Management Standard
		Maintenance Management Standard
		Well Integrity Management Standard
		Well Construction Management Standard
		Project Management Standard
7	Operational Control	Operational Integrity Standard
		Process Safety Standard
		Management of Change Standard
8	Risk Management and Hazard Control	Risk Management Standard
		Safe Systems of Work
		Emergency and Security Management Standard
9	Incident Management	Incident Management Standard
10	Environment and Community	Environment Management Standard
		Community Engagement Standard
11	Assurance and Reporting	Sustainability Standard
		Assurance Standard

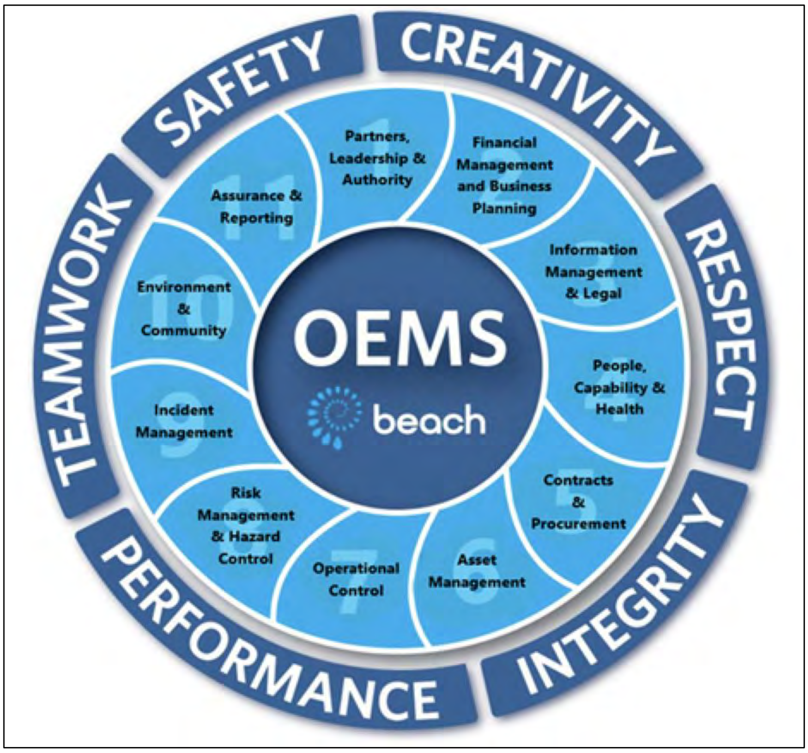


Figure 8.1. The Beach OEMS

8.2 Element 1 – Partners, Leadership and Authority

Element 1 focuses on ensuring the organisation is equipped, structured and supported to ensure a healthy, efficient and successful company. Communications with internal and external bodies, including joint venture partners, is essential to delivering successful projects and operations. The leadership styles and actions demonstrated within Beach will influence the performance of all staff and contractors. Clear levels of authority are necessary to remove organisational ambiguity and to support effective decision making.

There are three standards (see Table 8.1) and 11 outcomes to be delivered under this element.

To this effect, Beach's Environment Policy provides a clear commitment to conduct its operations in an environmentally responsible and sustainable manner.

Demonstratable compliance with this EP is a key commitment for Beach. This will be managed through the use of a commitments register to track all EP commitments throughout operations.

The Beach CEO has the ultimate responsibility for ensuring that Beach has the appropriate organisation in place to meet the commitments established within this EP. The General Manager Victorian Operations and Head of Environment, have the responsibility and delegated authority to ensure that adequate and appropriate resources are allocated to comply with the OEMS and this EP.

The organisation structure for the non-production well operations is illustrated in Figure 8.2 and the roles and responsibilities of key activity members are summarised in Table 8.2.

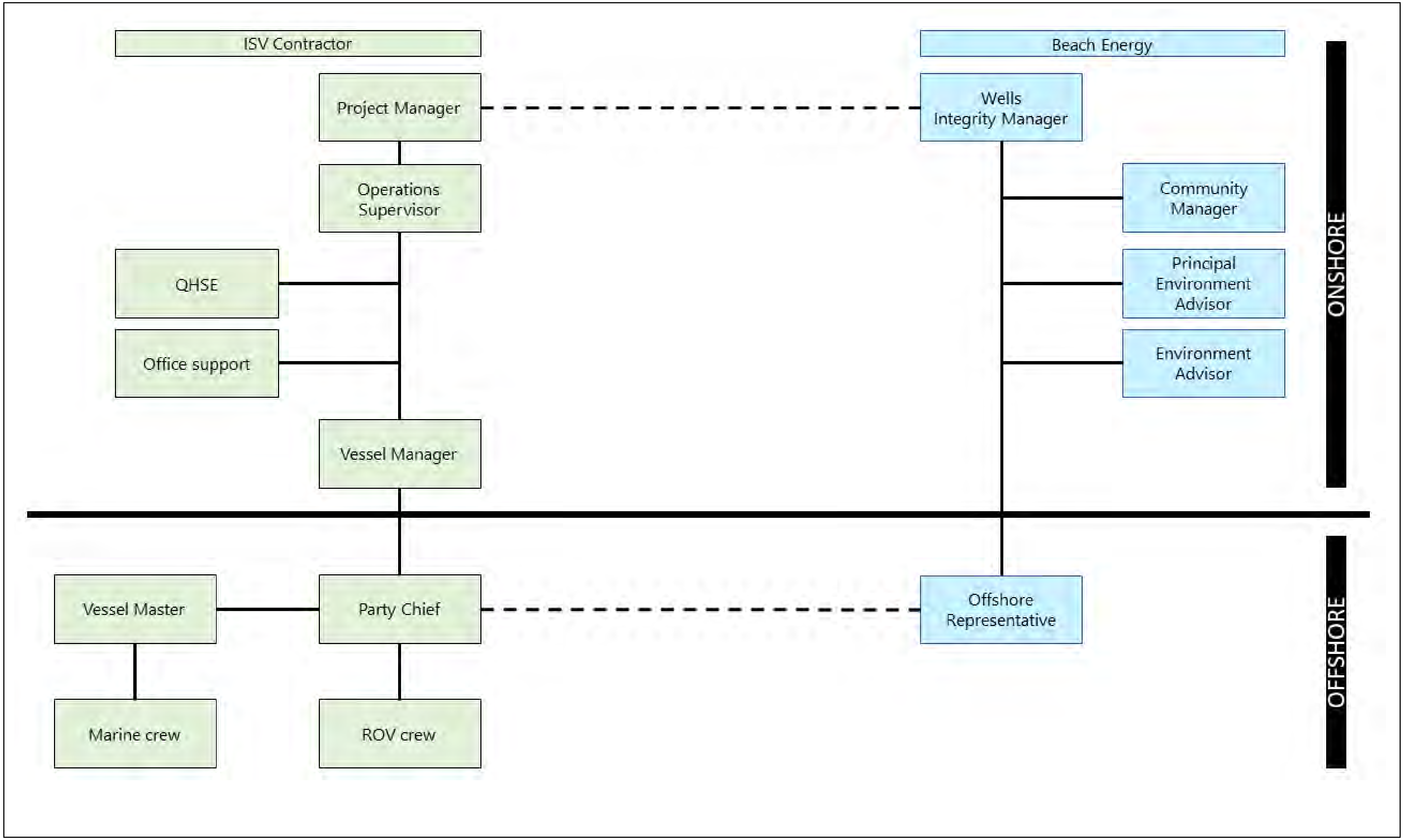


Figure 8.2. Non-production well operations organisation chart

Table 8.2. Non-production well operations roles and key responsibilities

Role	Key environmental responsibilities
Onshore	
Beach Chief Executive Officer	Ensures: • Beach has the appropriate organisation in place to be compliant with regulatory and other requirements and this EP. • Policies and systems are in place to guide the company's environmental performance. • Adequate resources are in place for the safe operation of all activities. • The OEMS continues to meet the evolving needs of the organisation.
Wells Integrity Manager	Ensures: • Compliance with regulatory and other requirements and this EP. • Records associated with the activity are maintained as per Section 8.4.2. • Personnel who have specific responsibilities pertaining to the implementation of this EP or OPEP know their responsibilities and are competent to fulfil their designated role. • Environmental impacts and risks associated with the activity have been identified and any new or increased impacts or risks are managed via the Management of Change (MoC) process detailed in Section 8.8.1. • Incidents are managed and reported as per Section 8.10.1. • The EP environmental performance report is submitted to NOPSEMA not within three months of activity completion. • Any changes to equipment, systems and documentation where there may be a new, or change to, an environmental impact or risk or a change that may impact the EP are assessed in accordance with the MoC process detailed in Section 8.8.1. • Oil spill response arrangements for the activity are tested as per Chapter 9. • Ensure audits and inspections are undertaken in accordance with Section 8.12.
Beach Principal Environment Advisor	Ensures: • Environmental and regulatory requirements are communicated to those who have specific responsibilities pertaining to the implementation of this EP or OPEP. • The environmental component of the activity induction is prepared and presented. • Environmental incidents are reported and managed as per Section 8.10. • The monthly and vessel inspection activity EP environmental performance report are prepared and submitted. • Any new or changed environmental impact or risk or a change that may impact the EP is reviewed and documented as per Section 8.12. • That audits and inspections are undertaken as detailed in Section 8.12 and any actions from non-conformances or improvement suggestions tracked. • Reviews and revisions to the EP are made as per the requirements in Section 8.12.
Beach Community Manager	Ensures: • Stakeholder consultation for the activity is undertaken in a timely and thorough manner. • Objections or claims raised by stakeholders are recorded and reported to the Wells Integrity Manager and Principal Environmental Advisor. • A stakeholder consultation log is maintained. • Stakeholder issues are addressed.
Offshore (relevant only during vessel activities)	
Beach Offshore Representative	Ensures: • The activity is carried out in accordance with this EP. • Vessel personnel participate in the activity induction. • Vessel personnel are competent to fulfil their designated role.

Role	Key environmental responsibilities
	• HSE issues are communicated via mechanisms such as the daily report and daily pre-start meetings. • New or increased environmental impacts or risks are managed via the MoC process detailed in Section 8.8.1. • Environmental incidents are reported and investigated as per Section 8.12. • Emissions and discharges identified in Section 8.12 are recorded and reported in the annual EP performance report. • The Well Integrity Manager is informed of any changes to equipment, systems and documentation where there may be a new or change to an environmental impact or risk or a change that may impact the EP as per Section 8.12. • HSE vessel due diligence is undertaken to ensure ongoing compliance with the EP.
Vessel Master	Ensures: • Vessel operations are carried out in accordance with regulatory requirements and this EP. • Vessel personnel are competent to fulfil their designated role. • Personnel new to the vessel receive a vessel-specific induction. • Environmental incidents are reported to the Beach Offshore Representative/Wells Integrity Manager within required timeframes as per Section 8.10. • Emissions and discharges identified in Section 8.12 are recorded and provided to the Beach Offshore Representative/Wells Integrity Manager. • Oil spill response arrangements are in place and tested as per the vessel's SMPEP. • General and hazardous wastes are backloaded to port for disposal to a licenced waste facility.
Vessel personnel	All vessel crew are responsible for: • Completing the Beach HSE induction. • Reporting hazards and/or incidents via company reporting processes. • Adhering to the vessel's HSEMS and this EP in letter and in spirit. • Undertaking tasks safely and without harm to themselves, others, equipment or the environment and in accordance with their training, operating procedures and work instructions. • Stopping any task that they believe to be unsafe or will impact on the environment.

This element recognises that a systematic risk-based approach to HSE management is in place as an integral part of leadership and planning, and that HSE goals and targets must be established and measured. A philosophy of continuous improvement is applied to all Beach operations.

Targets for environmental performance are detailed throughout Chapter 7 of this EP. The EPO and EPS have been established to ensure that the impacts of planned activities and the risks of unplanned events are managed to ALARP and to an acceptable level.

Additionally, the EPO and EPS emerging from this Implementation Strategy are summarised in Section 8.13.

8.3 Element 2 – Financial Management and Business Planning

Element 2 seeks to ensure robust and achievable business plans are developed and supported by a consistent and realistic understanding of facility constraints. It drives robust analysis and accountable decision-making to deliver assets that maximise lifecycle value, providing clear cost control throughout the life of an asset.

There are four standards (see Table 8.1) and ten outcomes to be delivered under this element.

This EP does not cover the risks involved in financial management and impact on the non-production well operations. The relevant impacts of financial and business planning risks are managed under the other OEMS elements described in this chapter.

8.4 Element 3 – Information Management and Legal

Element 3 describes the measures Beach must take to ensure ongoing compliance with regulatory and legal obligations in order to protect the Company's value and reputation, and to maintain Beach's licences to operate. Beach's ability to safely perform its duties in line with its legal obligations relies on robust management of documents and information.

There are three standards (see Table 8.1) and seven outcomes to be delivered under this element. The standards relevant to the implementation of this EP are described below.

8.4.1 Standard 3.1 – Regulatory Compliance Standard

Standard 3.1 describes the responsibilities of each stakeholder and the processes for identifying, maintaining, managing and reporting Beach's regulatory compliance obligations. The Standard details the minimum requirements of a system to ensure effective Regulator engagement can be maintained across all its activities including permissioning, project execution, operating and reporting.

Chapter 2 of this EP details the key environmental legislation applicable to the non-production well operations. The acceptability discussion for each hazard assessed in Chapter 7 specifically details the legislation pertaining to each hazard.

8.4.2 Standard 3.2 – Document Management Standard

Standard 3.2 specifies the minimum requirements to ensure that all Beach documents and records are managed in alignment with legal, regulatory and stakeholder requirements. It requires documents to be classified, developed, authorised, published, stored, accessed, reviewed and disposed consistently and in a manner that complies with company and statutory obligations. The document management system will clearly support the safe and efficient operations of the Company.

In accordance with Regulations 27 and 28 of the OPGGS(E), documents and records relevant to the implementation of this EP are stored and maintained in the Beach document control system ('BoardWalk') for a minimum of five years. These records will be made available to regulators in electronic or printed form upon request.

8.4.3 Standard 3.3 – Information Management Standard

Standard 3.3 ensures that Beach implements appropriate Information Management practices to ensure information is managed as a corporate asset, enabling it to be exploited to support corporate objectives as well as satisfying Beach's legal and stakeholder requirements.

8.5 Element 4 – People, Capability and Health

Element 4 focuses on ensuring the people within the business are fully equipped with the competencies required to perform their assigned duties and are physically and mentally prepared. This element is important in protecting workers' health and is closely aligned with Standard 8.1 (Risk Management) and Standard 8.2 (Safe Systems of Work).

There are two standards (see Table 8.1) and four outcomes to be delivered under this element. Standard 4.1 is discussed below, noting that the health management standard is not relevant to the EP.

8.5.1 Standard 4.1 – Training and Competency Standard

Standard 4.1 describes the minimum company requirements to ensure personnel training requirements are identified and meet the tasks they are required to perform, and that verification of competency is carried out where necessary. The Standard defines the responsibilities for ensuring suitable training programmes are available and for ensuring people's levels of capability are maintained at the required level.

Each employee or contractor with responsibilities pertaining to the implementation of this EP shall have the appropriate competencies to fulfil their designated role.

During vessel-based activities, to ensure that personnel are aware of the EP requirements for the activity, vessel personnel will complete an activity-specific environmental induction. Records of completion of the induction will be recorded and maintained. The induction will cover (but is not limited to):

- Description of the environmental sensitivities and conservation values of the activity area;
- Controls to be implemented to ensure impacts and risks are ALARP and of an acceptable level;
- Requirement to follow procedures and use risk assessments/job hazard assessments to identify environmental impacts and risks and appropriate controls;
- Requirements for interactions with fishers and/or fishing equipment;
- Requirement for responding to and reporting environmental hazards or incidents; and
- Overview of emergency response and spill management plans and vessel interaction procedures.

In addition to the activity-specific induction, each person with specific responsibilities pertaining to the implementation of this EP shall be made aware of their responsibilities, and the specific control measures required to maintain environmental performance and legislative compliance.

The Beach Offshore Representative is responsible for delivering the induction, or facilitating it if presented by another member of the team.

The vessel contractor will conduct their own company and vessel-specific inductions independently of the activity-specific HSE induction.

This element also includes the management of HSE risks to personnel associated within the working environment and encourages a healthy lifestyle for its employees and provides formal programs to promote health and fitness. These are not related to the implementation of the EP and are not addressed here.

8.5.2 Toolbox Talks and HSE Meetings

During vessel-based activities, environmental matters will be included in daily toolbox talks as required by the specific task being risk assessed (e.g., waste management).

Environmental issues will also be addressed in daily operations meetings, where each shift will participate with the Beach Offshore Representative and Vessel Master in discussing HSE matters that have arisen.

8.5.3 Communications

The Vessel Master and Beach Offshore Representative are jointly responsible for keeping the vessel crew informed about HSE issues, acting as a focal point for personnel to raise issues and concerns and consulting and involving all personnel in the following:

- Issues associated with implementation of the EP;
- Any proposed changes to equipment, systems or methods of operation of equipment, where these may have HSE implications; and

- Any proposals for the continuous improvement of environmental protection, including the setting of environmental objectives and training schemes.

Table 8.3 outlines the key meetings that will take place onshore and offshore during the inspection activities.

Table 8.3. Activity communications during inspections

Meeting	Frequency	Attendees
Onshore		
Beach activity team	Daily	All team members
Offshore		
Operations	Daily	Beach onshore activity team, department heads, Beach Offshore Representative, Vessel Master
Pre-start safety meeting	Daily – prior to each shift	All personnel
Toolbox	Before each task	All personnel involved in task

8.6 Element 5 – Contracts and Procurement

Element 5 addresses the acquiring of external services and materials, and the transportation of those materials. It ensures Beach's business interests are met while maintaining compliance with all legal obligations and retaining HSE performance as the top priority. Element 5 also documents requirements for management of land transport risks.

There are two standards (see Table 8.1) and four outcomes to be delivered under this element.

The vessel contractor will be assessed to ensure they have the capabilities and competencies to implement the control measures identified in Chapter 7. Training and competency of contractor personal engaged to work on the activity shall be managed in accordance with the contractor's HSEMS (or equivalent).

8.7 Element 6 – Asset Management

The focus of Element 6 is the design, build and operation of assets. The underpinning standards reflect the importance of inherent safety in design, recognising that hazards and risk are to be reduced to ALARP in the design phase of an asset. The standards define the minimum requirement for the monitoring and assurance processes that support the ongoing safe and reliable management of an asset throughout its lifecycle. Element 6 draws heavily on the principles of process safety and is closely aligned with Elements 7 (Operational Control) and Element 8 (Risk Management).

There are five standards (see Table 8.1) and eight outcomes to be delivered under this element, with the standards discussed below.

8.7.1 Standard 6.1 – Asset Management Standard

The Asset Management Standard (CDN 18985355) ensures that assets are engineered, designed and constructed to be inherently safe, delivered at optimal cost, and maintained throughout their full lifecycle. Verification of identified integrity barriers is performed periodically during the full life of the asset. The Standard ensures operating, integrity and reliability risks are controlled and managed to prevent major accident events or major incidents.

8.7.2 Standard 6.2 - Maintenance Management Standard

The Maintenance Management Standard (CDN 18985356) describes the minimum requirements of maintenance systems and activities required to maintain plant integrity, optimal reliability, availability and performance. The Standard covers the planning, management and execution of maintenance activities including tools to support maintenance processes.

8.7.3 Standard 6.3 - Well Integrity Management Standard

The Well Integrity Management Standard (CDN 18985354) ensures that the integrity of wells is assured through the Operate phase, and that the risk of failure of integrity is avoided. Maintaining well integrity prevents loss of containment events including major accident events, risk to personnel or assets, damage to the environment, production losses, financial loss, and damage to company reputation. The Standard describes the requirements of the operating system to ensure well limits are not exceeded, and a monitoring and assessment regime enables early warning signs to be identified which may require remedial activity.

8.7.4 Standard 6.4 - Well Construction Management Standard

The Well Construction Management Standard is not of particular relevance to this activity given that the design and construction of the wells took place many years ago.

Where Beach has no operational control of a facility (in this case, the ISV), plant and equipment that have been identified as a control measure for the purpose of managing potential environmental impacts and risks have an associated EPS that details the performance required of the plant and/or equipment as detailed in Chapter 7.

8.7.5 Standard 6.5 - Project Management Standard

The Project Management Standard (CDN 18985352) defines the minimum requirements for the management of all capital and other projects where Beach is the Operator. It includes drilling, workover and abandonment of wells, modification and maintenance project activities including decommissioning.

During the contractor selection process, Beach will ensure that the vessel contractor maintains all plant and equipment in good working order.

8.8 Element 7 – Operational Control

Element 7 focuses on the definition of parameters, practices and procedures required to ensure adequate controls and safe execution of work at operating assets. It deals with the ongoing management of barrier integrity throughout asset lifecycle, ensuring good process safety practices are consistently deployed, and that facility changes manage holistic risk.

There are three standards (see Table 8.1) and ten outcomes to be delivered under this element. The standard of relevance to this EP is briefly discussed below.

The Operational Integrity Standard (CDN 18985351) defines the minimum requirements to be met by critical operating and work control systems that ensure safe execution of work and operational control. It details core safe processes and systems such as Permit to Work, equipment isolation and over-ride of safety critical devices. The Standard covers operating requirements to ensure facilities do not exceed established operating design parameters and ensures that good safe operating practices are followed during the handover and start-up of equipment, shift handovers and during normal operations.

8.8.1 Standard 7.3 – Management of Change Standard

Standard 7.3 defines the minimum planning and implementation requirements for technical and organisational change at Beach. It details the requirement for holistic assessment of the change, the requirement for consultation with stakeholders dependent upon the nature of the change, and the need for clear accountability for the change. Risk associated with change is mitigated by ensuring change is appropriately approved, effectively implemented, formally assured and closed out upon completion. Any changes must be classified as either temporary or permanent.

The intent of the MoC Standard is that all temporary and permanent changes to the organisation, personnel, systems, procedures, equipment, products and materials are identified and managed to ensure HSE risks arising from these changes remain at an acceptable level.

Changes to equipment, systems and documentation are managed in accordance with the MoC Standard to ensure that all proposed changes are adequately defined, implemented, reviewed and documented by suitably competent persons. This process is managed using an electronic tracking database (called 'Stature'), which provides assurance that all engineering and regulatory requirements have both been considered and met before any change is operational. The MoC process includes not just plant and equipment changes, but also documented procedures where there is an HSE impact, regulatory documents and organisational changes that impact personnel in safety critical roles.

Not all changes require a MoC review. Each change is assessed on a case-by-case basis. The potential environmental impacts and/or risks are reviewed by a member of the Beach Environment Team to determine whether the MoC review process is triggered.

Where risk and hazard review processes nominated in Section 8.9 identify a change in hazards, controls or risk (compared to those described and assessed in Chapter 7), and triggers a regulatory requirement to revise this EP, the revision shall be defined, endorsed, completed and communicated in accordance with the MoC Standard.

8.9 Element 8 – Risk Management and Hazard Control

The identification, assessment and treatment of risk is central to maintaining control of assets. Element 8 defines the means by which Beach manages all types of risk to the business. This element includes general risk management, the Safe Systems of Work by which site activities are controlled and executed, and the emergency and security arrangements in place to protect the Company from unplanned events or the attempts of others to do harm to the business.

There are three standards (see Table 8.1) and seven outcomes to be delivered under this element. The standards of relevance to this EP are briefly discussed below.

8.9.1 Standard 8.1 – Risk Management Standard

Standard 8.1 defines Beach's requirements to mitigate and manage risk at all levels within the business. It defines the Risk Management Framework for identifying, understanding, managing and reporting risks. The framework defines the documents, training, tools and templates to be used, and the accountabilities to be applied in support of effective risk management. Risks to people, the environment, Beach's reputation, financial position and any legal risks are assessed through the framework. The Standard defines the purpose and use of risk assessments and risk registers. The environmental risk management framework applied to this activity is described in Chapter 6 and applied to all the hazards assessed in Chapter 7 of this EP.

As described in Section 8.12, Beach will undertake a review of this EP if required in order to ensure that any changes to the activity, controls, regulatory requirements and information from research, stakeholders, industry bodies or any other sources to inform the EP are assessed using the risk management tools nominated. The review will ensure that the environmental impacts and risks of the activity continue to be reduced to ALARP and an acceptable level.

If revision of this EP is trigged though a change in risk or controls, the revision process shall be managed in accordance with the MoC process outlined in Section 8.8.1.

8.9.2 Standard 8.3 – Emergency and Security Management Standard

Standard 8.3 defines the minimum performance requirements to effectively manage credible emergency and security events, and to enable an efficient recovery to normal operations following such an event. The Standard defines the prevention, preparedness, response and recovery principles to be applied, the organisational structures to support emergency and security measures, and the training and testing protocols that must be in place to assure Beach maintains a state of readiness.

The emergency response framework to be applied to the non-production well operations is outlined below.

Emergency Response Framework

The Beach Crisis and Emergency Management Framework consists of a tiered structure whereby the severity of the emergency triggers the activation of emergency management levels. The emergency response framework contains three tiers based on the severity of the potential impact, as outlined in Figure 8.3. This framework is described in the Beach Emergency Management Plan (EMP) (CDN/ID 128025990).

The responsibilities of the Emergency Response Team (ERT), Emergency Management Team (EMT) and Crisis Management Team (CMT) are outlined in Table 8.4.

The key emergency response arrangements for the non-production well operations are outlined herein.

<u>Emergency Response Plan</u>

Prior to the mobilisation of the vessel contractor to the activity area, Beach will prepare a bridging ERP that bridges to the emergency response measures in the vessel contractor's vessel-specific ERP to ensure that all emergency management functions are accounted for.

The Bridging ERP will describe the emergency roles and responsibilities for those on the vessel and outline the actions to be taken for potential activity-specific scenarios (e.g., loss of containment, vessel collision, fire, man overboard, fatality, etc). The Bridging ERP will define the communication requirements to notify both the company and external bodies of the incident so as to obtain assistance where needed and to fulfil reporting obligations.

The Bridging ERP will be supported by the Beach EMP. The EMP provides the standard mechanism for the EMT to operate from and includes guidance on effective decision-making for emergency events, identification, assessment and escalation of events and provides training and exercise requirements. The EMP provides information on reporting relationships for command, control and communications, together with interfaces to emergency services specialist response groups, statutory authorities and other external bodies. The roles and responsibilities are detailed for onshore and offshore personnel involved in an emergency, including the response teams, onshore support teams, visitors, contractors and employees. The EMP details the emergency escalation protocol depending on the nature of the emergency.

Associated with the EMP are the Emergency Response Duty Roster and Contact Lists. These documents constitute a suite of emergency response documents that form the basis for Beach's response to an emergency situation.

Where a third-party contractor (TPC) company is required to work under its own HSE management system while on the vessel, the Bridging ERP will detail the clear reporting lines between the TPC representatives and Beach personnel.

Table 8.4. Responsibilities of the Beach crisis and emergency management teams

Team	Base	Responsibilities
CMT	Adelaide head office	• Strategic management of Beach's response and recovery efforts in accordance with the Crisis Management Plan. • Provide overall direction, strategic decision-making as well as providing corporate protection and support to activated response teams. • Activate the CMT if required.
EMT	Melbourne office (or Adelaide office, depending on roster)	• Provide operational management support to the ERT to contain and control the incident. • Implement the Business Continuity Plan. • Liaise with external stakeholders in accordance with the Bridging ERP. • Regulatory reporting.
ERT	ISV	• Respond to the emergency in accordance with the site-specific ERP (e.g., SMPEP).

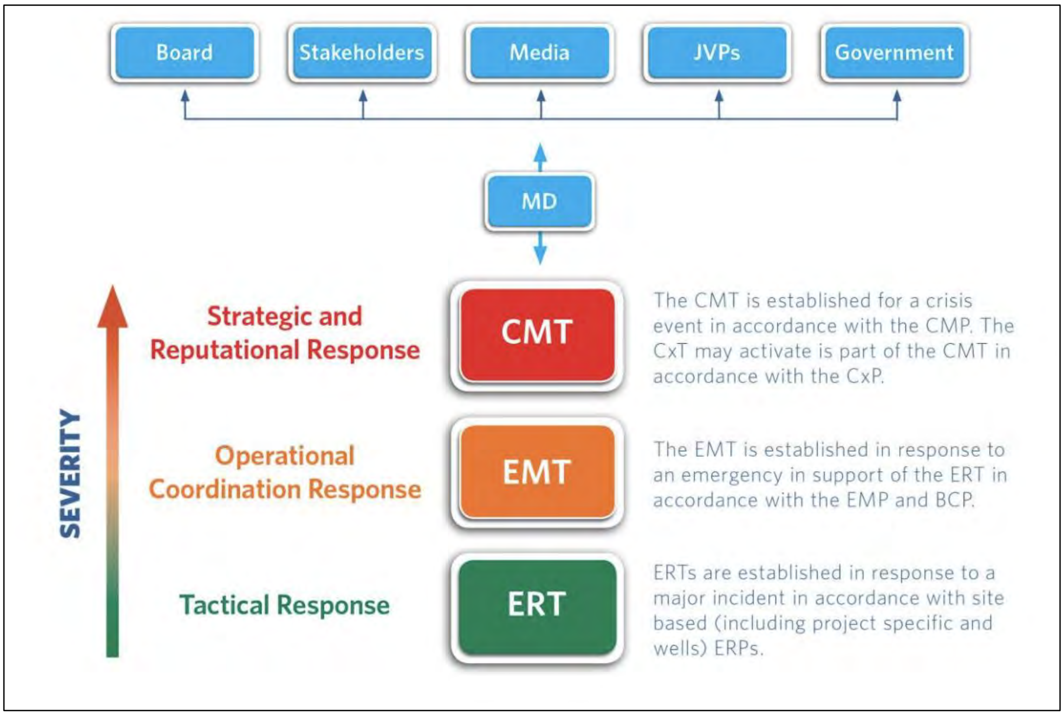


Figure 8.3. Beach Crisis and Emergency Management Framework

Prior to commencing inspection activities, office and vessel-based personnel will participate in a desktop emergency response review to test the emergency response arrangements. The outcomes of the review will be documented to assess the effectiveness of the review and to record any lessons and actions, and the outcomes will be communicated to participants. Actions will be recorded and tracked to completion. This emergency response review may be combined with a review of spill response arrangements (see Section 9.4).

8.9.3 Adverse Weather Protocols

It is the duty of the Vessel Master to act as the focal point for all actions and communications with regards to any emergency, including response to adverse weather or sea state, to safeguard his vessel, all personnel onboard and environment.

During adverse weather, the Vessel Master is responsible for the following:

- Ensuring the safety of all personnel onboard;
- Monitor all available weather forecasts and predictions;
- Initiating the vessel safety management system, vessel HSE procedures and/or vessel ERP;
- Keeping the Beach Offshore Representative fully informed of the prevailing situation and intended action to be taken;
- Assessing and maintaining security, watertight integrity and stability of vessel; and
- Proceeding to identified shelter location(s) as appropriate.

Other appropriate responsibilities shall be taken into consideration as dictated by the situation.

In addition to in-vessel VHF Marine Radio Weather Services, the vessel contractor will obtain daily weather forecasting from the Bureau of Meteorology (and/or other services) to monitor weather within the activity area in the lead up to and for the duration of the inspection activities.

8.10 Element 9 – Incident Management

Element 9 defines how Beach classifies, investigates, reports and learns from incidents. An incident is any unplanned event or change that results in potential or actual adverse effects or consequences to people, the environment, assets, reputation, or the community.

There is one standard (see Table 8.1) and five outcomes to be delivered under this element, with the standard discussed below.

8.10.1 Standard 9.1 – Incident Management Standard

Standard 9.1 defines the requirement for incident reporting and subsequent investigation requirements. It ensures that incident classification is applied consistently across the company, and that the appropriate level of investigation and approval authority is implemented. The standard describes the requirement for identifying and assigning remedial actions, and for communicating key learnings throughout the business. As such, the standard also defines the requirement for adequate training for those persons involved in performing investigations.

The incident management standard requires that all HSE incidents, including near misses, are reported, investigated and analysed to ensure that preventive actions are taken and learnings are shared throughout the organisation.

Incident reports and corrective actions are managed using the CMO Incident Management System.

The recordable and reportable incident types are described in this section.

Recordable Incident Management

Regulation 4 of the OPGGS(E) regulations defines a 'recordable' incident as:

A breach of an EPO or EPS in the EP that applies to the activity that is not a reportable incident.

Routine monthly recordable incident reports, including 'nil' incident reports, are prepared by the Beach Principal Environment Advisor and submitted to NOPSEMA by the 15th of each month. These are reported using the NOPSEMA template Monthly Environmental Incident Reports (N-03000-FM0928). Table 8.5 summarises the recordable incident reporting requirements. These reports will only be submitted when a vessel activity has taken place.

Table 8.5. Recordable incident reporting details

Timing	Reporting requirements	Contact
By the 15th of each month (when vessel activities have taken place)	• All recordable incidents that occurred during the previous calendar month. • The date of the incident. • All material facts and circumstances concerning the incidents that the operator knows or is able to reasonably find out. • The EPO and/or EPS breached. • Actions taken to avoid or mitigate any adverse environmental impacts of the incident. • Corrective actions taken, or proposed to be taken, to stop, control or remedy the incident. • Actions taken, or proposed to be taken, to prevent a similar incident occurring in the future. • Actions taken, or proposed, to prevent a similar incident occurring in the future.	NOPSEMA – submissions@nopsema.gov.au

Reportable Incident Management

Regulation 4 of the OPGGS(E) defines a 'reportable' incident as:

> *An incident that has caused, or has the potential to cause, moderate to significant environmental damage.*

In the context of the Beach Environmental Risk Matrix, Beach interprets 'moderate to significant' environmental damage to be those hazards identified through the EIA and ERA process (see Chapter 7) as having an inherent or residual impact consequence of 'serious (3)' or greater. There is only one risk with this rating (as outlined throughout Chapter 7):

- Risk 6 – Introduction of IMS.

Table 8.6 presents the reportable incident reporting requirements.

Table 8.6. Reportable incident reporting requirements

Timing	Requirements	Contact
Verbal notification		
Within 2 hours of becoming aware of incident	The verbal incident report must include: • All material facts and circumstances concerning the incident that the titleholder knows, or is able, by reasonable search or enquiry, to find out; • Any actions taken to avoid or mitigate any adverse environmental impacts of the reportable incident; and • The corrective action that have been taken, or is proposed to be taken, to stop, control or remedy the reportable incident.	• NOPSEMA – 1300 674 472
	For a Level 1, 2 or 3 hydrocarbon spill, as above.	As above, plus: • AMSA – 1800 641 792 (24 hrs) • DJPR – 0409 858 715 • DPIPWE – 03 6165 4599 • DNP - 0419 293 465

Timing	Requirements	Contact
	Oiled wildlife	• DELWP – 1300 134 444 (24 hrs) • DPIPWE - 03 6165 4599
	Suspected or confirmed IMS introduction	• DELWP – 136 186 (24 hrs) • DAWE - 1800 803 772 (general enquiries)
	Injury or death of EPBC Act-listed or FFG Act-listed fauna (e.g., vessel collision)	• DELWP – 1300 134 444 (24 hrs) • DAWE – 1800 803 772 • Whale and dolphin emergency hotline – 1300 136 017 • DELWP (Whale and Dolphin Emergency Hotline) – 1300 136 017 • AGL marine response unit – 1300 245 678
Written notification		
Not later than 3 days after the first occurrence of the incident	A written incident report must include: • All material facts and circumstances concerning the incident that the titleholder knows, or is able, by reasonable search or enquiry, to find out; • Any actions taken to avoid or mitigate any adverse environmental impacts of the reportable incident; • The corrective action that have been taken, or is proposed to be taken, to stop, control or remedy the reportable incident; and • The action that has been taken, or is proposed to be taken, to prevent similar recordable incidents occurring in the future.	• NOPSEMA – submissions@nopsema.gov.au
Within 72 hours of the incident	As above, with regard to details of a vessel strike incident with a cetacean	• Upload information to DAWE online National Ship Strike Database (https://data.marinemammals.gov.au/ report/shipstrike)
Within 7 days of the incident	As above, with regard to impacts to MNES, specifically injury to or death of EPBC Act-listed species	• EPBC.Permits@environment.gov.au
Within 7 days of providing written report to NOPSEMA	As above.	• NOPTA – reporting@nopta.gov.au

Incident Investigation

Any non-compliance with the EPS outlined in this EP during vessel activities will be investigated and follow-up action will be assigned as appropriate.

The findings and recommendations of investigations will be documented and distributed to the relevant contractor and Beach personnel for review. Tracking the close-out actions arising from investigations is managed via the Beach CMO Incident Management System.

Investigation outcomes will be communicated to relevant Beach personnel and the vessel contractor.

8.11 Element 10 – Environment and Community

Element 10 focuses on the measures the organisation must take to ensure that it upholds its reputation as a responsible and ethical company and continues its open and transparent engagements with its communities and stakeholders. Beach operates in environmentally sensitive areas, in close proximity to communities, with potential impacts on stakeholders. Beach has an obligation to ensure that potential impacts from its activities are clearly identified, minimised to ALARP and mitigated where there is an economic loss to a stakeholder directly impacted by Beach activities.

There are two standards (see Table 8.1) and three outcomes to be delivered under this element, with the standards discussed below.

8.11.1 Standard 10.1 – Environment Management Standard

Standard 10.1 ensures that Beach implements appropriate plans and procedures to conduct its operations in an environmentally responsible and sustainable manner. The standard defines the requirement to assess environmental impacts and risks that may result from the company's operations and for site-specific management plans to protect the environment from harm. The standard covers land disturbance, reinstatement and rehabilitation activities, and defines obligations for management of biodiversity, water systems, air quality, noise and vibration, amenities and waste.

This EP provides the key means of satisfying this HSEMS standard. The key environmental management issue for this EP is managing IMS risks, discussed below.

Beach Domestic IMS Biofouling Risk Assessment Process

Scope

The ISV and submersible equipment mobilised from international or domestic waters to undertake the activity within the activity area must complete the Beach Introduced Marine Species Management Plan (S4000AH719916) vessel risk assessment process and complete the associated checklist prior to the initial mobilisation into the activity area.

The Beach Introduced Marine Species Management Plan risk assessment process does not include an evaluation of potential risks associated with ballast water exchange given all vessel operators contracted to Beach must comply with the most recent version of the Australian Ballast Water Management Requirements.

Purpose

- Validate compliance with regulatory requirements (Commonwealth and State) in relation to biosecurity prior to engaging in the activity within the activity area;
- Identify the potential IMS risk profile of the ISV and submersible equipment prior to deployment within the activity area;
- Identify potential deficiencies of IMS controls prior to entering the activity area;
- Identify additional controls to manage IMS risk; and
- Prevent the translocation and potential establishment of IMS into non-affected environments (either to or from the activity area).

Screening Assessment

Prior to the initial mobilisation of the vessel or submersible equipment to the activity area, a screening assessment must be undertaken considering:

- All relevant IMO and regulatory requirements under the *Australian Biosecurity Act* 2015 and/or relevant State legislation must be met;
- If mobilising from a high or uncertain risk area, the vessel/submersible equipment must have been within that area for fewer than 7 consecutive days or inspected and deemed low risk by an independent IMS expert, within 7 days of departure from the area;
- The ISV must have valid antifouling coatings based upon manufacturers specifications;
- The ISV must have a biofouling control treatment system in use for key internal seawater systems; and
- The ISV must have a Biofouling Management Plan and record book consistent with the IMO 2011 *Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species* (IMO Biofouling Guidelines).

Where relevant criteria have been met, no further management measures are required, and the vessel/submersible equipment may be deployed into the activity area.

Where relevant criteria have not been met, or there is uncertainty if these criteria have been met, Beach must engage an independent IMS expert to undertake a detailed biosecurity risk assessment, and the vessel/submersible equipment must be deemed low risk prior to mobilisation into the activity area.

<u>Basis of Detailed IMS Biofouling Risk Assessment</u>

The basis by which an independent IMS expert evaluates the risk profile of a vessel/submersible equipment includes:

- Age, type and condition of the vessel/submersible equipment;
- Previous cleaning and inspection undertaken and the outcomes of previous inspections;
- Assessment of internal niches with potential to harbour IMS;
- Vessel/equipment history since previous inspection;
- Origin of the vessel/submersible equipment including potential for exposure to IMS;
- Translocation risk based upon source location in relation to activity location – both in relation to the water depth/proximity to land at the point of origin and the potential survivorship of IMS from the point of origin to the activity area;
- Mobilisation method – whether dry or in-water (including duration of low-speed transit through high or uncertain risk areas);
- For the ISV, the application, age and condition of antifouling coatings;
- Presence and condition of internal seawater treatment systems;
- Assessment of Biofouling Management Plan and record book against IMO Biofouling Guidelines; and
- Where deemed appropriate, undertake in-water inspections.

8.11.2 Standard 10.2 – Community Engagement Standard

Standard 10.2 defines the minimum requirements for the conduct of Beach and its staff within the community, and the commitments to plan and execute effective community engagement in the course of its business. Beach staff will conduct themselves as ambassadors for the company and engage positively and respectfully with the community.

The standard describes the obligation of the company to proactively engage with the community at the outset of any activity that may have an impact on that community, and to develop a stakeholder engagement plan to manage that engagement.

Stakeholder consultation specific to this activity is described in Chapter 4 of the EP.

8.12 Element 11 – Assurance and Reporting

Element 10 establishes that the company must apply the requirements of relevant policies, and the commitments detailed in the OEMS standards throughout its activities. An assurance process therefore exists to systematically quantify compliance with those commitments, and with the underlying procedures and systems. This Element also documents Beach's approach to sustainability and reporting company performance using established sustainability performance metrics.

There are two standards (see Table 8.1) and four outcomes to be delivered under this element, with the standards relevant to the non-production well operations discussed below.

8.12.1 Standard 11.2 – Assurance Management Standard

Standard 11.2 describes the "Three Lines of Defence" assurance model employed by Beach to govern its activities and ensure compliance with its commitments and standards. The standard defines Beach's requirements for the establishment and management of risk-based assurance activities at all levels within the company. The assurance process establishes the adequacy and effectiveness of Beach's risk controls and quantifies the status of compliance against our obligations. It ensures the organisation proactively closes any gaps in performance so it can address those issues before harm is manifested. As such, the assurance programme identifies improvement opportunities in business processes and risk controls.

The Standard describes the need to have assurance plans across the business, and for the assurance activities to take place on multiple levels of the organisation. This approach collectively ensures the operational activities Beach perform are compliant with its procedures, standards and ultimately with governing policies and legislative obligations. The holistic results of the assurance programme are reportable to the Board and Committees.

The assurance methods that will be used to ensure compliance with the EPS in this EP are described in this section.

Emissions and Discharge Records

Beach maintains a quantitative record of emissions and discharges as required under Regulation 14(7) of the OPGGS(E). This includes emissions and discharges to air and water (from both planned and unplanned activities). Results are reported in the ISV activity EP performance report submitted to NOPSEMA.

A summary of the environmental monitoring to be undertaken during vessel activities is presented in Table 8.7.

Table 8.7. Summary of environmental monitoring

Aspect	Monitoring parameter	Frequency	Record
Impacts			
Atmospheric emissions	Fuel consumption	Tallied at end of the campaign from daily reports and/or bunker receipts	Emissions register
Bilge water	Volume of bilge water discharged during the activity	Each discharge (infrequent)	Oil record book
Risks			

Aspect	Monitoring parameter	Frequency	Record
Waste disposal	Weight/volume of wastes sent ashore (including oil sludge, solid/hazardous wastes)	Tallied at end of the activity	Waste manifest
Displacement of or interaction with third-party vessels	Ongoing patrol for, and communications with, third-party vessels. Radar surveillance from the vessel.	Continuous during activity	Bridge communications book
Introduction of IMS to activity area	Volume and location of ballast water discharges noted	Each discharge	Ballast water log
MDO spill	Operational monitoring in line with the OPEP and scientific monitoring in line with the OSMP (depending on spill volume)	As required	Incident reports

Routine Reporting and Notifications

Regulation 11A of the OPGGS(E) specifies that consultation with relevant authorities, persons and organisations must take place. This consultation includes an implicit obligation to report on the progress of the activity. Table 8.8 outlines the routine reporting obligations that Beach will undertake with external organisations before, during and after vessel activities.

Table 8.8. External routine reporting obligations

Requirement	Timing	Contact details	OPGGS(E) regulation
Before inspection activity			
Notify AMSA's Joint Rescue Coordination Centre (JRCC) in order to issue daily AusCoast warnings.	Within 24 - 48 hours of activity starting.	rccaus@amsa.gov.au 1800 641 792 +61 2 6230 6811	11A
Notify NOPSEMA with the activity commencement date.	At least 10 days prior to activity starting.	submissions@nopsema.gov.au	29
Notify all other stakeholders in the stakeholder register with the activity commencement date.	Two weeks prior to activity starting.	Via email addresses managed by the Community Manager	11A
Notify the AHO of the activity commencement date and duration to enable Notices to Mariners to be issued.	Three weeks prior to activity starting.	datacentre@hydro.gov.au, 02 4223 6500	11A
Inspection activity completion			
Notify AMSA in order to cease daily AusCoast warnings.	Within 24 hours of activity completion.	rccaus@amsa.gov.au	11A
Notify all stakeholders in the stakeholder register.	Within 2 days of activity completion.	Via email addresses managed by the Community Manager	11A
Notify the AHO in order to cease the issuing of Notices to Mariners.	Within 2 days of activity completion.	datacentre@hydro.gov.au, 02 4223 6590	11A
Notify NOPSEMA of the vessel inspection activity end date.	Within 10 days of activity completion.	submissions@nopsema.gov.au	29
Performance reporting			

Requirement	Timing	Contact details	OPGGS(E) regulation
Submit an activity EP Performance Report.	Within 3 months of completion of inspection activities.	submissions@nopsema.gov.au	26C

Environment Plan Review

A member of the Beach Environment Team may determine that an internal review of the EP may be necessary based on any one or all of the following factors:

- Changes to hazards and/or controls identified in the review of the EP, which in itself is supported by:
  - Reviewing changes to AMP management arrangements (through subscription to the AMP email update service at https://parksaustralia.gov.au/marine/about/).
  - Environment and industry legislative updates (through subscriptions to NOPSEMA, APPEA and legal firms).
  - Running a new EPBC Act PMST for the EMBA to determine whether there are newly-listed threatened species or ecological communities in the EMBA.
  - Remaining up to date with new scientific research that may impact on the EIA/ERA in the EP (for example, through professional networking and APPEA membership).
  - Remaining in regular contact with stakeholders.
- Implementation of corrective actions to address internal or external inspection findings;
- An environmental incident and subsequent investigation identifies issues in the EP that require review and/or updating;
- A modification of the activity is proposed that is not significant but needs to be documented in the EP;
- Changes identified through the MoC process, such as hazards or controls, organisational changes affecting personnel in safety critical roles or OEMS; and
- Changes to any of the relevant legislation.

The Environment Team provides advice to the Wells Integrity Manager on the material impact of the items listed previously and whether or not a review of the EP should be undertaken. The scope of a review is determined by the factors that trigger the review and an appropriate team will be assembled by the Principle Environmental Advisor to conduct the review. The team may consist of representatives from the Community, Engineering, HSE, Operations or Supply Chain teams as required by the scope.

All personnel can propose changes to HSE documentation via a register located in the Document Management System. If a review of the EP is initiated, then any proposed changes held in the register will also be considered by the review team.

If a review of the EP relates to a topic that had previously been raised by a stakeholder, an updated response to affected stakeholders will be prepared and provided to affected stakeholders in a process managed by the Community Manager.

Revisions Triggering EP Re-submission

Beach will revise and re-submit the EP for assessment as required by the OPGGS(E) regulations listed in Table 8.9.

Table 8.9. EP revision submission requirements

Regulations	OPGGS(E) regulation
Submission of a revised EP before the commencement of a new activity	17(1)
Submission of a revised EP when any significant modification or new stage of the activity that is not provided for in the EP is proposed	17(5)
Submission of a revised EP before, or as soon as practicable after, the occurrence of any significant new or significant increase in environmental impact or risk not provided for in the EP	17(6)
Submission of a revised EP if a change in titleholder will result in a change in the manner in which the environmental impacts and risks of an activity are managed	17(7)

Revisions and re-submission of the EP generally centre around 'new' activities, impacts or risks and 'increased' or 'significant' impacts and risks. Beach defines these terms in the following manner:

- New impact or risk – one that has not been assessed in Chapter 7.
- Increased impact or risk – one with greater extent, severity, duration or uncertainty than is detailed in Chapter 7.
- Significant change –
  - The change to the integrity of one or more wells or the GVI deviates from the EP to the degree that it results in new activities that are not intrinsic to the existing Activity Description in Chapter 3.
  - The change affects the ability to achieve ALARP or acceptability for the existing impacts and risks described in Chapter 7.
  - The change affects the ability to achieve the EPO and EPS contained in Chapter 7.

A change in the activities, knowledge, or requirements applicable to the non-production well operations are considered to result in a 'significant new' or 'significant increased' impact or risk if any of the following criteria apply:

- The change results in the identification of a new impact or risk and the assessed level of risk is not 'Low', acceptable and ALARP;
- The change results in an increase to the assessed impact consequence or risk rating for an existing impact or risk described in Chapter 7; and
- There is both scientific uncertainty and the potential for significant or irreversible environmental damage associated with the change.

While an EP revision is being assessed by NOPSEMA, any activities addressed under the existing accepted EP are authorised to continue. Additional guidance is provided in NOPSEMA Guideline *When to submit a proposed revision of an EP* (N04750-GL1705, Rev 1, January 2017).

Minor EP Revisions

Minor revisions to this EP that do not require resubmission to NOPSEMA will be made where:

- Minor administrative changes are identified that do not impact on the environment (e.g., document references, contact details, etc.).
- A review of the activity and the environmental risks and impacts of the activity do not trigger a requirement for a revision, as outlined in Table 8.9.

Minor revisions to the EP will not be submitted to the regulators for formal assessment. Minor revisions will be tracked in the document control system.

Vessel Due Diligence

Prior to contracting a vessel for the GVI, Beach will undertake due diligence on the vessel contractor and the vessel to ensure that the EPS in the EP can be met (see also Section 8.6, Element 5 – Contracts and Procurement).

Any opportunities for improvement identified at the time of conducting the due diligence will be communicated to the relevant Beach and contractor personnel at the time. These are tracked in the Beach incident management system, which includes assigning responsibilities to personnel to manage the issue and verify that it is closed out.

Beach will provide a summary of the EP commitments for the inspection activities to the vessel contractor ahead of each inspection.

Regulatory Inspections

Under Part 5 of the OPGGS Act, NOPSEMA inspectors have the authority to enter Beach premises, including the inspection activity vessel, to undertake monitoring or investigation against this EP.

Beach will cooperate fully with the regulator during such investigations.

Completion of Vessel Activity EP Performance Report

In accordance with the OPGGS(E) Regulation 14(2), Beach will submit an EP performance report to NOPSEMA within three months of completion of each inspection. Performance will be measured against the EPO and EPS outlined in Chapter 7. The information in the report will be based on the information collected during routine communications, inspections and audits, as outlined in this chapter.

8.13 Summary of Implementation Strategy Commitments

Table 8.11 summarises the commitments provided throughout this Implementation Strategy by assigning EPOs, EPS and measurement criteria to each commitment.

Table 8.11. Summary of non-production well operations implementation strategy commitments

Section	EPO	EPS	Measurement criteria
8.4.2	All records relevant to implementation of the EP are available for five years.	All records relevant to implementation of the EP are stored in 'BoardWalk'.	EP documents are readily accessible through BoardWalk.
8.5.1	Activity personnel are trained and competent to fulfil their duties.	The LMS records and tracks core and critical HSE and technical compliance training.	Training records are readily accessible through the LMS.
		Due diligence is undertaken on contractors to ensure they are competent to work on the activity.	Contractor due diligence reports are readily available and verify their suitability to work on the activity.

Section	EPO	EPS	Measurement criteria
8.5.1	Activity personnel are familiar with their HSE responsibilities.	All personnel working on the ISV are inducted into the activity HSE requirements.	Vessel crews and visitor lists, along with induction familiarisation checklists are readily available, verifying that all personnel working on and visiting the vessel are inducted.
8.5.2 & 8.5.3	Vessel-based personnel are familiar with environmental issues.	Regular communications take place between vessel- and office-based personnel.	Records are available and verify regularity of communications.
8.8.1	Changes to approved plans (including this EP), equipment, plant, standards or procedures are assessed through the MoC process.	Changes are documented in accordance with the MoC Directive.	MoC records are available in the Stature database.
8.9.1	The EP is reviewed for currency in light of any changes to the activity, controls, legislation or relevant scientific research.	Beach Environment Team updates the EP as required.	The revision history of this EP is updated to record document changes.
8.9.2	Emergency response responsibilities are clearly defined.	A Bridging ERP will be prepared to link between Beach's EMP and the vessel contractor's vessel-specific ERP.	Bridging ERP is in place prior to the inspection activities commencing.
8.9.2	Vessel- and office-based personnel are familiar with their emergency response responsibilities.	All relevant vessel- and office-based personnel participate in a desktop emergency response review.	Review records are available.
8.10	Incident reports are issued to the regulators as required.	Recordable incidents reports are issued to NOPSEMA as per Table 8.5.	Recordable and reportable incident reports and associated email correspondence is available to verify their issue to NOPSEMA (and other agencies, as required).
		Reportable incidents are reported to NOPSEMA in accordance with the timing requirements provided in Table 8.6.	
8.10	Incidents are investigated.	Incident investigations are undertaken by suitably qualified and experienced personnel in a timely manner.	Incident investigation reports are available and align with incidents recorded in the CMS incident management system.
8.12.1	Emissions and discharges from the vessel are recorded.	Emissions and discharges from the vessel, in line with Table 8.7, are recorded.	Monitoring records are available and align with the requirements in Table 8.7.
8.12.1	Regulatory agencies and stakeholders are aware of inspection activity start and end.	Pre- and post-inspection notifications to regulatory agencies and stakeholders are issued as per Table 8.8.	Notification records verify issue.
8.12.1	This EP is reviewed and updated on an as-required basis.	This EP is reviewed and updated based on the triggers presented in Section 8.12.1 on an as-required basis.	A record of EP reviews and updates is available in BoardWalk.
			The review and/or update details are recorded in the document control page of this EP.
		If the review identifies that significant changes to the EP are required, the EP (and OPEP, if required) is updated and re-issued to the regulators.	A record of EP revision is included in the document control page of this EP.
			Associated correspondence is available to verify the re-issue of the EP to NOPSEMA.

Section	EPO	EPS	Measurement criteria
8.12.1	Contractor and vessel due diligence is undertaken ahead of offshore activities.	Due diligence is undertaken by competent personnel.	Contractor and vessel due diligence report is available.
8.12.1	A Vessel Inspection Activity EP Performance Report is submitted to NOPSEMA.	The Vessel Inspection Activity EP Performance Report is issued to NOPSEMA within three months of completion of the inspection activities.	The Vessel Inspection Activity EP Performance Report and associated email correspondence is available to verify its issue to NOPSEMA.

9. Oil Pollution Emergency Plan

The following OPEP provides an overview of Beach's arrangements for responding in a timely manner to an MDO spill during the routine monitoring and inspection of the suspended wellheads. The OPEP is presented as an EP chapter rather than a stand-alone document in recognition of the fact that the ISV is not classified as a 'facility' in Section 15 and Schedule 3 of the OPGGS Act 2006 because it:

- Does not rest on the seabed;
- Is not fixed or connected to the seabed; and
- Is not attached or tethered to a facility, structure or installation.

Because the ISV is not a 'facility', for oil spill response purposes, it is treated as any other vessel under legislation such as the *Protection of the Sea (Prevention of Pollution from Ships) Act* 1983 (Cth), *Australian Maritime Safety Authority Act* 1990 (Cth) and the *Navigation Act 2012* (Cth). It is therefore suitable to describe the spill response arrangements provided at the Commonwealth and state levels for responding to hydrocarbon spills (described in Section 9.1).

In the event of an MDO spill, the Vessel Master will assume onsite command, will make the initial regulatory notifications to AMSA as defined in Section 9.4 and will act as onsite coordinator directed by AMSA. All persons aboard the vessel will be required to act under the direction of the Vessel Master.

The ISV will have equipment on board for responding to emergencies, including but not limited to medical equipment, firefighting equipment and oil spill response equipment as defined in the vessel SMPEP.

In accordance with the Bridging ERP, the Vessel Master will notify the Beach EMT Leader of the emergency, with the EMT Leader acting as onshore liaison. Beach has insurance policies in place that will cover the costs of any clean-up or remediation activities following a spill, no matter the jurisdiction.

9.1 Oil Spill Response Arrangements

Given the nature of the activity, the credible hydrocarbon scenarios identified in Section 7.13 of this EP are associated with the ISV. The wellheads are isolated from the hydrocarbon zone, risk assessed as having adequate tested temporary barriers, and a loss of well containment is not considered credible. Therefore, the OPEP addresses the potential loss of marine diesel from the ISV only.

Based on conservative hydrocarbon spill modelling presented in Section 7.13, no impacts are expected at any shorelines or in State coastal waters. Short-term exposures of marine diesel may occur on the sea surface or in the upper water column in Commonwealth waters.

This OPEP has been developed based on the results of this modelling and encompasses multiple levels of planning and response capability. The spill scenario is considered to be very conservative because ISV tanks are never filled 100% full, fuel will have already been combusted to reach the activity area, there are no emergent features to collide into and vessel-to-vessel collision (resulting in a spill) is extremely rare.

The overall OPEP for the routine monitoring and inspection of the suspended wellheads comprises the following emergency plans:

- Vessel SMPEP – for spills contained on the vessel or spills overboard that can be managed by the vessel;
- Bridging ERP (described in Section 8.9.2);
- Beach EMP (described in Section 8.9.2); and

- The National Plan for Maritime Environmental Emergencies ('NatPlan') (AMSA, 2020) – AMSA is the jurisdictional authority and control agency for spills from vessels originating in or affecting Commonwealth waters.

9.2 National Plan Summary

The NatPlan is an integrated government and industry framework that seeks to enable effective response to marine pollution incidents and maritime casualties. In accordance with the polluter pays principles of the OPRC 1990, The framework provides for industry as the Control Agency for all spills that originate from offshore petroleum facilities (e.g., platforms, drill rigs). NOPSEMA collaborates closely with AMSA, as the manager of NatPlan, to ensure that arrangements under NatPlan, the OPGGS Act and associated regulations are aligned and understood.

As stated in Section 4.4 of the NatPlan (AMSA, 2020), for all marine pollution incidents that do not originate from a petroleum facility, AMSA is the Control Agency for spills that cannot be managed locally (i.e., Level 2 or 3 spills). Guidance for spill classification, as noted in Part 5 of the NatPlan (AMSA, 2020) is provided in Table 9.1.

Table 9.1. Guidance for spill incident classification

Characteristic	Level 1	Level 2	Level 3
Jurisdiction	Single	Multiple	Multiple, including international
Agencies	First response (e.g., vessel only)	Multiple	Agencies across government and industry
Resources	From within one area (e.g., vessel)	Intrastate	National or international resources
Type of response	First-strike	Escalated	Campaign
Duration	Single shift	Multiple shifts (days to weeks)	Extended (weeks to months)
Environment at risk	Isolated impacts, natural recovery within weeks	Significant impacts, recovery may take months, remediation required	Significant area of impacts, recovery may take months, remediation required

In Commonwealth waters, initial spill response actions will be undertaken by the vessel with subsequent actions determined in consultation with regulatory authorities under the NatPlan. AMSA is the responsible Combat Agency for hydrocarbon spills from vessels in Commonwealth waters; upon notification of a Level 2 or 3 spill, AMSA will assume control of the incident.

9.2.1 Vessel SMPEP

MARPOL Annex I requires a SMPEP to be carried on all vessels greater than 400 gross tonnes. In general, a SMPEP describes the steps to be taken:

- In the event that a hydrocarbon spill has occurred;
- If a vessel is at risk of a hydrocarbon spill occurring, and
- For notification procedures in the event of a hydrocarbon spill occurring and provides all important contact details.

The Vessel Master is in charge of implementing the SMPEP and ensuring that all crew comply with the plan.

Vessel SMPEPs include vessel-specific procedures for managing a fuel spill. The SMPEP includes information about initial response, reporting requirements and arrangements for the involvement of third parties having the appropriate skills and facilities to effectively respond to oil spill issues. The SMPEP will be the principal working document for the vessel and crew in the event of an MDO spill. The SMPEP describes specific emergency procedures including steps to control discharges for bunkering spills, hull damage, grounding and stranding, fire and explosion, collisions, vessel list, tank failure, sinking and vapour releases. The SMPEP also includes requirements for regular emergency response drills of the plan and revisions following drills or incidents.

Priority actions in the event of an MDO spill are to:

1. Make the area safe;
2. Stop the leak (source control); and
3. Ensure that further spillage is avoided.

All deck spills will be cleaned-up immediately, using appropriate equipment from the onboard spill response kits to minimise any likelihood of discharge of hydrocarbons or chemicals to the sea.

The Vessel Master is responsible for activating and implementing the vessel SMPEP, the shipboard ERT is responsible for both prevention and response activities with detailed instructions for the team being listed in the vessel SMPEP.

Specifically, the SMPEP provides the following:

- A description of all actions to be taken by onboard personnel to reduce or control the discharge following an MDO spill;
- A detailed description of all spill response equipment held onboard the vessel, including what equipment is available and where it is stored;
- Detailed diagrams of the vessel, including locations of drainage systems, location of spill response equipment and general layout of the vessel;
- An outline of the roles and responsibilities of all onboard personnel with regard to MDO spills;
- A description of the procedures and contacts required for the coordination of MDO spill response activities with the relevant Commonwealth and state agencies; and
- Requirements for testing of the SOPEP and associated drills.

Beach will conduct a desktop SMPEP review prior to the commencement of the EP activity (see Section 9.4).

9.3 Spill Response Options Assessed

Spill response mitigation measures will be implemented as appropriate to reduce the likelihood of impacts to key marine environmental receptors. The objectives of spill response include the protection of human health, environmental values, and the protection of assets.

The selection of spill response techniques in any situation will include an operational net environmental benefit analysis (NEBA) to confirm the suitability of the strategic spill response NEBA (see Section 7.14). The operational NEBA would be jointly conducted between AMSA and Beach and will take into account priorities for protection and sensitivity of the receptors at risk, as well as operational limitations including the amount and availability of equipment, access to competent personnel, logistical support, access, maintaining equipment deployments, waste management and weather conditions.

9.3.1 Preferred Spill Response

A number of response options have been assessed specific to the activity location, fuel type and spill modelling results, which are outlined in Section 7.14. These are:

- Source control – locating the source of the leakage and isolating the tanks and transferring fuel to slack or empty tanks (where safe to do so);

- Monitor and evaluate the trajectory and extent of the spill; and
- Assisted natural dispersion using propeller wash, if advised by the Control Agency that it is safe to do so.

Initial actions for source control are outlined in the vessel SMPEP and would be undertaken in consultation with the relevant Combat Agency (initially AMSA, given the activity's location in Commonwealth waters).

These spill response activities are not expected to introduce additional hazards to the marine environment or to result in significant additional potential impacts. The response options of source control, monitor and evaluate and assisted natural dispersion, and the potential impacts associated with the ISV is evaluated throughout Chapter 7.

9.4 Spill Notifications

The Vessel Master has the responsibility for reporting overboard spills to the AMSA Response Coordination Centre (RCC) (via POLREP Form contained in the vessel's SMPEP).

Once this initial report has been undertaken, further reports (SITREP forms) will be issued from the vessel at regular intervals to keep relevant parties (such as AMSA, NOPSEMA, etc.) informed. The Beach Offshore Representative is responsible for advising the Wells Integrity Manager of the spill incident. The Wells Integrity Manager is then responsible for notifying NOPSEMA.

Regulatory notification arrangements are provided in Table 9.2. In addition to this, Beach will advise potentially affected stakeholders of the spill.

Table 9.2. MDO spill regulatory notifications

Notification timing	Authority	Notification By	Contact Number	Details
Level 1				
ASAP	Beach PM	Vessel Master	TBA	Vessel to notify Beach immediately or ASAP to ensure further notifications can be undertaken
ASAP	DNP	Beach PM	0419 293 465	Beach to verbally notify the DNP via the Marine Park Compliance Duty Officer in the event that a spill may enter an AMP.
Within 2 hours	AMSA	Vessel Master	1800 641 792	Verbally notify AMSA RCC of spill. Follow up with written POLREP ASAP. http://www.amsa.gov.au/forms-and-publications/AMSA1522.pdf https://www.amsa.gov.au/environment/maritime-environmental-emergencies/national-plan/Contingency/Oil/documents/Appendix7.pdf
Within 2 hours	NOPSEMA	Beach PM	08 6461 7090	Beach to verbally notify NOPSEMA of spill >80L http://www.nopsema.gov.au/assets/Guidance-notes/N-03000-GN0926-Notification-and-Reporting-of-Environmental-Incidents-Rev-4-February-2014.pdf
Level 2 or 3 (in addition to Level 1 notifications)				
Within 2 hours	Type II Monitoring Service Provider (RPS)	Beach PM	08 9211 1111	Verbally notify service provider to initiate scientific monitoring if triggered (as outlined in Section 9.7.2).
Within 1 day	NOPTA	Beach PM	08 6424 5317	Provide a verbal or written incident summary.

Notification timing	Authority	Notification By	Contact Number	Details
Within 3 days	NOPSEMA	Beach PM	08 6461 7090	Provide a written incident report form.

9.5 Spill Response Testing Arrangements

The vessel SMPEP includes provision for testing emergency drills (in accordance with Regulation 14(8A)(8C) of the OPGGS(E)). Furthermore, a test of the oil spill emergency response arrangements referred to in this EP will be conducted:

- When they are introduced;
- When they are significantly amended;
- Not later than 12 months after the most recent test; and
- If and when a new vessel is engaged for the activity.

Prior to commencing the inspection activities, spill response arrangements applicable to the vessel will be reviewed. The outcomes of the review will be documented to record any lessons and actions. Any actions will be recorded and tracked to completion.

The review will focus on the onboard spill response capability against the SMPEP to verify spill preparedness and ensure vessel personnel are familiar with required actions.

<u>OPEP Review</u>

In accordance with OPGGS(E) Regulation 14(8), the OPEP must be kept up to date. A review of the OPEP occurs on an annual basis and is revised as required. Any of the following factors may trigger a revision of the OPEP:

- Changes to hazards and/or controls identified in the EP;
- Changes to response and/or monitoring capability;
- Outcomes from annual testing of the response arrangements;
- Revision of emergency management procedures;
- When major changes that may affect the oil spill response coordination or capabilities have occurred;
- After an actual emergency if gaps are identified within the plan;
- Change in state or Commonwealth oil spill response arrangements and resources; and
- Before installing and commissioning new plant and equipment (if risk profile changes).

9.6 Cost Recovery

In the event of a hydrocarbon spill, Part 6.1A of the OPGGS Act states that titleholders are required to eliminate or control the spill, clean up the spill and remediate any environmental damage and undertake environmental monitoring of the impact of the spill. The Act also states that any costs incurred by NOPSEMA and Commonwealth and state/Territory government agencies must be reimbursed by the titleholder.

Part 1B of the OPGGS(E) specifies that titleholders are required to maintain sufficient financial assurance to meet the costs, expenses and liabilities that may result from a worst-case event associated with its offshore activities.

In the case of the non-production well operations, the most credible such event would be a 100m^3 MDO spill from the ISV. Financial assurance must be demonstrated to NOPSEMA before the EP can be accepted.

Beach has insurance policies in place that will cover the costs of spill response and operational and scientific monitoring (see the following section).

9.7 Hydrocarbon Spill Monitoring

Beach will implement a monitoring program that reflects the scale and potential effects of the spill. To this effect, Beach has in place an Operational and Scientific Monitoring Program (OSMP) (CDN/ID S4100AH717908) that can be rapidly activated in the event of a MDO spill.

Monitoring appropriate to the nature and scale of the spill will be determined based on the hydrocarbon characteristics, the size and nature of the release (e.g., slow continuous release or instantaneous short duration release), weathering characteristics (dispersion and dilution rates), the location of the spill and the modelled trajectory of the spill. There are two types of monitoring considered, discussed in detail below.

9.7.1 Type I Operational Monitoring

As the Control Agency, AMSA is responsible for initiating an appropriate level of Type I Operational Monitoring using NatPlan resources to monitor the spill and any response effort, if required.

Operational monitoring may include spill surveillance and tracking to validate oil spill trajectory modelling. Beach may, at the direction of the Control Agency, support Type I monitoring with on-the-water surveillance to:

- Determine the location and extent of a spill;
- Track the movement and trajectory of the spill;
- Identify receptors at risk; and
- Determine sea conditions and potential constraints to spill response activities.

This monitoring will also enable the Vessel Master to provide information to the relevant Combat Agency (AMSA), via a POLREP/SITREP form, to allow for determination and planning of appropriate response actions under the NatPlan (if required).

Operational monitoring and observation in the event of a spill will inform an adaptive spill response and, if required, will support the identification of appropriate scientific monitoring of relevant key sensitive receptors.

Specific monitoring/data requirements for Type 1 monitoring may include:

- Estimation of sea state;
- Estimation of wind direction and speed;
- Locating and characterising any surface slicks;
- GPS tracking;
- Manual or computer predictions of oil trajectory and weathering; and
- GIS mapping.

Determining the location and characterisation of surface slicks will likely be restricted to daylight hours only, when surface slicks will be visible from the ISV. Evaluations of sea state and weather conditions from the vessel/s will continue until this function is taken over by the Combat Agency. The information gathered from this initial monitoring will be passed on to the Combat Agency, via the POLREP form, but also via ongoing SITREP reports following the initial spill notification to AMSA RCC.

Beach will implement, assist with, or contribute to (including funding if required) any other Type I monitoring (e.g., computer OSTM) as directed by the Combat Agency.

9.7.2 Type II Scientific Monitoring

In consultation with the Control Agency, Beach is committed to scientific monitoring dependent on the circumstances of the spill, and the sensitivities at risk. Beach's OSMP describes the detailed arrangements and studies that could be activated upon request and agreement with AMSA. The OSMP ensures Beach has a capability to undertake Type II scientific monitoring if required and also enable the chosen service provider to act (in a capacity as agreed with all parties) to either assist the Control Agency or to undertake key Type II monitoring activities on Beach's behalf (if initiation criteria are triggered).

Beach will work with AMSA and relevant stakeholders to develop and implement appropriate scientific monitoring. The aim of the scientific monitoring is to understand the environmental impacts of the spill and response activities on the marine environment, with a focus on relevant environmental and social values and sensitive receptors.

The scientific monitoring program outlined in the OSMP has been developed to ensure that it is sufficient to inform any remediation activities and is consistent with monitoring guidelines and methodologies such as CSIRO (2016).

The scientific monitoring may comprise some or all of the monitoring studies described in Table 9.3 and detailed in Section 5 of the Beach OSMP. As described previously, Beach will engage with AMSA to coordinate and review operational monitoring data. Operational monitoring may provide valuable surveillance and modelling data to confirm the predicted extent and degree of MDO exposure and impacts. This data will then be used to determine if scientific monitoring of relevant key sensitive receptors may be of value in the longer term to evaluate environmental impacts and recovery of affected receptors. The requirement for, and design of scientific monitoring studies will be based on desktop/technical studies and/or field investigations, in order to ensure they are feasible and will obtain relevant information based on available monitoring data, the nature of the receiving environment and results of the consultation process.

Table 9.3 summarises Beach's OSMP scientific monitoring studies relevant to the activity, based on the EMBA. If triggered, a detailed monitoring plan for each study will be developed in line with the OSMP. It is noted that where termination criteria for a study includes comparison to appropriate thresholds of concern, those thresholds will be confirmed and specified in the monitoring plan.

If deemed necessary, following consultation with the Combat Agency and relevant stakeholders, Beach will activate its contract with its OSMP provider (RPS) to design and implement the appropriate scientific monitoring studies as outlined in the Beach OSMP. RPS has undertaken a wide range of relevant marine environmental monitoring studies in Australia and internationally and has the relevant skills, expertise and resources in place to provide scientific monitoring support. RPS prepares a monthly OSMP readiness review for Beach outlining the resources available to undertake OSMP requirements.

Initiation criteria for scientific monitoring studies are outlined throughout Section 5 of the Beach OSMP. Following Beach's notification to RPS that a spill has occurred, RPS will make the necessary preparations for the potentially required monitoring studies.

Table 9.3. Scientific monitoring program summary relevant to the activity

Scientific Monitoring Study	Objectives	Initiation triggers	Termination criteria
SM01 Water quality impact assessment	Determine the impact to, and recovery of; offshore and intertidal water quality from oil exposure and/or any impacts to associated with response activities.	• The EMT Environment Leader (or delegate) has confirmed that a Level 2 or Level 3 offshore oil spill has occurred **and** data from the Study O2 has confirmed exposure to offshore or intertidal waters **or** • The EMT Environment Leader (or delegate) advises that either full or partial implementation of the study is to commence.	• The EMT Environment Leader (or delegate) considers that: ◦ MDO concentrations in offshore waters have returned to within the expected natural dynamics of baseline state and/or control sites **or** ◦ MDO concentrations in offshore waters are below relevant ANZG (2018) 99% species protection levels or other applicable benchmark values **and** • The EMT Environment Leader (or delegate) considers that: ◦ Relevant water quality parameter concentrations in offshore waters have returned to within the expected natural dynamics of baseline state and/or control sites **or** ◦ Relevant water quality parameter concentrations in offshore waters are below relevant ANZG (2018) 99% species protection levels or other applicable benchmark values **and** • The EMT Environment Leader (or delegate) in conjunction with relevant government agency, considers that water quality values within protected areas (i.e., AMPs, Ramsar wetlands or State marine protected areas) have not been impacted or have returned to within the expected natural dynamics of baseline state **and** • Agreement has been reached with the Statutory Authority relevant to the spill to terminate the monitoring
SM05 Marine fauna impact assessment	Determine the impact to, and recovery of, marine fauna from oil exposure and/or any impacts associated with response activities.	• The EMT Environment Leader (or delegate) has confirmed that a Level 2 or Level 3 offshore oil spill has occurred **and** data from the Study O4 has confirmed exposure to marine fauna **or** • The EMT Environment Leader (or delegate) advises that either full or partial implementation of the study is to commence.	• The EMT Environment Leader (or delegate) considers that disturbance parameters (e.g., population size, breeding success) have returned to within the expected natural dynamics of baseline state and/or control sites **and** • The EMT Environment Leader (or delegate) in conjunction with relevant government agency, considers that protected marine fauna (i.e., threatened or migratory species) have not been impacted or have returned to within the expected natural dynamics of baseline state (including any assessment against management requirements in Conservation Advices and/or Recovery Plans) **and** • Agreement has been reached with the Statutory Authority relevant to the spill to terminate the monitoring.
SM06 Fisheries impact assessment	Determine the presence of, and recovery from, oil taint in commercially or recreationally important fish	• The EMT Environment Leader (or delegate) has confirmed that a Level 2 or Level 3 offshore oil spill has occurred **and** data	• The EMT Environment Leader (or delegate) considers that: ◦ Fish or shellfish show no presence of tissue taint **or** ◦ PAH levels in fish and shellfish tissue have returned to within the expected natural dynamics of baseline state and/or control sites **or**

Scientific Monitoring Study	Objectives	Initiation triggers	Termination criteria
	species and/or any impacts associated with response activities.	from Study O6 has confirmed the presence of fishing tainting **or** • Allegations of damage are received from commercial fisheries or government agencies **or** • The EMT Environment Leader (or delegate) advises that either full or partial implementation of the study is to commence.	◦ PAH levels in fish and shellfish tissue are at or below regulatory levels of concern **and** • Agreement has been reached with the Statutory Authority relevant to the spill to terminate the monitoring.

10. References

A

Addison, R.F. and Brodie,P.F. 1984. Characterization of ethoxyresorufin O-de-ethylase in gray seal *Halichoerus grypus*. *Comp. Biochem. Physiol*. 79C: 261–263.

Addison, R.F., Brodie,P.F., Edwards, A. and Sadler, M.C. 1986. Mixed function oxidase activity in the harbour seal (Phoca vitulina) from Sable Is., N.S. *Comp. Biochem. Physiol*. 85C (1): 121–124.

AMSA. 2015. Technical guidelines for preparing contingency plans or marine and coastal facilities. Australian Maritime Safety Authority. Canberra.

AMSA. 2012. Advisory Note for Offshore Petroleum Industry Consultation with Respect of Oil Spill Contingency Plans. Australian Maritime Safety Authority. Canberra.

APASA. 2012. Marine diesel fuel oil spills and weathering. Memorandum from Trevor Gilbert, Director Maritime, Environment and Chemical Services at APASA, to Phil Harrick, HSEQ Manager, AGR Petroleum Services. 24th June 2012.

APPEA. 2019. Key Statistics 2018. A WWW document accessed at https://www.appea.com.au/wp-content/uploads/2018/05/APPEA_Key_Stats_2018_web.pdf. Australian Petroleum Production and Exploration Association. Canberra.

APPEA. 2008. Code of Environmental Practice. Australian Petroleum Production and Exploration Association.

Arnould J.P.Y. & Hindell M.A. 2001. Dive behaviour, foraging locations, and maternal-attendance patterns of Australian fur seals (*arctocephalus pusillus doriferus*). *Canadian J. Zoo. Vol*. 79(1): 35–48.

Arnould J.P.Y. & Kirkwood R. 2007. Habitat selection by female Australian fur seals (*Arctocephalus pusillus doriferus*). *Aquatic Conservation: Marine and Freshwater Ecosystems* (17).

AQIS. 2011. Australian Ballast Water Management Requirements. Version 5. Australian Quarantine Inspection Service, Department of Agriculture, Fisheries and Forestry. Canberra.

B

Baines, P. and Fandry, C. 1983. Annual cycle of the density field in Bass Strait. *Marine and Freshwater Research* 34, 143–153.

Barton, J., Pope, A. and Howe, S. 2012. Marine Natural Values Study Vol 2: Marine Protected Areas of the Flinders and Twofold Shelf Bioregions. Parks Victoria Technical Series. Number 79. Parks Victoria. Melbourne.

Bell, B., Spotila, J., and Congdon, J. 2006. High Incidence of Deformity in Aquatic Turtles in the John Heinz National Wildlife Refuge. *Env Poll*. 142(3): 457– 465.

Birdlife Australia. 2020. Species fact sheets. A WWW database accessed at http://birdlife.org.au/.

Black, K.P., Brand, G.W., Grynberg, H., Gwyther, D., Hammond, L.S., Mourtikas, S., Richardson, B.J., and Wardrop, J.A. 1994. Production facilities. In *Environmental implications of offshore oil and gas development in Australia – the findings of an independent scientific review*. Edited by J.M. Swan, J.M. Neff and P.C. Young. Australian Petroleum Exploration Association. Sydney.

Blumer, M. 1971. Scientific aspects of the oil spill problem. *Environmental Affairs* (1):54–73.

BoM. 2020. Climate Statistics for Australian Locations: King Island. A WWW database accessed at http://www.bom.gov.au/climate/averages/tables/cw_098017.shtml. Bureau of Meteorology. Canberra.

BP. 2015. Gulf of Mexico Environmental Recovery and Restoration. Five-year Report. March 2015. BP Exploration and Production Inc. London.

BP. 2014. Abundance and Safety of Gulf Seafood. Seafood Background White Paper. BP Exploration and Production Inc. London.

Brown, P.B. and Wilson, R.I. 1980. A Survey of the Orange-bellied Parrot *Neophema chrysogaster* in Tasmania, Victoria and South Australia. Tasmanian National Parks & Wildlife Service. Hobart.

Brusati, E.D. and Grosholz, E.D. 2007. Effect of native and invasive cordgrass on *Macoma petalum* density, growth and isotopic signatures. *Estuarine Coastal and Shelf Science* (71): 517–522.

Burger, A.E. 1993. Estimating the mortality of seabirds following oil spills: effects of spill volume. *Mar. Poll. Bull*. (26):140–143.

C

CarbonNet. 2018. Geotechnical and Geophysical Investigations Environment Plan Summary. A WWW publication accessed at https://info.nopsema.gov.au/home/underway_offshore. Department of Jobs, Precincts and Regions. Melbourne.

Carls, M.G., Holland. L., Larsen, M., Collier, T.K., Scholz, N.L. and Incardona, J.P. 2008. Fish embryos are damaged by dissolved PAHs, not oil particles. *Aquatic Toxicology* (88):121–127.

Carlyon, K., Pemberton, D. and Rudman, T. 2011. Islands of the Hogan Group, Bass Strait: Biodiversity and Oil Spill Response Survey. Resource Management and Conservation Division, DPIPWE, Hobart, Nature Conservation Report Series 11/03.

Challenger, G. and Mauseth, G. 2011. Chapter 32 – Seafood safety and oil spills. In *Oil Spill Science and Technology*. Edited by M. Fingas.

Charlton, C., Guggenheimer, S. and Burnell, S. 2014. Long term Southern Right Whale population monitoring at the Head of the Great Australian Bight, South Australia (1991-2013). Report to the Department of Environment, Australian Antarctic Division, Australian Marine Mammal Centre. May 2014.

Cintron, G., Lugo, A.E., Marinez, R., Cintron, B.B., Encarnacion, L. 1981. Impact of oil in the tropical marine environment. Prepared by Division of Marine Research, Department of Natural Resources. Puerto Rico.

Clark, R.B. 1984. Impact of oil pollution on seabirds. *Environmental Pollution* (Series A) 33: 1–22.

Committee on Oil in the Sea. 2003. Oil in the Sea III: Inputs, Fates and Effects. Washington, D.C. The National Academies Press.

Connell, D. W., Miller, G.J. and Farrington, J.W. 1981. Petroleum hydrocarbons in aquatic ecosystems—behaviour and effects of sublethal concentrations: Part 2. *Critical Reviews in Environmental Science and Technology*. 11(2): 105-162.

Currie, D.R. & Isaac, L.R. 2005. Impact of exploratory offshore drilling on benthic communities in the Minerva gas field, Port Campbell, Australia. Marine Environmental Research 59, 217–233.

Curtin University. 2010. Report on Necropsies from a Timor Sea Horned Sea Snake. Curtin University, Perth.

Curtin University. 2009. Report on Biopsy Collections from Specimens Collected from the Surrounds of the West Atlas Oil Leak – Sea Snake Specimen. Curtin University, Perth.

D

DAFF. 2009. The National Biofouling Management Guidance for the Petroleum Production and Exploration Industry. Department of Agriculture, Fisheries and Forestry. Canberra.

DAFF. 2020. Marine Pests Interactive Map. A WWW database accessed at http://www.marinepests.gov.au/Pages/marinepest-map.aspx. Department of Agriculture, Fisheries and Forestry. Canberra.

Danion, M., Le Floch, S., Kanan, R., Lamour, F. and Quentel, C. 2011. Effects of in vivo chronic hydrocarbons pollution on sanitary status and immune system in sea bass (*Dicentrarchus labrax*). *Aquatic toxicology*. 105. 300-311. 10.1016/j.aquatox.2011.06.022.

DAWE. 2020. The Australian Ballast Water Management Requirements (v8). Department of Agriculture, Water and the Environment. Canberra.

DAWE. 2021a. EPBC Act Protected Matters Search Tool. A WWW database accessed at http://www.environment.gov.au/epbc/pmst/. Department of Agriculture, Water and the Environment. Canberra.

DAWE. 2021b. Species Profile and Threats (SPRAT) Database. A WWW database accessed at http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl. Department of Agriculture, Water and the Environment. Canberra.

DAWE. 2021c. National Conservation Values Atlas. A WWW database accessed at https://www.environment.gov.au/topics/marine/marine-bioregional-plans/conservation-values-atlas. Department of Agriculture, Water and the Environment. Canberra.

DAWE. 2021d. Australia's World Heritage List. A WWW database accessed at http://www.environment.gov.au/heritage/places/world-heritage-list. Department of Agriculture, Water and the Environment. Canberra.

DAWE. 2021e. Australia's National Heritage List. A WWW database accessed at http://www.environment.gov.au/heritage/places/national-heritage-list. Department of Agriculture, Water and the Environment. Canberra.

DAWE. 2021f. Australia's Commonwealth Heritage List. A WWW database accessed at http://www.environment.gov.au/topics/heritage/heritage-places/ commonwealth-heritage-list. Department of Agriculture, Water and the Environment. Canberra.

DAWE. 2021g. Directory of Important Wetlands in Australia. A WWW database accessed at https://www.environment.gov.au/water/wetlands/australian-wetlandsdatabase/directory-important-wetlands. Department of Agriculture, Water and the Environment. Canberra.

DAWE. 2021h. Australian National Shipwreck Database. A WWW database accessed at http://environment.gov.au/heritage/historic-shipwrecks/australian-national-shipwreck-database. Department of Agriculture, Water and the Environment. Canberra.

DAWR. 2020. Australian Ballast Water Management Requirements. Department of Agriculture and Water Resources. Canberra.

DAWR. 2019. Offshore Installation Biosecurity Guideline. Department of Agriculture and Water Resources. Canberra.

DAWR. 2018. Marine Pest Plan 2018-2023. National Strategic Plan for Marine Pest Biosecurity. Department of Agriculture and Water Resources. Canberra.

Davis, J.E. and Anderson, S.S. 1976. Effects of oil pollution on breeding gray seals. *Mar. Pollut. Bull*. (7): 115–118.

Davis, H.K., Moffat, C.F. and Shepherd, N.J. 2002. Experimental Tainting of Marine Fish by Three Chemically Dispersed Petroleum Products, with Comparisons to the Braer Oil Spill. *Spill Science & Technology Bulletin*. 7(5–6): 257– 278.

DEH. 2006. A Guide to the Integrated Marine and Coastal Regionalisation of Australia. Department of the Environment and Heritage. Canberra.

DEWHA. 2008. EPBC Act Policy Statement 2.1-Interaction between offshore seismic exploration and whales, Department of Environment, Water, Heritage & the Arts, Canberra.

DELWP. 2016. National Recovery Plan for the Orange-bellied Parrot, *Neophema chrysogaster*. Department of Environment, Land, Water and Planning. Melbourne.

DNP. 2013. South-east Commonwealth Marine Reserves Network Management Plan 2013-23. Director of National Parks. Canberra.

DoA and DoE. 2015. Anti-Fouling and In-Water Cleaning Guidelines. Department of Agriculture and Department of the Environment. Canberra.

DoE. 2015a. South-east Marine Regional Profile. Department of the Environment. Canberra.

DoE. 2015b. Conservation Advice *Calidris ferruginea* curlew sandpiper. Department of the Environment. Canberra.

DoE. 2015c Conservation Advice *Numenius madagascariensis* eastern curlew. Department of the Environment. Canberra.

DoE. 2015d. Conservation Management Plan for the Blue Whale. A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999. Department of the Environment. Canberra.

DoE. 2013. EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – Matters of National Environmental Significance. Department of the Environment. Canberra.

DoEE. 2020. National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds. Department of the Environment and Energy. Canberra.

DoEE. 2018b. Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans 2018. Department of the Environment and Energy. Canberra.

DoEE. 2017a. National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna. Department of the Environment and Energy. Canberra.

DoEE. 2017b. Australian National Guidelines for Whale and Dolphin Watching. Department of the Environment and Energy. Canberra.

DoEE. 2017c. Recovery Plan for Marine Turtles in Australia. Department of the Environment and Energy. Canberra.

DPIPWE. 2020a. Rock Lobster Fishery. A WWW database accessed at https://dpipwe.tas.gov.au/sea-fishingaquaculture/commercial-fishing/rock-lobster-fishery. Department of Primary Industries, Parks, Water and Environment. Hobart.

DPIPWE. 2020b. Shellfish Fishery. A WWW database accessed at https://dpipwe.tas.gov.au/sea-fishingaquaculture/commercial-fishing/shellfish-fishery. Department of Primary Industries, Parks, Water and Environment. Hobart.

DPIPWE. 2020c. Seaweed Fishery. A WWW database accessed at https://dpipwe.tas.gov.au/sea-fishingaquaculture/commercial-fishing/seaweed-fishery. Department of Primary Industries, Parks, Water and Environment. Hobart.

DPIPWE. 2020d. Abalone Fishery. A WWW database accessed at https://dpipwe.tas.gov.au/sea-fishing-aquaculture/commercial-fishing/abalone-fishery. Department of Primary Industries, Parks, Water and Environment. Hobart.

DPIPWE. 2020e. Scallop Fishery. A WWW database accessed at https://dpipwe.tas.gov.au/sea-fishing-aquaculture/commercial-fishing/scallop-fishery. Department of Primary Industries, Parks, Water and Environment. Hobart.

DPIPWE. 2020f. Scalefish Fishery. A WWW database accessed at https://dpipwe.tas.gov.au/sea-fishing-aquaculture/commercial-fishing/scalefish-fishery. Department of Primary Industries, Parks, Water and Environment. Hobart.

DPIPWE. 2020g. Commercial Dive Fishery. A WWW database accessed at https://dpipwe.tas.gov.au/sea-fishing-aquaculture/commercial-fishing/commercial-dive-fishery. Department of Primary Industries, Parks, Water and Environment. Hobart.

DPIPWE. 2020h. Octopus Fishery. A WWW database accessed at https://dpipwe.tas.gov.au/sea-fishing-aquaculture/commercial-fishing/octopus-fishery. Department of Primary Industries, Parks, Water and Environment. Hobart.

DSEWPC. 2013a Approved Conservation Advice for *Rostratula australis* (Australian painted snipe). Department of Sustainability, Environment, Water, Population and Communities. Canberra.

DSEWPC. 2013b. Recovery Plan for the White Shark (*Carcharodon carcharias*). Department of Sustainability, Environment, Water, Population and Communities. Canberra.

DSEWPC. 2012. Conservation Management Plan for the Southern Right Whale 2011-21. Department of Sustainability, Environment, Water, Population and Communities. Canberra.

DSEWPC. 2011a. National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016. Department of Sustainability, Environment, Water, Population and Communities. Australian Antarctic Division. Canberra.

DSEWPC. 2011b. Approved Conservation Advice for *Sternula nereis nereis* (Fairy Tern). Department of Sustainability, Environment, Water, Population and Communities. Canberra.

E

Edyvane, K.S. 1999. Conserving Marine Biodiversity in South Australia – Part 2 – Identification of areas of high conservation value in South Australia. South Australian Research and Development Institute. Adelaide.

Emery, T., Hartmann, K. and Gardner, C. 2015. Tasmanian Giant Crab Fishery – 13/14. Institute for Marine Science. Tasmania.

Engelhardt, F.R. 1983. Petroleum Effects on Marine Mammals. *Aquatic Toxicology* (4):199–217.

ESDSC. 1992. National Strategy for Ecologically Sustainable Development. Ecologically Sustainable Development Steering Committee. Canberra.

European Commission. 2019. Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production. Luxembourg: Publications Office of the European Union.

F

Falconer, R. and Linforth, D. 1972. Winds and waves in Bass Strait. Bureau of Meteorology. Department of the Interior. Canberra.

Felder, D.L., Thoma, B.P., Schmidt, W.E., Sauvage, T., Self-Krayesky, S.L., Christoserdov, A., Bracken-Grissom, H.D. and Fredericq, S. 2014. Seaweeds and Decapod Crustaceans on Gulf Deep Banks after the Macondo Oil Spill. *Bioscience* (64): 808–819.

Flegg, J. 2002. Photographic Field Guide Birds of Australia. Second Edition. Reed New Holland. Sydney.

French, D. Schuttenberg, H. and Isaji, T. 1999. Probabilities of oil exceeding thresholds of concern: examples from an evaluation for Florida Power and Light In: Proceedings of the 22nd Artic and Marine Oil Spill Program (AMOP), Technical Seminar, June 1999. Alberta, Canada.

French-McCay, D.P., 2002. Development and application of an oil toxicity and exposure model, OilToxEx. *Environmental Toxicology and Chemistry* (21):2080-2094.

French-McCay, D.P. 2003. Development and application of damage assessment modelling: example assessment for the North Cape oil spill. *Mar. Poll. Bull*. 47(9):9–12.

French-McCay, D.P. 2009. State-of-the-art and research needs for oil spill impact assessment modelling. Proceedings of the 32nd Arctic and Marine Oil Spill Program Technical Seminar. Environment Canada, Ottawa.

G

Gagnon, M.M. and Rawson, C. 2011. Montara Well Release, Monitoring Study S4A – Assessment of Effects on Timor Sea Fish. Curtin University, Perth, Australia.

Gala, W.R. 2001. Predicting the Aquatic Toxicity of Crude Oils. International Oil Spill Conference Proceedings (2):935–940.

Geraci, J.R. and St. Aubin, D.J. 1988. Synthesis of Effects of Oil on Marine Mammals. Report to US Department of the Interior, Minerals Management Service, Atlantic OCS Region, OCS Study. Ventura, California.

Gill, P. and Morrice, M. 2003. Cetacean Observations. Blue Whale Compliance Aerial Surveys. Santos Ltd Seismic Survey Program Vic/P51 and P52. November-December 2002. Report to Santos Ltd.

Gibbs, C.F., Tomczak, M. and Longmore, A.R. 1986. The Nutrient Regime of Bass Strait. *Australian Journal of Marine and Freshwater Resources* (37): 471–466.

Gibbs, C. 1992. Oceanography of Bass Strait: Implications for the food supply of little penguins *Eudyptula minor*. *EMU* (91): 395–401.

Gohlke, J.M. 2011. A Review of Seafood Safety after the Deepwater Horizon Blowout. *Environmental Health Perspectives* 119(8):1062–1069.

Gomez, C., Lawson, J.W., Wright, A.J., Buren, A.D., Tollit, D. and Lesage, V. 2016. A systematic review on the behavioural responses of wild marine mammals to noise: the disparity between science and policy. *Canadian Journal of Zoology* 94(12): 801–819.

Gotz, T., Hastie, G., Hatch, L., Raustein, O, Southall, B., Tasker, M, Thomsen, F. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. OSPAR Commission. London.

Green, R.H. 1969. The birds of Flinders Island. *Records of the Queen Victoria Museum* (34):1-32.

H

Heyward, A., Moore, C., Radford, B. and Colquhoun, J. 2010. Monitoring Program for the Montara Well Release Timor Sea: Final Report on the Nature of Barracouta and Vulcan Shoals. Report prepared by the Australian Institute of Marine Science for PTTEP Australasia (Ashmore Cartier) Pty Ltd.

Higgins, L.V. and Gass, L. 1993. Birth to weaning: parturition, duration of lactation, and attendance cycles of Australian sea lions (*Neophoca cinerea*). *Canadian Journal of Zoology* (71):2047-2055.

Higgins, P.J. (ed.). 1999. Handbook of Australian, New Zealand and Antarctic Birds. Volume Four - Parrots to Dollarbird. Oxford University Press, Melbourne.

Hill, N., Krueck, N. and Hartmann, K. 2020. Tasmanian Octopus Fishery Assessment 2018/19. Institute for Marine and Antarctic Studies. UTAS.

Holdway, D.A. 2002. The acute and chronic effects of wastes associated with offshore oil and gas production on temperate and tropical marine ecological processes. *Mar. Poll. Bull*. (44): 185–203.

Hook, S., Batley, G., Holloway, M., Irving, P. and Ross, A. 2016. Oil Spill Monitoring Handbook. CSIRO Publishing. Melbourne.

Hume, F., Hindell M.A., Pemberton, D. and Gales, R. 2004. Spatial and temporal variation in the diet of a high trophic level predator, the Australian fur seal (*Arctocephalus pusillus doriferus*). Mar. Biol. 144(3): 407–415.

I

International Maritime Organisation. 2012. Guidelines for the Development of Garbage Management Plans. Resolution MEPC.220(63).

IOGP-IPIECA, 2020. Environmental management in the upstream oil and gas industry. Report No. 254. August 2020. International Association of Oil & Gas Producers and IPIECA. London.

IOGP/IAGC, 2017. Recommended monitoring and mitigation measures for cetaceans during marine seismic survey geophysical operations. March 2017. International Association of Oil & Gas Producers and International Association of Geophysical Contractors. London.

IMO. 2016. International Maritime Dangerous Goods Code. Amendment 38.16. International Maritime Organisation.

IPIECA. 2017. Mapping the Oil and Gas Industry to the Sustainable Development Goals: An Atlas. International Petroleum Industry Conservation Association. London.

IPIECA/OGP. 2015. Aerial observation of oil spills at sea. Good practice guidelines for incident management and emergency response personnel. International Petroleum Industry Conservation Association and International Association of Oil & Gas Producers. London.

IPIECA/OGP. 2014a. A guide to oiled shoreline assessment (SCAT) surveys. Good practice guidelines for incident management and emergency response personnel. International Petroleum Industry Conservation Association and International Association of Oil & Gas Producers. London.

IPIECA/OGP. 2014b. Oil spill waste minimisation and management. Good practice guidelines for incident management and emergency response personnel. International Petroleum Industry Conservation Association and International Association of Oil & Gas Producers. London.

ITOPF. 2011. Effects of Oil Pollution on the Marine Environment. Technical Information Paper 13. The International Tanker Owners Pollution Federation Ltd. London.

J

Jenssen, B.M. 1994. Effects of Oil Pollution, Chemically Treated Oil, and Cleaning on the Thermal Balance of Birds. *Env. Poll*. (86):207–215.

Jones, I.S.F. 1980. Tidal and Wind-drive Currents in Bass Strait. *Aus. J. Mar. Freshwater Res*. (31): 109–117.

Jung, J. 2011. Biomarker Responses in Pelagic and Benthic Fish Over One Year Following the Hebei Spirit Oil Spill (Taean, Korea). *Mar. Poll. Bull*. 62(8): 1859–1866.

K

Kauss, P., Hutchinson, T.C., Soto, C., Hellebust, J. and Griffiths, M. 1973. The Toxicity of Crude Oil and its Components to Freshwater Algae. International Oil Spill Conference Proceedings: March 1973, Vol. 1973, No. 1, pp. 703-714.

Kennish, M.J. 1996. Practical Handbook of Estuarine and Marine Pollution. CRC Press. Florida.

Kent, C.S., McCauley, R.D., Duncan, A., Erbe, C., Gavrilov, A., Lucke, K. And Parnum, I. 2016. Underwater sound and vibration from offshore petroleum activities and their potential effects on marine fauna: an Australian perspective. Centre for Marine Science and Technology (CMST), Curtin University. Perth.

Kimmerer, W.J. & McKinnon, A.D. 1984. Zooplankton Abundances in Bass Strait and Tasmanian Shelf Waters, March 1983. *Proceedings of the Royal Society of Victoria* (96): 1161–1167.

Kirkwood, R., Warneke, R.M., Arnould. J.P. 2009. Recolonization of Bass Strait, Australia, by the New Zealand fur seal, *Arctocephalus forsteri*. *Mar. Mam. Sci.* 25(2): 441–449.

Kirkwood, R., Gales, R., Terauds, A., Arnould, J. P. Y., Pemberton, D., Shaughnessy, P. D., Mitchell, A. T., and Gibbens, J. 2005. Pup production and population trends of the Australian fur seal *Arctocephalus pusillus doriferus*. *Mar. Mam. Sci.* 21: 260–282.

Klimey, A.P. and Anderson, S.D. 1996. Residency patterns of White Sharks at the South Farrallone Islands, California. In: Great White Sharks: The biology of Carcharodon carcharias. Edited by A.P. Klimley & D.G. Ainley. Academic Press, New York USA.

Kooyman, G.L., Gentry, R.L. and McAllister, W.B. 1976. Physiological impact of oil on pinnipeds. Report N.W. Fisheries Center. *Natl. Mar. Fish. Serv*. Seattle, WA.

Kooyman, G.L., Davis, R.W. and Castellini, M.A. 1977. Thermal conductance of immersed pinniped and sea otter pelts before and after oiling with Prudhoe Bay crude. pp. 151-157. In: Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D.A. Wolfe (ed.). Pergammon Press, New York, New York.

L

Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S., & Podesta, M. 2001. Collisions between Ships and Whales. *Mar. Mam. Sci.* 17(1): 35-75.

Law, R.J. 1997. Hydrocarbons and PAH in Fish and Shellfish from Southwest Wales following the Sea Empress Oil Spill in 1996. International Oil Spill Conference Proceedings 1997 (1): 205–211.

LCC. 1993. Marine and Coastal Descriptive Report (special investigation). Land Conservation Council. June 1993.

Lee, H.J., Shim, W.J., Lee, J. and Kim, G.B. 2011. Temporal and geographical trends in the genotoxic effects of marine sediments after accidental oil spill on the blood cells of striped beakperch (*Oplegnathus fasciatus*). *Mar. Poll. Bull*. 62:2264– 2268.

Lewis, M. and Pryor, R. 2013. Toxicities of oils, dispersants and dispersed oils to algae and aquatic plants: Review and database value to resource sustainability. *Env. Poll*. 180:345–367.

Limpus, C.J. 2009. A Biological Review of Australian Marine Turtles. Leatherback Turtle, *Dermochelys coriacea* (*Vandelli*). Prepared for the Queensland Environment Protection Agency.

Limpus, C.J. 2008a. A biological review of Australian Marine Turtles. 1. Loggerhead Turtle *Caretta caretta* (*Linneaus*). Queensland Environment Protection Agency.

Limpus, C.J. 2008b. A Biological Review of Australian Marine Turtles. Green Turtle, *Chelonia mydas* (Linnaeus). Prepared for the Queensland Environment Protection Agency.

Lindquist, D., Shaw, R. and Hernandez, F Jr. 2005. Distribution patterns of larval and juvenile fishes at offshore petroleum platforms in the north-central Gulf of Mexico. *Estuar. Coast. Shelf Sci.* 62(4):655–665.

Loyn, R.H., Lane, B.A., Chandler, C and Carr, G.W. 1986. Ecology of Orange-bellied Parrots *Neophema chrysogaster* at their main remnant wintering site. Emu. 86:195-206.

M

MacGillivray, A., Li, Z., and Yurk, H. 2018. Modelling of Cumulative Vessel Noise for Haro Strait Slowdown Trial: Final Report. in, ECHO Program: Voluntary Vessel Slowdown Trial Summary Findings. Appendix A. Vancouver Fraser Port Authority. Victoria, BC: JASCO Applied Sciences.

McLeay, L., Sorokin, S., Rogers, P. and Ward, T. 2003. Benthic Protection Zone of the Great Australian Bight Marine Park: 1. Literature review. South Australian Research and Development Institute (Aquatic Sciences). Final report to: National Parks and Wildlife South Australia and the Commonwealth Department of the Environment and Heritage.

McCauley, R.D. 1998. Radiated underwater noise measured from the drilling rig Ocean General, rig tenders Pacific Ariki and Pacific Frontier, fishing vessel Reef Venture and natural sources in the Timor Sea, Northern Australia. CMST Report No. 98-20, CMST, Curtin University, Perth, Australia.

Meekan, M. G., Wilson, S. G., Halford, A. and Retzel, A. 2001. A comparison of catches of fishes and invertebrates by two light trap designs, in tropical NW Australia. *Mar. Biol*. 139: 373 – 381.

Middleton, J. and Black, K. 1994. The low frequency circulation in and around Bass Strait: a numerical study. *Cont. Shelf Res.* 14: 1495-1521.

Mollet, H.F., Cliff, G., Pratt Jr, H.L. and Stevens, J.D. 2000. Reproductive Biology of the female shortfin mako, *Isurus oxyrinchus* (Rafinesque, 1820), with comments on the embryonic development of lamnoids. *Fish. Bull*. 98: 299-318.

Moore, B., Lyle, J. & Hartmann, K. 2019. Tasmanian Scalefish Fishery Assessment 2017/18. Institute for Marine and Antarctic Studies.

N

Neptune. 2020. Trefoil Site Investigation Results Report. Prepared for Beach Energy.

Nichols, T., Anderson, T. and Širović, A. 2015 Intermittent Noise Induces Physiological Stress in a Coastal Marine Fish. *PLoS ONE* 10(9): e0139157. https://doi.org/10.1371/journal.pone.0139157.

NERA. 2017. Environment Plan Reference Case: Planned Discharge of Sewage, Putrescible Waste and Grey Water. Department of Industry, Innovation and Science. Canberra.

NMFS. 2018. Revision to: Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0). Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. National Marine Fisheries Service. U.S. Department of Commerce. NOAA. NOAA Technical Memorandum NFMS-OPR-59.

NMSC. 2010. Marine Incidents during 2009. Preliminary Data Analysis. A WWW database accessed at http://www.nmsc.gov.au. Australian National Marine Safety Committee.

NOAA. 2013. Deepwater Horizon Oil Spill: Assessment of Potential Impacts on the Deep Softbottom Benthos. Interim data summary report. NOAA Technical Memorandum NOS NCCOS 166. National Oceanic and Atmospheric Administration. Washington.

NOO. 2002. Ecosystems - Nature's Diversity. The South-East Regional Marine Plan Assessment Reports. National Oceans Office. Hobart.

NOPSEMA. 2020a. Environment Plan Assessment Policy (NOPSEMA Policy N-04750-PL1347, Rev 8, March 2020). National Offshore Petroleum Safety and Environmental Management Authority. Available from: https://www.nopsema.gov.au/assets/Policies/A662608.18.19.pdf.

NOPSEMA, 2020c. Operational and scientific monitoring programs (NOPSEMA Information Paper, N-04750-IP1349, October 2020. National Offshore Petroleum Safety and Environmental Management Authority. Available from: https://www.nopsema.gov.au/assets/Information-papers/A343826.pdf

NOPSEMA. 2019a. Environment plan decision making guideline (NOPSEMA Guideline GL1721, Rev 6, November 2019). National Offshore Petroleum Safety and Environmental Management Authority. Available from: https://www.nopsema.gov.au/assets/Guidelines/A524696.pdf.

NOPSEMA. 2019b. Environment plan content requirements (NOPSEMA Guidance Note, N-04750-GN1344, Rev 4, April 2019). National Offshore Petroleum Safety and Environmental Management Authority. Available from: https://www.nopsema.gov.au/assets/Guidance-notes/A339814.pdf.

NOPSEMA. 2019c. Oil spill modelling (NOPSEMA Environment Bulletin, April 2019). National Offshore Petroleum Safety and Environmental Management Authority. Available from: https://www.nopsema.gov.au/assets/Bulletins/A652993.pdf.

NOPSEMA. 2018a. Acoustic impact evaluation and management (NOPSEMA Information Paper, N-04750-IP1765, Rev 2, December 2018). National Offshore Petroleum Safety and Environmental Management Authority. Available from: https://www.nopsema.gov.au/assets/Information-papers/A625748.pdf.

NOPSEMA. 2018b. Petroleum activities and Australian Marine Parks (NOPSEMA Guidance Note, N-04750-GN1785, Rev 0, July 2018). National Offshore Petroleum Safety and Environmental Management Authority. Available from: https://www.nopsema.gov.au/assets/Guidance-notes/A620236.pdf.

NOPSEMA, 2018c. Oil pollution risk management (NOPSEMA Guidance Note GN1488, Rev 2, February 2018). National Offshore Petroleum Safety and Environmental Management Authority. Available from: https://www.nopsema.gov.au/assets/Guidance-notes/A382148.pdf.

NOPSEMA, 2016. Assessment of Environment Plans: Deciding on Consultation Requirements Guidelines (NOPSEMA Guidance Note, N-04750-GL1629, Rev 0, April 2016).

NRDA. 2012. April 2012 Status Update for the Deepwater Horizon Oil Spill. A WWW publication accessed at: http://www.gulfspillrestoration.noaa.gov. Natural Resource Damage Assessment.

O

O'Brian, P. and Dixon, P. 1976. The effects of oils and oil components on algae: A review. *British Phycological Journal* 11:115– 141.

Oritsland, N.A. 1975. Insulation in marine mammals: the effect of crude oil on ringed seal pelts. pp. 48-67. In: The Effect of Contact and Ingestion of Crude Oil on Ringed Seals of the Beaufort Sea. T.G. Smith and J.R. Geraci (eds.). Beaufort Sea Project. Inst. of Ocean Sci. Sidney, British Columbia. Technical Report No. 5.

P

Pade, N., Queiroz, N., Humphries, N., Witt, M., Jones, C., Noble, L. and Sims, D. 2009. First results from satellitelinked archival tagging of Porbeagle shark, *Lamna nasus*: area fidelity, wider-scale movements and plasticity in diel depth changes. *J. Exp. Mar. Bio. and Ecol*. 370:64-74.

Patterson, H., Noriega, R., Georgeson, L., Larcombe, J. and Curtotti, R. 2020. Fishery status reports 2020. Australian Bureau of Agricultural and Resource Economics and Sciences. Canberra.

Patterson, H., Noriega, R., Georgeson, L., Larcombe, J. and Curtotti, R. 2019. Fishery status reports 2019. Australian Bureau of Agricultural and Resource Economics and Sciences. Canberra.

Patterson, H., Noriega, R., Georgeson, L., Larcombe, J. and Curtotti, R. 2018. Fishery status reports 2018. Australian Bureau of Agricultural and Resource Economics and Sciences. Canberra.

Patterson, H., Noriega, R., Georgeson, L., Larcombe, J. and Curtotti, R. 2017. Fishery status reports 2017. Australian Bureau of Agricultural and Resource Economics and Sciences. Canberra.

Patterson, H., Noriega, R., Georgeson, L., Stobutski, I. and Curtotti, R. 2016. Fishery status reports 2016. Australian Bureau of Agricultural and Resource Economics and Sciences. Canberra.

Parry, G.D., Campbell, S.J., and Hobday, D.K. 1990. Marine resources off East Gippsland, Southeastern Australia. Technical Report No. 72, Marine Science Laboratories. Queenscliff, Victoria.

Peakall, D.B., Wells, P.G. and Mackay, D. 1987. A hazard assessment of chemically dispersed oil spills and seabirds. Mar. Env. Res. 22(2):91-106.

Peel, D., Kelly, N., Smith, J. and Childerhouse, S. 2016. National Environmental Science Program Project C5 – Scoping of Potential Species for Ship Strike Risk Analysis, Pressures and impacts. CSIRO. Australia.

Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D.A., Bartol, S., Carlson, T.J., Coombs, S., Ellison, W.T., Gentry, R.L. 2014. Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. Springer Briefs in Oceanography, Volume ASA S3/SC1.4 TR-2014. ASA Press.

PTTEP. 2013. Montara Environmental Monitoring Program. Report of Research. A WWW document accessed at: www.au.pttep.com/sustainable-development/environmentalmonitoring. PTTEP Australasia. Perth.

R

Ramachandran, S.D., Hodson, P.V., Khan, C.W. and Lee, K. 2004. Oil dispersant increases PAH uptake by fish exposed to crude oil. *Ecotoxicology and Environmental Safety* 59:300– 308.

Rawson, C., Gagnon, M.M. and Williams, H. 2011. Montara Well Release Olfactory Analysis of Timor Sea Fish Fillets. Curtin University, Perth, Western Australia, November 2011.

Remplan, 2019. Bass Coast economy profile. A WWW database accessed at https://www.economyprofile.com.au/basscoast/tourism/value-added. Remplan Economy.

Richardson, W. J., Greene, C. R., Maime, C. I. and Thomson, D. H. 1995. Marine Mammals and Noise. Academic Press. California.

Robinson S., Gales R., Terauds A. & Greenwood M. 2008. Movements of fur seals following relocation from fish farms. *Aquatic Conservation: Marine and Freshwater Ecosystems*. Vol. 18, no. 7, pp. 1189-1199

Ronconi, R., Allard, K. and Taylor, P. 2015. Bird interactions with offshore oil and gas platforms: review of impacts and monitoring techniques. *Journal of Environmental Management*, 147: 34-35.

Rowe, C.L., Mitchelmore, C.L. and Baker, J.E. 2009. Lack of Biological Effects of Water Accommodated Fractions of Chemically and Physically Dispersed Oil on Molecular, Physiological, and Behavioural Traits of Juvenile Snapping Turtles Following Embryonic Exposure. *Science of the Total Environment*. 407(20): 5344– 5355.

RPS. 2020. Prion 3D Marine Seismic Survey. Oil Spill Modelling. Rev 0. 30 April 2020. Prepared by RPS for Beach Energy Ltd.

S

Sandegren, F.E. 1970. Breeding and maternal behaviour of the Steller sea lion (*Eumetoias jubata*) in Alaska. M.Sc. Thesis, Univ. Alaska, Anchorage, AK. Sergeant.

Sandery P.A. and Kampf J. 2005. Winter Spring flushing of Bass Strait, South Eastern Australia; Numerical modelling study. *Estuarine and coastal shelf science* 63.

Shaughnessy, P.D. 1999. The action plan for Australian seals. CSIRO Wildlife and Ecology.

Shaw, R. F., Lindquist, D. C., Benfield, M. C., Farooqi, T., Plunket, J. T. 2002. Offshore petroleum platforms: functional significance for larval fish across longitudinal and latitudinal gradients. Prepared by the Coastal Fisheries Institute, Louisiana State University. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2002-077.

Shigenaka, G. 2003. Oil and Sea Turtles: Biology, Planning, and Response. National Oceanographic and Atmospheric Administration, United States of America.

Shigenaka, G. 2011. Chapter 27 – Effects of Oil in the Environment. In: Oil Spill Science and Technology. Gulf Professional. Pp 985-1024.

Short, M. 2011. Pacific adventurer oil spill: big birds, sea snakes and a couple of turtles. In: International Oil Spill Conference Proceedings. IOSC, Washington, DC, p207.

Simmonds, M., Dolman, S. and Weilgart, L. 2004. Oceans of Noise. Whale and Dolphin Conservation Society. Wiltshire.

Skjoldal, H. 2009. Arctic Marine Shipping Assessment. Background Research Report on Potential Environmental Impacts from Shipping in the Arctic. Draft Version July.

Smith, M., Kane, A. and Popper, A. 2004. Acoustical stress and hearing sensitivity in fishes: does the linear threshold shift hypothesis hold water? *Journal of Experimental Biology*. 207: 3591-3602.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A and Tyack, P.L. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals*. 33(4): 411–521.

Spiga, I., Fox, J. and Benson, R. 2012. Effects of Short-and Long-Term Exposure to Boat Noise on Cortisol Levels in Juvenile Fish. *Advances in experimental medicine and biology*. 730. 251-3. 10.1007/978-1-4419-7311-5_55.

Stephenson, L.H. 1991. Orange-bellied Parrot Recovery Plan: Management Phase. Tasmanian Department of Parks, Wildlife & Heritage. Hobart.

T

Tasmanian SMPC. 1999. Iron Baron oil spill, July 1995: long term environmental impact and recovery. Tasmania State Marine Pollution Committee. Long Term Impact Assessment Group.

Thales Geosolutions. 2001. “BassGas Project: Offshore Shallow Geotechnical Survey Report”, Report No. 3259C.

Thursby, G.B. and Steele, R. L. 2004. Toxicity of arsenite and arsenate to the marine macroalga *Champia parvula* (*rhodophyta*). *Environmental Toxicology and Chemistry* 3 (3):391-397.

TSSC 2015a Conservation Advice *Pachyptila turtur subantarctica* fairy prion (southern). Threatened Species Scientific Committee. Canberra.

TSSC. 2015b. Conservation Advice – *Megaptera novaeangliae* (humpback whale). Threatened Species Scientific Committee. Canberra.

TSSC. 2015c. Conservation Advice – *Balaenoptera physalus* (fin whale). Threatened Species Scientific Committee. Canberra.

TSSC. 2015d. Conservation Advice – *Balaenoptera borealis* (sei whale). Threatened Species Scientific Committee. Canberra.

TSSC. 2014. Commonwealth Listing Advice on *Ardenna carneipes* (flesh-footed shearwater). Threatened Species Scientific Committee. Canberra.

Tsvetnenko, Y. 1998. Derivation of Australian Tropical Marine Water Quality Criteria for Protection of Aquatic Life from Adverse Effects of Petroleum Hydrocarbons. *Environmental Toxicology and Water Quality* 13(4):273284.

V

Van Meter, R.J., Spotila, J.R. and Avery, H.W. 2006. Polycyclic Aromatic Hydrocarbons Affect Survival and Development of Common Snapping Turtle (*Chelydra serpentina*) Embryos and Hatchlings. Env. Poll. 142(3): 466–475.

Van Overbeek, J., & Blondeau, R. 1954. Mode of Action of Phytotoxic Oils. Weeds, 3(1), 55-65.

DTPLI. 2013. Advisory Note Offshore Petroleum Industry Oil Spill Contingency Planning Consultation. Victorian Department of Transport, Planning and Local Infrastructure. Melbourne.

Victorian Fisheries Authority. 2020. Commercial fisheries. A WWW database accessed at: https://vfa.vic.gov.au/commercial-fishing. Victorian Fisheries Authority, Melbourne.

Volkman, J.K., Miller, G.J., Revill, A.T. and Connell, D.W. 1994. 'Oil spills.' In: Environmental Implications of offshore oil and gas development in Australia - the findings of an independent scientific review. Edited by Swan, J.M., Neff, J.M. and Young, P.C. Australian Petroleum Exploration Association. Sydney.

W

Walker, D.I. and McComb, A.J. 1990. Salinity response of the seagrass *Amphibolis antarctica* (Labill.) Sonder et Aschers: an experimental validation of field results. *Aquat Bot*. 36:359–366.

Watson, C.F. and Chaloupka, M.Y. 1982. Zooplankton of Bass Strait: Species Composition, Systematics and Artificial key to Species. Tasmanian Institute of Marine Science Technical Report No. 1.

WDCS. 2006. Vessel collisions and cetaceans: What happens when they don't miss the boat. Whale and Dolphin Conservation Society. United Kingdom.

Wiese, F. K., W. A. Montevecci, G. K. Davoren, F. Huettmann, A. W. Diamond, and J. Linke. 2001. Seabirds at risk around offshore oil platforms in the northwest Atlantic. *Mar. Poll. Bull.* 42:1285–1290.

Wilson, R. and Poore, G. 1987. The Bass Strait survey: biological sampling stations, 1979-1984. Occasional papers from the Museum of Victoria 3, 1–14.

Wilson, S. and Swan, G. 2005. A Complete Guide to the Reptiles of Australia. Reed New Holland. Sydney.

Woodside. 2011. Browse LNG Development. Draft Upstream Environmental Impact Assessment, EPBC Referral 2008/4111, November 2011. Woodside Energy Ltd. Perth.

Woodside. 2008. Browse LNG Development. Torosa South-1 Pilot Appraisal Well Environment Plan. Woodside Energy Ltd. Perth.

World Bank Group. 2015. Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development. World Bank Group. Washington.

Wysocki, L., & Dittami, J. and Ladich, F. 2006. Ship noise and cortisol secretion in European freshwater fishes. *Biological Conservation*. 128. 501-508. 10.1016/j.biocon.2005.10.020.