Plan

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Environment Plan

Artisan-1 Exploration Well Drilling

Revision	Date	Reason for issue	Reviewer/s	Consolidator	Approver
0	21/06/2019	Issued to NOPSEMA	PW	GLE	PS

Review due	Review frequency
Annually from date of acceptance	1 year/s

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

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Acronyms

Terms/acronym	Definition/Expansion
3DTZSS	3D Transitions Zone Seismic Survey
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AHO	Australian Hydrographic Office
ALARP	As Low as Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
APPEA	Australian Petroleum Production and Exploration Association
ASAP	As Soon as Practicable
Bass Strait CZSF	Bass Strait Central Zone Scallop Fishery
Beach	Beach Energy Limited
BIA	Biologically Important Area
BOM	Bureau of Meteorology
CMT	Crisis Management Team
COLREG	Convention on The International Regulations for Preventing Collisions at Sea
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAWR	Commonwealth Department of Agriculture and Water Resources
DELWP	Victorian Department of Environment, Land, Water and Planning
DPIPWE	Tasmanian Department of Primary Industries, Parks, Water and Environment
DJPR	Victorian Department of Jobs, Precincts and Regions
DotEE	Commonwealth Department of the Environment and Energy
DP	Dynamic Positioning
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMBA	Environment That May Be Affected
EMT	Emergency Management Team
EP	Environment Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPO	Environment Performance Outcome
EPS	Environment Performance Standard
ERT	Emergency Response Team
ESD	Ecologically Sustainable Development
ETBF	Eastern Tuna and Billfish Fishery
HFO	Heavy Fuel Oil

HSE	Health, Safety and Environment
HSEMS	Health, Safety and Environment Management System
IBRA	Interim Biogeographic Regionalisation for Australia
IC	Incident Commander
IAPP	International Air Pollution Prevention
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMO	International Maritime Organisation
IMS	Invasive Marine Species
IOGP	International Association of Oil and Gas Producers
IUCN	International Union for Conservation of Nature
JRCC	Joint Rescue Coordination Centre
KEF	Key Ecological Features
Lattice	Lattice Energy Limited (100% owned by Beach)
MARPOL	International Convention for The Prevention of Pollution from Ships
MC	Measurement Criteria
MNES	Matters of National Environmental Significance
MNP	Marine National Park
MO	Marine Order
MOC	Management of Change
MODU	Mobile Offshore Drilling Unit
NatPlan	National Plan for Maritime Environmental Emergencies
NEBA	Net Environmental Benefit Analysis
NP	National Park
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NSW	New South Wales
OGUK	Oil and Gas UK
OPEP	Oil Pollution Emergency Plan
OPGGSA	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OPGGS(E)R	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Commonwealth)
Origin	Origin Energy Resources Limited
OSMP	Operational and Scientific Monitoring Plan
OSTM	Oil Spill Trajectory Modelling
OWR	Oiled Wildlife Response
PHG	Pre-hydrated Gel
PMS	Planned Maintenance System
POLREP	Marine Pollution Report
PSZ	Petroleum Safety Zone
PTS	Permanent Threshold Shift

ROV	Remotely Operated Underwater Vehicle
RSEZ	Rig Safety Exclusion Zone
SBDF	Synthetic-Based Drilling Fluid
SBTF	Southern Bluefin Tuna Fishery
SCCP	Source Control Contingency Plan
SEEMP	Ship Energy Efficiency Management Plan
SEL	Sound Exposure Level
SEMR	South-East Marine Region
SESSF	Southern and Eastern Scalefish And Shark Fishery
SETFIA	South East Trawl Fishing Industry Association
SIV	Seafood Industry Victoria
SMP	Scientific Monitoring Program
SMPEP	Shipboard Marine Pollution Emergency Plan
SMS	Scientific Monitoring Study
SPF	Small Pelagic Fishery
SPL	Sound Pressure Level
TEC	Threatened Ecological Community
TTS	Temporary Threshold Shift
WBDF	Water-Based Drilling Fluid
Woodside	Woodside Petroleum Ltd
WOMP	Well Operations Management Plan

1 Overview of the Activity

Lattice Energy Limited (Lattice), who are wholly owned by Beach Energy Limited (Beach), proposes to drill a single exploration well (with the option to suspend and develop pending reservoir analysis) in Commonwealth waters of the Otway Basin approximately 32 km off Victoria's south-west coast. The proposed Artisan-1 well location is at a water depth of approximately 71 m.

The operational area for the drilling program has been defined as a 2 km radius around the well whilst the MODU is moored on location. The 2 km radius encompasses both the outer extent of mooring equipment on the seabed, and the 500 m rig safety exclusion zone (RSEZ).

The drilling activity is planned to commence in Q4 2019 or Q1 2020 with drilling expected to take approximately 35 to 55 days, depending on the final work program and potential operational delays. The Artisan-1 well maybe suspended for future production if commercial quantities of hydrocarbons are discovered. In this eventuality, the well will be suspended in accordance with the Well Operations Management Plan (WOMP) and the wellhead will be left in place to facilitate future operations. Any potential future production drilling of Artisan-1 well will be addressed under a separate Environment Plan (EP). Drilling and support operations will be conducted on a 24-hour basis for the duration of the program.

Activities included in the scope of this EP are detailed in Section 0.

Activities excluded from the scope of this EP include:

- Activities associated with the establishment and operation of a shore base to support the activity which are regulated by the relevant State government.
- Vessels transiting to or from the operational area. The vessels are deemed to be operating under the Commonwealth Navigation Act 2012 and not performing a petroleum activity whilst outside the operational area.
- Mobilisation of the MODU into Australian Commonwealth waters and Victorian State waters, and associated biosecurity and ballast water management prior to the arrival of the MODU into the operational area. The MODU is subject to biosecurity control on entering Australian territory (12NM offshore) in accordance with the Biosecurity Act 2015. Ballast water must be managed in accordance with the Australian Ballast Water Management Requirements Rev 7. Both biosecurity and ballast water management are administered by the Commonwealth Department of Agriculture and Water Resources (DAWR). The planned mobilisation of the MODU into Port Phillip Bay prior to the commencement of drilling activities in Commonwealth waters is administered by Victorian State regulators and the Victorian Port. Biosecurity and ballast water management of the MODU prior to the movement of the MODU into the operational area is managed directly by and remains the responsibility of the Drilling Contractor – Diamond Offshore General Company (Diamond Offshore).

1.1 Environment Plan Summary

This Artisan-1 Exploration Well Drilling Environment Plan (EP) Summary has been prepared from material provided in this EP. The summary consists of the following (Table 1-1) as required by Regulation 11(4) of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R).

Table 1-1: EP Summary of material requirements

EP Summary Material Requirement	Relevant Section of EP Containing EP Summary Material
The location of the activity	Section 4.1 (page 32)
A description of the receiving environment	Section 5 (pages 41-49) and Appendix B
A description of the activity	Section 4 (pages 32-40)
Details of the environmental impacts and risks	Section 7 (pages 61-147)
The control measures for the activity	Section 7.8 (pages 144-147)
The arrangements for ongoing monitoring of the titleholder's environmental performance	Section 8.10 (page 159), Section 8.20 (pages 165) and Section 8.23 (pages 169-170)
Response arrangements in the oil pollution emergency plan	Refer to OPEP (Appendix E)
Consultation already undertaken and plans for ongoing consultation	Section 9 (pages 171-197)
Details of the titleholders nominated liaison person for the activity	Section 2.2 (Table 2-1 page 16)

2 Introduction

This document has been prepared to meet the requirements of an EP under the OPGGS(E)R. It addresses the activities to be undertaken during the Artisan-1 Exploration Well Drilling Program located in Commonwealth waters of the Otway Basin off the coast of Victoria.

The Artisan-1 Exploration Well Drilling Program will be undertaken within Permit VIC/P43. Figure 2-1 details the proposed location of the Artisan-1 Exploration Well.

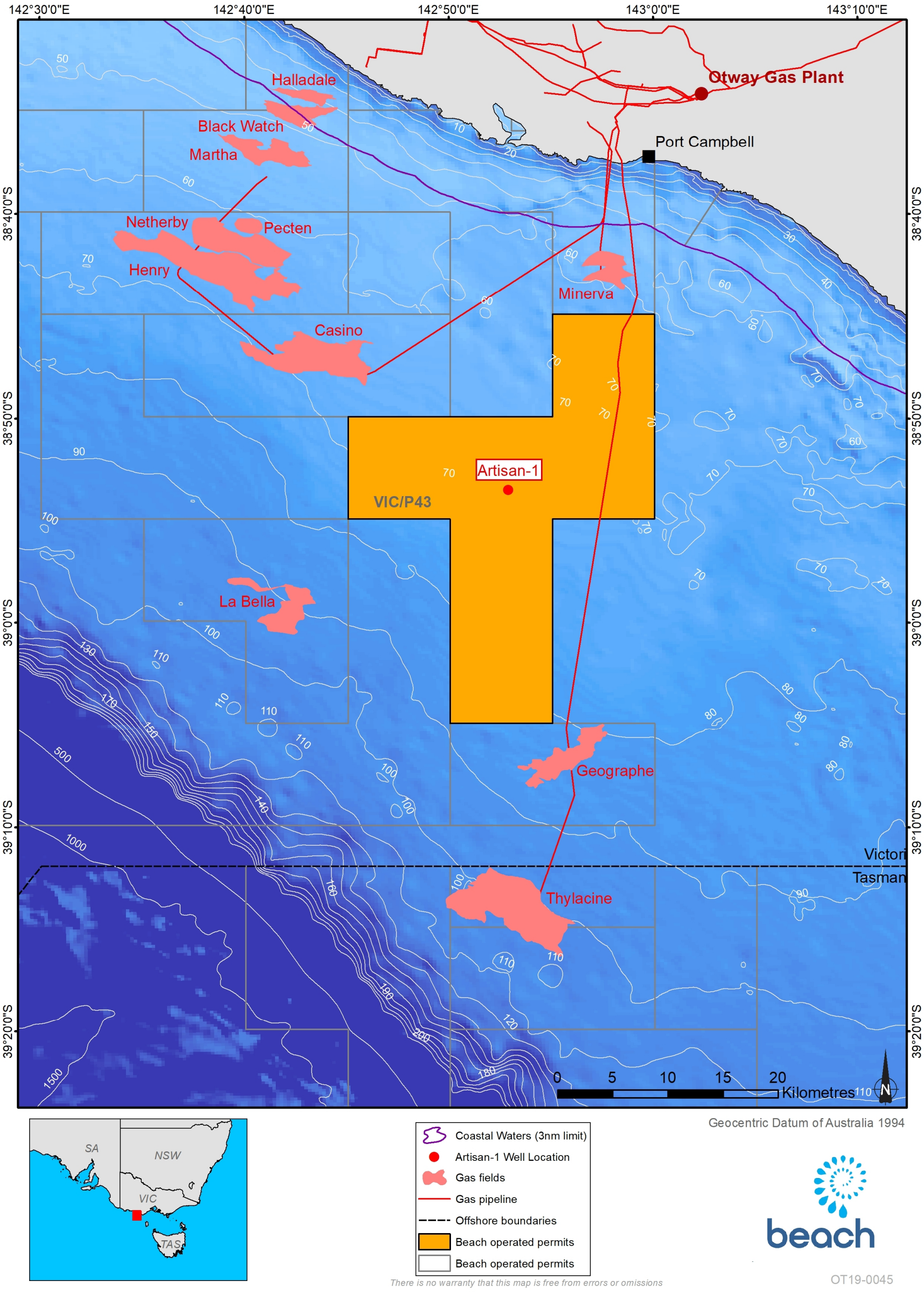


Figure 2-1: Artisan-1 well proposed location

2.1 Background

Beach has several gas producing assets in the Otway Basin. To date, three development phases have been completed to support natural gas supply via the onshore Otway Gas Plant:

- Phase 1: Otway Gas Plant and Thylacine offshore platform;
- Phase 2: Inlet Gas Compression; and
- Phase 3: Geographe Subsea Development.

To maintain continued economic natural gas production, further phases to develop additional offshore wells are being investigated. One of the proposed developments is an exploration well in the Artisan Field (Artisan-1).

2.2 Titleholder and liaison person details

The titleholder of Permit VIC/P43 is Lattice Energy Limited, a company wholly owned by Beach. Table 2-1 details the titleholder and the liaison person for the title applicable to the activity.

Beach is an Australian Stock Exchange listed oil and gas exploration and production company headquartered in Adelaide, South Australia. Beach has operated and non-operated, onshore and offshore oil and gas production assets in five producing 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 2-2).

In accordance with the Regulation 15(3) of the OPGGS(E)R Beach shall notify the Regulator (National Offshore Petroleum Safety and Environmental Management Authority [NOPSEMA]) of a change to the 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 during the proposed activity.

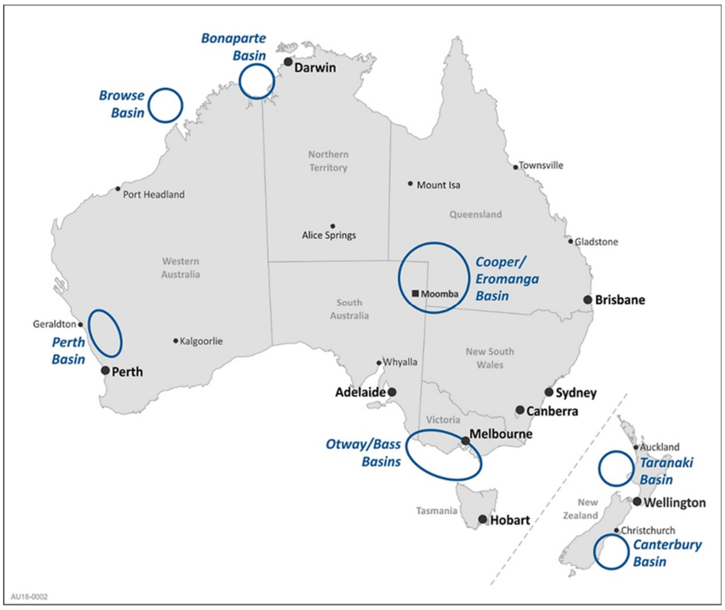


Figure 2-2: Beach operations

Table 2-1: Details of titleholder and liaison person

Petroleum Title	Details	
VIC/P43	Titleholder	Lattice Energy Limited
	Business address	Glenside South Australia 5065
	Telephone number	(08) 8338 2833
	Fax number	(08) 8338 2336
	Email address	info@beachenergy.com.au
	Australian Company Number	Lattice Energy Limited (ACN: 007 845 338)
Titleholder Liaison Person		
Mr Peter Sparkes Offshore & Special Projects Drilling Manager	Business address	GPO Box 175 Adelaide South Australia 5001
	Telephone number	(08) 8338 2833
	Fax number	(08) 8338 2336
	Email address	info@beachenergy.com.au

3 Applicable Requirements

This section provides information on the requirements that apply to the activity, in accordance with Regulation 13(4) of the OPGGS(E)R. Requirements include relevant laws, codes, other approvals and conditions, standards, agreements, treaties, conventions or practices (in whole or part) that apply to the jurisdiction that the activity takes place in.

The proposed activity is within Commonwealth waters. Commonwealth legislation (including relevant international conventions) and other requirements relevant to exploration drilling are summarised in Table 3-1.

Although activities under this EP are located entirely in Commonwealth waters, Victorian and Tasmanian legislation relevant to offshore petroleum activities is described in Table 3-2 and Table 3-3 on the basis that a worst-case credible oil spill has the potential to intersect Victorian or Tasmanian waters.

3.1 EPBC Act Requirements

This EP considers the impacts to matters of national environmental significance (MNES) protected under Part 3 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Relevant requirements associated with the EBPC Act, related policies, guidelines, plans of management, recovery plans, threat abatement plans and other relevant advice issued by the Department of the Environment and Energy (DotEE) are detailed in the applicable sections within Section 5 as part of the description of the existing environment.

Table 3-4 details the recovery plans, threat abatement plans and species conservation advices applicable to species identified in Section 5. The following management plans have also been taken into consideration:

- The action plan for Australian Cetaceans (Bannister et al. 1996).
- National Recovery Plan for Ten Species of Seabirds (Department of the Environment and Heritage, 2005)
- King Island Biodiversity Management Plan (Department of Primary Industries, Parks, Water and Environment, 2012)

A recovery plan for the Australian Fur Seal is currently in draft with the Commonwealth Government and not currently available; this will be assessed for relevance when released.

Table 3-1: Commonwealth environmental legislation relevant to the drilling activity

Legislation/Regulation	Scope	Related International Conventions	Administering Authority
Australian Maritime Safety Authority Act 1990	This Act facilitates international cooperation and mutual assistance in preparing and responding to a major oil spill incident and encourages countries to develop and maintain an adequate capability to deal with oil pollution emergencies. Requirements are affected through AMSA who administers the National Plan for Maritime Environmental Emergencies (NatPlan). **Application to activity**: AMSA is the designated Control Agency for oil spills from vessels in Commonwealth waters. *These arrangements are detailed in the OPEP*	International Convention on Oil Pollution Preparedness, Response and Cooperation 1990 Protocol on Preparedness, Response and Co-operation 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 Articles 198 and 221 of the United Nations Convention on the Law of the Sea 1982	Australian Maritime Safety Authority (AMSA)
Australian Ballast Water Management Requirements (DAWR, 2017)	The Australian Ballast Water Management Requirements set out the obligations on vessel operators with regards to the management of ballast water and ballast tank sediment when operating within Australian seas. **Application to activity**: Provides requirements on how vessel operators should manage ballast water when operating within Australian seas to comply with the Biosecurity Act. Section *7.2 details these requirements in relation to the management of ballast water.*	International Convention for the Control and Management of Ships' Ballast Water and Sediments (adopted in principle in 2004 and in force on 8 September 2017)	Department of Agriculture and Water Resources (DAWR)
Biosecurity Act 2015 Biosecurity Regulations 2016	This Act replaced the *Quarantine Act 1908* in 2015 and is the primary legislation for the management of the risk of diseases and pests that may cause harm to human, animal or plant health, the environment and the economy. The objects of this Act are to provide for: (a) managing biosecurity risks; human disease; risks related to ballast water; biosecurity emergencies and human biosecurity emergencies;	International Convention for the Control and Management of Ships' Ballast Water and Sediments (adopted in principle in 2004 and in force on 8 September 2017)	DAWR

Legislation/Regulation	Scope	Related International Conventions	Administering Authority
	(b) to give effect to Australia's international rights and obligations, including under the International Health Regulations, the Sanitary and Phytosanitary Agreement and the Biodiversity Convention. **Application to activity**: The Biosecurity Act and regulations apply to 'Australian territory' which is the airspace over and the coastal seas out to 12 Nm from the coastline. For the activity the Act regulates vessels entering Australian territory regarding ballast water and hull fouling. *Biosecurity risks associated with the activity are detailed in Section 7.2.*		
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	This Act applies to actions that have, will have or are likely to have a significant impact on matters of national environmental or cultural significance. The Act protects Matters of National Environmental Significance (MNES) and provides for a Commonwealth environmental assessment and approval process for actions. There are eight MNES, these being: • World heritage properties; • Ramsar wetlands; • Listed Threatened species and communities; • Listed Migratory species under international agreements; • Nuclear actions; • Commonwealth marine environment; • Great Barrier Reef Marine Park; and • Water trigger for coal seam gas and coal mining developments. **Application to activity**: Petroleum activities are excluded from within the boundaries of a World Heritage Area (Sub regulation 10A(f). *The activity is not within a World Heritage Area.* The EP must describe matters protected under Part 3 of the EPBC Act and assess any impacts and risks to these.	1992 Convention on Biological Diversity and 1992 Agenda 21 Convention on International Trade in Endangered Species of Wild Fauna and Flora 1973 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 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 Agreement between the Government of Australia and the Government of the Republic of Korea on The Protection of Migratory Birds 2006 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	Department of the Environment and Energy (DotEE)

Legislation/Regulation	Scope	Related International Conventions	Administering Authority
	Section 5.3 Appendix A and Appendix B describes matters protected under Part 3 of the EPBC Act. The EP must assess any actual or potential impacts or risks to MNES from the activity. *Section 0 provides an assessment of the impacts and risks from the activity to matters protected under Part 3 of the EPBC Act.*		
Environment Protection and Biodiversity Conservation Regulations 2000	Part 8 of the regulations provide distances and actions to be taken when interacting with cetaceans. **Application to activity**: The interaction requirements are applicable to the activity in the event that a cetacean is sighted. *Section 7.8 details how these requirements will be applied.*	-	DotEE
Underwater Cultural Heritage Act 2019	Protects the heritage values of shipwrecks, sunken aircraft and relics (older than 75 years) in Australian Territorial waters from the low water mark to the outer edge of the continental shelf (excluding the State's internal waterways). The Act allows for protection through the designation of protection zones. Activities / conduct prohibited within each zone will be specified. **Application to activity**: In the event of removal, damage or interference to shipwrecks, sunken aircraft or relics declared to be historic under the legislation, activity is proposed with declared protection zones, or there is the discovery of shipwrecks or relics. *Section 5.3 identifies no known shipwrecks or sunken aircrafts in the EMBA.*	Agreement between the Netherlands and Australia concerning old Dutch Shipwrecks 1972	DotEE
National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry 2009	The guidance document provides recommendations for the management of biofouling hazards by the petroleum industry. **Application to activity**: Applying the recommendations within this document and implementing effective biofouling controls can reduce the risk of the introduction of an introduced marine species. *Sections 7.8 details the requirements applicable to vessel activities.*	Certain sections of MARPOL International Convention for the Safety of Life at Sea 1974 Convention on the International Regulations for Preventing Collisions at Sea (COLREG) 1972	DAWR

Legislation/Regulation	Scope	Related International Conventions	Administering Authority
Navigation Act 2012	This Act regulates ship-related activities 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 offshore petroleum activities, including: • MO 21: Safety of navigation and emergency arrangements. • MO 30: Prevention of collisions. • MO 31: Vessel surveys and certification. **Application to activity**: The relevant vessels (according to class) will adhere to the relevant MO with regard to navigation and preventing collisions in Commonwealth waters. *Sections 7.8details the requirements applicable to vessel activities.*	Certain sections of MARPOL International Convention for the Safety of Life at Sea 1974 COLREG 1972	AMSA
Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGSA) OPGGS(E)R	The Act addresses all licensing, health, safety, environmental and royalty issues for offshore petroleum exploration and development operations extending beyond the three-nautical mile limit. Part 2 of the OPGGS(E)R specifies that an EP must be prepared for any petroleum activity and that activities are undertaken in an ecologically sustainable manner and in accordance with an accepted EP. **Application to activity**: The OPGGS Act provides the regulatory framework for all offshore petroleum exploration and production activities in Commonwealth waters, to ensure that these activities are carried out: • Consistent with the principles of ecologically sustainable development as set out in section 3A of the EPBC Act. • So that environmental impacts and risks of the activity are reduced to as low as reasonably practicable (ALARP). • So that environmental impacts and risks of the activity are of an acceptable level.	-	NOPSEMA

Legislation/Regulation	Scope	Related International Conventions	Administering Authority
	Demonstration that the activity will be undertaken in line with the principles of ecologically sustainable development, and that impacts and risks resulting from these activities are ALARP and acceptable is provided in Section 0.		
Protection of the Sea (Prevention of Pollution from Ships) Act 1983	This Act regulates Australian regulated vessels with respect to ship-related operational activities and invokes certain requirements of the MARPOL Convention relating to discharge of noxious liquid substances, sewage, garbage, air pollution etc. **Application to activity**: All ships involved in petroleum activities in Australian waters are required to abide to the requirements under this Act. Several MOs 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. *Sections 7.8 details the requirements applicable to vessel and MODU activities.*	Various parts of MARPOL	AMSA
Protection of the Sea (Harmful Antifouling Systems) Act 2006	Under this Act, it is an offence for a person to engage in negligent conduct that results in a harmful anti-fouling compound being applied to or present on a ship. The Act also provides that Australian ships must hold 'anti-fouling certificates', provided they meet certain criteria. **Application to activity**: All ships involved in offshore petroleum activities in Australian waters are required to abide to the requirements under this Act. The MO 98: Marine Pollution Prevention – Anti-fouling Systems is enacted under this Act. *Sections 7.8 details the requirements applicable to vessel activities.*	International Convention on the Control of Harmful Anti-fouling Systems on Ships 2001	AMSA

Table 3-2: Victorian Environment Legislation Relevant to potential impacts to State waters and lands

Legislation/ Regulation	Scope	Application to Activity	Administering Authority
Environment Protection Act 1970 (& various regulations)	This is the key Victorian legislation which controls discharges and emissions (air, water) to the environment within Victoria (including state and territorial waters). It gives the Environment Protection Authority (EPA) powers to licence premises discharges to the marine environment, control marine discharges and to undertake prosecutions. Provides for the maintenance and, where necessary, restoration of appropriate environmental quality.	Oil pollution management in Victorian State waters	Environment Protection Authority (EPA)
	The State Environment Protection Policy (Waters of Victoria) designates: • Spill response responsibilities by Victorian Authorities to be undertaken in the event of spills (DJPR) with EPA enforcement consistent with the *Environment Protection Act 1970* and the *Pollution of Waters by Oil & Noxious Substances Act 1986*. • Requires vessels not to discharge to surface waters sewage, oil, garbage, sediment, litter or other wastes which pose an environmental risk to surface water beneficial uses. To protect Victorian State waters from marine pests introduced via domestic ballast water, ballast water management arrangements applying to all ships in State and territorial waters must be observed as per the *Environment Protection (Ships' Ballast Water) Regulations 2006, Waste Management Policy (Ships' Ballast Water)* and the *Protocol for Environmental Management*. High risk domestic ballast water (ballast water which leachates from an Australian port or within the territorial sea of Australia (to 12 nm)), regardless of the source, must not be discharged into Victorian State waters. Ship masters must undertake a ballast water risk assessment on a voyage by voyage basis to assess risk level, provide accurate and comprehensive information to the EPA on the status and risk of ballast water contained on their ships (i.e. domestic/international), and to manage domestic ballast water discharges with EPA written approval.	Discharge of domestic ballast water from emergency response vessels into Victorian State waters must comply with these requirements.	
Emergency Management Act 2013 (& Regulations 2003)	Provides for the establishment of governance arrangements for emergency management in Victoria, including the Office of the Emergency Management Commissioner and an Inspector-General for Emergency Management. Provides for integrated and comprehensive prevention, response and recovery planning, involving preparedness, operational co-ordination and community participation, in relation to all hazards. These arrangements are outlined in the Emergency Management Manual Victoria.	Emergency response structure for managing emergency incidents within Victorian State waters. Emergency management structure will be triggered in the event of a spill impacting or potentially impacting State waters. See OPEP.	Department of Justice and Regulation (Inspector General for Emergency Management)

Legislation/ Regulation	Scope	Application to Activity	Administering Authority
Flora and Fauna Guarantee Act 1988 (FFG Act) (& Regulations 2011)	The purpose of this Act is to protect rare and threatened species; and enable and promote the conservation of Victoria's native flora and fauna and to provide for a choice of procedures that can be used for the conservation, management or control of flora and fauna and the management of potentially threatening processes. Where a species has been listed as threatened an Action statement is prepared setting out the actions that have or need to be taken to conserve and manage the species and community.	Action Statement controls for threatened species present in the zone of potential impact (EMBA) as adopted (as relevant) within this EP. Triggered if an incident results in the injury or death of a FFG Act listed species (e.g. collision with a whale).	DELWP
Heritage Act 1995	The purpose of the Act is to provide for the protection and conservation of historic places, objects, shipwrecks and archaeological sites in state areas and waters (complementary legislation to Commonwealth legislation). Part 5 of the Act is focused on historic shipwrecks, which are defined as the remains of all ships that have been situated in Victorian State waters for 75 years or more. The Act addresses, among other things, the registration of wrecks, establishment of protected zones, and the prohibition of certain activities in relation to historic shipwrecks.	May be triggered in the event of impacts to a known or previously un-located shipwreck in Victorian State waters whilst undertaking emergency response activities.	Heritage Victoria (DELWP)
Marine Safety Act 2010 (& Regulations 2012)	Act provides for safe marine operations in Victoria, including imposing safety duties on owners, managers and designers of vessels, marine infrastructure and marine safety equipment; marine safety workers, masters and passengers on vessels; regulation and management of vessel use and navigation in Victorian State waters; and enforcement provisions of Police Officers and the Victorian Director of Transport Safety. This Act reflects the requirements of international conventions - *Convention on the International Regulations for Preventing Collisions at Sea* & *International Convention for the Safety of Life at Sea*. The Act also defines marine incidents and the reporting of such incidents to the Victorian Director of Transport Safety.	Applies to vessel masters, owners, crew operating vessels in Victorian State waters.	Maritime Safety Victoria
National Parks Act 1975	Established a number of different types of reserve areas onshore and offshore, including Marine National Parks and Marine Sanctuaries. A lease, licence or permit under the OPGGS Act 2010 that is either wholly or partly over land in a marine national park or marine sanctuary is subject to the *National Parks Act 1975* and activities within these areas require Ministerial consent before activities are carried out.	Applies where there are activities within marine reserve areas.	DELWP

Legislation/ Regulation	Scope	Application to Activity	Administering Authority
Pollution of Waters by Oil and Noxious Substances Act 1986 (POWBONS) (& Regulations 2002)	The purpose of the *Pollution of Waters by Oils and Noxious Substances Act 1986* (POWBONS) is to protect the sea and other waters from pollution by oil and noxious substances. This Act also implements the MARPOL Convention (the International Convention for the Prevention of Pollution from Ships 1973) in Victorian State waters. Requires mandatory Reporting of marine pollution incidents. Act restricts within Victorian State waters the discharge of treated oily bilge water according to vessel classification (>400 tonnes); discharge of cargo substances or mixtures; prohibition of garbage disposal and packaged harmful substances; restrictions on the discharge of sewage; regulator reporting requirements for incidents; ship construction certificates and survey requirements. Restriction on discharges within Victorian State waters incorporated into EP.	Triggered in the event of a spill impacting or potentially impacting State waters.	Jointly administered by DJPR and EPA
Wildlife Act 1975 (& Regulations 2013)	The purpose of this Act is to promote the protection and conservation of wildlife. Prevents wildlife from becoming extinct and prohibits and regulates persons authorised to engage in activities relating to wildlife (including incidents). The *Wildlife (Marine Mammal) Regulations 2009* prescribe minimum distances to whales and seals/seal colonies, restrictions on feeding/touching and restriction of noise within a caution zone of a marine mammal (dolphins (150m), whales (300m) and seals (50m).	Applies where vessels are within State waters responding to a spill event. Prescribed minimum proximity distances to whales, dolphins and seals will be maintained. Triggered if an incident results in the injury or death of whales, dolphins or seals.	DELWP

Table 3-3: Tasmanian Environment Legislation Relevant to potential impacts to State waters and lands

Legislation/ Regulation	Scope	Application to Activity	Administering Authority
Environmental Management and Pollution Control Act 1994 (EMPCA) (& Regulations)	EMPCA is the primary environment protection and pollution control legislation in Tasmania. It is a performance-based style of legislation, with the fundamental basis being the prevention, reduction and remediation of environmental harm. The clear focus of the Act is on preventing environmental harm from pollution and waste. Relevant regulations under the EMPCA include: • Environmental Management and Pollution Control (General) Regulations 2017 • Environmental Management and Pollution Control (Waste Management) Regulations 2010 The EPA Division Compliance Policy provides the Director of the EPA powers of compliance.	Defines the EPA's jurisdiction during a spill event. Prescribes the fee structure to waste events and environmental protection notices. Regulates the management and control of controlled wastes. See OPEP	Department of Primary Industries, Parks, Water and Environment (DPIPWA)
Pollution of Waters by Oil and Noxious Substances Act 1987	Pollution of the sea in Tasmanian State waters may be regulated by general pollution laws such as the EMPCA (see above), but the Pollution of Waters by Oil and Noxious Substance Act 1987 deals specifically with discharges of oil and other pollutants from ships. In accordance with current national arrangements, the Pollution of Waters by Oil and Noxious Substance Act 1987 gives effect in Tasmania to the MARPOL international convention on marine pollution.	Gives effect to MARPOL in Tasmanian waters.	DPIPWA

Table 3-4: Recovery plans, threat abatement plans and species conservation advices relevant to the activity

Relevant Plan/Advice	Applicable Threats or Management Advice
National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011–2016 (DSEWPaC, 2011)	The recovery plan is a co-ordinated conservation strategy for albatrosses and giant petrels listed as threatened. • **Marine pollution**: Evaluate risk of oil spill impact to nest locations and, if required, appropriate mitigation measures are implemented. • **Marine debris**: Evaluate risk of marine debris (including risk of entanglement and/or ingestion) and, if required, appropriate mitigation measures are implemented.
Approved Conservation Advice for *Sternula nereis nereis* (Fairy Tern) (TSSC, 2011)	Conservation advice provides management actions that can be undertaken to ensure the conservation of the Fairy tern. • **Marine pollution:** Evaluate risk of oil spill impact to nest locations and, if required, appropriate mitigation measures are implemented.

Relevant Plan/Advice	Applicable Threats or Management Advice
Approved Conservation Advice for *Calidris canutus* (Red Knot)	Conservation advice provides management actions that can be undertaken to ensure the conservation of the Red knot. • **Marine pollution**: Evaluate risk of oil spill impact to nest locations and, if required, appropriate mitigation measures are implemented.
Approved Conservation Advice for *Botaurus poiciloptilus* (Australasian Bittern) (TSSC, 2011)	• None identified.
National Recovery Plan for Gould's Petrel (*Pterodroma leucoptera leucoptera*) (DEC NSW, 2006)	• None identified.
National Recovery Plan for the Orange-bellied Parrot (*Neophema chrysogaster)* (DELWP, 2016)	The recovery plan is a co-ordinated conservation strategy for the orange-bellied parrot. • **Illuminated boats and structures**: Evaluate risk of lighting on vessels and offshore structures.
Approved Conservation Advice for the Blue Petrel *(Halobaena caerulea)* (TSSC, 2015)	• None identified.
Wildlife Conservation Plan for Migratory Shorebirds – 2015 (DoE, 2015)	• None identified.
National Recovery Plan for the Australian Grayling (*Prototroctes maraena*) (Backhouse et al., 2008)	The recovery plan is a co-ordinated conservation strategy for the Australian grayling. • **Poor water quality and siltation**: Typically, from onshore sources. • **Impact of introduced fish**: Typically, from onshore sources.
Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013)	The overarching objective of this recovery plan is to assist the recovery of the white shark in the wild throughout its range in Australian waters. **Threats**: • None identified.
Recovery Plan for Marine Turtles in Australia, 2017-2027 (DEE, 2017)	The long-term recovery objective for marine turtles is to minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act Threatened species list. **Threats** • Chemical and terrestrial discharge. • Marine debris. • Light pollution. • Habitat modification. • Vessel strike.

Relevant Plan/Advice	Applicable Threats or Management Advice
	• Noise interference. • Vessel disturbance.
Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle)	See above for Recovery Plan for Marine Turtles in Australia, 2017-2027.
Conservation Management Plan for the Blue Whale, 2015-2025 (DoE, 2015)	The long-term recovery objective for blue whales is to minimise anthropogenic threats to allow for their conservation status to improve so that they can be removed from the EPBC Act threatened species list. **Threats** • Noise interference: Evaluate risk of noise impacts and, if required, appropriate mitigation measures are implemented. • Vessel disturbance: Evaluate risk of vessel strikes and, if required, appropriate mitigation measures are implemented.
Approved Conservation Advice for *Balaenoptera borealis* (Sei Whale)	Conservation advice provides threat abatement activities that can be undertaken to ensure the conservation of the sei whale. **Threats** • Noise interference: Evaluate risk of noise impacts to cetaceans and, if required, appropriate mitigation measures are implemented. • Vessel disturbance: Evaluate risk of vessel strikes and, if required, appropriate mitigation measures are implemented.
Approved Conservation Advice for *Megaptera novaeangliae* (Humpback Whale) (TSSC, 2015)	Conservation advice provides threat abatement activities that can be undertaken to ensure the conservation of the humpback whale. **Threats** • Noise interference: Evaluate risk of noise impacts to cetaceans and, if required, appropriate mitigation measures are implemented. • Vessel disturbance: Evaluate risk of vessel strikes and, if required, appropriate mitigation measures are implemented.
Conservation Management Plan for the Southern Right Whale 2011-2021 (DSEWPaC, 2012)	Conservation advice provides threat abatement activities that can be undertaken to ensure the conservation of the Southern right whale. **Threats** • Noise interference: Evaluate risk of noise impacts to cetaceans and, if required, appropriate mitigation measures are implemented. • Vessel disturbance: Evaluate risk of vessel strikes and, if required, appropriate mitigation measures are implemented.
Approved Conservation Advice for *Balaenoptera physalus* (Fin Whale)	Conservation advice provides threat abatement activities that can be undertaken to ensure the conservation of the fin whale. **Threats** • Noise interference: Evaluate risk of noise impacts to cetaceans and, if required, appropriate mitigation measures are implemented. • Vessel disturbance: Evaluate risk of vessel strikes and, if required, appropriate mitigation measures are implemented.

3.2 Commonwealth guidance material

This EP has been prepared considering the following regulatory guidance:

- AMSA Technical guidelines for preparing contingency plans for marine and coastal facilities – January 2015
- AMSA National Plan for Maritime Environmental Emergencies (the NatPlan)
- NOPSEMA Guidance note: Environment plan content requirements – Rev4 – April 2019 (GN1344)
- NOPSEMA Guidance note: Petroleum activities and Australian marine parks – Rev0 – July 2018 (GN1785)
- NOPSEMA Guidance note: Oil pollution risk management – Rev 2 – February 2018 (GN1488)
- NOPSEMA Guidance note: Notification and reporting of environmental incidents – Rev4 – February 2014 (GN0926)
- NOPSEMA Guidance note: ALARP – Rev6 – June 2015 (GN0166)
- NOPSEMA Policy: Environment plan assessment - Rev 7 - April 2019 (PL1347)
- NOPSEMA Guideline: Environment plan decision making – Rev5 – June 2018 (GL1721)
- NOPSEMA Guideline: Environment plan summaries – Rev 2 – April 2019 (GL1566)
- NOPSEMA Guideline: Making submissions to NOPSEMA – Rev 17 – April 2019 (GL0255)
- NOPSEMA Information paper: Consultation requirements under the OPGGS Environment Regulations 2009 – Rev2 – December 2014 (IP1411)
- NOPSEMA Information paper: Operational and scientific monitoring programs – Rev2 – March 2016 (IP1349)
- NOPSEMA Bulletin #1: Oil Spill Modelling – Rev 0 - April 2019 (A652993)

3.3 Industry codes of practice and guideline material

This EP has been prepared considering the following petroleum industry codes of practice and guidance material:

- the APPEA Code of Environmental Practice (CoEP) (2008). The 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 IFC environmental, health, and safety guidelines for offshore oil and gas development (2015). These guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP) and contain the performance levels and measures that are generally considered to be reasonably achievable, depending on the hazards and risks associated with the activity;
- American Petroleum Institute (API);
- International Association of Oil and Gas Producers (IOGP);
- Global oil and gas industry association for environmental and social issues (IPIECA);
- International Well Control Forum (IWCF); and
- International Organisation for Standardisation (ISO).

Other guidelines relevant to this EP include:

- Australian Maritime Safety Authority (AMSA) Technical guidelines for preparing contingency plans for marine and coastal facilities (Commonwealth of Australia, January, 2015)
- Commonwealth Scientific and Industrial Research Organisation (CSIRO) (2016). Oil Spill Monitoring Handbook
- IPIECA-IOGP (2016). Oil spill risk assessment and response planning for offshore installations
- Antifouling and in-water cleaning guidelines (Department of Agriculture 2015)
- Australian National Guidelines for Whale and Dolphin Watching (DEH 2005)
- Draft Revised Australian National Guidelines for Whale and Dolphin Watching (DoEE 2016)
- Australian Standard AS ISO 31000:2018 Risk Management and Handbook 203:2012 Managing Environmental Risk
- Department of Transport (DoT) (2012). Marine Pollution Response Arrangements in Victoria – An Industry Perspective, Sean Moran, Security and Emergency Management Division, Department of Transport (Victoria)
- Advisory Note: Offshore Petroleum Industry Oil Spill Contingency Planning Consultation, V 2.0 August 2013. Victorian Department of Transport, Planning and Local Infrastructure (DTPLI 2013)
- IOGP Report 254: Environmental Management in Oil and Gas Exploration and Production (IOGP 2008)
- IOGP Report 594: Source Control Emergency Response Planning Guide for Subsea Wells (IOGP 2019)
- Environmental Manual for Worldwide Geophysical Operations (IAGC 2001)
- EPBC Act Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species.
- Society of Petroleum Engineers (SPE) Technical Report: Calculation of Worst-Case Discharge (WCD) (April, 2015).

3.4 Protected area management plans

Management measures in this EP are in accordance with the following protected area management plans:

- South-east Commonwealth Marine Reserves Network Management Plan 2013-23 (Director of National Parks 2013)
- Small Bass Strait Island Reserves Draft Management Plan October 2000 (TPAWS 2000)
- Parks Victoria Marine Protected Areas Program Plan 2012-2014 (Parks Victoria 2012)
- Corner Inlet Ramsar site Ecological Character Description. Department of Sustainability, Environment, Water, Population and Communities, 2011
- Corner Inlet Ramsar Site Strategic Management Plan (Parks Victoria 2002a)
- Wilsons Promontory Marine National Park and Wilsons Promontory Marine Park Management Plan May 2006 (Parks Victoria 2006a)
- Corner Inlet Marine National Park Management Plan (Parks Victoria 2005a)
- Corner Inlet Ramsar Site Management Plan (WGCMA, 2014)
- Western Port Ramsar Site Management Plan (DELWP, 2017)
- Port Phillip Bay (Western Shoreline) & Bellarine Peninsula Ramsar Site Strategic Management Plan (DSE, 2003)

- Lavinia Ramsar Site Ecological Character Description. Lloyd Environmental for Department of Sustainability, Environment, Water, Population and Communities, 2012
- Western Port Ramsar Wetland Ecological Character Description. Kellogg, Brown and Root Pty Ltd, 2010 for Department of Sustainability, Environment, Water, Population and Communities
- Bunurong Marine National Park Management Plan (Parks Victoria, 2006)
- NgootyoongGunditj Ngootyoong Mara South West Management Plan (Parks Victoria, 2015)
- Management Plan for Point Addis Marine National Park, Point Danger Marine Sanctuary and Eagle Rock Marine Sanctuary (Parks Victoria, 2005)
- Port Phillip Heads Marine National Park Management Plan (Parks Victoria, 2006)
- Management Plan for Twelve Apostles Marine National Park and The Arches Marine Sanctuary (Parks Victoria, 2006)
- Marengo Reefs Marine Sanctuary Management Plan (Parks Victoria, 2007)
- Barwon Bluff Marine Sanctuary Management Plan (Parks Victoria, 2007)
- Merri Marine Sanctuary Management Plan (Parks Victoria, 2007)
- Mushroom Reef Marine Sanctuary Management Plan (Parks Victoria, 2005)
- The Port Campbell National Park and Bay of Islands Coastal Park (Parks Victoria, 1998)
- The Great Otway National Park and Otway Forest Park Management Plan (Parks Victoria and DSE, 2009)
- Mornington Peninsula National Park and Arthurs Seat State Park Management Plan (Parks Victoria, 2013)
- Wilsons Promontory National Park Management Plan (Parks Victoria, 2002)
- Cape Liptrap Coastal Park Management Plan (Parks Victoria, 2003)
- Kent Group National Park Management Plan 2005
- Tasmanian Marine Protected Areas Strategy.

4 Description of the Activity

4.1 Activity location

This EP provides for a single exploration well (with possible side-track) in Commonwealth waters of the Otway Basin approximately 32 km off Victoria's south-west coast. The Otway Basin is an area where petroleum exploration and production activities are well established (Figure 2-2).

The proposed well location is at a water depth of approximately 71 m. Indicative coordinates for the proposed well is presented in Table 4-1.

Table 4-1: Artisan-1 well location

Well name	Well type	Well location*		Petroleum title	Water depth (m)	Distance from Port Campbell
		Easting	Northing			
Artisan-1	Exploration / Development	663,232	5,693,578	VIC/P43	~71 m	32 km

* The final location for Artisan-1 may be subject to change, but is expected to be within 500 m of these coordinates

4.2 Operational area

The operational area has been defined as the area within which routine drilling operations occur at the well site. For this drilling activity, the operational area is an approximate 2 km radius around the well whilst the MODU is moored on location. This radius encompasses both the outer extent of mooring equipment on the seabed and the 500 m rig safety exclusion zone.

4.3 Activity timing

The drilling activity is planned to commence in Q4 2019 or Q1 2020 with drilling expected to take approximately 35 to 55 days, depending on the final work program and potential operational delays. The Artisan-1 well may be suspended for future production if the well intersects a commercial hydrocarbon column. In the event of the well being suspended, the well head will remain in place and may be used to facilitate future production well operations. This future use would be subject to a separate Environment Plan (EP).

Drilling and support operations will be conducted on a 24-hour basis for the duration of the program.

4.4 Field characteristics

The Turonian Waarre Formation is the source of hydrocarbons targeted for Artisan-1. Artisan-1 is an exploration well, therefore, exact reservoir data is unavailable. The producing formations in the nearby Thylacine reservoir properties are considered to be a suitable analogue for Artisan-1. The reservoir properties for Thylacine are provided in Table 4-2.

Table 4-2: Artisan-1 target reservoir physical characteristics (based on a Thylacine analogue)

Parameter	Thylacine Condensate
Density (kg/m^3)	805 at 15°C
API	44.3
Dynamic viscosity (cP)	0.875 at 20°C
Pour point (°C)	-50
Oil category	Group I
Oil persistence classification	Non-persistent oil

Table 4-3: Condensate boiling point ranges

Parameter	Volatiles (%)	Semi-volatiles (%)	Low-volatiles (%)	Residual (%)
Boiling point (°C)	<180	180-265	265-380	>380
Thylacine Condensate	64.0	19.0	16.0	1
	⇦	Non-Persistent	⇨	⇦ Persistent ⇨

4.5 Activities that have the potential to impact the environment

This section outlines the planned activities covered by the scope of this EP which have the potential to result in environmental aspects or hazards, leading to impacts on receptors. The activities included in this EP are:

- Drilling activities including MODU operations and any pre-lay anchoring operations
- Routine support activities:
    - Vessel operations
    - Helicopter operations
    - ROV operations
- Emergency response activities

4.5.1 Well design and drilling methodology

An indicative overview of the drilling design and process is described in this section. This process is subject to change, depending on individual well design requirements and the final location of the well. Well schematics are provided in the WOMP submitted to NOPSEMA for assessment prior to drilling.

The top hole well sections (conductor and surface hole) will be drilled without a riser, which is standard practice. The cuttings (rock chips) and drilling fluids from this section will be discharged to sea. A riser and blow-out preventer (BOP) will be installed to facilitate the drilling of the deeper well sections once the surface casing is cemented in place. Once the riser and BOP are installed, drilling fluids and cuttings will be returned to the MODU via the marine riser where the drilling fluids will be separated using solids control equipment (SCE). The SCE comprises of shale shakers that remove coarse cuttings from the drilling fluids. After processing by the shale shakers, the recovered fluids, that have been separated from the cuttings, may be directed to centrifuges, which are used to remove the finer solids. The cuttings are usually discharged below the water line and the reconditioned fluids are recirculated into the fluid system. Where synthetic-based drilling fluids (SBDF) are used, the fluids may be further processed using an additional stage of cuttings/fluid separation during which the cuttings are processed through a cuttings dryer system.

4.5.1.1 Blow-out preventer installation and function testing

A BOP is installed onto the wellhead after completion of the top-hole sections. A BOP consists of a series of hydraulically-operated valves and sealing mechanisms (annular preventers and ram preventers) that are normally open to allow the mud to circulate up the marine riser to the rig during drilling. The BOP is used to close in the well in the event of an influx. The MODU's high pressure circulating system would be used in this event, after closing of the BOP, to remove the influx from the well and regain hydrostatic overbalance. The annular preventers and ram preventers are used to shut in around various tubulars in the well, while the blind shear rams are design to shear the pipe in the well and seal the well.

Once installed, regular function and pressure tests are undertaken. Function tests are generally undertaken every 7 days, and pressure tests on a 21-day basis, in accordance with industry standards and Drilling Contractor maintenance system. Function testing is undertaken by activating the hydraulic control system aboard the MODU to confirm functionality of the BOP systems, whilst a pressure test is undertaken to verify seals on the BOP stack. on a regular basis during the campaign.

The BOP control system discharges control fluid into the sea upon operation. A full function test to close and open all ram preventers and annular preventers discharges approximately 2200 L of diluted control fluid. The control fluid used for function testing is a water-soluble product and is diluted with potable water to 1 to 3% concentration for use. Likewise, water-based products are used for pressure testing. The fluids is are fully biodegradable and will readily disperse after discharge from the BOP.

Greater detail on the performance standards for the BOP system, inclusive of design, functionality and preventative maintenance, is provided in a NOPSEMA-accepted WOMP.

4.5.1.2 Drill fluids and cuttings handling and disposal

Drilling fluids used during the drilling program will be either water-based (WBDF) or synthetic-based (SBDF) or brines. Drilling fluid performs several functions including; cooling and lubrication of the drill bit; transportation of drill cuttings to the surface; and maintaining hydrostatic pressure in excess of formation pressure, thus preventing the influx of hydrocarbons from the formation into the wellbore, this is the primary well control barrier.

Liquid drilling fluid, bulk dry products, base oil, brine and drill water are added to their respective systems via bunkering stations from supply vessels. Dry and liquid additives can also be mixed into the fluid system from sacks or containers.. The facility has liquid water-based fluid, synthetic base oil, drill water and brine storage facilities in the column and pontoon tanks and pits forward of the mud pump room that can be used for each type of mud and brine.

A summary of the base case drilling methodology for the Artisan-1 well is described below (Table 4-4).

Table 4-4: Summary of well design and drilling methodology

Well	Hole size	Conductor / casing / liner size	Approx. MDRT (m) / TVD (m)	Fluid type	Approx. cuttings volume (m^3)	Fluid discharge location	Cuttings discharge location
Artisan-1	42"	36"	~161 mMDRT	Sea water & pre-hydrated gel (PHG) sweeps	59	Seabed	Seabed
	17-1/2"	13-3/8"	~650 mMDRT	Sea water & PHG sweeps	76	Seabed	Seabed
	12-1/4"	9-5/8"	~1900 mMDRT	SBDF	95	No whole fluid discharge	Surface – with residual SBDF
	8-1/2"	7"	~2,384 mMDRT	SBDF	18	No whole fluid discharge	Surface – with residual SBDF

4.5.1.3 Cementing Operations

Bulk dry cement is transported to the MODU via project support vessel and transferred to dry bulk storage tanks. During the transfer process, the holding tanks are vented to atmosphere, resulting in small amounts of dry cement being discharged from venting pipes located under the MODU.

Prior to the commencement of cementing operations, the cementing unit is tested resulting in a discharge of between 2.4 m^3 (15 bbl) to 8 m^3 (50 bbls) of cement slurry to sea.

After a string of casing or liner has been installed into the well, a cementing spacer is pumped to flush drilling fluids and filter cake from the well to allow a good cement bond to be formed with the formation. During riserless drilling, the spacer is displaced by the cement slurry and discharged directly to the seabed at the mudline. Once the riser is installed, the preflush volumes are such that the spacer will remain downhole or very minor volumes may be returned to the rig and discharged to sea.

Cement slurry is pumped down the inside of the landing string and then casing (or liner). A displacement fluid is then pumped into the casing with a wiper plug to displace the cement out of the bottom of the casing and up into the annular space between the pipe and the borehole wall. Cement volumes are such that for the 36" casing and the 20 x 13-3/8" casing the cement approximately 15 m^3 (94 bbl) of cement will be discharged to seabed, for all other casing and liner cementations the cement will predominantly remain downhole. In the case of a liner cement job, some excess cement will be circulated back to surface and discharged into the sea. When the wiper plug is pumped and reaches the bottom of the casing string it stops and allows the casing to be pressure tested.

In the event that mixed batches of cement spoil within the cementing unit, or there is a problem encountered during the cementing operation, cement slurry will be either flushed from the cement unit or circulated out of the well and discharged to sea. A discharged batch of cement slurry may be up to 22 m^3 (140 bbls)

Upon completion of each cementing activity, the cementing head and blending tanks are cleaned which results in a release of cement contaminated water to the ocean. While this volume may vary, it is typically in the order of <1 m^3 (<6 bbl) per cement job.

4.5.1.4 Formation evaluation

During drilling, the formation is evaluated to determine the presence and quantity of hydrocarbon within the target reservoir. This information is gathered real-time from Logging Whilst Drilling (LWD) techniques and mud logging.

Sonic logs are considered part of the primary formation evaluation objective for the Artisan-1 well. The sonic tool is a completely self-contained down-hole tool. There are no air-guns or any other noise sources on surface, and there will be no noise transmitted to the surface. The tool is run as part of a standard LWD (or wireline) suite and the data is transmitted to surface in the same way as the data from all the other LWD tools.

Additional down-hole logging sources may include the deployment of resistivity tools and sensors or low-level radioactive sources (such as density-neutron Am-Be & Gamma-Ray Cesium-137). These sources may be required to acquire additional information that cannot be gathered during primary evaluation. These low-level radioactive sources are stored in lockers aboard the MODU and deployed directly down hole with no exposure to the marine environment. Nuclear magnetic resonance tools, Rotary sidewall coring tools, and formation pressure and downhole sampling formation evaluation tools (LWD or wireline) may also be run to fully evaluate the reservoir.

Vertical Seismic Profiling (VSP) or check-shot surveys are not proposed to be undertaken for this activity.

4.5.1.5 Well suspension

As a contingency to the drilling activity, after completion of drilling operations and before well completion (covered under a separate EP) the well may be suspended in accordance with a NOPSEMA-accepted WOMP. To suspend the well, cement plugs and/or a retrievable suspension packer may be installed within the well. The cement plugs and/or suspension packer provides a barrier, isolating the formation and ensuring well integrity is maintained while the well is temporarily suspended.

Following the suspension of the well with appropriate barriers, a wellhead cap may be installed to provide mechanical protection to the wellhead and protect it from marine growth. To inhibit marine growth or corrosion, a biocide and corrosion inhibitor may either be injected or placed within the wellhead cap. The wellhead cap can hold approximately 210 L of dilute corrosion / biocide mixture. Typically, the corrosion / biocide mixture is at a ratio of approximately 3 L corrosion inhibitor, 0.25 L biocide, and 207 L water. If the well is suspended, at this stage, there is no release to the environment; however, when the well cap is removed, the fluid will be discharged to the environment.

4.5.1.6 Plug and abandonment

Depending on the outcome of the formation evaluation, should the Artisan-1 well not be considered viable for future production, the well shall be permanently plugged and abandoned in alignment with Section 572 of the OPGGS Act. Plug and abandonment procedures are designed to permanently isolate the well and mitigate the risk of a potential release of wellbore fluids to the marine environment.

Plug and abandonment operations involve setting a series of permanent cement and mechanical plugs within the wellbore, including plugs above and between any hydrocarbon bearing intervals, at appropriate barrier depths in the well and at the surface. These plugs are tested to confirm their integrity.

Following plug and abandonment operations and confirmation of the permanent barriers, the wellhead is cut with the use of a mechanical cutting tool and removed below the mudline leaving no remaining well infrastructure on the seabed. The cutting process produces metal shaving (swarf), some of which remains on the seabed.

All plug and abandon operations will be conducted in accordance with a NOPSEMA-accepted WOMP.

If the well head cannot be removed whilst the MODU is on location, Beach will develop a plan to remove the wellhead at a later date.

4.5.2 MODU Details and Layout

The Artisan-1 well is proposed to be drilled by a semi-submersible mobile offshore drilling unit (MODU). The Ocean Onyx is currently proposed to undertake this drilling activity. The Ocean Onyx is a conventionally moored, non-self-propelled, column-stabilised semi-submersible mobile offshore drilling unit (MODU) owned and operated by the Diamond Offshore General Company (Diamond Offshore).

The MODU consists of two large inboard pontoons, two large outboard pontoons and sixteen columns supporting a rectangular upper hull. The MODU's principle dimensions are provided in Table 4-5. The MODU can support a maximum of 140 persons on board and has onboard storage capacities as summarised in Table 4-6.

Table 4-5: Ocean Onyx principle dimensions

Dimension	Value
Overall	
Length	111 m (363 ft)
Width	105 m (345 ft)
Height	97.7 m (321 ft)
Draft and Displacement	
Drilling draft (approx.)	22.7 m (74.5 ft)
Drilling displacement (approx.)	49,453 t
Transit draft (approx.)	12.6 m (41.5 ft)
Transit displacement (approx.)	37,866 t

Table 4-6: Ocean Onyx storage capacities

Tank	Capacity
Water ballast	24,445 m^3
Diesel Oil	1,097 m^3
Heli fuel	5 m^3
Potable water	475 m^3
Drill water	1,824 m^3
Brine	962 m^3
Base oil	524 m^3
Liquid mud	1,345 m^3
Cement	179 m^3
Barite / bentonite	213 m^3
Sewage	25.2 m^3
Saltwater	21.8 m^3
Bilge, drain & skimmer tanks	43.8 m^3
Sack storage	4,000 sacks

4.5.2.1 MODU Positioning and Mooring

The MODU will be towed to location and moored prior to commencing drilling activities. Anchors may be positioned (pre-laid) on the sea floor up to 3 months prior to the commencement of drilling.

The MODU may be moored with between 8 and 12 anchors ranging from 15 to 30 MT each, with an individual footprint from approximately 30 m^2 to 60 m^2. A mooring analysis will be undertaken to determine specific mooring requirements for the Artisan-1 well location. This mooring analysis will incorporate the results from the geophysical and geotechnical survey obtained beforehand. Anchors are attached to the MODU using a chain or chain / wire system. The anchors will be positioned at around 1300 m to 2000 m from the drilling location.

Transponders may be required to inform anchor positioning. The expected frequency (Hz) and source level (dB re 1 uPa @ 1 m) of the signal from transponders is 18 - 36 kHz, 196 dB (ref. 1 µPa @ 1 m).

The temporary wet-storage of mooring equipment such as anchors, weights and chain on the seabed may be required throughout the drilling campaign. The footprint of the wet-stored mooring equipment will cover approximately 30 m^2 to 60 m^2.

4.5.2.2 Power Generation System

The MODU engine room is equipped with a number of diesel engines coupled to generators. Additionally, the MODU is fitted with emergency diesel engine and generator auxiliary system, including batteries, transformers and switchboards.

4.5.2.3 Fuel Oil

The MODU has two primary diesel oil tanks, each located in the inboard pontoons. These tanks are generally filled by supply vessels through the bunkering hoses at the aft loading stations.

4.5.2.4 Saltwater Distribution and Cooling System

The primary purpose of the salt water distribution and cooling system is to provide salt water for the reverse osmosis (RO) units, the fire water system, the main engine cooling system heat exchanger, the anchor chain washing system, the draw works brake cooling unit heat exchanger and various flushing and deck wash connection points throughout the facility.

4.5.2.5 Freshwater Generation, Distribution and Cooling System

The freshwater generation system provides fresh water to the potable water, drill water, engine jacket water, anchor winch and draw works brake cooling system The RO freshwater generators use sea water to generate fresh water, and this sea water is supplied with the saltwater from a RO submersible pump. Brine is discharged from the RO system to the sea.

4.5.2.6 Drain, Effluent and Waste Systems

The drainage and effluent systems and associated environmental pollution control systems on the facility include:

- Non-contaminated bilge sumps, deck drains, headers and oily water tanks and separators;
- Contaminated drains, oily water tanks and solids separators;
- Helideck drainage and containment system;
- Black and greywater drainage and sewage treatment plant;
- Domestic waste segregation and disposal;
- Galley waste disposal including macerator;
- Equipment oil drainage, bunding and waste oil tanks; and
- third-party cutting processing equipment (see solids control equipment).

4.5.2.7 Solids Control Equipment

Solids control equipment (SCE) will be used when drilling to separate the solids in the drilling fluids that are crushed by the drill bits and carried out of the well surface. SCE aboard the facility includes:

- shale shakers;
- centrifuging systems;
- and cuttings dryer.

4.5.3 Routine support operations

4.5.3.1 Vessel operations

Vessel operations include:

- MODU mobilisation and positioning;
- Deployment and retrieval of mooring equipment;
- Standby support to monitor and maintain the 500 m rig safety exclusion zone from errant vessels;
- Transfer of goods and equipment to and from the MODU
- Deployment of survey equipment

The MODU will be supported by up to 3 assigned project support vessels, plus spot-hire vessels as required. Project support vessels generally have approximately 12 to 15 persons on board (POB) at any given time.

Project support vessels generally maintain station-keeping via dynamic positioning (DP), but may anchor within the operational area during the drilling activity.

4.5.3.2 Helicopter operations

Helicopters are the primary form of transport for personnel to and from the MODU during drilling operations but may also be used during emergency situations, including operational and scientific monitoring in the event of a hydrocarbon spill. Helicopters may service the MODU up to 7 times per week for the duration of the drilling program generally operating in daylight hours.

Helicopter operations within the operational area are limited to landing and take-off directly to and from the MODU helideck.

Offshore refuelling of the helicopters whilst onboard the MODU is not a primary plan, however, may be undertaken if required.

4.5.3.3 ROV operations

Underwater remotely operated vehicles (ROVs) shall be deployed and controlled from either the MODU or a project vessel to undertake:

- Pre and post-activity site surveys
- Equipment deployment, monitoring and retrieval
- Tool deployment and operation
- BOP activation under emergency conditions

ROVs are generally equipped with a video camera, lighting and have the ability to monitor the subsea infrastructure and the surrounding environment. ROVs are also used to deploy specialist tooling and equipment. Tooling and equipment may be operated with the use of electrics or hydraulics. Hydraulics on ROVs are closed system, where hydraulic fluid is circulated to move components and is designed not to release hydraulic fluid.

The ROVs will be moored on the deck of the vessels and / or MODU and are unlikely to be temporarily parked on the seabed during operations.

5 Description of the Environment

The physical, biological and socio-economic environment that may be affected (EMBA) and the 'region' in general are described in this section, together with the values and sensitivities of the region.

The EMBA is based upon the outer extent of potential hydrocarbon exposure from the two worst-case spill scenarios (Section 7.4). The outer boundary of this area represents the combined results of 200 separate hypothetical spill events for each worst-case scenario (100 summer release scenarios and 100 winter release scenarios) and is based on the low exposure thresholds as defined in Table 7-4. The EMBA is highly conservative and does not represent the actual area that may be affected by a single worst-case spill event.

5.1 Regulatory context

The OPGGS(E)R define 'environment' as the ecosystems and their constituent parts, natural and physical resources, qualities and characteristics of areas, the heritage value of places and includes the social, economic and cultural features of those matters. In accordance with the Regulations, this document describes the physical, ecological, and social components of the environment.

A greater level of detail is provided for those particular values and sensitivities as defined by the Regulations 13(3) of the OPGGS(E)R which states that particular relevant values and sensitivities may include any of the following:

a) the world heritage values of a declared World Heritage property within the meaning of the EPBC Act;

b) the national heritage values of a National Heritage place within the meaning of that Act;

c) the ecological character of a declared Ramsar wetland within the meaning of that Act;

d) the presence of a listed Threatened species or listed Threatened Ecological Community within the meaning of that Act;

e) the presence of a listed Migratory species within the meaning of that Act;

f) any values and sensitivities that exist in, or in relation to, part or all of:

   i. Commonwealth marine area within the meaning of that Act; or

   ii. Commonwealth land within the meaning of that Act.

With regards to 13(3)(d) and (e) more detail has been provided where listed Threatened or Migratory species have a spatially defined biologically important area (BIA) or habitat critical to survival – as they are spatially defined areas where aggregations of individuals of a regionally significant species are known to display biologically important behaviours such as breeding, foraging, resting or migration.

With regards to 13(3)(f) more detail has been provided (Appendix B) for Key Ecological Features (KEFs) as they are considered as conservation values of the Commonwealth marine area; and Australian Marine Parks (AMPs) as they are enacted under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

5.2 Regional environmental setting

The EMBA is located in the South-east Commonwealth Marine Region, which extends from the south coast of New South Wales to Kangaroo Island in South Australia and around Tasmania.

There are significant variations in sea-floor features throughout the South-east Marine Region (SEMR) including seamounts, canyons, escarpments, soft sediments and rocky reefs, which support high levels of biodiversity and species endemism (DoE 2015a). Compared to other marine areas, the SEMR is relatively low in nutrients and primary production; however localised areas of high productivity are known to occur. There are areas of continental shelf, which includes Bass Strait and Otway Shelf, which have rocky reefs and soft sediments that support a wide range of species. The shelf break increases currents, eddies and upwelling, and the area is especially biodiverse, including species that are fished recreationally and commercially. There are seafloor canyons along the continental shelf which provide habitat for sessile invertebrates such as temperate corals. The Bonney Upwelling is an area of seasonally higher primary productivity which attracts baleen whales and other species (including EPBC-listed species) which feed on the plankton swarms (krill).

The SEMR has a high diversity of species and also a large number of endemic species. The fish fauna in the region includes around 600 species, of which 85% are thought to be endemic. Additionally, approximately 95% of molluscs, 90% of echinoderms, and 62% of macroalgae (seaweed) species are endemic to these waters (DNP, 2013).

5.3 Summary of environmental receptors within the EMBA

The following tables list the presence of ecological (Table 5-1) and socio-economic and cultural (Table 5-2) receptors that may occur within the EMBA.

Examples of values and sensitivities associated with each of the receptors have been included in the tables. These values and sensitivities have been identified based on:

- presence of listed Threatened or Migratory species or Threatened Ecological Communities identified in the EPBC Protected Matter search (Appendix A).
- presence of BIAs and habitats critical to the survival of the species.
- presence of important behaviours (e.g. foraging, roosting or breeding) by fauna, including those identified in the EPBC Protected Matter search (Appendix A).
- important linkage to other receptors (e.g. nursery habitat, food source, commercial species).
- important benefit to human activities (e.g. recreation and tourism, aesthetics, economic benefit).

A detailed description of the environment is provided in Appendix B.

Table 5-1: Presence of ecological receptors within the EMBA

Receptor Type	Receptor Description	Values and Sensitivities	Present	EMBA
Shoreline	Rocky	• Foraging habitat (e.g. birds) • Nesting or breeding habitat (e.g. birds, pinnipeds) • Haul-out sites (e.g. pinnipeds)	✓	The Otway coastal includes areas of rocky and sandy beaches. Each of these shoreline types has the potential to support different flora and fauna assemblage due to the different physical factors (e.g. waves, tides, light etc.) influencing the habitat; for example: • Pinnipeds are known to use rocky shores for haul-out and/breeding • Birds species may use sandy, rocky or cliff areas for roosting and breeding sites • Cliff and rocky coasts can provide a hard substrate for sessile invertebrate species (e.g. barnacles, sponges etc) to attach
	Sandy	• Foraging habitat (e.g. birds) • Nesting or breeding habitat (e.g. birds, pinnipeds) • Haul-out sites (e.g. pinnipeds)	✓	
Mangroves	Intertidal/subtitle habitat, mangrove communities	• Nursery habitat (e.g. crustaceans, fish) • Breeding habitat (e.g. fish)	✓	Mangroves are not a dominant habitat along the Otway coast, but are known to occur further east within bays and wetlands (e.g. Western Port Bay, Corner Inlet). Mangrove habitat can provide foraging, nesting and nursery habitat for many species. *See Appendix B.1.5.1 and Appendix B.3.1.1 for more detail*
Saltmarsh	Upper intertidal zone, saltmarsh habitat, habitat for fish and benthic communities	• Nursery habitat (e.g. crustaceans, fish) • Breeding habitat (e.g. fish)	✓	Saltmarsh, including the Threatened Ecological Community 'Subtropical and Temperate Coastal Saltmarsh' is known to occur along the Otway coast. *See Appendix B.3.4.3 and Appendix B.3.1.2 for more detail.*
Soft sediment	Predominantly unvegetated soft sediment substrates	• Key habitat (e.g. benthic invertebrates)	✓	The drilling activity will be conducted in water depths of approximately 71 m. Unvegetated soft sediments are a widespread habitat in both intertidal and subtidal areas, particularly in areas beyond the photic zone. The Middle Otway Shelf (typically 70–130 m depth) is a zone of large tracts of open sand with little or no epifauna to characterise the area: infaunal communities and bivalves, polychaetes and crustaceans dominate in the open sand habitat. *See Appendix B.2.1, B.2.2 and Appendix B.3.1.3 for more detail.*

Receptor Type	Receptor Description	Values and Sensitivities	Present	EMBA
Seagrass	Seagrass meadows	• Nursery habitat (e.g. crustaceans, fish) • Food source (e.g. fish, turtles)	✓	Seagrass typically occurs on soft sediment substrates within the photic zone (i.e. intertidal and shallow subtidal areas). Seagrass is known to occur in the nearshore area of the Otway coast, including within protected areas (e.g. Twelve Apostles Marine Park). *See Appendix B.3.1.4 for more detail.*
Algae	Macroalgae	• Nursery habitat (e.g. crustaceans, fish) • Food source (e.g. birds, fish)	✓	Macroalgae can occur on rocky substrates within the photic zone (i.e. intertidal and shallow subtidal areas). Macroalgae is known to occur in the nearshore area of the Otway coast, including within protected areas (e.g. Twelve Apostles Marine Park). During video surveys, only in waters shallower than approximately 20 m, was an area of significant, high profile reef and associated high density macroalgae dominated epibenthos encountered. *See Appendix B.2.1 and Appendix B.3.1.5 for more detail.*
Coral	Soft corals, hard corals	• Nursery habitat (e.g. crustaceans, fish) • Breeding habitat (e.g. fish)	✓	Hard corals will typically occur in shallower (<50 m) waters. They are not a dominant feature of reef habitat within the SEMR, but their presence has been recorded around Cape Otway and within the Wilsons Promontory National Park. Soft corals are typically present in deeper waters throughout the continental shelf, slope and off slope regions, to well below the limit of light penetration. Soft corals are typically smaller and often solitary. *See Appendix B.3.1.6 for more detail.*
Plankton	Phytoplankton and zooplankton	• Food source (e.g. fish, cetaceans, marine turtles)	✓	Phytoplankton and zooplankton are widespread throughout oceanic environments. *See Appendix B.3.2 for more detail.*

Receptor Type	Receptor Description	Values and Sensitivities	Present	EMBA
Seabirds	Birds that live or frequent the ocean	• Listed marine species • Listed Threatened species • Listed Migratory species • BIA	✓	105 seabird and shorebird species (or species habitat) may occur within the EMBA; with breeding, foraging and roosting behaviours identified. The EMBA intersects foraging BIAs for a number of albatross (Antipodean albatross, black-browed albatross, Buller's albatross, Campbell albatross, Indian yellow-nosed albatross, shy albatross, wandering albatross); wedge-tailed shearwater; common diving-petrel and short-tailed shearwater. A breeding and foraging BIA for the Little Penguin also exists within the EMBA. Roosting and breeding for a variety of bird species, wader birds and terns, occurs within the EMBA. *See Appendix B.3.5.1 for more detail.*
Marine invertebrates	Benthic and pelagic invertebrates	• Food source (e.g. fish)	✓	A variety of invertebrate species may occur within the EMBA, including sponges and arthropods. Shallower (typically <70 m) areas of the Otway Shelf contain areas of exposed limestone substrate that can host variable densities of encrusting mollusc, sponge, bryozoan and red algae assemblages. *See Appendix B.2.1, B.2.2 and B.3.3 for more detail.*
		• Commercial species	✓	Commercially important species (e.g. rock lobster, giant crab) may occur within the EMBA.
Fish	Fish	• Listed Threatened species	✓	Three threatened fish species (or species habitat) may occur within the EMBA: • Australian grayling • Whale shark • White shark. *See Appendix B.3.5.2 for more detail.*
	Sharks and rays	• Listed marine species • Listed Threatened species • Listed Migratory species • BIA	✓	Four shark species (or species habitat) may occur within the EMBA: • porbeagle shark; • shortfin mako shark; and • white shark • whale shark. The EMBA is within a distribution BIA for the white shark. No habitat critical to the survival of the species or behaviours were identified. *See Appendix B.3.5.2 for more detail.*

Receptor Type	Receptor Description	Values and Sensitivities	Present	EMBA
	Pipefish, seahorse, seadragons	• Listed marine species	✓	33 syngnathid species (or species habitat) may occur within the EMBA. No important behaviours or BIAs have been identified. *See Appendix B.3.5.2 for more detail.*
Marine reptiles	Marine turtles	• Listed marine species • Listed Threatened species • Listed Migratory species	✓	Three marine turtle species (or species habitat) may occur within the EMBA: • loggerhead turtle; • green turtle; and • leatherback turtle. No BIAs or habitat critical to the survival of the species occur within the EMBA. *See Appendix B.3.5.5 for more detail.*
Marine mammals	Pinnipeds	• Listed marine species	✓	Three pinniped species (or species habitat) may occur within the EMBA: • New Zealand Fur-seal; • Australian Fur-seal; and • Australian sea-lion Known breeding and haul out sites exist for the New Zealand and Australian Fur-seals within the EMBA, on islands off the coast including Kanowna Island, Lady Julia Percy Island, Seal Rocks and Cape Bridgewater. *See Appendix B.3.5.4 for more detail.*
	Whales	• Listed marine species • Listed Threatened species • Listed Migratory species • BIA	✓	24 whale species (or species habitat) may occur within the EMBA. Foraging behaviours were identified for some species (sei, blue, fin and pygmy right whales); and breeding behaviour identified for the southern right whale. The EMBA intersects a foraging BIA for the pygmy blue whale and an aggregation and migration BIA for the southern right whale. *See Appendix B.3.5.3 for more detail.*
	Dolphins	• Listed marine species • Listed Migratory species	✓	Six dolphin species (or species habitat) may occur within the EMBA: • Risso's dolphin; • dusky dolphin; • southern right whale dolphin; • Indian Ocean bottlenose dolphin; • common dolphin; and • bottlenose dolphin. No important behaviours or BIAs have been identified. *See Appendix B.3.5.3 for more detail.*

Table 5-2: Presence of socio-economic and cultural receptors within the EMBA

Receptor Type	Receptor Description	Values and Sensitivities		EMBA
Commonwealth Marine Area	AMP	• Aggregations of marine life	✓	The AMPs that overlap the EMBA are: • Apollo; • Beagle; • Murray; • Nelson; and • Zeehan *See Appendix B.1.1 for more detail*
	KEF	• High productivity • Aggregations of marine life	✓	The KEFs that overlap the EMBA are: • The Bonney Coast Upwelling • Upwelling East of Eden • The West Tasmanian Marine Canyons • Shelf Rocky Reefs and Hard Substrates • Bass Cascade *See Appendix B.1.10 for more detail.*
	TEC	• Wildlife corridors • Aggregations of marine life	✓	The TECs that overlap the EMBA are: • Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community • Giant Kelp Marine Forests of South East Australia *See Appendix B.3.4 for more detail.*
State Parks and Reserves	Marine Protected Areas	• Aggregations of marine life	✓	Both Victoria and Tasmania have marine protected areas present within the EMBA. *See Appendix B.1.6 and Appendix B.1.8 for more detail.*
	Terrestrial Protected Areas	• Aggregations of terrestrial life	✓	Victoria and Tasmania have terrestrial protected areas present in the EMBA. *See Appendix B.1.7 and Appendix B.1.9 for more detail.*
Wetlands of International Importance	Ramsar Wetlands	• Aggregation, foraging and nursery habitat for marine life	✓	There are six Ramsar wetlands in the EMBA: • Corner Inlet • Port Phillip Bay • Western Port • Glenelg Estuary • Lavinia • Piccaninnie Ponds Karst Wetlands *See Appendix B.1.5 for more detail.*
Commercial Fisheries	Commonwealth-managed	• Economic benefit	✓	The Commonwealth-managed fisheries that overlap the EMBA are: • Bass Strait Central Zone Scallop Fishery (Bass Strait CZSF); • Eastern Tuna and Billfish Fishery (ETBF); • Skipjack Tuna Fishery; • Small Pelagic Fishery (SPF); • Southern and Eastern Scalefish and Shark Fishery (SESSF); • Southern Bluefin Tuna Fishery (SBTF); and • Southern Squid Jig Fishery.

Receptor Type	Receptor Description	Values and Sensitivities		EMBA
				Based on data within the ABARES Fishery Status Reports 2013 to 2017 (Patterson et al. 2018, 2017, 2016, 2015 and Georgeson et al. 2014) the following have catch effort within the EMBA: • Bass Strait CZSF • ETBF; • SBTF; • SESSF; and • Southern Squid Jig Fishery. *See Appendix B.4.8 for more detail.*
	Victorian State-managed	• Economic benefit	✓	The Victorian State-managed fisheries that overlap the EMBA are: • Rock Lobster Fishery; • Giant Crab Fishery; • Abalone Fishery; • Scallop (Ocean) Fishery; • Wrasse (Ocean) Fishery; and • Snapper Fishery. Based on data from Seafood Industry Victoria (SIV) 2014 to 2018 the above listed fisheries have catch effort within the EMBA. *See Appendix B.4.8 for more detail.*
	Tasmanian State-managed	• Economic benefit	✓	The Tasmanian State-managed fisheries that overlap the EMBA are: • Abalone Fishery • Commercial Dive Fishery • Giant Crab Fishery • Rock Lobster Fishery • Scalefish Fishery • Scallop Fishery • Seaweed Fishery • Shellfish Fishery Based on historic catch assessments, only the following are expected to be active within the EMBA: • Abalone Fishery • Commercial Dive Fishery • Giant Crab Fishery • Rock Lobster Fishery • Scalefish Fishery • Seaweed Fishery *See Appendix B.4.9 for more detail.*
Recreational Fisheries	State-managed	• Community • Recreation	✓	Recreational fishing is popular in Victoria largely centred within Port Phillip Bay and Western Port. Recreational fisheries that occur within the EMBA are: • Rock lobster • Finfish • Abalone • Scallops • Squid

Receptor Type	Receptor Description	Values and Sensitivities		EMBA
				• Pipi *See Appendix B.4.7 for more detail.*
Recreation and Tourism	Various human activities and interaction	• Community • Recreation • Economic benefit	✓	Consultation has identified the key areas of tourism in the region include sightseeing, chartered vessels, diving and fishing. *See Appendix B.4.5 and Appendix B.4.6 for more detail.*
Industry	Shipping	• Community • Economic benefit	✓	The SEMR is one of the busiest shipping regions in Australia and Bass Strait is one of Australia's busiest shipping routes. Commercial vessels use the route when transiting between ports on the east, south and west coasts of Australia, and there are regular passenger and cargo services between mainland Australia and Tasmania. *See Appendix B.4.2 for more detail.*
	Petroleum exploration and production	• Economic benefit	✓	Petroleum exploration has been undertaken within the Otway Basin since the early 1960s. The Cooper Energy Casino-Henry fields and pipeline and Minerva field and pipeline are within the EMBA. A search of NOPSEMA website indicates that there are no planned petroleum activities within the operational area or petroleum title or that would coincide with the proposed Beach exploration drilling activities. *See Appendix B.4.3 and Appendix B.4.4 for more detail.*
Heritage	Maritime	• Shipwrecks	✓	There are over 200 historic shipwrecks in the EMBA, however only one with a protection zone within the EMBA, the *SS Alert*. *See Appendix B.5.1 for more detail.*
	Cultural	• World Heritage Properties • Commonwealth Heritage Places • National Heritage Places	✓	There are no World Heritage Properties present within the EMBA. There are eight Commonwealth Heritage Places, only two of which include natural coastal areas within the EMBA: • HMAS Cerberus Marine and Coastal Area (Natural, Listed place) • Swan Island and Naval Waters (Natural, Listed place) There are three places of National Heritage that were identified by the PMST Report but are located onshore, outside the EMBA and do not have marine or coastal components. *See Appendix B.1.2, Appendix B.1.3 and Appendix B.1.4 for more detail.*

6 Environmental Impact and Risk Assessment Methodology

6.1 Overview

This section outlines the environmental impact and risk assessment methodology used for the assessment of the drilling activities. The 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 this risk assessment process.

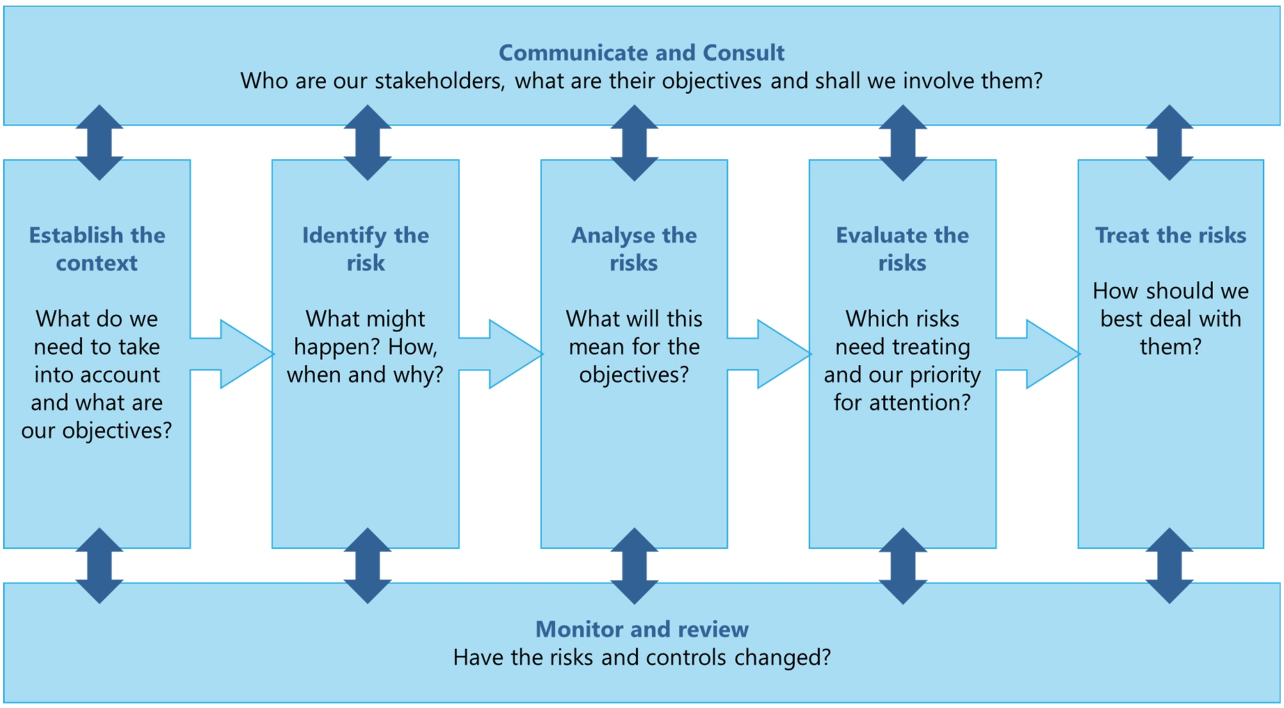


Figure 6-1: Risk assessment process

6.1.1 Definitions

Definitions of the term used in the risk assessment process are detailed in Table 6-1.

Table 6-1: Risk assessment process definitions

Term	Definition
Activity	Refers to a 'petroleum activity' as defined under the OPGGS(E)R as: • petroleum activity means operations or works in an offshore area undertaken for the purpose of: a. exercising a right conferred on a petroleum titleholder under the Act by a petroleum title; or, b. discharging an obligation imposed on a petroleum titleholder by the Act or a legislative instrument under the Act.
Consequence	The consequence of an environmental impact is the potential outcome of the event on affected receptors (particular values and sensitivities). Consequence can be positive or negative.
Control measure	Defined under the OPGGS(E)R as a system, an item of equipment, a person or a procedure, that is used as a basis for managing environmental impacts and risks.

Term	Definition
Emergency condition	An unplanned event that has the potential to cause significant environmental damage or harm to MNES. An environmental emergency condition may, or may not, correspond with a safety incident considered to be a Major Accident Event.
Environmental aspect	An element or characteristic of an operation, product, or service that interacts or can interact with the environment. Environmental aspects can cause environmental impacts.
Environmental impact	Defined under the OPGGE(E)R as any change to the environment, whether adverse or beneficial, that wholly or partially results from an activity.
Environmental performance outcome	Defined under the OPGGS(E)R as 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.
Environmental performance standard	Defined under the OPGGS(E)R as a statement of the performance required of a control measure.
Environmental risk	An unplanned environmental impact has the potential to occur, due either directly or indirectly from undertaking the activity.
Likelihood	The chance of an environmental risk occurring.
Measurement criteria	A verifiable mechanism for determining control measures are performing as required.
Residual risk	The risk remaining after control measures have been applied (i.e. after risk treatment).

6.2 Communicate and consult

In alignment with Regulation 11A(2) of the OPGGS(E)R, during the development of this EP, Beach has consulted with relevant person(s) (stakeholders) to obtain information in relation to their activities within the operational area and potential impacts to their activities. This information is used to inform the EP and the risk assessment undertaken for the activity. Stakeholder consultation is an iterative process that continues throughout the development of the EP and for the duration of a petroleum activity as detailed in Section 9.

6.3 Establish the context

Context for the risk assessment process is established by:

- understanding the regulatory framework in which the activity takes place (described in the 3, 'Environmental Requirements');
- identifying the environmental aspects of the activity (and associated operations) that will or may cause environmental impacts or may present risks to the environment (based upon the 'Activity Description' in Section 0);
- identifying the environment that may be affected, either directly or indirectly, by the activity (based upon the 'Existing Environment' as described in Section 5); and
- understanding the concerns of stakeholders and incorporating those concerns into the design of the activity where appropriate (outlined in Section 9, 'Stakeholder Consultation').

6.4 Identify the potential impacts and risks

Potential impacts (planned) and risks (unplanned) associated with the environmental aspects of the activity are identified in relation to the EMBA, either directly or indirectly, by one or multiple aspects of the activity i.e., identifying the cause-effect pathway by which environmental and social receptors may be impacted. Table 7-1 details the aspects identified for the activity.

6.5 Analyse the potential impacts and risks

Once impacts and risks have been identified, an analysis of the nature and scale of the impact or risk is undertaken. This involves determining the possible contributing factors associated with the impact or risk. Each possible cause should be identified separately, particularly where controls to manage the risk differ. In this way, the controls can be directly linked to the impact or risk.

6.5.1 Establish environmental performance outcomes

Environmental Performance Outcomes (EPOs) are developed to provide a measurable level of performance for the management of environmental aspects of an activity to ensure that environmental impacts and risks will be of an acceptable level. EPOs have been developed based on the following:

- ecological receptors: MNES: Significant Guidelines 1.1 to identify the relevant significant impact criteria. The highest category for the listed threatened species or ecological communities likely to be present within the EMBA is used, for example: endangered over vulnerable.
- commercial fisheries: Victorian Fisheries Authority core outcome of sustainable fishing and aquaculture (https://vfa.vic.gov.au/about).
- marine users: OPGGS Act 2006 (Cth) Section 280.

6.6 Evaluate and treat the potential impacts and risks

The following steps are undertaken using the environmental risk assessment matrix (Table 6-2) to evaluate the potential impacts and risks:

- identify the consequences of each potential environmental impact, corresponding to the maximum credible impact;
- for unplanned events, identify the likelihood (probability) of unplanned environmental impacts occurring;
- for unplanned events, assign a level of risk to each potential environmental impact using the risk matrix.
- identify control measures to manage potential impacts and risks to as low as reasonably practicable (ALARP) (Section 6.7) and an acceptable level (Section 6.8); and
- establish environmental performance standards for each of the identified control measures.

Table 6-2: Environmental risk assessment matrix

Environmental Risk Assessment Matrix									
Consequence Rating	Natural Environment	Reputational and/or Community damage / impact / social / cultural heritage	Likelihood of Occurrence						
			Remote (1)	Highly Unlikely (2)	Unlikely (3)	Possible (4)	Likely (5)	Almost Certain (6)
			<1% chance of occuring within the next year. Occurance requires exceptional circumstances. Exceptionally unlikely event in the long-term future. Only occur as a 100 year event.	>1% chance of occuring within the next year. May occur but not anticipated. Could occur years to decades.	>5% chance of occuring in the next year. May occur but not for a while. Could occur within a few years.	>10% chance of occuring within the next year. May occur shortly but a ditict probability iot won't. Could occur within months to years.	>50% chance of occuring within the next year. Balance of probability that it will occur. Could occur within weeks to months.	99% chance of occuring within the next year. Impact is occuring now. Could occur within days to weeks.
Catastrophic (6)	Long-term destruction of highly valued ecosystem or very significant effects on endangered species or habitats (formally managed).	Irreparable damage or highly valued items or structures of great cultural significance. Negative international or prologed national media (e.g. 2 weeks)	High	High	Severe	Severe	Extreme	Extreme
Critical (5)	Significant impact on highly valued (formally managed) species or habitats to the point of eradication or impairment of ecosystem. Widespread long-term impact.	Major irreparable damage to highly valued structures / items of cultural significance. Negative national media for 2 days or more. Significant public outcry.	Medium	Medium	High	Severe	Severe	Extreme
Major (4)	Very serious environmental effects, such as dosplacement of species and partial impairment of ecosystem (formally managed). Widespread medium and some long-term impact.	Significant damage to items of cultural significance. Negative national media for 1 day. NGO adverse attention.	Medium	Medium	Medium	High	Severe	Severe
Serious (3)	Moderate effects on biological or physical environment (formally managed) and serious short-term effects but not affecting ecosystem functions.	Permanent damage to items of cultural significance. Negative State media. Heightened concern from local community. Criticism by NGOs.	Low	Medium	Medium	Medium	High	Severe
Moderate (2)	Minor short-term damage to area of limited significance (not formally managed). Short-term effects but not affecting ecosystem functions.	Some damage to items of cultural significance. Minor adverse local public or media attention and complaints.	Low	Low	Medium	Medium	Medium	High
Minor (1)	No lasting effects. Low-level impacts on biological and physical environment to an area of low significance (not formally managed).	Low level repairable damage to commonplace structures. Public concern restricted to local complaints.	Low	Low	Low	Medium	Medium	Medium

6.7 Demonstration of ALARP

Beach's approach to demonstration of ALARP includes:

- systematically identify and assess all potential environmental impacts and risks associated with the activity;
- where relevant, apply industry 'good practice' controls to manage impacts and risks;
- assess the effectiveness of the controls in place and determine whether the controls are adequate according to the 'hierarchy of control' principle;
- for higher order impacts and risks undertake a layer of protection analysis and implement further controls if both feasible and reasonably practicable to do so.

NOPSEMA's EP decision making guideline (NOPSEMA, 2018) 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.

For this EP, the guidance provided in NOPSEMA's EP decision making guideline (NOPSEMA, 2018) has been applied, whereby 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.

The following section details how the guidance provided in NOPSEMA's EP decision making guideline (NOPSEMA, 2018).

6.7.1 Residual impact and risk levels

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 environmental risk assessment matrix, the impact consequence is rated as 'minor' or 'moderate' or risks are rated as 'low', 'medium' or 'high.' In these cases, applying 'good industry practice' (as defined in Section 6.7.2.1) is sufficient to manage the risk.

Higher-order environmental impacts and risks

All other impacts are risks are defined by NOPSEMA as higher-order environmental impacts and risks (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 environmental risk assessment matrix (Table 6-2), the impact consequence is rated as 'serious', 'major', 'critical' or 'catastrophic', or when the risk is rated as 'severe' or 'extreme'. In these cases, further controls must be considered as per Section 6.7.2.

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 for the consequence of planned operations and the risks of unplanned events is outlined in Table 6-3.

Table 6-3: ALARP determination for consequence (planned operations) and risk (unplanned events)

Consequence ranking	Minor	Moderate	Serious	Major	Critical	Catastrophic
Planned operation	Broadly acceptable	Tolerable if ALARP		Intolerable		
Residual impact category	Lower order impacts		Higher order impacts			
Risk ranking	Low	Medium	High	Severe	Extreme	
Unplanned event	Broadly acceptable	Tolerable if ALARP		Intolerable		
Residual risk category	Lower order risks			Higher order risks		

6.7.2 Uncertainty of impacts and risks

In addition to the evaluation of residual impacts and risks as described above, the relative level of uncertainty associated with the impact or risk is also used to inform whether the application of industry good practice is sufficient to manage impacts and risks to ALARP, or if the evaluation of further controls is required.

In alignment with NOPSEMA's ALARP Guidance Note (NOPSEMA, 2015), Beach have adapted the approach developed by Oil and Gas UK (OGUK) (OGUK, 2014) for use in an environmental context to determine the assessment technique required to demonstrate that potential impacts and risks are ALARP (Figure 6-2). Specifically, the framework considers impact severity and several guiding factors:

- activity type;
- risk and uncertainty; and
- stakeholder influence.

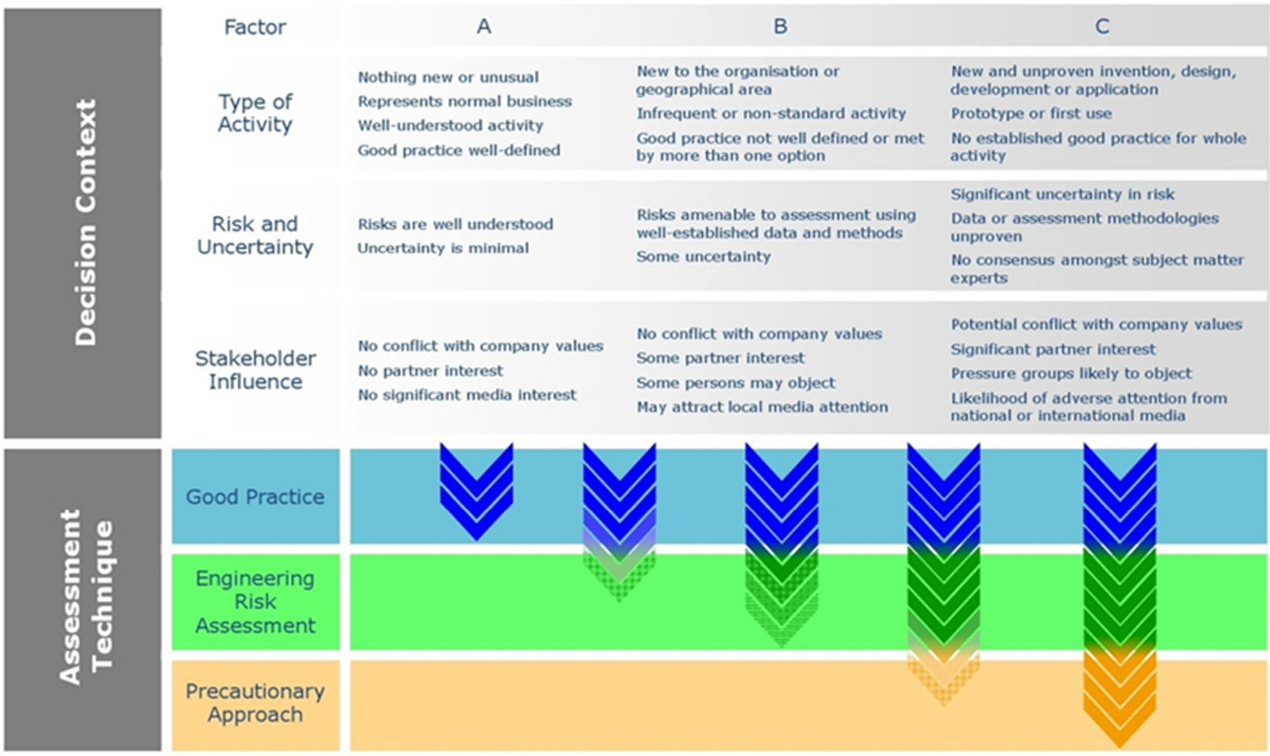


Figure 6-2: OGUK (2014) decision support framework

A **Type A** decision is made if the risk is relatively well understood, the potential impacts are low, activities are well practised, and there are no conflicts with company values, no partner interests and no significant media interests. However, if good practice is not sufficiently well-defined, additional assessment may be required.

A **Type B** decision is made if there is greater uncertainty or complexity around the activity and/or risk, the potential impact is moderate, and there are no conflict with company values, although there may be some partner interest, some persons may object, and it may attract local media attention. In this instance, established good practice is not considered sufficient and further assessment is required to support the decision and ensure the risk is ALARP.

A **Type C** decision typically involves sufficient complexity, high potential impact, uncertainty, or stakeholder influence to require a precautionary approach. In this case, relevant good practice still must be met, additional assessment is required, and the precautionary approach applied for those controls that only have a marginal cost benefit.

In accordance with the regulatory requirement to demonstrate that environmental impacts and risks are ALARP, Beach has considered the above decision context in determining the level of assessment required.

The levels of assessment techniques considered include:

- good practice;
- engineering risk assessment; and
- precautionary approach.

6.7.2.1 Good practice

OGUK (2014) defines '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.

'Good practice' can also be used as the generic term for those measures that are recognised as satisfying the law. For this EP, sources of good practice include:

- requirements from Australian legislation and regulations;
- relevant Australian policies;
- relevant Australian Government guidance;
- relevant industry standards and/or guidance material; and
- relevant international conventions.

If the ALARP technique is determined to be 'good practice', further assessment ('engineering risk assessment') is not required to identify additional controls. However, additional controls that provide a suitable environmental benefit for an insignificant cost are also identified at this point.

6.7.2.2 Engineering risk assessment

All potential impacts and risks that require further assessment are subject to an 'engineering risk assessment'. Based on the various approaches recommended in OGUK (2014), Beach believes the methodology most suited to this activity is a comparative assessment of risks, costs, and environmental benefit. A cost–benefit analysis should show the balance between the risk benefit (or environmental benefit) and the cost of implementing the identified measure, with differentiation required such that the benefit of the control can be seen and the reason for the benefit understood.

6.7.2.3 Precautionary approach

OGUK (2014) states that if the assessment, considering all available engineering and scientific evidence, is insufficient, inconclusive, or uncertain, then a precautionary approach to impact and risk management is needed. A precautionary approach will mean that uncertain analysis is replaced by conservative assumptions that will result in control measures being more likely to be implemented.

That is, environmental considerations are expected to take precedence over economic considerations, meaning that a control measure that may reduce environmental impact is more likely to be implemented. In this decision context, the decision could have significant economic consequences to an organisation.

6.8 Demonstration of acceptability

Regulation 13(5)(c) of the OPGGS(E)R requires demonstration that environmental impacts and risks are of an acceptable level.

Beach considers a range of factors when evaluating the acceptability of environmental impacts and risks associated with its activities. This evaluation works at several levels, as outlined in Table 6-4, which is based on Beach's interpretation of the NOPSEMA EP content requirements (NOPSEMA, 2016).

Table 6-4: Acceptability criteria

Test	Question	Acceptability demonstration
Policy compliance	Is the proposed management of the impact or risk 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 impact or risk aligned with Beach's Health, Safety and Environment Management System (HSEMS)?	Where specific Beach procedures, guidelines, expectations are in place for management of the impact or risk in question, acceptability is demonstrated.
Stakeholder engagement	Have stakeholders raised any concerns about activity impacts or risks, and if so, are measures in place to manage those concerns?	Merits of claims or objections raised by stakeholder must have been adequately assessed and additional controls adopted where appropriate.
Laws and standards	Is the impact or risk being managed in accordance with existing Australian or international laws or standards?	Compliance with specific laws or standards is demonstrated.
Industry practice	Is the risk being managed in line with industry practice?	Management of the impact or risk complies with relevant industry practices.
Environmental context	Is the impact or risk being managed pursuant to the nature of the receiving environment (e.g. sensitive or unique environmental features generally require more management measures to protect them than environments widely represented in a region)?	The proposed impact or risk controls, environmental performance objectives and standards must be consistent with the nature of the receiving environment.
Ecologically Sustainable Development (ESD) Principles	Is the impact or risk being managed such that the activity can be carried out in a manner consistent with the principles of ESD?	Activity must be carried out in a manner consistent with the relevant ESD principles.

6.8.1 Ecologically sustainable development

Section 3A of the EPBC Act defines ecologically sustainable development (ESD), which is based on Australia's National Strategy for Ecological Sustainable Development (1992) that 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.'

Relevant ESD principles and how they are applied by Beach:

- 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 development process, as such this principal is not considered separately for each acceptability evaluation.
- 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. If there is, the project shall assess whether there is significant uncertainty in the evaluation, and if so, whether the precautionary approach should be applied.
- 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 EP risk assessment methodology ensures that potential impacts and risks are ALARP, where the potential impacts and risks are determined to be serious or irreversible the precautionary principle is implemented to ensure the

environment is maintained for the benefit of future generations. Consequently, this principal is not considered separately for each acceptability evaluation.

- The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making. Beach considers if there is the potential to affect biological diversity and ecological integrity through the risk assessment process.

6.9 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, environmental performance standards and measurement criteria that are described for each environmental hazard. Monitoring and review are described in detail in the Implementation Strategy (Section 8).

7 Environmental Impact and Risk Assessment

7.1 Overview

In alignment with Regulation 13 (5) of the OPGGS(E) Regulations, this section of the EP details the potential environmental impacts and risks associated with the activity and provides an evaluation of all the impacts and risks appropriate to the nature and scale of each impact or risk. This evaluation includes impacts and risks arising directly or indirectly from the activity and includes potential oil pollution emergencies and the implementation of oil spill response strategies and oil spill monitoring.

In addition, this section details the control measures (systems, procedures, personnel or equipment) that will be used to reduce potential impacts and risks to ALARP and acceptable levels. Environmental performance outcomes (EPOs), environmental performance standards (EPSs) and measurement criteria associated with each of the identified control measures are provided in Section 7.6.

To establish context for the environmental impact and risk assessment, the environmental aspects associated with this petroleum activity (as described in Section 0) are identified in Table 7-1. Tables 7-2 and 7-3. These provide a summary of all impacts and risks associated with these environmental aspects, with an assessment of lower-order impacts (Minor and Moderate consequence) and risks (Low, Medium and High risk) also provided. Higher-order impacts (Major and above) and risks (Severe and above), as well as impacts or risks for which an ALARP decision context B has been selected, are assessed in more detail in Section 7.2 to 7.6. Note that, due to the similarity in aspects and impacts, general MODU operations such as station-keeping, routine waste discharges, work lighting etc have been grouped with routine support operations (such as vessel operations), instead of with the drilling activity (as described in Section 4).

Aspects related to oil spill response options are identified in Table 7-1 and related impacts and risks are described in Sections 7.6 and 7.4.7.

Table 7-1: Activity – Aspect Relationship

	Environmental Aspect																			
						Planned Marine discharges											Unplanned marine discharges			
ACTIVITIES	Light Emissions	Atmospheric emissions	Underwater noise and vibration	Physical presence: displacement of other marine users, relevant persons or public and / or heritage	Benthic disturbance	Cooling water and brine	Sewage and grey water	Deck drainage and bilge water	Putrescible food waste	Hydraulic control fluids	Drill Fluids and cuttings	Cement	Suspension fluids	Chemical dispersants	Introduction & Establishment of IMP	Physical presence: collision with or disturbance to fauna	Waste	Loss of containment (LOC) - chemicals	Loss of containment (LOC) - hydrocarbons	Loss of well control (LOWC)
Routine Support																				
MODU operations	✓	✓	✓	✓	✓	✓	✓	✓	✓						✓		✓	✓	✓	
Vessel operations	✓	✓	✓	✓		✓	✓	✓	✓						✓	✓	✓	✓	✓	
Helicopter operations				✓												✓				
ROV operations					✓					✓										
Drilling																				
Drilling			✓		✓															✓
Blow-out preventer installation and function testing										✓										
Drill fluids and cuttings handling and disposal											✓									
Cementing operations												✓								
Well suspension													✓							✓
Plug and abandonment												✓								
Oil spill response																				
Monitor and evaluate				✓												✓				
Source control	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓	
Protection and deflection	✓			✓												✓				
Shoreline clean-up	✓			✓												✓				
Oiled wildlife response (OWR)	✓			✓												✓				
Application of chemical dispersants														✓						

Table 7-2: Routine Support (including MODU Operations) environmental impact and risk ratings, control identification, ALARP and acceptability assessment

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	Acceptability Assessment	Acceptability Outcome
MODU operations Vessel operations	Light Emissions	Change in ambient light	Ambient Light	Light emissions from MODU and vessel operations will result in a change in ambient light. Light glow from the vessel is likely to be limited to the operational area and temporary in nature as the vessel moves through the water. Studies of MODU light emissions indicate that light is visible to receptors within 30 km of the source (Woodside, 2014).	Minor (1)	A	None identified	None identified	N/A	Low	• The proposed management of the impact is aligned with the Beach Environment Policy. • The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements. • No stakeholder objections or claims have been raised. • The impact is being managed in accordance with legislative requirements. • No relevant good practice controls have been identified due to low risk of light emissions to sensitive receptors. • Activity will not impact the long-term survival and recovery of albatross and giant petrel populations breeding and foraging as per the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC, 2011). • Activity will not impact the recovery of the Australian grayling as per the National Recovery Plan for the Australian Grayling (*Prototroctes maraena)* (DSE, 2008). • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The environmental impact assessment (EIA) demonstrates consistency with the principles of ESD.	Acceptable
		Change in fauna behaviour	Seabirds	A change in ambient light levels could result in a localised light glow, which has the potential to disrupt ecological processes which rely on light cues. The operational area overlaps foraging BIAs for a number of albatross species, the wedge-tailed shearwater, common diving-petrel and short-tailed shearwater. Light emissions are identified as a threat in National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC, 2011). However, impacts from light emissions will be localised and temporary; limited to the operational area.	Minor (1)	A	None identified	None identified	N/A	Low		
			Fish	High levels of light may attract fish which are then preyed upon. Light glow from the vessel is likely to be limited to the operational area and temporary in nature as the vessel moves through the water. The threatened Australian grayling may be present in the area; however, light is not identified as a threat to this species in the National Recovery Plan for the Australian Grayling (*Prototroctes maraena)* (DSE, 2008). Commercial fish species may be present in the operational area but light from a vessel undertaking offshore activities would be the equivalent as for a fishing vessel, hence impacts to commercial fish species are unlikely.	Minor (1)	A	None identified	None identified	N/A	Low		
			Marine turtles	Artificial light can disrupt turtle nesting and hatching behaviours. There are no turtle nesting beaches or	N/A							

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	Acceptability Assessment	Acceptability Outcome
				coastline within the operational area (>25 km from coastline), therefore no impact is expected.								
			Marine mammals	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. Therefore, no impact is expected.	N/A							
MODU operations Vessel operations	Atmospheric emissions	Change in air quality	Air quality	Emissions from the MODU and vessels will result in a localised decrease in air quality. Offshore winds will rapidly disperse atmospheric emissions when they are discharged into the environment.	Minor (1)	A	CM#1: MO 97: Marine Pollution Prevention – Air Pollution	None identified	N/A	Low	• The proposed management of the impact is aligned with the Beach Environment Policy. • The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements. • No stakeholder objections or claims have been raised. • The impact is being managed in accordance with legislative requirements. • Good practice controls have been defined. • Activity will not impact the long-term survival and recovery of albatross and giant petrel populations breeding and foraging as per the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC, 2011). • The EIA demonstrates consistency with the principles of ESD.	Acceptable
			Coastal settlements	There are no coastal settlements within the operational area or at a distance where impacts from air emissions would occur.	N/A							
		Injury / mortality to fauna	Seabirds	The operational area overlaps foraging BIAs for a number of albatross, the wedge-tailed shearwater, common diving-petrel and short-tailed shearwater. The impacts on air quality is predicted to be localised to the emission point and can be expected to be reduced to background levels close to the source. No habitat critical to the survival of birds occur within the operational area. Atmospheric emissions are not identified as a threat in the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC, 2011). Climate change is; however, MODU and vessel emissions attributable to this drilling campaign would not be significant enough to impact on climate change.	Minor (1)	A	CM#1: MO 97: Marine Pollution Prevention – Air Pollution	None identified	N/A	Low		
MODU operations Vessel operations	Underwater noise & vibration	Change in ambient noise	Ambient noise	During normal operations the vessels will generate continuous noise from propeller cavitation, thrusters, hydrodynamic flow around the hull, and operation of machinery and equipment. The MODU does not have self-propulsion so will not generate noise and vibration from propellers. There may; however, be some residual noise and vibration generated from the turbines and general onboard activities Studies of underwater noise generated from propellers of support vessels when holding position indicate highest measured levels up to 182 dB re 1 µPa, with	Minor (1)	A	None identified	None identified	N/A	Low	• The proposed management of the impact is aligned with the Beach Environment Policy. • The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements. • No stakeholder objections or claims have been raised.	Acceptable

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	Acceptability Assessment	Acceptability Outcome
				levels of 120 dB re 1 µPa recorded at 3–4 km (Hannay et al., 2004). DP vessels are capable of generating sound at levels between 108 and 182 dB re 1 µPa @ 1 m at dominant frequencies between 50 Hz and 7 kHz (Simmonds et al., 2004; McCauley, 1998Changes in ambient noise are therefore expected to extend 3-4 km from the operations., However, the well is known to be in a major commercial shipping area and is likely to have elevated ambient noise levels from these commercial shipping operations.							• The impact is being managed in accordance with legislative requirements. • No relevant good practice controls have been identified due to the low risk from geotechnical activities. • Activity will not impact the recovery of the Australian grayling as per the National Recovery Plan for the Australian Grayling (*Prototroctes maraena*) (DSE, 2008). • Activity will not impact the recovery of the white shark as per the Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013). • Activity will not impact the recovery of marine turtle species as per the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a). • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The EIA demonstrates consistency with the principles of ESD.	
		Change in fauna behaviour	Fish Marine reptiles	Popper et al. (2014) details that risks of mortality and potential mortal injury, and recoverable injury impacts to fish with no swim bladder (sharks) and turtles is low and that temporary threshold shift (TTS) in hearing may be a moderate risk near (tens of metres) the vessel. For fish with a swim bladder risks of mortality and potential mortal injury impacts is low. No cumulative impacts are expected as there are no locations supporting site-attached fish in the immediate area. Behavioural impacts are more likely such as moving away from the vessel. There are no habitats or features within the operational area that would restrict fish, whale sharks or turtles from moving away from the vessel. The threatened Australian grayling maybe present in the area. The National Recovery Plan for the Australian Grayling (*Prototroctes maraena*) (DSE, 2008) does not identify noise impacts as a threat to this species. The operational area is within a distribution BIA for the white shark though no habitat critical to the survival of the species or behaviours were identified. The Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013) does not identify noise impacts as a threat. Three marine turtle species (or species habitat) may occur within the operational area though no BIAs or critical habitat to the survival of the species were identified. The Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a) identified noise interference as a threat; however, disturbance impacts to individuals are predicted which will not impact on turtles at a population level.	Minor (1)	A	None identified	None identified	N/A	Low		
			Marine mammals - Pinnipeds	Two species of pinniped (or species habitat) may occur within the operational area; the long-nosed fur-seal and the Australian fur-seal. No BIAs or habitat critical to the survival of the species were identified for pinnipeds. Onset thresholds for TTS and permanent threshold shift (PTS) for seals for non-impulsive noise (vessels) suggested by NMFS (2018) are as cumulative sound exposure levels over a period of 24 hours. These cannot be compared to the sounds level recorded by Hannay et al., (2004) or McCauley (1998; 2004) which report sound pressure levels. However, based on the lack of BIAs or critical habitat for pinnipeds within the operational area or within 4 km where vessel noise levels would dissipate	Moderate (2)	A		None identified	N/A	Low		

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	Acceptability Assessment	Acceptability Outcome
				to 120 dB re 1 µPa (Hannay et al., 2004) which is the recommended threshold for behavioural disruption for continuous noise for marine mammals (NMFS, 2013), impacts are likely to only result in behavioural changes such as avoidance of the area rather than TTS or PTS impacts. Continuous vessel noise from the vessels responding to a pollution incident in State waters is not expected to be any higher than that generated by existing shipping traffic within the region. Temporary behavioural impacts to these species are not expected to result in a significant change to behaviours or natural movement that would result in further impact to individuals or local population levels.								
			Marine mammals - cetaceans	Six dolphin species may occur within the operational area. No important behaviours or BIAs have been identified. 22 whale species (or species habitat) may occur within the operational area. Foraging behaviours were identified for some species (sei, blue, fin and pygmy right whales); no other important behaviours were identified. The operational area intersects a foraging BIA for the pygmy blue whale. Onset thresholds for TTS and PTS for cetaceans for non-impulsive noise (vessels) suggested by NMFS (2018) are as cumulative sound exposure levels over a period of 24 hours. These cannot be compared to the sounds level recorded by Hannay et al., (2004) or McCauley (1998; 2004) which report sound pressure levels. Foraging behaviours and two BIAs are within the operational area or within 4 km where vessel noise levels would dissipate to 120 dB re 1 µPa (Hannay et al., 2004) which is the recommended threshold for behavioural disruption for continuous noise for marine mammals (NMFS, 2013). Thus, impacts are likely to result in behavioural changes such as avoidance of the area rather than TTS or PTS impacts. The Conservation Management Plan for the blue whale and for the Southern right whale and Conservation Advice for the sei whale, fin whale and humpback whale identify noise interference as a threat. However, continuous vessel noise is not expected to be any higher than that generated by existing shipping traffic within the region. Temporary behavioural impacts to these species are not expected to result in a significant change to foraging behaviours or natural movement that would result in further impact to individuals or local population levels.	Moderate (2)	A	CM#9: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans	None identified	N/A	Low		
			Commercial fisheries	Commercial fish species may be present in the operational area but noise from a vessel and MODU undertaking offshore activities would be the equivalent as for a fishing vessel, hence impacts to commercial fish species are not expected.	N/A							

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	Acceptability Assessment	Acceptability Outcome
MODU operations Vessel operations Helicopter operations	Physical presence: Displacement of other marine users	Changes to the functions, interests or activities of other users	Commercial fisheries Recreation and tourism	Due to the distance that the activity is offshore and no emergent features within the operational area recreational fishing and tourism is unlikely. Based on data within the ABARES Fishery Status Reports 2013 to 2017 (Patterson et al. 2018, 2017, 2016, 2015 and Georgeson et al. 2014) the Commonwealth EETBF, SESSF and Southern Squid Jig Fishery have catch effort within the operational area. Based on SIV data from 2014 to 2018 the Rock Lobster Fishery and Giant Crab Fishery have catch effort in the area with a maximum of four fishers. During stakeholder consultation, up to six fishers have identified they may fish in the operational area. Stakeholders have raised concerns in relation to displacement of their fishing activities. Displacement impacts will be minor based on: • Drilling is expected to take approximately 35-55 days, with impacts ceasing immediately following completion of activity. • Look-ahead information will be provided to fisher allowing them to avoid the vessel and fish in other parts of the operational area. • The activity will take place within Q4 2019. The closed season for the rock lobster and crab fisheries is: Females = 1 Jun to 15, Nov, Males = 15 Sept to 15 Nov. Thus, the period of overlap will be 4 weeks for these fisheries. Permanent exclusion zones are not required.	Minor (1)	A	CM#10: Ongoing consultation	None identified	N/A	Low	• The proposed management of the impact is aligned with the Beach Environment Policy. • The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements. • Stakeholder objections or claims have been raised, however, impacts to stakeholders are minor and do not Interfere with other marine users to a greater extent than is necessary for the exercise of right conferred by the titles granted. • The impact is being managed in accordance with legislative requirements. • Good practice controls have been defined to alert relevant stakeholders of the seabed assessment activities. • Activity will not result in serious or irreversible damage. • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The EIA demonstrates consistency with the principles of ESD.	Acceptable
			Commercial shipping	The operational area includes major shipping routes; however, vessels and MODU activities associated with the Otway Gas Development have been ongoing for over 10 years and to date there has been no interactions or incidents.	Minor (1)	A	CM#10: Ongoing consultation	None identified	N/A	Low		
MODU operations ROV operations	Benthic disturbance	Change in habitat	Benthic habitat (soft sediment, macroalgae, soft corals)	Transponders used during MODU positioning and ROV parking on the seabed can lead to benthic disturbance. Smothering and alteration to benthic habitats can occur as a result of seabed disturbance. The type of damage that could be sustained by smothering may include destruction of habitat. Any disturbance will be limited to the area surrounding the MODU position / ROV operations. Given the homogenous seabed within the operational area no long-term changes are expected.	Minor (1)	A	CM#30: Site survey	None identified	N/A	Low	• The proposed management of the impact is aligned with the Beach Environment Policy. • The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements.	Acceptable

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	Acceptability Assessment	Acceptability Outcome
		Change in water quality	Water quality	Benthic disturbance can result in increased sedimentation and turbidity, resulting in a change in water quality. After a period, the suspended sediments settle and the turbidity in the water column returns to pre disturbance levels. No impacts to AMPs or KEFs are expected.	Minor (1)	A	None identified	None identified	N/A	Low	• No stakeholder objections or claims have been raised. • The impact is being managed in accordance with legislative requirements. • No relevant good practice controls have been identified due to the low risk from geotechnical activities. • No potential significant impact to MNES. • Activity will not result in serious or irreversible damage. • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The EIA demonstrates consistency with the principles of ESD.	
		Injury / mortality to fauna	Marine invertebrates	As a result of a change in water quality and change in habitat, further impacts to receptors may occur, which include injury or mortality to marine fauna resulting from an increase in turbidity, or physical contact with the MODU or ROV. Temporary increases in suspended sediment and turbidity can lead to reduction in light, damage to feeding and breathing apparatus, reduction in oxygen levels and toxicological effects. A variety of invertebrate species may occur within the EMBA, including sponges and arthropods. Commercially important species (e.g. rock lobster, giant crab) may occur within the EMBA. Filter-feeders such as those likely present in the operational area are sensitive to changes in suspended sediment and turbidity, however given the homogenous nature of the seabed and the lack of MNES or other sensitivities, impacts will be minor.	Minor (1)	A	None identified	None identified	N/A	Low		
MODU operations Vessel operations	Planned marine discharges: Cooling water Brine Deck drainage & bilge water Sewage and greywater	Change in water quality	Water quality	Planned marine discharges such as cooling water, brine, deck drainage, bilge water, sewage and grey water can result in changes in water quality such as increased temperature, salinity, nutrients, chemicals and hydrocarbons. Total discharge volumes will be low, due to the small number of vessels and the limited duration of planned operations. Open marine waters are typically influenced by regional wind and large-scale current patterns resulting in the rapid mixing of surface and near surface waters thus it is expected that any wastewater discharges would disperse quickly over a small area.	Minor (1)	A	CM#2: Hazardous Material Risk Assessment CM#6: *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* CM#7: Preventative Maintenance System	None identified	N/A	Low	• The EIA demonstrates consistency with the principles of ESD. • The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements. • No stakeholder objections or claims have been raised. • The impact is being managed in accordance with legislative requirements. • Good practice controls have been defined. • Activity will not impact the recovery of the Australian grayling as per the National Recovery Plan for the Australian Grayling (*Prototroctes maraena*) (DSE, 2008). • Activity will not impact on the recovery of marine	Acceptable
		Injury/mortality to fauna	Plankton Fish Marine reptiles Marine mammals	Wastewater discharges can result in localised impact on water quality, leading to potentially toxic effects to sensitive marine fauna. Juvenile lifecycle stages are most vulnerable; however, recovery will be rapid (UNEP, 1985). The threatened Australian grayling maybe present in the area. The National Recovery Plan for the Australian Grayling (*Prototroctes maraena*) (DSE, 2008) identifies poor water quality as a threat to this species; however, this is associated with onshore waterways. Commercial fish species may be present in the operational area; however, as the discharge disperse quickly over a small area, impacts are not predicted.	Minor (1)	A	CM#2: Hazardous Materials Risk Assessment CM#6: *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* CM#7: Preventative Maintenance System	None identified	N/A	Low		Acceptable

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	Acceptability Assessment	Acceptability Outcome
				The operational area is also within the distribution BIA for white shark, although no critical habitats or behaviours are known to occur. Sharks will be transient through the area thus impacts are not predicted. The Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013) does not identify vessel discharges or equivalent as a threat. No turtle BIAs are located within the operational area though listed Threatened species may occur. Chemical and terrestrial discharge is identified as a threat to turtles in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a) though not specifically from vessels. As these species would be transient in the area and impacts are predicted to be to be localised and temporary. Marine mammals can actively avoid plumes, limiting exposure. The operational area overlaps the pygmy blue whale foraging BIA. The Conservation Management Plan for the Blue Whale (Commonwealth of Australia, 2015) does not identify discharges from vessels as a threat to the recovery of these species.							turtles as per the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a). • Activity will not impact the recovery of the white shark as per the Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013). • Activity will not impact the recovery of the blue whale as per the Conservation Management Plan for the Blue Whale, 2015-2025 (Commonwealth of Australia, 2015). • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The EIA demonstrates consistency with the principles of ESD.	
	Planned discharge: Putrescible waste	Change in water quality	Water quality	Periodic discharge of macerated food scraps to the marine environment will result in a temporary increase in nutrients in the water column that is expected to be localised to the operational area, and last for the duration of operations only.	Minor (1)	A	CM#8: MO 95: Marine Pollution Prevention - Garbage	None identified	N/A	Low		Acceptable
		Change in fauna behaviour	Seabirds Fish	The operational area overlaps foraging BIAs for a number of albatross species, the wedge-tailed shearwater, common diving-petrel and short-tailed shearwater. No habitat critical to the survival of seabirds occur within the operational area. Marine pollution is identified as a threat in the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC, 2011); however, as the discharge would be sporadic and for a short duration marine pollution impacts or changes to behaviour are not expected. The threatened Australian grayling maybe present in the area. The National Recovery Plan for the Australian Grayling (*Prototroctes maraena*) (DSE, 2008) identifies poor water quality as a threat to this species; however, this is associated with onshore waterways. Commercial fish species may be present in the operational area, however as the discharge would be sporadic and for a short duration changes to behaviour is not expected.	Minor (1)	A	CM#8: MO 95: Marine Pollution Prevention - Garbage	None identified	N/A	Low		Acceptable
	Planned Discharges: Sewage and greywater	Change in aesthetic value	Recreation and tourism	Sewage discharges will be rapidly diluted, with impacts limited to the operational area. No recreation and tourism expected within the operational area due to lack of features.	N/A							
MODU operations	Introduction & establishment of IMSs	Change in ecosystem dynamics	Further assessment required (Section 7.2)									

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	Acceptability Assessment	Acceptability Outcome
Vessel operations		Changes to the functions, interests or activities of other users										
Vessel operations Helicopter operations	Physical presence: collision with marine fauna	Injury/mortality to fauna	Fish – sharks and rays Marine reptiles Marine mammals	Marine fauna species most susceptible to vessel strike are typically characterised by one or more of the following characteristics: • commonly dwells at or near surface waters; • often slow moving or large in size; • frequents areas with a high levels of vessel traffic; and • fauna population is small, threatened, or geographically concentrated in areas that also correspond with high levels of vessel traffic. Impacts will be limited to the operational area. Three marine turtle species (or species habitat) may occur within the operational area though no BIAs or critical habitat to the survival of the species were identified. The Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a) identified vessel strike as a threat. Two species of pinniped (or species habitat) may occur within the operational area; the long-nosed fur-seal and the Australian fur-seal. No BIAs or habitat critical to the survival of the species were identified for pinnipeds. 22 whale species (or species habitat) may occur within the operational area. Foraging behaviours were identified for some species (sei, blue, fin and pygmy right whales); no other important behaviours were identified. The operational area intersects a foraging BIA for the pygmy blue whale. The Conservation Management Plan for the blue whale and for the southern right whale and Conservation Advice for the sei whale, fin whale and humpback whale identify vessel strike as a threat. The occurrence of vessel strikes is very low with no incidents occurring during the activities to date associated with the Beach development and operations. If an incident occurred, it would be restricted to individual fauna and not have impacts to local population levels.	Moderate (2)	A	CM#9: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans	None identified	Highly Unlikely (2)	Low	• The proposed management of the impact is aligned with the Beach Environment Policy. • The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements. • No stakeholder objections or claims have been raised. • The impact is being managed in accordance with legislative requirements. • Good practice controls have been defined. • Activity will not impact the recovery of marine turtle species as per the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a). • Activity will not impact the recovery of the blue whale as per the Conservation Management Plan for the Blue Whale, 2015-2025 (Commonwealth of Australia, 2015). • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The EIA demonstrates consistency with the principles of ESD.	Acceptable
MODU operations Vessel operations	Unplanned marine discharge: waste	Change in water quality	Water quality	Hazardous solid wastes such as paint cans, oily rags, etc., can cause localised contamination of the water through a release of toxins and chemicals. Transfer of waste will only occur in port.	Minor (1)	A	CM#8: MO 95: Marine Pollution Prevention - Garbage	None identified	Remote (1)	Low	• The proposed management of the impact is aligned with the Beach Environment Policy.	Acceptable

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	Acceptability Assessment	Acceptability Outcome
		Injury/mortality to fauna	Seabirds Fish Marine reptiles Marine mammals	Waste accidently released to the marine environment may lead to injury or death to individual marine fauna through ingestion or entanglement. Impacts will be restricted in exposure and quantity and will be limited to individual fauna and not have impacts to local population levels. The operational area overlaps foraging BIAs for a number of albatross species, the wedge-tailed shearwater, common diving-petrel and short-tailed shearwater. No habitat critical to the survival of birds occur within the operational area. Marine debris is identified as a threat in the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC, 2011). Three marine turtle species (or species habitat) may occur within the operational area though no BIAs or critical habitat to the survival of the species were identified. The Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a) identified marine debris as a threat. Two species of pinniped (or species habitat) may occur within the operational area; the long-nosed fur-seal and the Australian fur-seal. No BIAs or habitat critical to the survival of the species were identified for pinnipeds. 22 whale species (or species habitat) may occur within the operational area. Foraging behaviours were identified for some species (sie, blue, fin and pygmy right whales); no other important behaviours were identified. The operational area intersects a foraging BIA for the pygmy blue whale. The Conservation Management Plan for the blue whale and for the southern right whale and Conservation Advice for the sei whale, fin whale and humpback whale do not identify marine debris as threat.	Minor (1)	A	CM#8: MO 95: Marine Pollution Prevention - Garbage	None identified	Remote (1)	Low	• The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements. • No stakeholder objections or claims have been raised. • The impact is being managed in accordance with legislative requirements. • Good practice controls have been defined. • Activity will not result in serious or irreversible damage. • Activity will not impact the long-term survival and recovery of albatross and giant petrel populations breeding and foraging as per the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC, 2011). • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The EIA demonstrates consistency with the principles of ESD.	Acceptable
MODU Operations Vessel operations	Unplanned marine discharge: LOC – chemicals LOC - hydrocarbons	Injury / mortality to fauna	Plankton Seabirds Fish Marine reptiles Marine mammals	Minor spills may occur from: • Bunkering of chemicals & hydrocarbons • Bulk storage or package chemical leak (deck spill). Given the small volumes and the low-toxicity hydrocarbons and chemicals that could be discharged, minor spills are expected to rapidly dissipate and dilute in the high energy environment of the Otway Basin. Impacts to water quality are expected to be temporary and localised and thus will not impact on plankton and marine fauna that maybe transient within the operational area.	Minor (1)	A	CM#20 Bunkering procedure CM#11: Spill containment CM#27: NOPSEMA accepted OPEP CM#12: Shipboard Marine Pollution Emergency Plan (SMPEP), or equivalent	Non identified	Remote (1)	Low	• The proposed management of the impact is aligned with the Beach Environment Policy. • The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements. • No stakeholder objections or claims have been raised. • The impact is being managed in accordance with legislative requirements.	Acceptable

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	Acceptability Assessment	Acceptability Outcome
											• Good practice controls have been defined. • Activity will not result in serious or irreversible damage. • No potential significant impact to MNES. • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The EIA demonstrates consistency with the principles of ESD.	
Vessel operations	Unplanned marine discharge: LOC – hydrocarbons (from vessel collision)	Change in water quality Change in fauna behaviour Injury / mortality to fauna Change in habitat Change in aesthetic value	Further assessment required (Section 7.5).									

Table 7-3: Drilling activities environmental impact and risk ratings, control identification, ALARP and acceptability assessment

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	• Acceptability Assessment	Acceptability Outcome
Drilling	Underwater noise & vibration	Change in ambient noise	Ambient Noise	During drilling operations, the MODU and drilling apparatus will emit low-intensity continuous sound emission. Broadband source sound levels ranging between 157 and 162 dB re 1 µPa (SPL) have been recorded for semisubmersible drilling rigs (Hannay et al., 2004; McCauley, 1998, 2002). These noise emissions will result in a change in ambient noise within the operational area.	Minor (1)	A	Non identified	None identified	N/A	Low	• The proposed management of the impact is aligned with the Beach Environment Policy. • The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements. • No stakeholder objections or claims have been raised. • The impact is being managed in accordance with legislative requirements. • No relevant good practice controls have been identified due to the low risk from geotechnical activities. • Activity will not impact the recovery of the Australian grayling as per the National Recovery Plan for the Australian Grayling (*Prototroctes maraena*) (DSE, 2008). • Activity will not impact the recovery of the white shark as per the Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013). • Activity will not impact the recovery of marine turtle species as per the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a). • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The EIA demonstrates consistency with the principles of ESD.	Acceptable
		Change in fauna behaviour	Fish Marine reptiles	Popper et al. (2014) details that risks of mortality and potential mortal injury, and recoverable injury impacts to fish with no swim bladder (sharks) and turtles is low and that temporary threshold shift (TTS) in hearing may be a moderate risk near (tens of metres) the vessel. For fish with a swim bladder risks of mortality and potential mortal injury impacts is low. No cumulative impacts are expected as there are no locations supporting site-attached fish in the immediate area. Behavioural impacts are more likely such as moving away from the MODU. There are no habitats or features within the operational area that would restrict fish, whale sharks or turtles from moving away from the MODU. The threatened Australian grayling maybe present in the area. The National Recovery Plan for the Australian Grayling (*Prototroctes maraena*) (DSE, 2008) does not identify noise impacts as a threat to this species. The operational area is within a distribution BIA for the white shark though no habitat critical to the survival of the species or behaviours were identified. The Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013) does not identify noise impacts as a threat. Three marine turtle species (or species habitat) may occur within the operational area though no BIAs or critical habitat to the survival of the species were identified. The Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a) identified noise interference as a threat; however, disturbance impacts to individuals are predicted which will not impact on turtles at a population level.	Minor (1)	A	None identified	None identified	N/A	Low		Acceptable
			Marine mammals - cetaceans	Six dolphin species may occur within the operational area. No important behaviours or BIAs have been identified. 22 whale species (or species habitat) may occur within the operational area. Foraging behaviours were identified for some species (sei, blue, fin and pygmy right whales); no other important behaviours were identified. The operational area intersects a foraging BIA for the pygmy blue whale.	Moderate (2)	A	CM#9: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans	None identified	N/A	Low		Acceptable

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	• Acceptability Assessment	Acceptability Outcome
				Foraging behaviours and two BIAs are within the operational area. Thus, impacts are likely to result in behavioural changes such as avoidance of the area rather than TTS or PTS impacts. The Conservation Management Plan for the blue whale and for the Southern right whale and Conservation Advice for the sei whale, fin whale and humpback whale identify noise interference as a threat. However, continuous vessel noise is not expected to be any higher than that generated by existing shipping traffic within the region. Temporary behavioural impacts to these species are not expected to result in a significant change to foraging behaviours or natural movement that would result in further impact to individuals or local population levels.								
			Commercial fisheries	Commercial fish species may be present in the operational area but noise from a vessel or MODU undertaking offshore activities would be the equivalent as for a fishing vessel, hence impacts to commercial fish species are not expected.	N/A							
Well suspension	Physical presence	Changes to the functions, interests or activities of other users	Recreation and tourism Recreational fisheries Commercial fisheries	Due to the distance that the activity is offshore and no emergent features within the operational area recreational fishing and tourism is unlikely. Based on data within the ABARES Fishery Status Reports 2013 to 2017 (Patterson et al. 2018, 2017, 2016, 2015 and Georgeson et al. 2014) the Commonwealth EETBF, SESSF and Southern Squid Jig Fishery have catch effort within the operational area. Based on SIV data from 2014 to 2018 the Rock Lobster Fishery and Giant Crab Fishery have catch effort in the area with a maximum of four fishers. During stakeholder consultation, up to six fishers have identified they may fish in the operational area. Stakeholders have raised concerns in relation to displacement of their fishing activities. Displacement impacts will be minor based on: • Drilling is expected to take approximately 35-55 days, with impacts ceasing immediately following completion of activity. • Look-ahead information will be provided to fisher allowing them to avoid the vessel and fish in other parts of the operational area. • The activity will take place within Q4 2019. The closed season for the rock lobster and crab fisheries is: Females = 1 Jun to 15, Nov, Males = 15 Sept to 15 Nov. Thus, the period of overlap will be 4 weeks for these fisheries. Should a permanent Petroleum Safety Zone (PSZ) be established if the Artisan-1 well is suspended for future petroleum production, the PSZ would exclude Commercial Fishers from a negligible portion of the overall fishing grounds (500m from the well location).	Minor (1)	A	CM#10: Ongoing consultation CM#29: PSZ	None identified	N/A	Low	• The proposed management of the impact is aligned with the Beach Environment Policy. • The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements. • Stakeholder objections or claims have been raised, however, impacts to stakeholders are minor and do not Interfere with other marine users to a greater extent than is necessary for the exercise of right conferred by the titles granted. • The impact is being managed in accordance with legislative requirements. • Good practice controls have been defined to alert relevant stakeholders of the seabed assessment activities. • Activity will not result in serious or irreversible damage. • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The EIA demonstrates consistency with the principles of ESD.	Acceptable

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	• Acceptability Assessment	Acceptability Outcome
			Commercial shipping	The operational area includes major shipping routes; however, permanent infrastructure, subsea well, pipelines & platforms associated with the Otway Gas Development are located across the Otway Basin and to date there has been no interactions or incidents. If suspended, the Artisan-1 would be located at approximately 71 m water depth and would therefore have not impact on commercial shipping. A permanent Petroleum Safety Zone (PSZ) would be established should the Artisan-1 well be suspended for future petroleum production.	N/A							
Drilling Plug & abandonment	Benthic disturbance	Change in habitat	Benthic habitat (soft sediment, macroalgae, soft corals)	Installation and removal of the wellhead can lead to benthic disturbance. Smothering and alteration to benthic habitats can occur as a result of seabed disturbance. The type of damage that could be sustained by smothering may include destruction of habitat. Any disturbance will be limited to the area surrounding the well location. Given the homogenous seabed in the vicinity of the well location, no long-term changes are expected.	Minor (1)	A	CM#30: Site survey	None identified	N/A	Low	• The proposed management of the impact is aligned with the Beach Environment Policy. • The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements. • No stakeholder objections or claims have been raised. • The impact is being managed in accordance with legislative requirements. • Good practice controls have been defined. • Activity will not result in serious or irreversible damage. • No potential significant impact to MNES. • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The EIA demonstrates consistency with the principles of ESD.	Acceptable
		Change in water quality	Water quality	Benthic disturbance can result in increased sedimentation and turbidity, resulting in a change in water quality. After a period, the suspended sediments settle and the turbidity in the water column returns to pre disturbance levels. No impacts to AMPs or KEFs are expected.	Minor (1)	A	None identified	None identified	N/A	Low		Acceptable
		Injury / mortality to fauna	Marine invertebrates	As a result of a change in water quality and change in habitat, further impacts to receptors may occur, which include injury or mortality to marine fauna resulting from an increase in turbidity, or physical contact with the wellhead. Temporary increases in suspended sediment and turbidity can lead to reduction in light, damage to feeding and breathing apparatus, reduction in oxygen levels and toxicological effects. A variety of invertebrate species may occur within the EMBA, including sponges and arthropods. Commercially important species (e.g. rock lobster, giant crab) may occur within the EMBA. Filter-feeders such as those likely present in the operational area are sensitive to changes in suspended sediment and turbidity, however given the homogenous nature of the seabed and the lack of MNES or other sensitivities, impacts will be minor.	Minor (1)	A	None identified	None identified	N/A	Low		Acceptable
BOP installation & testing	Planned marine discharges: Hydraulic control fluids	Change in water quality	Water quality	BOP hydraulic fluids are released during BOP pressure testing and function testing. These fluids are released directly to the ocean from the functioning of the hydraulically controlled valves. In addition to this, BOP fluids are released whenever the riser is unlatched resulting in an additional release of fluids to the environment.	Minor (1)	A	CM#2: Hazardous Material Risk Assessment CM#22: Preventative Maintenance System	None identified	N/A	Low	• The EIA demonstrates consistency with the principles of ESD. • The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements.	Acceptable

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	• Acceptability Assessment	Acceptability Outcome
				Hydraulic control fluids are water-based and readily biodegradable. Potential impacts are localised to the operational area.							• No stakeholder objections or claims have been raised.	
		Injury/mortality to fauna	Plankton Fish Marine reptiles Marine mammals	Open marine waters are typically influenced by regional wind and large-scale current patterns resulting in the rapid mixing of surface and near surface waters thus it is expected that any wastewater discharges would disperse quickly over a small area. Juvenile lifecycle stages are most vulnerable; however, recovery will be rapid (UNEP, 1985). The threatened Australian grayling maybe present in the area. The National Recovery Plan for the Australian Grayling (*Prototroctes maraena*) (DSE, 2008) identifies poor water quality as a threat to this species; however, this is associated with onshore waterways. Commercial fish species may be present in the operational area; however, as the discharge disperse quickly over a small area, impacts are not predicted. The operational area is also within the distribution BIA for white shark, although no critical habitats or behaviours are known to occur. Sharks will be transient through the area thus impacts are not predicted. The Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013) does not identify vessel discharges or equivalent as a threat. No turtle BIAs are located within the operational area though listed Threatened species may occur. Chemical and terrestrial discharge is identified as a threat to turtles in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a) though not specifically from vessels. As these species would be transient in the area and impacts are predicted to be to be localised and temporary. Marine mammals can actively avoid plumes, limiting exposure. The operational area overlaps the pygmy blue whale foraging BIA. The Conservation Management Plan for the Blue Whale (Commonwealth of Australia, 2015) does not identify discharges from vessels as a threat to the recovery of these species.	Minor (1)	A	CM#2: Hazardous Materials Risk Assessment CM#22: Preventative Maintenance System	None identified	N/A	Low	• The impact is being managed in accordance with legislative requirements. • Good practice controls have been defined. • Activity will not impact the recovery of the Australian grayling as per the National Recovery Plan for the Australian Grayling (*Prototroctes maraena*) (DSE, 2008). • Activity will not impact on the recovery of marine turtles as per the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a). • Activity will not impact the recovery of the white shark as per the Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013). • Activity will not impact the recovery of the blue whale as per the Conservation Management Plan for the Blue Whale, 2015-2025 (Commonwealth of Australia, 2015). • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The EIA demonstrates consistency with the principles of ESD.	Acceptable
Drill fluids & cuttings handling & disposal	Planned marine discharges: Drill fluids and cuttings	Change in water quality Change in sediment quality Change in habitat	Further assessment required (Section 7.3).									
Cementing Well suspension Plug & abandonment	Planned discharges: Cement (including swarf)	Change in water quality	Water quality	Cement will be discharged at both the surface and the seabed during general operations. Cement discharges can result in a change in water quality through increased turbidity and chemical toxicity. Cement discharged at the surface will disperse under action of waves and currents, and eventually settle out	Minor (1)	A	CM#2: Hazardous Materials Risk Assessment CM#22: Preventative	None identified	N/A	Low	• The proposed management of the impact is aligned with the Beach Environment Policy. • The proposed management of the impact is aligned with the Lattice	Acceptable

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	• Acceptability Assessment	Acceptability Outcome
				of the water column; the initial discharge will generate a downwards plume, increasing the initial mixing of receiving waters. Modelling of the release of 18 m^3 of cement wash water by de Campos et al. (2017) indicate an ultimate average deposition of 0.05 mg/m^2 of material on the seabed; with particulate matter deposited within the three-day simulation period. Given the low concentration of the deposition of the material, it is therefore expected that the in-water suspended solids (i.e. turbidity) created by the discharge is not likely to be high for an extended period of time, or over a wide area.			Maintenance System				HSEMS and/or procedural requirements. • No stakeholder objections or claims have been raised. • The impact is being managed in accordance with legislative requirements. • Good practice controls have been defined. • Activity will not result in serious or irreversible damage. • No potential significant impact to MNES. • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The EIA demonstrates consistency with the principles of ESD.	
		Change in sediment quality	Sediment quality	Cements discharged at the seabed can lead to smothering and hardening of the seabed surface surrounding the discharge. Studies indicate that cement from top hole sections displaced to the seabed may affect the seabed around the well to a radius of approximately 10 m-50 m of the well. Once cement overspill from cementing activities hardens, the area directly adjacent to the well (10-50m) will be altered, resulting in the destruction of seabed habitat within the footprint of the discharge.	Minor (1)	A	CM#2: Hazardous Materials Risk Assessment CM#22: Preventative Maintenance System	None identified	N/A	Low		Acceptable
		Injury / mortality to fauna	Benthic habitat (soft sediment, macroalgae, soft corals) Marine invertebrates	Injury / mortality to benthic fauna and habitats may occur as a result of change in water or sediment quality, and are likely directly related to increased turbidity, chemical exposure and/or change in habitat. Toxicity in cement occurs when additives are added to dry cement mix, therefore toxic effects will be limited to seabed discharges. Once cement discharges have hardened, the risk of toxic exposure is removed. Jenkins and McKinnon (2006) reported that levels of suspended sediments greater than 500 mg/L are likely to produce a measurable impact upon larvae of most fish species, and that levels of 100 mg/L will affect the larvae of some species if exposed for periods greater than 96 hours. Jenkins and McKinnon (2006) also indicated that levels of 100 mg/L may affect the larvae of several marine invertebrate species and that fish eggs and larvae are more vulnerable to suspended sediments than older life stages. Neither the modelling by de Campos et al (2017) or BP (2013) suggest that suspended solids concentrations from a discharge of the cement washing will be at or near levels required to cause an effect on fish or invertebrate larvae, i.e. predicted levels were well below a 96-hr exposure at 100 mg/L, or instantaneous 500 mg/L exposure.	Minor (1)	A	CM#2: Hazardous Material Risk Assessment CM#22: Preventative Maintenance System	None identified	N/A	Low		Acceptable
Plug and abandonment	Planned marine discharges: Suspension fluids	Change in water quality	Water quality	Fluids will be discharged to the marine environment during wellhead removal. Fluids will likely contain chemicals such as biocides, and control fluid.	Minor (1)	A	CM#2: Hazardous Materials Risk Assessment	None identified	N/A	Low	• The proposed management of the impact is aligned with the Beach Environment Policy.	Acceptable

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	• Acceptability Assessment	Acceptability Outcome
				The volume of discharge will be small (<500 L) and impacts will be localised to the operational area.							• The proposed management of the impact is aligned with the Lattice HSEMS and/or procedural requirements. • No stakeholder objections or claims have been raised. • The impact is being managed in accordance with legislative requirements. • Good practice controls have been defined. • Activity will not result in serious or irreversible damage. • Activity will not impact the recovery of the Australian grayling as per the National Recovery Plan for the Australian Grayling (*Prototroctes maraena*) (DSE, 2008). • Activity will not impact on the recovery of marine turtles as per the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a). • Activity will not impact the recovery of the white shark as per the Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013). • Activity will not impact the recovery of the blue whale as per the Conservation Management Plan for the Blue Whale, 2015-2025 (Commonwealth of Australia, 2015). • The activity will not be conducted in a way which is inconsistent with the objectives of the specific zones within an AMP, the Principles of the IUCN categories or the values of an AMP. • The EIA demonstrates consistency with the principles of ESD.	
		Injury / mortality to fauna	Plankton Fish Marine reptiles Marine mammals	Open marine waters are typically influenced by regional wind and large-scale current patterns resulting in the rapid mixing of surface and near surface waters thus it is expected that any suspension fluid discharges would disperse quickly over a small area. Juvenile lifecycle stages are most vulnerable; however, recovery will be rapid (UNEP, 1985). The threatened Australian grayling maybe present in the area. The National Recovery Plan for the Australian Grayling (*Prototroctes maraena*) (DSE, 2008) identifies poor water quality as a threat to this species; however, this is associated with onshore waterways. Commercial fish species may be present in the operational area; however, as the discharge disperse quickly over a small area, impacts are not predicted. The operational area is also within the distribution BIA for white shark, although no critical habitats or behaviours are known to occur. Sharks will be transient through the area thus impacts are not predicted. The Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013) does not identify vessel discharges or equivalent as a threat. No turtle BIAs are located within the operational area though listed Threatened species may occur. Chemical and terrestrial discharge is identified as a threat to turtles in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a) though not specifically from vessels. As these species would be transient in the area and impacts are predicted to be to be localised and temporary. Marine mammals can actively avoid plumes, limiting exposure. The operational area overlaps the pygmy blue whale foraging BIA. The Conservation Management Plan for the Blue Whale (Commonwealth of Australia, 2015) does not identify discharges from vessels as a threat to the recovery of these species.	Minor (1)	A	CM#22: Hazardous Materials Risk Assessment	None identified	N/A			Acceptable
Drilling Well suspension	Unplanned marine discharges: LOWC	Change in water quality Change in ecosystem dynamics Change in habitat Injury / mortality to fauna Change in fauna behaviour	Further assessment required (Section 7.6).									

Activity	Aspect	Potential Impact / Risk	Receptor	Consequence Evaluation	Consequence Rating	ALARP Decision Context	Good Practice Control Measure	Additional Control Measures	Likelihood of Occurrence	Residual Risk	• Acceptability Assessment	Acceptability Outcome
		Changes to the functions, interests or activities of other users										

7.2 Vessel and MODU Operations: Establishment of Invasive Marine Species (IMS)

7.2.1 Background information

The Ocean Onyx will be 'dry-towed' from Singapore to Australian waters via a heavy lift vessel (HLV). The Ocean Onyx is likely to be offloaded from the HLV within Port Philip Bay (Port of Melbourne).

Biosecurity and ballast water management controls to be implemented by Diamond Offshore for the Ocean Onyx prior to the arrival of the MODU to the proposed drilling location include:

- Hull cleaning and inspection (by an approval Australian Inspector) a minimum of seven days prior to departure from Singapore;
- Obtaining a letter of determination confirming the 'low risk status' of the MODU and a Biosecurity Status Document from the Commonwealth Department of Agriculture and Water Resources (DAWR) including any birthing conditions in Australian first point of entry prior to entering the 12 nm limit;
- Compliance with Australian Ballast Water Management Requirements – Rev 7 (DAWR, 2017), the Offshore Installations – Biosecurity Guide Version 1.23 (DAWR, October 2018) and relevant controls as detailed within the International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Convention), including:
    - Having a Ballast Water Management Plan (BWMP) consistent with the Ballast Water Convention's *Guidelines for Ballast Water Management and Development of Ballast Water Management Plans (G4 Guidelines)*;
    - Holding a valid Ballast Water Management Certificate (BWMC) inclusive of the principal ballast water method used;
    - A ballast water treatment system (BWTS) in compliance with the D-2 standard of the Ballast Water Convention and a Type Approval Certificate relating specifically to the BWTS;
    - A ballast water recording system (record book) in compliance with Regulation B-2 of the Annex to the Ballast Water Convention; and
    - Undertaking required reporting via the Maritime Arrivals Reporting System (MARS) prior to entering the 12 nm limit
- Undertaking ballast water exchange in accordance with International Maritime Organisation (IMO) requirements for ballast water exchange for international voyages; and
- Compliance with any conditions imposed by the Port of Melbourne under the Port Management Act 1995 (Vic).

Whilst the mobilisation of the MODU into Australian Commonwealth waters and Victorian State waters, and associated biosecurity and ballast water management prior to the arrival of the MODU into the operational area is not within the scope of this EP, Beach shall validate that the above controls have been adopted by Diamond Offshore prior to the mobilisation of the MODU to the Artisan-1 well location.

7.2.2 Hazards

The introduction of marine pests could occur during vessel and MODU operations as a result of:

- Discharge of ballast water containing foreign species.
- Translocation of species through biofouling of the MODU or vessel hull, anchors and/or niches (e.g. sea chests, bilges and strainers).
- Disposal of contaminated waste and materials.

Successful IMS invasion requires the following three steps:

- Colonisation and establishment of the marine pest on a vector (e.g., MODU hull) in a donor region (e.g., home port).
- Survival of the settled marine species on the vector during the voyage from the donor to the recipient region (e.g., project area).
- Colonisation (e.g., dislodgement or reproduction) of the marine species in the recipient region, followed by successful establishment of a viable new local population.

7.2.3 Known and potential environmental risks

Introduced marine species or pathogens may become established where conditions are suitable, and these species may have impacts on local ecological and economic values. However, establishment of introduced marine species is mostly likely to occur in shallow waters in areas where large numbers of vessels are present and are stationary for an extended period.

In the event that the risk of establishment of IMS is realised, the following known and potential environmental impacts may occur:

- Change in ecosystem dynamics
- Changes to the functions, interests or activities of other users.

Change in ecosystem dynamics may include 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 area.

7.2.4 Consequence Evaluation

IMS or pathogens may become established where conditions are suitable, and these species may have impacts on local ecological and economic values. Establishment of introduced marine species is most likely to occur in shallow waters in areas where large numbers of vessels are present and are stationary for an extended period.

In the event of an IMP being introduced to the marine environment, successful colonisation is dependent upon suitable substrate availability. The operational area does not present a location conducive to marine pest survival because it is located in deep waters with the majority of the operational area in water greater than 70 m.

Receptors potentially impacted by a change in ecosystem dynamics include:

- marine invertebrates
- benthic habitat (soft sediment, macroalgae, soft corals)
- commercial fisheries.

Given the distance from planned operations, no impacts to AMPs are expected.

7.2.4.1 Marine invertebrates and benthic habitats

IMS are likely to have little or no natural competition or predators, thus potentially outcompeting native species for food or space, preying on native species, or changing the nature of the environment. It is estimated that Australia has more than 250 established marine pests, and that approximately one in six introduced marine species becomes a pest (Department of the Environment, 2015). Once established, some pests can be difficult to eradicate (Hewitt et al., 2002) and therefore there is the potential for a long-term or persistent change in habitat structure. It has been found that highly disturbed environments (such as marinas) are more susceptible to colonisation than open-water environments, where the number of dilutions and the degree of dispersal are high (Paulay et al., 2002).

The chances of successful colonisation in the Otway region are considered small given:

- The nature of the benthic habitats near the operational area where seabed contact is made (i.e. predominantly bare sands with patchy occurrences of hard substrate, and outside of coastal waters where the risk of IMS establishment is considered greatest (BRS, 2007).
- The well locations are geographically isolated from other subsea or surface infrastructure which might be suitable for colonisation.
- The operational area does not present a location conducive to marine pest survival because it is located in deep waters with the majority of the operational area in water greater than 70 m.

Areas of higher value or sensitivity are located away from the Artisan-1 drilling site with Twelve Apostles Marine National Park on the Victorian coast approximately 35 km away. While unlikely, if an IMS was introduced, and if it did colonise an area, it is expected that any colony would remain fragmented and isolated, and only within the vicinity of the wells (i.e. it would not be able to propagate to nearshore environments, and protected marine areas present in the wider region).

7.2.4.2 Commercial fisheries

Marine pest species can deplete fishing grounds and aquaculture stock, with between 10% and 40% of Australia's fishing industry being potentially vulnerable to marine pest incursion. For example, the introduction of the Northern Pacific Seastar (*Asterias amurensis*) in Victorian and Tasmanian waters was linked to a decline in scallop fisheries (DSE, 2004). However, areas suitable for commercial scallop fishing are not expected near the well locations; commercially suitable scallop aggregations occur in the waters of eastern Victoria (Koopman *et al.* 2018).

7.2.5 Control measures, ALARP and acceptability assessment

Control, ALARP and acceptability assessment: MODU Operations: Introduction & establishment of invasive marine pests	
ALARP Decision Context and Justification	**ALARP Decision Context: Type B** On the basis of the impact assessment completed, Beach considers the control measures described are appropriate to manage the impacts associated with the risk of introduction and establishment of IMP. The Victorian DJPR have expressed interest in the management of IMS in Victorian State waters.
Control Measures	**Source of good practice control measures**
CM#35: MO 98: Marine pollution – anti-fouling systems	Marine Order 98 (Marine pollution — anti-fouling systems) 2013 provide for controls on anti-fouling systems and for the survey, inspection and certification of ships for those systems. Subject to class, vessels operating in Australian waters are required to hold a valid an anti-fouling system certificate.
CM#38: National Biofouling Management Guidance for the Petroleum Production and Exploration Industry	The National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia 2009) recommends and provides information on undertaking a vessel specific risk assessment to identify the level of risk a vessel poses, and the level of controls required to reduce IMS introduction risks.
	The National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia 2009) recommends that routine cleaning, maintenance, drying and storage of ROVs and in-water equipment to maintain a low risk of any biofouling mediated translocation of marine pests.

CM#36: Australian Ballast Water Management Requirements	The Australian Ballast Water Management Requirements (DAWR 2017) describe the requirements for ballast water management specifically: • Vessel ballasting operations must be undertaken as per an approved Ballast Water Management Plan (BWMP). • International vessels entering Australian waters require an International Ballast Water Management Certificate (BWMC). • Vessels that carry ballast water must maintain a complete and accurate Ballast Water Record System (record book).		
Additional Controls Assessed			
Control	**Control Type**	**Cost/Benefit Analysis**	**Control Implemented?**
Only use vessels that are based in Victoria to reduce the potential for introducing IMS.	Equipment	Specialised anchor handling and tug supply (AHTS) vessels are required to support the proposed drilling activity. Using vessels that are based in Victoria (if available) may reduce the likelihood of introducing an IMS but this would depend on the IMS risk level of the port where the vessel is based. The control measures that are to be implemented are required to be undertaken for vessels from any port in Victoria or Australia. Thus, there is limited environmental benefit associated with implementing this response.	Not selected
Consequence Rating	Serious (3)		
Likelihood of Occurrence	Remote (1)		
Residual Risk	Low		
Acceptability Assessment			
Policy compliance	The proposed management of the impact is aligned with the Beach Environment Policy.		
Management system compliance	Activities will be undertaken in accordance with the Implementation Strategy (Section 8).		
Stakeholder engagement	No objections or claims have been raised during stakeholder consultation regarding the potential for introduction of invasive marine species.		
Laws and standards	The impact will be managed in accordance with legislation requirements, including: • National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia 2009) • Australian Ballast Water Management Requirements (DAWR 2017) with gives effect to the Biosecurity Act 2015; International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Convention) and relevant guidelines or procedures adopted by the Marine Environment Protection Committee of the International Maritime Organization (IMO).		
Industry practice	Good practice control measures relevant to the activity will be implemented.		
Environmental context	No impacts to MNES are expected. There are no EPBC management plans (management plans, recovery plans or conservation advice) which relate specifically to IMS introduction and establishment as a threat. The activity does not take place within an AMP, and any impacts will not affect the natural values of an AMP.		

Environmentally Sustainable Development principles	There is potential for a localised impact to benthic communities and fisheries resulting in a **Serious (3)** consequence. Although the habitat with the potential to be impacted is characterised by soft sediment communities, because of the potential for serious impacts, this aspect is considered as having the potential to (although very unlikely) affect biological diversity and ecological integrity. There is little uncertainty associated with this aspect as the activities are well known, the cause pathways are well known, and activities are well regulated and managed. It is not considered that there is significant scientific uncertainty associated with this aspect. Therefore, the precautionary principle has not been applied.
Monitoring and reporting	Impacts as a result of the introduction of marine invasive species will be monitored and reported in accordance with the Section 8.9.
Acceptability outcome	**Acceptable**

7.3 Planned Discharge – Drilling Cuttings and Fluids

7.3.1 Hazard

Drilling activities will result in planned discharges of drilling fluids and cuttings.

- Seabed discharge: approximately 135 m^3 cuttings are discharged on the seabed during the drilling of the top-hole section of the well, prior to the riser being installed. Sea water and non-toxic gel sweeps are used for drilling top-hole sections.

- Surface discharge: approximately 140 m^3 cuttings with residual drilling fluids are discharged at surface from the drilling of lower-hole sections of the well (excluding potential side-track), following the installation of the riser and BOP. The riser enables drilling fluids and cuttings to be recirculated back to the MODU for treatment via the solids control equipment prior to discharge.

Drilling cuttings are discharged continuously whilst actively drilling well sections, which may occur for periods of around 24 hours at a time.

Whole SBDF are not routinely discharged during drilling activities, as these fluids are recycled and reconditioned aboard the MODU, returned to shore for reconditioning or used in future drilling activities.

7.3.2 Known and potential environmental impacts

A planned discharge of drill cuttings and fluids has the potential to result in an impact to receptors in the water column and sediments from:

- Change in water quality;
- Change in sediment quality; and
- Change in habitat.

7.3.3 Consequence Evaluation

7.3.3.1 Change in water quality

Receptors potentially impacted by a change in water quality through increased turbidity, chemical toxicity and oxygen depletion include:

- pelagic marine fauna
- plankton
- marine invertebrates
- benthic habitat (soft sediment, macroalgae, soft corals)

Hinwood et al (1994) indicates that larger particles of cuttings and adhered muds (90-95%) fall to the seabed within close proximity of the release point. When cuttings are discharged to the ocean, the larger particles, representing about 90% of the mass of the mud solids, form a plume that settles quickly to the bottom (or until the plume entrains enough seawater to reach neutral buoyancy). About 10% of the mass of the mud solids form another plume in the upper water column that drifts with prevailing currents away from the platform and is diluted rapidly in the receiving waters (Neff, 2005; 2010).

Neff (2005) states that in well-mixed oceans waters (as is the case within the operational area), the drilling cuttings and fluid plume is diluted by more than 100-fold within 10 m of the discharge. Because of the rapid dilution of the drilling mud and cuttings plume in the water column, "harm to communities of water column plants and animals is unlikely and has never been demonstrated" (Neff, 2005).

Drilling of the Artisan-1 well will require the use of both WBDF and SBDF. Due to the inert / PLONOR nature of its components, WBM have been shown to have little or no toxicity to marine organisms (Jones et al., 1996). Barite (a major insoluble component of water-based mud discharges) has been widely shown to accumulate in sediments following drilling (reviewed by Hartley 1996). Barium sulphate is of low bioavailability and toxicity to benthic organisms. Other metals present mainly as salts, in drilling wastes may originate from formation cuttings, or from impurities in barite and other mud components, however, do not contribute to mud toxicity due to their low bioavailability (Schaanning et al., 2002).

The American Chemistry Council (2006) found that because SBDF adhered to cuttings tends to clump together in particles that rapidly settle to the ocean floor, this suggests that SBDF-coated cuttings tend to be less likely to increase water column turbidity.

Neff (2010) explains that the lack of toxicity and low bioaccumulation potential of the drilling fluids means that the effects of the discharges are highly localised and are not expected to spread through the food web. Consequently, the potential impacts and risks from a change in water quality are considered to be Moderate (2) as this type of event may result in localised short-term impacts but is not expected to affect local ecosystem functions.

Benthic invertebrates and plankton

Jenkins and McKinnon (2006) reported that levels of suspended sediments greater than 500 mg/L are likely to produce a measurable impact upon larvae of most fish species, and that levels of 100 mg/L will affect the larvae of some species if exposed for periods greater than 96 hours. Jenkins and McKinnon (2006) also indicated that levels of 100 mg/L may affect the larvae of several marine invertebrate species, and that fish eggs and larvae are more vulnerable to suspended sediments than older life stages. Note, any impact to fish larvae is also expected to be limited due to high natural mortality rates (McGurk, 1986), intermittent exposure, and the dispersive characteristics of the open water in the operational area.

Based upon dilutions identified by Hinwood et al. (1994) and Neff (2005), turbidity in the water column is expected to be reduced to below 10 mg/L (9 ppm) within 100 m of release. Therefore, as previous dilution estimates (e.g. Hinwood et al., 1994; Neff, 2005) suggest suspended sediment concentrations caused by the discharge of drill cuttings will be well below the levels required to cause an effect on fish or invertebrate larvae (i.e. predicted levels are well below a 96-hr exposure at 100 mg/L, or instantaneous 500 mg/L exposure), minimal impact to larvae is expected from the discharge of drill cuttings.

Considering the relatively short-lived nature of the intermittent plumes, and that concentrations of suspended solids rapidly dissipate with the prevailing currents, the potential impacts on larvae is expected to be minimal.

Marine fauna

The operational area is also located within a Pygmy Blue Whale foraging BIA, and seabird foraging BIAs. However, cetaceans and avifauna are expected to be less sensitive to any potential impact from turbidity than fish larvae (described above), and therefore the evaluation of potential impacts to fish larvae provides a conservative evaluation of the level of potential impacts to marine fauna for this discharge.

Benthic habitats

Increases in turbidity from drill cutting discharges during the riserless drilling of the top-hole section (i.e. direct discharge to the seabed) are expected to be highly localised, and limited to within close proximity of the well. Given the short duration of riserless drilling, effects associated with this scenario are expected to be short-term, and no more significant than those described for surface discharges of drilling cuttings and fluids.

7.3.3.2 Change in Habitat

Environmental receptors with the potential to be exposed to a change in habitat through smothering of flora and fauna and alteration of seabed sediment distribution include:

- benthic habitat (soft sediment, macroalgae, soft corals)
- Marine invertebrates

The magnitude of the impact depends on cuttings volumes, discharge location and substrate within the operational area.

Hinwood et al. (1994) explain that the main environmental disturbance from discharging drilling cuttings and fluids is associated with the smothering and burial of sessile benthic and epibenthic fauna. Neff et. al. (2010) suggests that SBDF-coated cuttings, tend to clump and settle rapidly as large particles over a small area near the discharge point and tend not to disperse rapidly (Neff, 2010) indicating that when drilling with SBDF, extent of dispersion is expected to decrease, but thickness of cuttings piles can be expected to increase.

Many studies have shown that the effects on seabed fauna and flora from the discharge of drilling cuttings with water based muds are subtle, although the presence of drill-fluids in the seabed close to the drilling location (<500 m) can usually be detected chemically (see Change in Water Quality caused by Planned Discharge - Drill Cuttings and Fluids) (e.g. Cranmer 1988, Neff et al. 1989, Hyland et al. 1994, Daan & Mulder 1996, Currie & Isaacs 2005, OSPAR 2009, Bakke et al. 2013).

Jones et al. (2006, 2012) compared pre- and post-drilling ROV surveys and documented physical smothering effects from WBM cuttings within 100 m of the well. Outside the area of smothering, fine sediment was visible on the seafloor up to at least 250 m from the well. After three years, there was significant removal of cuttings particularly in the areas with relatively low initial deposition (Jones et al. 2012). The area impacted by complete cuttings cover had reduced from 90 m to 40 m from the drilling location, and faunal density within 100 m of the well had increased considerably and was no longer significantly different from conditions further away.

As indicated by previous site surveys within the Otway Basin at similar water depths to the Artisan-1 well location, the seabed within the operational area is likely to be predominantly sands with sparse sponge coverage. Whilst there is potential for hard substrate to be present the pre-drill site survey to determine a preferred well location will be used to avoid identified limestone outcrops. Although studies conducted by Hyland et al. (1994) noted negative response from sponges (disruption to feeding or respiration) to smothering resulting from drill cuttings, the lack of hard substrate in the vicinity of the well location, to be confirmed by pre-drilling benthic surveys, means that impacts to hard substrate communities are unlikely within the operational area.

In general, research suggests that any smothering impacts within the operational area will be limited to 500 m from the well site, and full recovery is expected. Given the inert nature and limited volume of drill cuttings being discharged directly onto the seabed during riserless drilling, the impacts to benthic habitats are expected to be limited. Consequently, the potential impacts from smothering and alteration of seabed substrate are considered to be Moderate (2) as this type of event may result in localised short-term impacts but is not expected to affect local ecosystem functions.

7.3.3.3 Change in Sediment Quality

Environmental receptors with the potential to be exposed to a change in sediment quality include:

- benthic habitat (soft sediment, macroalgae, soft corals)
- Marine invertebrates

As stated previously, Neff (2010), Hinwood et al. (1994) and the American Chemistry Council (2006) indicate larger particles of SBDF adhered to cuttings tend to clump together and settle to the seabed rapidly, with effects expected to be limited to within close proximity to the well location. Neff (2010) found that recolonisation of synthetic-based, drill fluid-cuttings piles in cold-water marine environments began within one to two years of ceasing discharges, once the hydrocarbon component of the cutting piles biodegraded. Additional studies indicate that benthic infauna and epifauna recover relatively quickly, with substantial recovery in deepwater benthic communities within three to ten years (Jones 2012).

No particular values and sensitivities were identified within 50 km of the Artisan-1 well location with the benthic environment likely to be limited to soft sediment communities.

Although these studies are associated with cold, deep water environments, the recovery processes associated with the drilling of the Artisan-1 exploration are expected to be similar and as species present in soft sediment are well adapted to changes in substrate, especially burrowing species (Kjeilen-Eilertsen et. al. 2004), a 10-year recovery period is considered suitable for providing a conservative indication of habitat recovery from this activity.

Consequently, the potential impacts from a change in sediment quality are considered to be Moderate (2) as this type of event may result in localised short-term impacts but is not expected to affect local ecosystem functions.

7.3.4 Control measures, ALARP and acceptability assessment

Control, ALARP and acceptability assessment: MODU Operations: Planned Discharge – Drilling Cuttings and Fluids	
ALARP Decision Context and Justification	**ALARP Decision Context: Type B** The planned release of drill cuttings and adhered fluids offshore is a well understood and practiced activity both nationally and internationally. The potential impacts are well regulated via various treaties and legislation, which specify industry best practice control measures. These are well understood and implemented by the industry. No stakeholder objections or were claims raised with regards to this activity or similar activities during previous campaigns. For this aspect, the Environmental, Health, and Safety Guidelines for Offshore Oil and Gas Development (IFC, 2015) recommend that feasible alternatives for disposing of drilling cuttings should be evaluated to ensure that impacts are reduced to ALARP. In accordance with this, ALARP Decision Context B has been applied.
Control Measures	**Source of good practice control measures**
CM#2: Hazardous Materials Risk Assessment Process	The Beach Energy Hazardous Materials Risk Assessment Process assesses chemicals that have the potential to be discharged to the environment to ensure selection criteria are met. This control addresses Environmental, Health, and Safety Guidelines Offshore Oil and Gas Development (IFC, 2015) – Drilling Fluids and Drilled Cuttings Guidance Number 59 that requires operators carefully select drilling fluid additives, taking into account their concentration, toxicity, bioavailability, and bioaccumulation potential.
CM#3: Drill Fluid and Cuttings Management Plan	Environmental, Health, and Safety Guidelines Offshore Oil and Gas Development (IFC, 2015) – Drilling Fluids and Drilled Cuttings Guidance Number 53 requires that consideration of discharges of drilling fluids including chemical content. Environmental, Health, and Safety Guidelines Offshore Oil and Gas Development (IFC, 2015) – Drilling Fluids and Drilled Cuttings Guidance Number 59 requires that

	environmental hazards related to residual chemical additives on discharged cuttings are reduced through the drilling fluid selection.

Additional Controls Assessed

Control	Control Type	Cost/Benefit Analysis	Control Implemented?
Reinject fluids and cuttings to subsurface formation	Elimination	Cuttings reinjection is a possible method for disposing of cuttings without discharge to the marine environment; however, significant time and costs are associated with site selection and reinjection requires a suitable, existing offshore well in proximity of the Artisan-1 well. Given the Artisan-1 well is a single exploration well within a petroleum permit that does not have existing production wells ready for abandonment, this is not a feasible option.	No
Contain and transfer cuttings to shore for treatment	Elimination	This option require access to dedicated facilities onshore available to treat cuttings, which do not currently exist. This control measure may result in increased offshore environmental impacts via generation of additional vessel movements and associated atmospheric emissions. In addition, this control may increase in environmental impact onshore (out of scope of this EP) due to emissions generated through transport, treatment and disposal. This control measure is considered to provide a small environmental benefit, that would be grossly disproportionate in time, cost and effort given the extent of impact from the discharge of drilling cuttings demonstrated to be localised and short-term.	No
Reconditioning and storage of synthetic-based drilling fluid for reuse	Substitution	Remaining synthetic-based drill fluid shall be contained on board the MODU for use when drilling future wells within the Otway Basin. When unable to be reconditioned offshore, whole synthetic-based drill fluid shall be transported to shore for reconditioning.	Yes
Riserless Mud Recovery (RMR) System	Equipment	RMR may be applied to recirculate drill fluids and cuttings from the top-hole section of the well, thus eliminating discharge to seabed (when applied in conjunction with containment and transfer to shore). RMR may also be implemented where shallow hazards are anticipated. Given low to no toxicity water- based fluids (e.g. water and gel sweeps) shall be used for riserless drilling sections and shallow hazards are not anticipated, there is limited technical benefit in using this system. Given the small extent and temporary nature of impacts from the discharge of water-based drill	No

		fluid and drill cuttings from the top-hole sections of the well, and the deep-water environment at the Artisan-1 well location not in the vicinity of formally-managed benthic communities, the application of RMR is considered grossly disproportionate to the negligible environmental benefit potentially gained.	
Caisson discharge closer to seabed	Equipment	Based on the small extent and short-term impacts resulting from an increase in turbidity and smothering of benthic habitats, modifying the discharge depth of drill cuttings is not expected to result in a significant change to the severity of the impact.	No
Slim hole / coil tubing drilling	System	This drilling technique results in a reduction of the volume of cuttings produced. However, given Artisan-1 well is exploratory, and there is some uncertainty in the formation that may be encountered, Beach has adopted a conventional hole size to intersect the target reservoir, thus enabling greater fluid volume to maintain downhole pressure when compared with slim-hole design using a smaller volume of drilling fluids, and carry an elevated risk of a LOWC event.	No
CM#4: Solids Control Equipment (SCE)	Equipment	Additional equipment such as cuttings driers, thermal desorption and thermomechanical cleaning can be used to reduce the volumes of oil on cuttings. Equipment such as de-sanders, de-silters and centrifuges are used to reduce the solids content during treatment of used drilling fluids, while thermal desorption and thermal mechanical cleaning units are designed to clean oily residues from oily cuttings prior to their discharge. The addition of one or more of these control measures would result in a reduction in the overall level of environmental impact associated with the discharge of cuttings. Thermal desorption technology is not fitted to the Ocean Onyx, due to this equipment not being available for rental and the significantly high purchase price, the elevated running costs (energy consumption) and the significant rig modifications required to install, thermal desorption technology is not considered a practical option. Given the above, Beach considers the adoption of thermal desorption technology to be grossly disproportionate to the limited environmental benefit gained via a further reduction (likely in the order of 4 to 5%) in overall residual fluid on cuttings in a deep water, open-ocean environment where cuttings are likely to disperse	Yes

		rapidly. The Ocean Onyx is to be fitted with industry-leading proven solids control systems to reduce lost fluid and ensure a maximum amount of drilling fluids are recycled and their useful life extended. The investment includes a package of newly installed NOV AX-1 shale shakers, an online centrfuging system and an NOV Verti-G cuttings dryer. Given the application of a Cefas / OCNS-aligned chemical selection process limiting the use of hazardous substances in drill fluids, and the installation of new conventional SCE aboard the MODU, Beach believes all reasonable measures have been implemented to treat drill cuttings and fluids.

Impact Evaluation Summary	
Consequence Rating	Moderate (2)
Residual Impact Category	Low-order impact
Acceptability Assessment	
Policy compliance	The proposed management of the impact is aligned with the Beach Environment Policy.
Management system compliance	Activities will be undertaken in accordance with the Implementation Strategy (Section 8).
Stakeholder engagement	No objections or claims have been raised during stakeholder consultation regarding the planned discharges of drilling cuttings and fluids.
Laws and standards	Legislation and other requirements considered as relevant control measures include World Bank (2015) Environmental, Health, and Safety Guidelines Offshore Oil and Gas Development. This guideline is considered to provide examples of good industry practices when managing impacts from specific industries.
Industry practice	Good practice control measures relevant to the activity will be implemented.
Environmental context	Given the benthic habitat generally comprises soft sediment communities that are widespread and well represented in the region, impacts within the operational area surrounding the Artisan-1 exploration well are not considered significant. The habitat is expected to be homogenous in the area (to be verified via benthic surveys prior to drilling), as such, impacts are not expected to result in fragmentation, isolation or disturbance to other communities and ecosystems, nor adversely impact on biodiversity or ecological integrity.
Environmentally Sustainable Development principles	The activities were evaluated as having the potential to result in a Moderate (2) consequence thus is not considered as having the potential to result in serious or irreversible environmental damage. No further evaluation against the principles of ESD is required.
Monitoring and reporting	Compliance against EPOs, EPSs shall be monitored in accordance with inspection / audit schedule Impacts shall be monitored and reported via the incident management procedure. Any complaints received from stakeholders are handled in accordance with the process outlined in Section 9.
Acceptability outcome	**Acceptable**

7.4 Quantitative Hydrocarbon Spill Modelling

Beach commissioned RPS Australia West Pty Ltd (RPS) to conduct quantitative spill modelling (Appendix D) for two credible, yet hypothetical, worst-case hydrocarbon release scenarios:

Scenario 1: a 222,224 bbl (2584 bbl/d) subsea release of condensate over 86 days.

This loss of well control (LOWC) scenario represents an unrestricted open-hole release from the Artisan-1 well location and has been identified in alignment with methodology detailed within the Society of Petroleum Engineers (SPE) Technical Report: Calculation of Worst-Case Discharge (WCD) (April, 2015). The modelled duration of this release represents the time determined to implement a full dynamic well kill via the drilling of a relief well at the Artisan-1 well location. A detailed environmental impact and risk assessment associated with this hypothetical scenario is provided in section 7.6.

Scenario 2: a 300 m^3 surface release of marine diesel oil (MDO) over 6 hours.

This scenario represents a loss of inventory from the largest fuel tank on a project support vessel due to a hypothetical vessel collision incident at the Artisan-1 well location. The calculation of discharge volume and timing aligns with the methodology recommended in the Australian Maritime Safety Authority (AMSA) Technical guidelines for preparing contingency plans for marine and coastal facilities (Commonwealth of Australia, January, 2015). A detailed environmental impact and risk assessment associated with this hypothetical scenario is provided in section 7.5.

In the event of an oil pollution incident, the environment may be affected in several ways, depending on the concentration and duration of exposure of the environment to hydrocarbons. The hydrocarbon exposure thresholds presented in Table 7-4 are considered appropriate to:

- predict potential hydrocarbon contact at conservative (low exposure) concentrations and inform the description of the environment (Section 5 and Appendix B), inform the EPBC Protected Matters Search (Appendix A) and identify the Australian Marine Parks (AMP), Marine National Parks (MNP), Marine Parks (MP), and RAMSAR wetlands that may require monitoring in the event of a worst-case discharge based upon conservative (low exposure) in-water thresholds (Table 8-6 and Table 8-7);
- identify the environment potentially exposed to conservative instantaneous moderate thresholds (Figure 7-1)
- inform the oil spill impact and risk evaluation (Sections 7.5 and 7.6) based upon conservative (moderate) environmental impact thresholds depicted in; and
- inform oil spill response planning based upon potentially actionable concentrations of hydrocarbons (see OPEP Appendix E) and potential monitoring requirements (see Section 8.16.1 and OSMP Appendix F).

Table 7-4: Hydrocarbon exposure thresholds

Exposure Type	Exposure Threshold		
	Low Exposure	**Moderate Exposure**	**High Exposure**
Surface	0.5 g/m^2	10 g/m^2	25 g/m^2
Shoreline	10 g/m^2	100 g/m^2	1,000 g/m^2
Entrained*	10 ppb	100 ppb	1,000 ppb
Dissolved*	6 ppb	50 ppb	400 ppb

* In-water (entrained & dissolved) hydrocarbon thresholds are based upon an instantaneous (1 hr) hydrocarbon exposure

Beach also applies a time-based exposure (ppb.hrs) for in-water hydrocarbons to evaluate the potential consequences associated with hydrocarbon contact at various concentrations, considering potential exposure pathways for various receptor types. Time-based exposure is not used to inform the outer geographical extent of potential hydrocarbon contact to various receptors.

The quantitative spill modelling assessment was completed for two distinct periods, defined by the unique prevailing wind and general current conditions; summer (November–April) and winter (May–October).

The spill modelling was performed using an advanced three-dimensional trajectory and fates model, SIMAP (Spill Impact Mapping Analysis Program). The SIMAP model calculates the transport, spreading, entrainment and evaporation of spilled hydrocarbons over time, based on the prevailing wind and current conditions and the physical and chemical properties.

The modelling study was carried out in several stages. Firstly, a five-year current dataset (2008–2012) that includes the combined influence of ocean currents from the HYCOM model and tidal currents from the HYDROMAP model was developed. Secondly, high-resolution local winds from the CFSR model and detailed hydrocarbon characteristics were used as inputs in the three-dimensional oil spill model (SIMAP) to simulate the drift, spread, weathering and fate of the spilled oils.

As spills can occur during any set of wind and current conditions, modelling was conducted using a stochastic (random or non-deterministic) approach, which involved running 100 spill simulations per season for ach scenario initiated at random start times, using the same release information (spill volume, duration and composition of the oil). This ensured that each simulation was subject to different wind and current conditions and, in turn, movement and weathering of the oil.

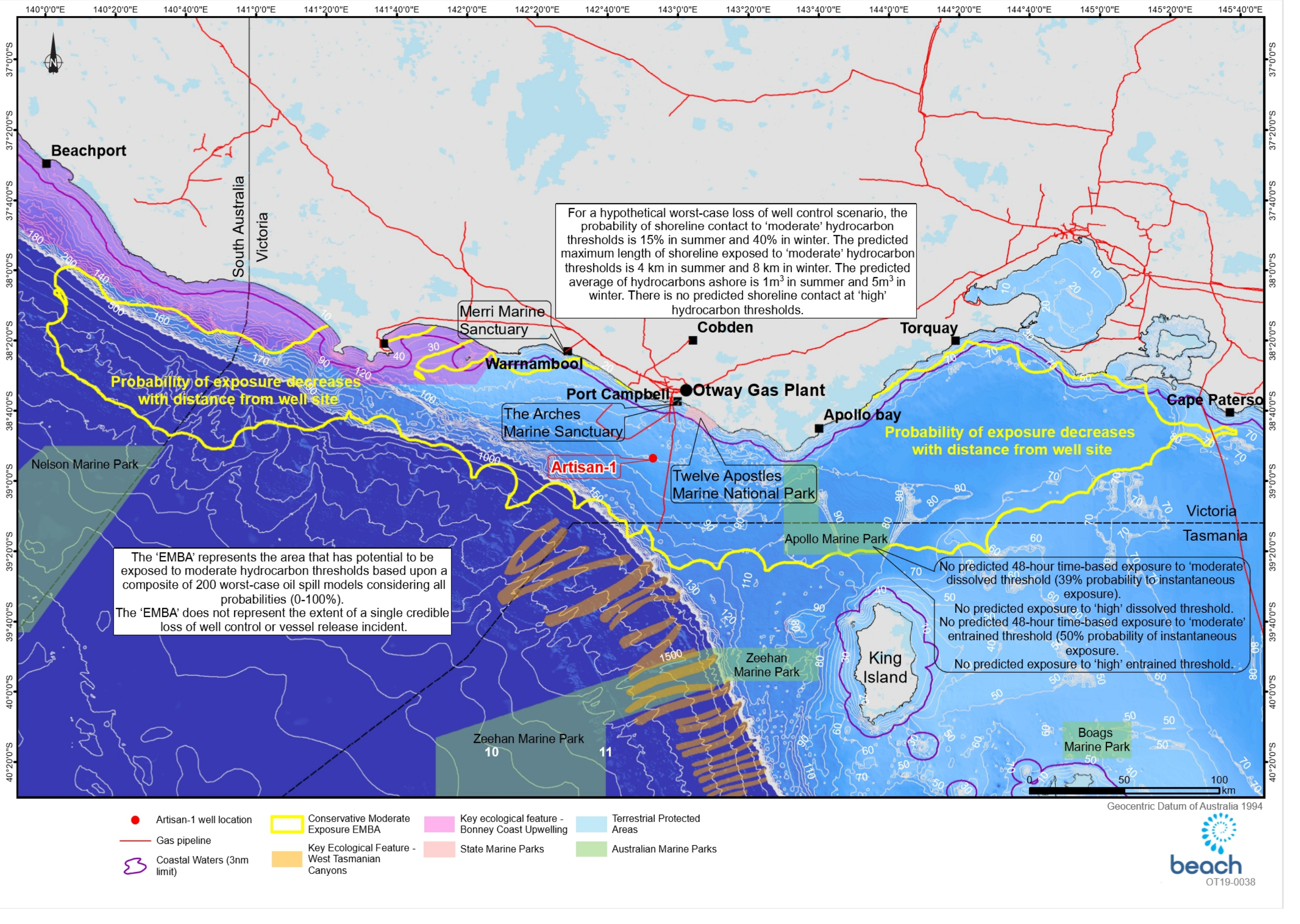


Figure 7-1: Environment potentially exposed to conservative (instantaneous) moderate thresholds

7.5 Vessel Operations: Loss of Containment – Marine Diesel

7.5.1 Hazards

Marine diesel oil is used in offshore vessels. A collision between a Beach contracted vessel and third-party vessel has the potential to result in a spill of fuel. Marine diesel oil is also used for power generation in the MODU and project support vessels. The following events have the potential to result in a spill of fuel:

- A collision between a project support vessel and the MODU or third-party vessel.
- MODU refuelling incident

7.5.1.1 Characteristics of diesel oils

Diesel oils are generally considered to be low viscosity, non-persistent oils, which are readily degraded by naturally occurring microbes.

Diesel oils are considered to have a higher aquatic toxicity in comparison to many other crude oils due to the types of hydrocarbon present and their bioavailability. They also have a high potential to bio-accumulate in organisms.

Marine diesel is a medium-grade oil (classified as a Group II oil) used in the maritime industry. It has a low density, a low pour point and a low dynamic viscosity (Table 7-5), indicating that this oil will spread quickly when spilled at sea and thin out to low thicknesses, increasing the rate of evaporation.

Due to its chemical composition, approximately 40% will generally evaporate within the first day, with the remaining volatiles evaporating over 3-4 days depending upon the prevailing conditions. Diesel shows a strong tendency to entrain into the upper water column in the presence of moderate winds and breaking waves (>12 knots) but floats to the surface when conditions are calm, which delays the evaporation process. Table 7-6 shows the boiling point ranges for the diesel used in the spill modelling.

Table 7-5: Physical characteristics of marine diesel oil

Parameter	Characteristics
Density (kg/m^3)	829 at 15°C
API	37.6
Dynamic viscosity (cP)	4.0 at 25°C
Pour point (°C)	-14
Oil category	Group II
Oil persistence classification	Light-persistent oil

Table 7-6: Boiling point ranges of marine diesel oil

Characteristic	Volatiles (%)	Semi-volatiles (%)	Low volatiles (%)	Residual (%)
Boiling point (°C)	<180	180 – 265	265 – 380	>380
Marine diesel oil	6.0	34.6	54.4	5
	Non-Persistent			Persistent

On release to the marine environment, diesel would evaporate and decay and be distributed over time into various components. Of these components, surface hydrocarbons, entrained hydrocarbons (non-dissolved oil droplets that are physically entrained by wave action) and dissolved aromatics (principally the aromatic hydrocarbons) have the most significant impact on the marine environment. These are discussed in further detail below.

7.5.1.2 Extent of potential hydrocarbon exposure

The extent of possible exposure to hydrocarbons is based upon a hypothetical worst-case 300 m^3 surface release of MDO over 6 hours at the Artisan-1 well location with results derived from the Artisan-1 Exploration Well Oil Spill Modelling, RPS 2019 (Appendix D). The extent of potential hydrocarbon exposure at moderate thresholds (including 48-hour time-based in-water dissolved and entrained) for a marine diesel spill scenario is presented in Figure 7-2.

Potential extent of hydrocarbon exposure to Australian Marine Parks

Whilst Apollo AMP could potentially be exposed to moderate (instantaneous) thresholds of entrained hydrocarbons (up to7% summer and 16% winter), spill modelling indicates there in no potential for Apollo AMP to be impacted by moderate or high time-based in-water exposure thresholds.

No AMPs are predicted to be exposed to high (instantaneous or time-based) thresholds of dissolved or entrained hydrocarbons.

Potential extent of hydrocarbon exposure to surface waters

During summer conditions, moderate (10 g/m^2) exposure to surface hydrocarbons were predicted to travel a maximum distance of 12 km from the release location. During winter, moderate exposure of surface hydrocarbons extended to a maximum distance of 10 km from the release location.

None of the receptors identified within the modelling report were exposed at or above the moderate or high (>25 g/m^2) thresholds with the exception of the Otway IMCRA. This receptor registered low, moderate and high exposure to sea surface hydrocarbons due to the release location being situated within the boundaries of this receptor.

Potential extent of hydrocarbon exposure to shorelines

No shoreline contact above the minimum threshold (>10 g/m^2) was predicted for any of the seasons modelled.

Potential extent of in-water dissolved hydrocarbon exposure

There was no dissolved hydrocarbon exposure (over the 48-hour window) in the 0-10 m depth layer to receptors at or above the low threshold (6 ppb), with the exception of the Otway IMCRA which registered 8 ppb and 9 ppb during summer and winter conditions, respectively. None of the receptors recorded exposure (over 48 hours) at or above the moderate (50 ppb) or high (400 ppb) thresholds.

No moderate or high dissolved hydrocarbon exposure (over 1 hour) was predicted for any receptor identified within the spill modelling report, except for the Otway IMCRA

Potential extent of in-water entrained hydrocarbon exposure

At the depths of 0-10 m, the maximum entrained hydrocarbon exposure (over a 48-hour window) during summer and winter conditions was 2,182 ppb and 792 ppb, respectively. None of the receptors were exposed at or above the moderate (10-100 ppb) or high (>1,000 ppb) thresholds, excluding the Otway IMCRA.

Within the 0-10 m depth layer, the maximum entrained hydrocarbon exposure (over 1 hour) for the Otway IMCRA was 5,933 ppb and 5,046 ppb, during summer and winter conditions, respectively. For receptors other than the Otway IMCRA (83% summer and 93% winter), the probability of exposure to entrained hydrocarbons at or above the moderate threshold (100-1,000 ppb) ranged from 1% (Cape Patton sub-Local Government Area (sub-LGA)) to 8% (within Victorian State Waters) during summer conditions and 1% (Twelve Apostles Marine National Park (MNP)) to 16% (Apollo AMP) during winter conditions. No other receptors were exposed at or above the high threshold (>1,000 ppb), except for the Otway IMCRA.

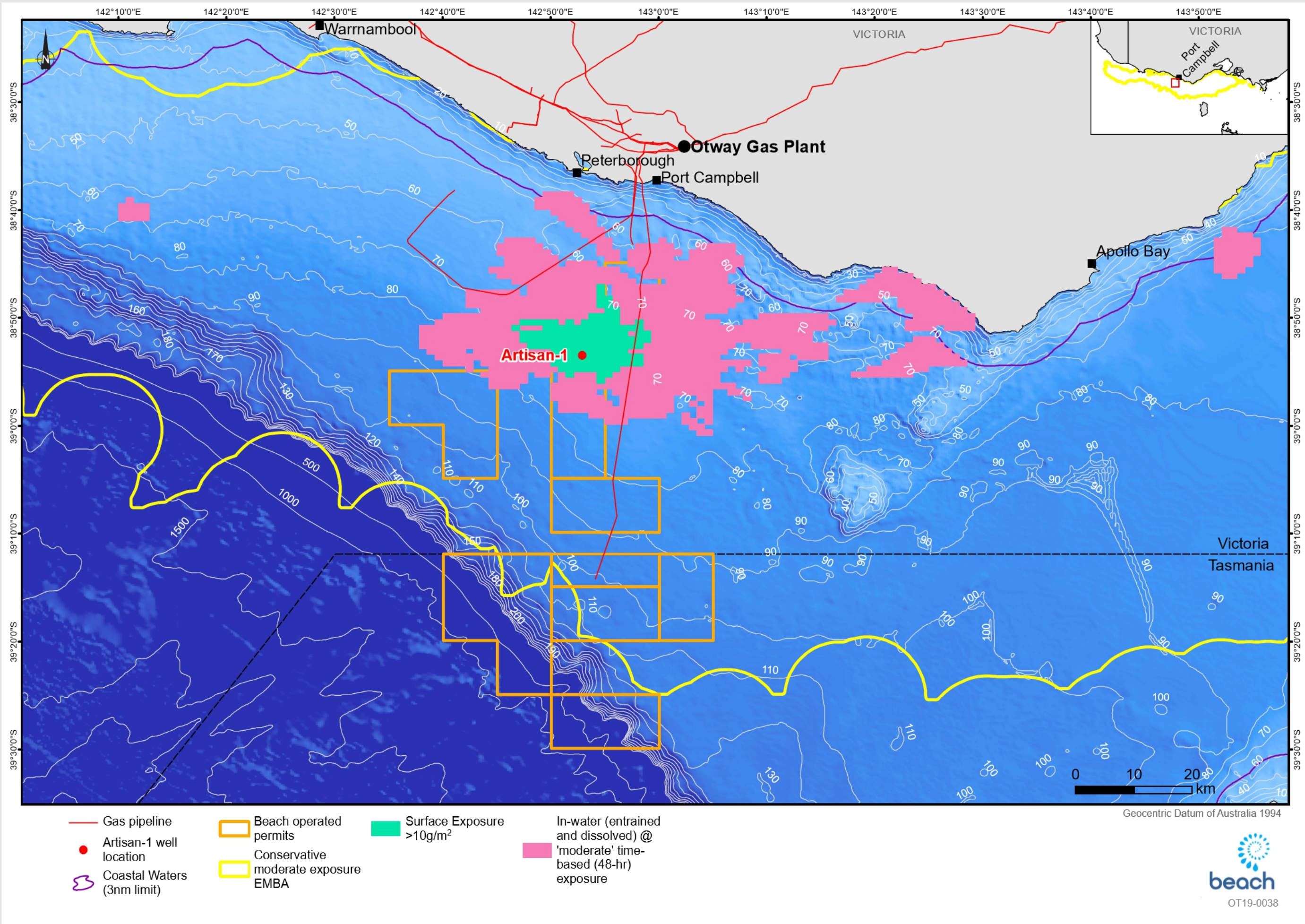


Figure 7-2: Environment potentially exposed to moderate surface and time-based in-water thresholds from a hypothetical 300m^3 diesel spill over 6 hours

7.5.2 Known and potential environmental impacts

The known and potential environmental impacts of a diesel spill are:

- Change in water quality
- Injury / mortality to fauna
- Change in fauna behaviour
- Change in ecosystem dynamics
- Changes to the functions, interests or activities of other users
- Change in aesthetic value

7.5.3 Consequence Evaluation

The potential environmental impacts to receptors within the EMBA are discussed in Table 7-7 to Table 7-10.

Table 7-7: Consequence evaluation to ecological receptors within the EMBA – sea surface

Receptor Group	Receptor Type	Impact	Exposure Evaluation	Consequence Evaluation
Marine fauna	Seabirds	Change in fauna behaviour Injury / mortality to fauna	Several listed Threatened, Migratory and/or listed marine species have the potential to be rafting, resting, diving and feeding within 12 km of the release location predicted to be exposed to moderate levels of surface hydrocarbons. There are foraging BIAs for a number of birds in the area (Appendix B.3.5.1) predicted to be above threshold. There are no breeding BIAs within the area, as breeding BIAs are associated with onshore habitats (Appendix B.3.5.1).	When first released, diesel has higher toxicity due to the presence of volatile components. Individual birds making contact close to the spill source at the time of the spill (i.e. areas of concentrations >10 g/m^2 out to 12 km from the release location) may be impacted; however, it is unlikely that many birds will be affected as volatile surface hydrocarbons are expected to evaporate over 3-4 days. Seabirds rafting, resting, diving or feeding at sea have the potential to encounter areas where hydrocarbons concentrations are greater than 10 g/m^2 and due to physical oiling may experience lethal surface concentrations. As such, acute or chronic toxicity impacts (death or long-term poor health) to birds are possible but unlikely for a diesel spill because of the limited period of exposure above 10 g/m^2. Sea surface oil >10 g/m^2 (10 µm) is only predicted for the first 36 hrs limiting the period when oiling may occur. Therefore, potential impact would be limited to individuals, with population impacts not anticipated. Consequently, the potential impacts and risks to seabirds from a loss of MDO containment are considered to be Moderate (2), as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.

Receptor Group	Receptor Type	Impact	Exposure Evaluation	Consequence Evaluation
	Marine reptiles	Change in fauna behaviour Injury / mortality to fauna	There may be marine turtles in the area predicted to be exposed to surface oil. However, there are no BIAs or habitat critical to the survival of the species within this area.	Marine turtles are vulnerable to the effects of oil at all life stages. Marine turtles can be exposed to surface oil externally (i.e. swimming through oil slicks) or internally (i.e. swallowing the oil). Ingested oil can harm internal organs and digestive function. Oil on their bodies can cause skin irritation and affect breathing. The number of marine turtles that may be exposed to surface diesel is expected to be low as there are no BIAs or habitat critical to the survival of the species present; however, turtles may be transient within the EMBA. Sea surface oil >10 g/m^2 (10 µm) is only predicted for the first 36 hrs limiting the period when oiling may occur. Therefore, potential impact would be limited to individuals, with population impacts not anticipated. Consequently, the potential impacts and risks to marine turtles are considered to be Minor (1), as they could be expected to result in localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning within an area of low significance.
	Marine mammals (pinnipeds)	Change in fauna behaviour Injury / mortality to fauna	There may be pinnipeds in the area predicted to be exposed to surface hydrocarbons >10 g/m^2. However, it is not identified as critical habitat, and there are no spatially defined aggregations (i.e. is not a BIA). Known breeding colonies occur on islands outside of the predicted area of moderate surface exposure.	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. Exposure to surface oil can result in skin and eye irritations and disruptions to thermal regulation. Fur seals are particularly vulnerable to hypothermia from oiling of their fur. The number of pinnipeds that may be exposed to surface diesel is expected to be low as there are no BIAs or habitat critical to the survival of the species present; however, pinnipeds may be transient within the EMBA. Sea surface oil >10 g/m^2 (10 µm) is only predicted for the first 36 hrs limiting the period when oiling may occur. Therefore, potential impact would be limited to individuals, with population impacts not anticipated. Consequently, the potential impacts and risks to pinnipeds are considered to be Minor (1), as they could be expected to result in localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning within an area of low significance.

Receptor Group	Receptor Type	Impact	Exposure Evaluation	Consequence Evaluation
	Marine mammals (whales)	Change in fauna behaviour Injury / mortality to fauna	Several threatened, migratory and/or listed marine species have the potential to be foraging the area predicted to be exposed to surface hydrocarbons of >10 g/m^2. Surface exposure of >10 g/m^2 is expected to extend out 12 km from the release location i.e., a relatively small areas compared to the overall distribution area of cetaceans. Known BIAs are present for foraging for pygmy blue whales and distribution for southern right whale within the area predicted to be exposed to surface hydrocarbons >10 g/m^2.	Physical contact by individual whales with a surface diesel spill is unlikely to lead to any long-term impacts. Given the mobility of whales, only a small proportion of the population would surface in the affected areas, resulting in short-term and localised consequences, with no long-term population viability effects. Geraci (1988) found little evidence of cetacean mortality from hydrocarbon spills; however, some behaviour disturbance (including avoidance of the area) may occur. While this reduces the potential for physiological impacts from contact with hydrocarbons, active avoidance of an area may displace individuals from important habitat, such as foraging. If whales are foraging at the time of the spill, a greater number of individuals may be present in the area where sea surface oil is present, however sea surface oil >10 g/m^2 (10 µm) is only predicted for the first 36 hrs limiting the period when oiling may occur. Also, the area exposed by moderate levels of surface hydrocarbons (12 km from the release location) is relatively small compared to the overall distribution area of cetaceans. Given this is a relatively small area of the total foraging BIA for pygmy blue whales and distribution BIA for southern right whales, the risk of displacement to whales is considered low. Consequently, the potential impacts and risks to cetaceans are considered to be Moderate (2) as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.

Receptor Group	Receptor Type	Impact	Exposure Evaluation	Consequence Evaluation
	Marine mammals (dolphins)	Change in fauna behaviour Injury / mortality to fauna	There may be dolphins in the area predicted to be exposed to surface oil. However, there are no BIAs or habitat critical to the survival of the species within this area.	Dolphins surface to breathe air and may inhale hydrocarbon vapours or be directly exposed to dermal contact with surface hydrocarbons. Direct contact with oil can result in direct impacts to the animal, due to toxic effects if ingested, damage to lungs when inhaled at the surface, and damage to the skin and associated functions such as thermoregulation (AMSA 2010). Dolphins are highly mobile and are considered to have some ability to detect and avoid oil slicks. Direct surface hydrocarbon contact may pose little problem to dolphins due to their extraordinarily thick epidermal layer which is highly effective as a barrier to the toxic, penetrating substances found in hydrocarbons. The number of dolphins exposed is expected to be low, with population impacts not anticipated. If dolphins are foraging at the time of the spill, a greater number of individuals may be present in the area where sea surface oil is present, however due to the short duration of the surface exposure above the impact threshold (approximately 36 hours), this is not likely. Consequently, the potential impacts and risks to dolphins from a loss of MDO containment are considered to be Minor (1), as they could be expected to result in localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning within an area of low significance.

Table 7-8: Consequence evaluation to socio-economic receptors within the EMBA – sea surface

Receptor Group	Receptor Type	Impact	Exposure Evaluation	Consequence Evaluation
Human systems	Recreation and tourism (including recreational fisheries)	Change in aesthetic value Changes to the functions, interests or activities of other users	Marine pollution can result in impacts to marine-based tourism from reduced visual aesthetic. The modelling predicts (visible surface rainbow sheen) surface sheens (0.5 g/m^2) may occur up to 93 km from the release location. This oil may be visible as a rainbow sheen on the sea surface during calm conditions.	Visible surface hydrocarbons (i.e. a rainbow sheen) have the potential to reduce the visual amenity of the area for tourism and discourage recreational activities. However, the relatively short duration means there may be short-term and localised consequences, which are ranked as Moderate (2). Refer also to: Marine mammals (whales)
	Industry (shipping)	Displacement of other marine users	Shipping occurs within the area predicted to be exposed to surface hydrocarbons >10 g/m^2 (12 km from the release location).	Vessels may be present in the area where sea surface oil is present, however, due to the short duration of the surface exposure (approximately 36 hours) deviation of shipping traffic would be unlikely.
	Industry (oil and gas)	Displacement of other marine users	Shipping occurs within the area predicted to be exposed to surface hydrocarbons >10 g/m^2 (12 km from the release location).	No impact as there are no non-Beach oil and gas platforms located within the area predicted to be exposed to surface hydrocarbons.

Table 7-9: Consequence evaluation to physical and ecological receptors within the EMBA – in water

Receptor Group	Receptor Type	Impact	Exposure Evaluation	Consequence Evaluation
Habitat	Algae	Change in habitat	Macroalgae communities may be within the overall area potentially exposed to moderate levels of in-water entrained hydrocarbons. Video surveys confirmed the presence of high density macroalgae dominated epibenthos in waters shallower than 20 m, however, it is not a dominant habitat feature in eastern Victoria. Note that the greater wave action and water column mixing within	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). The effect of hydrocarbons however is largely dependent on the degree of direct exposure, and the presence of morphological features (e.g. a mucilage layer and/or fine ‘hairs’) will directly influence the amount of hydrocarbon that will adhere to the algae. Generally, the effects of oil on macroalgae, such as kelp and many other species which dominate hard substrata in shallow waters is small due to their mucilaginous coating that resists oil absorption.

Receptor Group	Receptor Type	Impact	Exposure Evaluation	Consequence Evaluation
			the nearshore environment will also result in rapid weathering of the MDO residue.	Hydrocarbons may contact the intertidal shores as the tide ebbs, but it would be expected that this would be flushed with each flood tide. Natural flushing is more likely to reduce impacts in exposed areas of shoreline. Consequently, the potential impacts to algae are considered to be Minor (1), as they could be expected to result in localised short-term impacts to species/habitats.
	Soft Coral	Change in water quality Change in habitat	In-water exposure (entrained) is only predicted to occur within intertidal or shallow nearshore waters. Note that the greater wave action and water column mixing within the nearshore environment will also result in rapid weathering of the hydrocarbon.	Exposure of entrained hydrocarbons to shallow subtidal corals has the potential to result in lethal or sublethal toxic effects, resulting in acute impacts or death at moderate to high exposure thresholds (Shigenaka, 2001). Contact with corals may lead to reduced growth rates, tissue decomposition, and poor resistance and mortality of sections of reef (NOAA, 2010). However, given the lack of coral reef formations, no predicted dissolved in-water hydrocarbon exposure and the sporadic cover of hard or soft corals in mixed nearshore reef communities along the Otway coast, such impacts are considered to be limited to smothering of isolated corals. Hydrocarbons may contact the intertidal shores as the tide ebbs, but it would be expected that this would be flushed with each flood tide. Natural flushing is more likely to reduce impacts in exposed areas of shoreline. Consequently, the potential impacts to corals are considered to be Minor (1), as they could be expected to result in localised short-term impacts to species/habitats.
	Seagrass	Change in habitat	In-water exposure (entrained) is only predicted to occur within the surface layers with the potential to contain seagrasses. Note that the greater wave action and water column mixing within the nearshore environment will also result in rapid weathering of the MDO. Seagrass may be present within the area predicted to be exposed to in-water	There is the potential that entrained in-water hydrocarbon exposure could result in sub-lethal impacts from smothering, more so than lethal impacts, possibly because much of seagrasses' biomass is underground in their rhizomes (Zieman et al., 1984). Given the restricted range of exposure (shallow nearshore and intertidal waters only), no predicted dissolved in-water hydrocarbon exposure and the predicted moderate concentrations of entrained hydrocarbons expected to be in these waters, any impact to seagrass is not expected to result in long-term or irreversible damage.

Receptor Group	Receptor Type	Impact	Exposure Evaluation	Consequence Evaluation
			hydrocarbons (e.g. seagrass is known to occur within Twelve Apostles Marine Park). Exposure in nearshore and intertidal areas is predicted to only be at moderate thresholds (e.g. instantaneous exposure >100 ppb for entrained hydrocarbons only).	Consequently, the potential impacts to seagrass are considered to be Moderate (2), as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
Marine fauna	Plankton	Injury/Mortality to fauna	Plankton are likely to be exposed to entrained hydrocarbons. Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest.	Relatively low concentrations of hydrocarbon are toxic to both plankton [including zooplankton and ichthyoplankton (fish eggs and larvae)]. Plankton risk exposure through ingestion, inhalation and dermal contact. Impacts would predominantly result from exposure to dissolved fractions, as larval fish and plankton are pelagic, and are moved by seawater currents. Potential impacts would largely be restricted to planktonic communities, which would be expected to recover rapidly following a hydrocarbon spill. Plankton are numerous and widespread but do act as the basis for the marine food web, meaning that an oil spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Once background water quality conditions have re-established, the plankton community may take weeks to months to recover (ITOPF, 2011a), allowing for seasonal influences on the assemblage characteristics. Consequently, given the limited area exposed by moderate levels of dissolved hydrocarbons, the potential impacts to plankton are considered to be Minor (1), as they could be expected to cause short-term and localised impacts within an area of low significance.
	Marine invertebrates	Injury/Mortality to fauna	In-water invertebrates of value have been identified to include squid, crustaceans (rock lobster, crabs) and molluscs (scallops, abalone). Impact by direct contact of in-water hydrocarbons to benthic species in the deeper areas of potential exposure are not expected. Species located in shallow	Acute or chronic exposure through contact and/or ingestion can result in toxicological risks. However, the presence of an exoskeleton (e.g. crustaceans) reduces the impact of hydrocarbon absorption through the surface membrane. Invertebrates with no exoskeleton and larval forms may be more prone to impacts. Localised impacts to larval stages may occur which could impact on population recruitment that year. Tainting of recreation or commercial species is considered unlikely to occur given exposure is limited to entrained hydrocarbons, however if it did it is expected to be localised and low level with recovery expected.

Receptor Group	Receptor Type	Impact	Exposure Evaluation	Consequence Evaluation
			nearshore or intertidal waters may be exposed to in-water hydrocarbons. Several commercial fisheries for marine invertebrates are within the area predicted to be exposed to moderate levels of entrained in-water hydrocarbons.	Consequently, the potential impacts and risks to commercially fished invertebrates from a loss of MDO containment are considered to be Minor (1), as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
	Fish	Injury/Mortality to fauna	Entrained hydrocarbon droplets can physically affect fish exposed for an extended duration (weeks to months). Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest. Several fish communities in these areas are demersal and therefore more prevalent towards the seabed, which is not likely to be exposed. Therefore, any impacts are expected to be highly localised. The Australian grayling spends most of its life in fresh water, with parts of the larval or juvenile stages spent in coastal marine waters, therefore it is not expected to be present in offshore waters in large numbers. There is a known distribution and foraging BIA for the white shark in the EMBA, however, it is not expected that this species spends a large amount of time close to the surface where thresholds may be highest.	Pelagic free-swimming fish and sharks are unlikely to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons in water are not expected to be sufficient to cause harm (ITOPF, 2011a). Subsurface hydrocarbons could potentially result in acute exposure to marine biota such as juvenile fish, larvae, and planktonic organisms, although impacts are not expected cause population-level impacts. There is the potential for localised and short-term impacts to fish communities; the consequences are ranked as Moderate (2). Impacts on fish eggs and larvae entrained in the upper water column are not expected to be significant given the temporary nature of the resulting change in water quality, and the limited areal extent of the spill. As egg/larvae dispersal is widely distributed in the upper layers of the water column it is expected that current induced drift will rapidly replace any oil affected populations. Impacts are assessed as temporary and localised, and therefore considered to be Moderate (2).
	Marine mammals (pinnipeds)	Injury/Mortality to fauna Change in fauna behaviour	Localised parts of the foraging range for New Zealand fur-seals and Australian fur-seals may be temporarily exposed to moderate concentrations of in-water hydrocarbons in	Exposure to moderate effects level hydrocarbons in the water column or consumption of prey affected by the oil may cause sub-lethal impacts to pinnipeds. However, due to the temporary and localised nature of the spill, their widespread nature, the low-level exposure zones and rapid loss of the

Receptor Group	Receptor Type	Impact	Exposure Evaluation	Consequence Evaluation
			the water column. Noting that in-water exposure (dissolved or entrained) is only predicted to occur within the upper layers of the water column.	volatile components of diesel in choppy and windy seas (such as that of the area exposed by moderate in-water hydrocarbon thresholds), impacts at a population level are considered very unlikely. Impact is assessed as temporary and localised and are considered Moderate (2).
	Marine mammals (whales and dolphins)	Injury/Mortality to fauna Change in fauna behaviour	Several threatened, migratory and/or listed marine cetacean species have the potential to be migrating, resting or foraging within an area predicted to be exposed to in-water hydrocarbons. Known BIAs are present for foraging for pygmy blue whales and distribution for southern right whale in area exposed to moderate in-water thresholds, i.e. >50 ppb for dissolved and >100 ppb for entrained.	Cetacean exposure to entrained hydrocarbons can result in physical coating as well as ingestion (Geraci and St Aubin, 1988). Such impacts are associated with 'fresh' hydrocarbon; the risk of impact declines rapidly as the MDO weathers. The potential for impacts to cetaceans and dolphins would be limited to a relatively short period following the release and would need to coincide with seasonal foraging or aggregation event to result in exposure to a large number of individuals. However, such exposure is not anticipated to result in long-term population viability effects. A proportion of the foraging or distributed population of whales could be affected in the relatively localised area and water depth of the total foraging BIA for pygmy blue whales and distribution BIA for southern right whales, the risk of displacement to whales is considered low. Displacement behaviours could result in temporary and localised consequences, which are ranked as Moderate (2).

Table 7-10: Consequence evaluation to socio-economic receptors within the EMBA – in water

Receptor Group	Receptor Type	Impact	Exposure Evaluation	Consequence Evaluation
Human system	Commercial and recreational fisheries	Change in ecosystem dynamics Changes to the functions, interests or activities of other users	In-water exposure to entrained diesel may result in a reduction in commercially targeted marine species, resulting in impacts to commercial fishing and aquaculture. Actual or potential contamination of seafood can affect commercial and recreational fishing and can impact	Any acute impacts are expected to be limited to small numbers of juvenile fish, larvae, and planktonic organisms, which are not expected to affect population viability or recruitment. Impacts from entrained exposure are unlikely to manifest at a fish population level.

Receptor Group	Receptor Type	Impact	Exposure Evaluation	Consequence Evaluation
			seafood markets long after any actual risk to seafood from a spill has subsided (NOAA, 2002) which can have economic impacts to the industry. Several commercial fisheries operate in the EMBA and overlap the spatial extent of the water column hydrocarbon predictions.	Any exclusion zone established would be limited to the immediate vicinity of the release point, and due to the rapid weathering of diesel would only be in place 1-3 days after release, therefore physical displacement to vessels is unlikely to be a significant impact. The consequence to commercial and recreational fisheries is assessed as localised and short term and ranked as Moderate (2).
	Recreation and tourism	Change in ecosystem dynamics Changes to the functions, interests or activities of other users Change in aesthetic value Change in water quality	Tourism and recreation is also linked to the presence of marine fauna (e.g. whales), particular habitats and locations for recreational fishing. The area between Cape Otway and Port Campbell is frequented by tourists. It is a remote stretch of coastline dominated by cliffs with remote beaches subject to the high energy wave action. Access to the entire coastline is via a 7 to 8-day walking track from Apollo Bay ending at the Twelve Apostles. Recreation is also linked to the presence of marine fauna and direct impacts to marine fauna such as whales, birds, and pinnipeds can result in indirect impacts to recreational values. It is important to note that the impact from a public perception perspective may be even more conservative. This may deter tourists and locals from undertaking recreational activities. If this occurs, the attraction is temporarily closed, economic losses to the business are likely to eventuate. The extent of these losses would be dependent on how long the attraction remains closed.	Any impact to receptors that provide nature-based tourism features (e.g. whales) may cause a subsequent negative impact to recreation and tourism activities. Refer also to: Fish Birds Pinnipeds Marine mammals (whales and dolphins) Marine invertebrates Recreational fisheries Any impact to receptors that provide nature-based tourism features (e.g. fish and marine mammals) may cause a subsequent negative impact to recreation and tourism activities. However, the relatively short duration, and distance from shore means there may be short-term and localised consequences, which are ranked as Moderate (2).
Natural system	State Marine Protected Areas	Change in ecosystem dynamics Change in aesthetic value Change in water quality	State marine protected areas (e.g. Twelve Apostles Marine Park) occur within the area predicted to be exposed to in-water hydrocarbons at the instantaneous screening level of 100 ppb (entrained).	Refer to: Marine invertebrates Macroalgae

Receptor Group	Receptor Type	Impact	Exposure Evaluation	Consequence Evaluation
			Conservation values for these areas include high marine fauna and flora diversity, including fish and invertebrate assemblages and benthic coverage (sponges, macroalgae).	The consequence to conservation values within the Twelve Apostles Marine Park is assessed as localised and short term and ranked as Moderate (2).
	Australian Marine Parks	Change in ecosystem dynamics Change in aesthetic value Change in water qualitry	Stochastic modelling indicates in-water hydrocarbons at the instantaneous screening level of 100 ppb (entrained) may extend to within the boundaries of the Apollo Marine Park. Conservation values for Apollo Marine Park include foraging habitat for seabirds, dolphins, seals and white sharks, and blue whales migrate through Bass Strait. A reduction in water quality will lead to a breach in management objectives for AMPs.	Refer to: Seabirds Marine mammals (cetaceans and pinnipeds) Fish Plankton The concentration at which the water column within Apollo Marine Park may be exposed is within the moderate thresholds for entrained hydrocarbons. Given the nature of the exposure to foraging habitats, and transient nature of migrating and foraging marine fauna, the consequence is ranked as Moderate (2).

7.5.4 Control measures, ALARP and acceptability assessment

Control, ALARP and acceptability assessment: Loss of marine diesel from vessel collision	
ALARP Decision Context and Justification	**ALARP Decision Context: Type B** Vessel have been used for activities within the Otway offshore natural gas development for many years with no major incident. Vessel activities are well regulated with associated control measures, well understood, and are implemented across the offshore industry. During stakeholder engagement, no concerns were raised regarding the acceptability of impacts from these events. However, if a diesel spill occurred from a vessel collision this could attract public and media interest. Consequently, Beach believes that ALARP Decision Context B should be applied.
Control Measures	**Source of good practice control measures**
CM#10: Ongoing consultation	Under the *Navigation Act 2012*, the Australian Hydrographic Service (AHS) are responsible for maintaining and disseminating hydrographic and other nautical information and nautical publications such as Notices to Mariners. AMSA also issue AUSCOAST warnings. Relevant details in relation to the vessel activity will be provided to the AHS and AMSA and to relevant stakeholders to ensure the presence of the vessel is known in the area. See Section 9.7 (Ongoing Stakeholder Consultation).
	Under the *OPGGS Act 2006* there is provision for ensuring that petroleum activities are carried out in a manner that doesn't interfere with other marine users to a greater extent than is necessary or the reasonable exercise of the rights and performance of the duties of the titleholder. Beach ensures this is achieved by conducting suitable consultation with relevant stakeholders. Consultation with potentially affected fisheries ensures the risk of interaction with these users is limited.
CM#12: SMPEP (or equivalent)	In accordance with MARPOL Annex I and AMSA's MO 91 [Marine Pollution Prevention – oil], a SMPEP (or equivalent, according to class) is required to be developed based upon the Guidelines for the Development of Shipboard Oil Pollution Emergency Plans, adopted by IMO as Resolution MEPC.54(32) and approved by AMSA. To prepare for a spill event, the SMPEP details: • response equipment available to control a spill event; • review cycle to ensure that the SMPEP is kept up to date; and • testing requirements, including the frequency and nature of these tests. • In the event of a spill, the SMPEP details: • reporting requirements and a list of authorities to be contacted; • activities to be undertaken to control the discharge of hydrocarbon; and • procedures for coordinating with local officials. Specifically, the SMPEP contains procedures to stop or reduce the flow of hydrocarbons to be considered in the event of tank rupture.
CM#13: MO 21: Safety and emergency arrangements	AMSA MO 21 [Safety of navigation and emergency procedures] gives effect to SOLAS regulations dealing with life-saving appliances and arrangements, safety of navigation and special measures to enhance maritime safety.
CM#14: MO 30: Prevention of collisions	AMSA MO 30 [Prevention of collisions] requires that onboard navigation, radar equipment, and lighting meets industry standards.
	All vessels contracted to Beach will have in date certification in accordance with AMSA MO 31 [Vessel surveys and certification].

Additional Controls Assessed			
Control	**Control Type**	**Cost/Benefit Analysis**	**Control Implemented?**
Eliminate or substitute the use of diesel.	Equipment	The use of diesel for fuel for vessels and machinery cannot be eliminated. Substituting for another fuel, i.e. HFO or bunker fuel oil, would have a higher environmental impact than diesel.	No
CM#16: Rig safety exclusion zone established around the MODU during the drilling activity.	System	The drilling activity will be short in duration (approx. 35-55 days). The temporary exclusion of vessels from a 500 m radius of the MODU would not cause significant impact on socio-economic receptors, such as fisheries and shipping. By restricting the potential interactions between vessels and the MODU, the overall benefit in spill prevention is considered reasonable.	Yes
CM#17: Controlled access to rig safety exclusion zone	Procedure	By the MODU controlling access into the 500 m rig safety zone, including approach directions and speed, the overall benefit in spill prevention is considered reasonable.	Yes
Dedicated guard vessel on location at all times to guard MODU from errant vessels	Equipment	A dedicated guard vessel would incur a cost to the project of approximately $20-30K per day of operation. Given the presence of a project support vessel on location at all times, there is no identified net benefit in contracting an additional dedicated guard vessel.	No
CM#18: Project support vessel on location at all times to guard MODU from errant vessels	System / Equipment	The overall benefit for a project support vessel to maintain guard on a 24-hour basis to prevent an errant vessel from impacting the MODU is considered reasonable.	Yes
Smaller vessel used to support drilling activities	Equipment	The project support vessels for the drilling activity must capable of moving and securing the MODU, therefore it is not feasible to use smaller vessels as support.	No
Consequence Rating	Moderate (2)		
Likelihood of Occurrence	Highly Unlikely (2)		
Residual Risk	Low		
Acceptability Assessment			
Policy compliance	The proposed management of the impact is aligned with the Beach Environment Policy.		
Management system compliance	Activities will be undertaken in accordance with the Implementation Strategy (Section 8).		
Stakeholder engagement	No objections or claims have been raised during stakeholder consultation regarding the potential for diesel spills.		
Laws and standards	Vessels will comply with: • MO 21 (Safety of navigation and emergency procedures); • MO 30 (Prevention of collisions); • MO 31 (Vessel surveys and certification);		

	• MO 91 (Marine pollution prevention – oil); and • *Navigation Act 2012*.
Industry practice	The use of vessels to support exploration of the offshore environment is considered to be standard industry practice.
Environmental context	Diesel is a medium-grade oil that has a low density, a low pour point and a low dynamic viscosity, indicating that this oil will spread quickly when spilled at sea and thin out to low thicknesses, increasing the rate of evaporation. In the marine environment diesel will tend to spread rapidly in the direction of the prevailing wind and waves. Evaporation is the dominant process contributing to the fate of spilled diesel from the sea surface and will account for >50% reduction of net hydrocarbon balance. In addition, a proportion of the diesel will entrain under the water surface particularly when wind speed and resultant wave action increase. Because of the nature of diesel to spread quickly to a thin surface layer, small amounts over a relatively large area will become entrained. As such, entrained oil at concentrations above impact thresholds will be limited to a localised area around the vessel. Long-term impacts to physical, ecological and socio-economic receptors that come in contact with the diesel both on the sea surface and in-water are unlikely. Shoreline impacts are not predicted.
Environmentally Sustainable Development principles	The activities were evaluated as having the potential to result in a Moderate (2) consequence thus is not considered as having the potential to result in serious or irreversible environmental damage. Consequently, no further evaluation against the principles of ESD is required.
Monitoring and reporting	Impacts as a result of a hydrocarbon spill will be monitored and reported in accordance with the OSMP
Acceptability outcome	**Acceptable**

7.6 Drilling: Loss of Well Control – Gas Condensate

7.6.1 Hazards

During the drilling activity or whilst the well is suspended there is a risk of a loss of well control (LOWC) event as a result of:

- A loss of well integrity resulting from the failure of multiple well control barriers
- A prolonged and uncontrolled influx of formation fluid into the well bore (a well kick)

7.6.1.1 Characteristics of the condensate

Thylacine condensate has been used as an analogue. It has a low density, a low pour point and a low dynamic viscosity (Table 4-3), indicating that this oil will spread quickly when spilled at sea and thin out to low thicknesses, increasing the rate of evaporation (refer to Section 4.4 for further details).

On release to the marine environment, condensate would be evaporated and decayed and distributed over time into various components. Of these components, surface hydrocarbons, entrained hydrocarbons (non-dissolved oil droplets that are physically entrained by wave action) and dissolved aromatics (principally the aromatic hydrocarbons) have the most significant impact on the marine environment. These are discussed in further detail below.

7.6.1.2 Extent of potential hydrocarbon exposure

The extend of possible exposure to hydrocarbons is based upon a hypothetical worst-case subsea release of 222,224 bbl (2584 bbl/d) of condensate over 86 days from the Artisan-1 well location with results derived from the Artisan-1 Exploration Well Oil Spill Modelling, RPS 2019 (Appendix D). . The extent of potential hydrocarbon exposure at moderate thresholds (including 48-hour time-based in-water dissolved and entrained) for a LOWC scenario is presented in Figure 7-3.

Potential extent of hydrocarbon exposure to Australian Marine Parks

Only Apollo is predicted to be exposed to moderate (instantaneous) thresholds of in-water hydrocarbons (up to 30% summer and 39% winter for dissolved; and up to 50% and 48% winter for entrained).

No AMPs are predicted to be exposed to high (instantaneous) thresholds of dissolved or entrained hydrocarbons.

Potential extent of hydrocarbon exposure to surface waters

During summer conditions, moderate (10 - 25 g/m^2) exposure to surface hydrocarbons were predicted to travel a maximum distance of 4 km from the release location. Under winter conditions, moderate exposure from surface hydrocarbons extended to a maximum distance of 3 km from the release location. Note, no high exposure was predicted on the sea surface for any of the seasons assessed.

No other receptors except the Otway IMCRA were exposed to moderate or high levels for any seasons assessed.

Potential extent of hydrocarbon exposure to shorelines

The probability of contact to any shoreline was 16% and 57% for the summer and winter season, respectively. While the minimum time for visible surface hydrocarbons to reach a shoreline was 3 days for 5 days, respectively.

The maximum volume of hydrocarbons predicted to come ashore was 15 m^3 and 33 m^3, during summer and winter conditions, respectively, while the maximum length of shoreline contacted above the low threshold (10 – 100 g/m^2) was 7.0 km and 11.0 km, respectively. Note, no shoreline loading was predicted for the high threshold (above 1,000 g/m^2).

Cape Otway West LGA was the receptor predicted with the greatest probability of contact above the moderate threshold during summer (15%) and winter (40%). The modelling results during winter conditions demonstrated additional shoreline contact to Moyne, Corangamite, Moonlight head and Childers Cove.

Potential extent of in-water dissolved hydrocarbon exposure

At the depth of 0-10 m, the maximum concentration of dissolved hydrocarbons over the 48-hour window was 30 ppb in summer and 34 ppb in winter, and hence no moderate or high exposure was predicted during either season.

None of the receptors identified within the spill model were exposed to moderate (50 – 400 ppb) or high (>400 ppb) dissolved hydrocarbons (over a 48-hour basis) during the summer or winter season.

Potential extent of in-water entrained hydrocarbon exposure

The maximum entrained hydrocarbon concentrations time-averaged over 48 hours for the summer and winter season was 559 ppb and 569 ppb, respectively. No moderate or high exposure was predicted for any of the receptors identified within the spill model for any of the seasons.

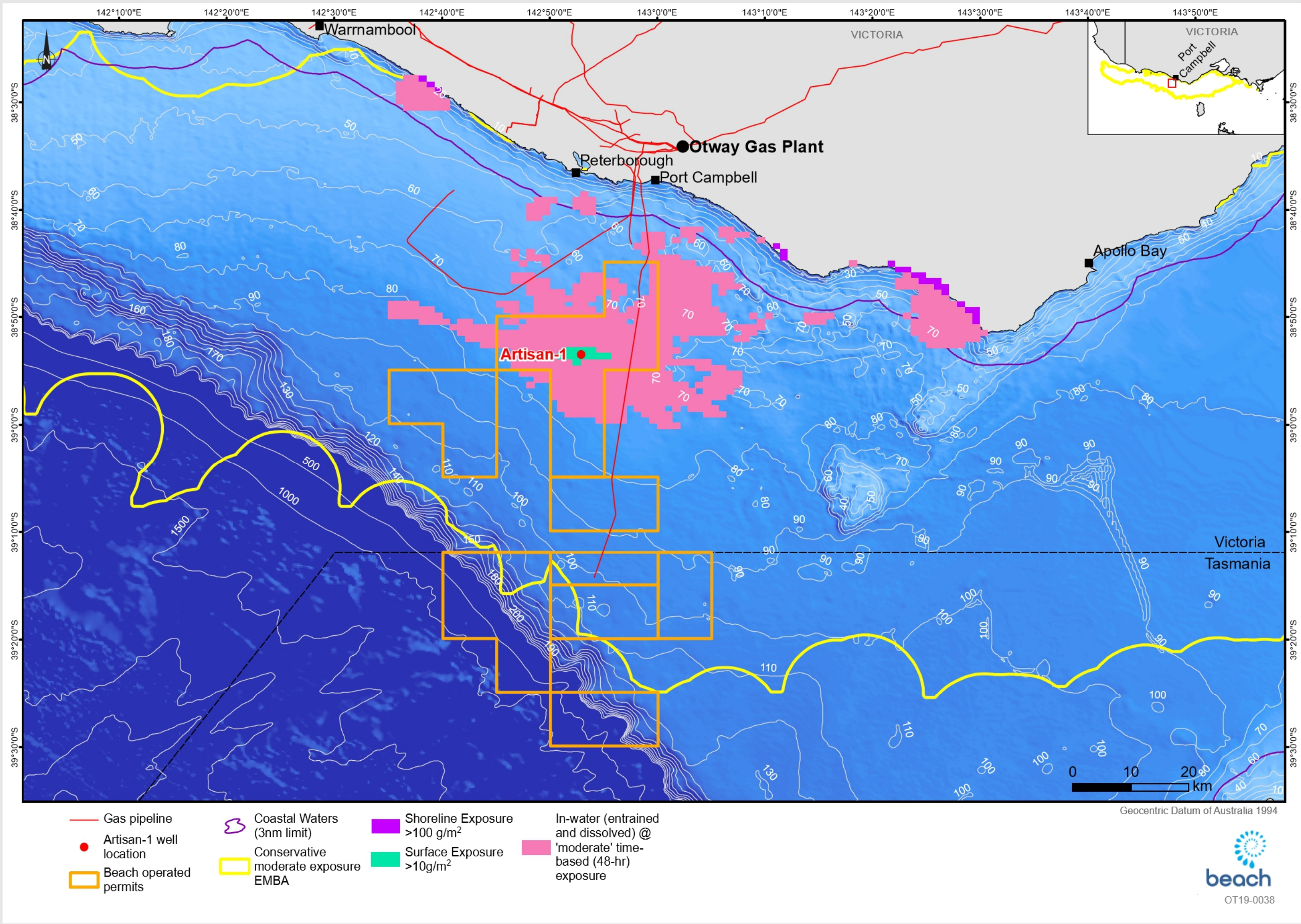


Figure 7-3: Environment potentially exposed to moderate surface, shoreline and time-based in-water thresholds from a hypothetical 222,224 bbl (2584 bbl/d) condensate over 86 days

7.6.2 Known and potential environmental risks

Known and potential environmental risks as result of an uncontrolled hydrocarbon release include:

- Change in water quality
- Injury / mortality to fauna
- Change in fauna behaviour
- Change in ecosystem dynamics
- Changes to the functions, interests or activities of other users
- Change in aesthetic value

7.6.3 Consequence Evaluation

The potential environmental impacts to receptors within the EMBA from condensate spill are discussed in Table 7-11 to Table 7-15.

Table 7-11: Consequence evaluation to ecological receptors within the EMBA – sea surface

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
Marine fauna	Seabirds	Injury / mortality to fauna Change in fauna behaviour	Several listed Threatened, Migratory and/or Listed Marine species have the potential to be rafting, resting, diving or feeding within 4 km of the release location predicted to be exposed to moderate levels of surface hydrocarbons. There are foraging BIAs for a number of birds in the area (Appendix B.3.5.1) predicted to be above threshold. There are no breeding BIAs within the area, breeding BIAs are outside of the predicted area of moderate surface exposure (Appendix B.3.5.1).	When first released, gas condensate has higher toxicity due to the presence of volatile components. Individual birds making contact close to the spill source at the time of the spill (i.e. areas of concentrations >10g/m^2 out to 4 km from the release location) may suffer impacts however it is unlikely that a large number of birds will be affected. Seabirds rafting, resting, diving or feeding at sea have the potential to come into contact with localised areas of sheen >10 µm and may experience lethal surface thresholds for the duration of the spill. Contact with areas of high hydrocarbon exposure is highly unlikely (i.e. areas of concentrations >25 g/m^2 limited to immediate release location). As such, acute or chronic toxicity impacts (death or long-term poor health) to small numbers of birds are possible, however this is not considered significant at a population level. Consequently, the potential impacts and risks to seabirds from a LOWC event are considered to be Moderate (2), as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
	Marine reptiles	Injury / mortality to fauna Change in fauna behaviour	There may be marine turtles in the area predicted to be exposed to surface oil. However, there are no BIAs or habitat critical to the survival of the species within this area.	Marine turtles are vulnerable to the effects of oil at all life stages. Marine turtles can be exposed to surface oil externally (i.e. swimming through oil slicks) or internally (i.e. swallowing the oil). Ingested oil can harm internal organs and digestive function. Oil on their bodies can cause skin irritation and affect breathing. The number of marine turtles that may be exposed to surface diesel is expected to be low as there are no BIAs or habitat critical to the survival of the species present and the localised (4 km from the release location) extent of exposure above the 10 g/m^2 threshold; however, turtles may be transient within the EMBA. Therefore, potential impact would be limited to individuals, with population impacts not anticipated. Consequently, the potential impacts and risks to marine turtles are considered to be Minor (1), as they could be expected to result in localised

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
				short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning within an area of low significance.
	Marine mammals (pinnipeds)	Injury / mortality to fauna Change in fauna behaviour	There may be pinnipeds in the area predicted to be exposed to surface hydrocarbons >10 g/m^2. However, it is not identified as critical habitat, and there are no spatially defined aggregations (i.e. is not a BIA). Known breeding colonies occur on islands outside of the predicted area of moderate surface exposure.	Exposure to surface oil can result in skin and eye irritations and disruptions to thermal regulation. Fur seals are particularly vulnerable to hypothermia from oiling of their fur – however the characteristics of Thylcine condensate mean this is not likely. The number of pinnipeds exposed is expected to be low, with population impacts not anticipated. Due to the rapid weathering of condensate, the potential exposure time is short. Consequently, the potential impacts and risks to pinnipeds from a LOWC event are considered to be Minor (1), as they could be expected to result in localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning within an area of low significance.
	Marine mammals (whales)	Injury / mortality to fauna Change in fauna behaviour	Several threatened, migratory and/or listed marine species have the potential to be foraging the area predicted to be exposed to surface hydrocarbons of >10 g/m^2. Surface exposure of >10 g/m^2 is expected to extend out 4 km from the release location i.e., a relatively small areas compared to the overall distribution area of cetaceans. Known BIAs are present for foraging for pygmy blue whales and distribution for southern right whale within the EMBA.	Physical contact by individual whales to condensate is unlikely to lead to any long-term impacts. Given the mobility of whales, only a small proportion of the population would surface in the affected areas, resulting in short-term and localised consequences, with no long-term population viability effects. Geraci (1988) found little evidence of cetacean mortality from hydrocarbon spills; however, some behaviour disturbance (including avoidance of the area) may occur. While this reduces the potential for physiological impacts from contact with hydrocarbons, active avoidance of an area may displace individuals from important habitat, such as foraging. If whales are foraging at the time of the spill, a greater number of individuals may be present in the plume, however due to the small area of the surface exposure above the impact threshold (<4 km from release location), this is not likely. Given this is a relatively small area of the total foraging BIA for pygmy blue whales and distribution BIA for southern right whales, the risk of displacement to whales is considered low. Consequently, the potential impacts and risks to cetaceans are considered to be Moderate (2) as they could be expected to result in localised short-term

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
				impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.
	Marine mammals (dolphins)	Injury / mortality to fauna Change in fauna behaviour	There may be dolphins in the area predicted to be exposed to surface hydrocarbons >10 g/m2. However, it is not identified as critical habitat, and there are no spatially defined aggregations (i.e. is not a BIA) in the area exposed by moderate levels of surface hydrocarbons.	Dolphins surface to breathe air and may inhale hydrocarbon vapours or be directly exposed to dermal contact with surface hydrocarbons. Direct contact with oil can result in direct impacts to the animal, due to toxic effects if ingested, damage to lungs when inhaled at the surface, and damage to the skin and associated functions such as thermoregulation (AMSA 2010). Dolphins are highly mobile and are considered to have some ability to detect and avoid oil slicks. Direct surface hydrocarbon contact may pose little problem to dolphins due to their extraordinarily thick epidermal layer which is highly effective as a barrier to the toxic, penetrating substances found in hydrocarbons. The number of dolphins exposed is expected to be low, with population impacts not anticipated. Due to the rapid weathering of condensate, the potential exposure time is short. Consequently, the potential impacts and risks to dolphins from a LOWC event are considered to be Minor (1), as they could be expected to result in localised short-term impacts to species of recognised conservation value but not affecting local ecosystem functioning within an area of low significance.

Table 7-12: Consequence evaluation to socio-economic receptors within the EMBA – sea surface

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
Human systems	Recreation and tourism (including recreational fisheries)	Changes to the functions, interests or activities of other users Change in aesthetic value	Marine pollution can result in impacts to marine-based tourism from reduced visual aesthetic. The modelling predicts (visible surface rainbow sheen) surface sheens (0.5 g/m^2) may occur up to 53 km from the release location. This oil may be visible as a rainbow sheen on the sea surface during calm conditions.	Visible surface hydrocarbons (i.e. a rainbow sheen) have the potential to reduce the visual amenity of the area for tourism, and discourage recreational activities. However, the relatively short duration means there may be short-term and localised consequences, which are ranked as Moderate (2). Refer also to: Marine mammals (whales)
	Industry (shipping)	Changes to the functions, interests or activities of other users	Shipping occurs within the area predicted to be exposed to surface hydrocarbons >10 g/m^2.	Vessels may be present in the area where moderate levels of sea surface oil is present, however, due to the short duration of the surface exposure (approximately 12 hours) deviation of shipping traffic would be unlikely.
	Industry (oil and gas)	Changes to the functions, interests or activities of other users	There are no oil and gas platforms located within the area predicted to be exposed to surface hydrocarbons.	No impact as there are no oil and gas platforms located within the area predicted to be exposed to moderate thresholds of surface hydrocarbons.

Table 7-13: Consequence evaluation to physical receptors within the EMBA – shorelines

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
Shoreline	Saltmarsh	Change in habitat Change in ecosystem dynamics	Saltmarsh communities may be within the overall are potentially exposed to hydrocarbons ashore; and is present within estuaries and inlet/riverine systems. Some of the saltmarsh habitat along this coast may be representative of the Subtropical and Temperate Saltmarsh TEC. Shorelines predicted to be exposed by shoreline hydrocarbons >100 g/m^2 include Moyne, Corangamite, Colac Otway, Cape Otway West, Moonlight Head and Childers Cove. Therefore, exposure (with the risk of ecological impact) to known saltmarsh areas along the Otway coast is limited. Oil can enter saltmarsh systems during the tidal cycles, if the estuary/inlet is open to the ocean. Similar to mangroves, this can lead to a patchy distribution of the oil and its effects, because different places within the inlets are at different tidal heights. Oil (in liquid form) will readily adhere to the marshes, coating the stems from tidal height to sediment surface. Heavy oil coating would be expected to be restricted to the outer fringe of thick vegetation, although lighter oils can penetrate deeper, to the limit of tidal influence.	Saltmarshes are considered to have a high sensitivity to hydrocarbon exposure. Saltmarsh vegetation offers a large surface area for oil absorption and tends to trap oil. Evidence from case histories and experiments shows that the damage resulting from oiling, and recovery times of oiled marsh vegetation, are very variable. In areas of light to moderate oiling where oil is mainly on perennial vegetation with little penetration of sediment, the shoots of the plants may be killed but recovery can take place from the underground systems. Good recovery commonly occurs within one to two years (IPIECA, 1994). Consequently, the potential impacts and risks to saltmarsh are considered to be Serious (3), as they could be expected to result in localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function.

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
Marine fauna	Seabirds and shorebirds	Injury / mortality to fauna Change in fauna behaviour	Several threatened, migratory and/or listed marine species have the potential to be foraging or breeding within the area predicted to be contacted by >100 g/m^2 shoreline exposure. The largest length of actionable shoreline oil (defined as >10 g/m^2) is predicted to reach up to 11 km. Predicted peak volume ashore of 33 m^3 was estimated during winter. Shorelines predicted to be exposed by shoreline hydrocarbons >100 g/m^2 include Moyne, Corangamite, Colac Otway, Cape Otway West, Moonlight Head and Childers Cove.	Shoreline species may suffer both direct oiling and potential displacement from foraging and nesting sites. Acute or chronic toxicity impacts (death or long-term poor health) to small numbers of birds are possible, however this is not considered significant at a population level. Direct oiling of nesting sites is considered unlikely as hydrocarbon would typically accrue within the upper swash zone, and nests would occur above this level on a beach. However, oiled fauna may track oil into their nests, which may then have subsequent impacts on any eggs present. This would be more of a risk for fauna, such as the Little Penguin, that have to traverse the intertidal area to reach nesting sites. There are no known breeding locations for penguins along the Otway mainland coast at risk of shoreline oil accumulation. In addition, given the volatility of the exposed oil, any impact to nests is expected to occur to individuals and not considered to pose a long-term risk at population level. Given the potential for sensitive shoreline habitat to be exposed to hydrocarbons above the actionable >100 g/m^2 shoreline exposure thresholds, the length of shoreline that has the potential to be exposed and the peak volume potentially accumulated ashore, the consequence has been ranked as Serious (3)

Table 7-14: Consequence evaluation to physical and ecological receptors within the EMBA – in water

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
Habitat	Algae	Change in habitat	In-water exposure (dissolved or entrained) is only predicted to occur within the surface layers; therefore, the only exposure to benthic habitat is possible within intertidal or shallow nearshore waters. Note that the greater wave action and water column mixing within the	Reported toxic responses to oils have included a variety of physiological changes to enzyme systems, photosynthesis, respiration, and nucleic acid synthesis (Lewis & Pryor 2013). 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.

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
			nearshore environment will also result in rapid weathering of the condensate. Macroalgae may be present within reef and hard substrate areas within the area predicted to be exposed to in-water hydrocarbons (e.g. macroalgae is known to occur within Twelve Apostles Marine Park, and areas around Warrnambool). Noting also that exposure in nearshore and intertidal areas is predicted to only be at moderate thresholds (e.g. instantaneous exposure >50 ppb for dissolved and >100 ppb for entrained hydrocarbons).	Given the restricted range of exposure (shallow nearshore and intertidal waters only) and only the predicted moderate threshold concentrations of hydrocarbons expected to be in these waters, any impact to macroalgae is not expected to result in long-term or irreversible damage. Consequently, the potential impacts to macroalgae are considered to be Moderate (2), as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
	Soft Coral	Change in habitat	In-water exposure (dissolved or entrained) is only predicted to occur within the surface layers; therefore, the only exposure to benthic habitat is possible within intertidal or shallow nearshore waters. Note that the greater wave action and water column mixing within the nearshore environment will also result in rapid weathering of the condensate. Corals may be present within reef and hard substrate areas within the area predicted to be to in-water hydrocarbons, noting also that exposure in nearshore and intertidal areas is predicted to only be at moderate thresholds (e.g. instantaneous exposure >50 ppb for dissolved and >100 ppb for entrained hydrocarbons).	Exposure of entrained hydrocarbons to shallow subtidal corals has the potential to result in lethal or sublethal toxic effects, resulting in acute impacts or death at moderate to high exposure thresholds (Shigenaka, 2001). Contact with corals may lead to reduced growth rates, tissue decomposition, and poor resistance and mortality of sections of reef (NOAA, 2010). However, given the lack of coral reef formations, and the sporadic cover of hard or soft corals in mixed nearshore reef communities along the Otway coast, such impacts are considered to be limited to isolated corals. Consequently, the potential impacts to corals are considered to be Moderate (2), as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
	Seagrass	Change in habitat	In-water exposure (dissolved or entrained) is only predicted to occur within the surface layers; therefore, benthic habitat within intertidal or shallow nearshore waters has the	There is the potential that exposure could result in sub-lethal impacts, more so than lethal impacts, possibly because much of seagrasses' biomass is underground in their rhizomes (Zieman et al., 1984). Exposure also can take place via uptake of hydrocarbons through plant membranes

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
			potential to be exposed. Note that the greater wave action and water column mixing within the nearshore environment will also result in rapid weathering of the condensate. Seagrass may be present within the area predicted to be exposed to in-water hydrocarbons (e.g. seagrass is known to occur within Twelve Apostles Marine Park, and areas around Warrnambool). Exposure in nearshore and intertidal areas is predicted to only be at moderate thresholds (e.g. instantaneous exposure >50 ppb for dissolved and >100 ppb for entrained hydrocarbons).	and seeds may be affected by contact with oil contained within sediments (NRDA 2012). When seagrass leaves are exposed to petroleum oil, sub-lethal quantities of the soluble fraction can be incorporated into the tissue, causing a reduction in tolerance to other stress factors (Zieman et al. 1984). The toxic components of petroleum oils are thought to be the PAH, which are lipophilic and therefore able to pass through lipid membranes and tend to accumulate in the thylakoid membranes of chloroplasts (Ren et al. 1994). Susceptibility of seagrasses to hydrocarbon spills will depend largely on distribution, with deeper communities protected from oiling under all but the most extreme weather conditions. Shallow seagrasses are more likely to be affected by dispersed oil droplets. Given the restricted range of exposure (shallow nearshore and intertidal waters only) and the predicted moderate concentrations of hydrocarbons expected to be in these waters, any impact to seagrass is not expected to result in long-term or irreversible damage. Consequently, the potential impacts to seagrass are considered to be Moderate (2), as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.
	Plankton	Injury / mortality to fauna	Plankton are typically more abundant in surface waters where in-water exposure (dissolved or entrained) is predicted to occur. Potential in-water dissolved hydrocarbon exposure at the instantaneous moderate threshold does occur in the Bonney Coast Upwelling KEF. While hydrocarbon presence would not affect the upwelling itself, if the spill occurs at the time of an upwelling event, it may result in plankton being exposed to low instantaneous concentrations of in-water hydrocarbons. While these levels are not expected to cause lethal effects on the plankton, if this did occur there is the potential	Relatively low concentrations of hydrocarbon are toxic to both plankton [including zooplankton and ichthyoplankton (fish eggs and larvae)]. Plankton risk exposure through ingestion, inhalation and dermal contact with in-water hydrocarbons. Impacts would predominantly result from exposure to dissolved fractions, as larval fish and plankton are pelagic, and are moved by seawater currents. Potential impacts would largely be restricted to planktonic communities, which would be expected to recover rapidly following a hydrocarbon spill. Plankton are numerous and widespread but do act as the basis for the marine food web. However, any impact is expected to be localised and temporary, meaning that an oil spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Once background water quality conditions have re-established, the plankton

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
			for flow on effects to whales or other marine fauna that use this as a food source (i.e. reduced prey availability).	community may take weeks to months to recover (ITOPF, 2011), allowing for seasonal influences on the assemblage characteristics. Consequently, the potential impacts to plankton are considered to be Moderate (2), as they could be expected to cause short-term and localised impacts, but not affecting local ecosystem functioning.
	Marine invertebrates	Injury / mortality to fauna Changes to the functions, interests or activities of other users	The modelling indicates that area predicted to be exposed for dissolved hydrocarbons would predominately be at 0-10 m and 10-20 m water depth, with some patch exposure extending into the 20-30 m water depths. Modelling indicated entrained hydrocarbons to only expose the 0-10 m water depth. Impact by direct contact of in-water hydrocarbons to benthic species in the deeper areas of potential exposure are not expected. Species located in shallow nearshore or intertidal waters may be exposed to in-water hydrocarbons. Filter-feeding benthic invertebrates such as sponges, bryozoans, abalone and hydroids may be exposed to in-water hydrocarbons at concentrations with the potential for sub-lethal impacts however population level impacts are considered unlikely. Tissue taint, if it occurs, may remain for several months in some species (e.g., abalone). In-water invertebrates of value that may be exposed to in nearshore/intertidal waters have been identified to include molluscs (scallops, abalone). Management areas for several commercial fisheries focussed on marine invertebrates are	Acute or chronic exposure through contact and/or ingestion can result in toxicological risks. However, the presence of an exoskeleton (e.g. crustaceans) reduces the impact of hydrocarbon absorption through the surface membrane. Invertebrates with no exoskeleton and larval forms may be more prone to impacts. Localised impacts to larval stages may occur which could impact on population recruitment that year. Tainting of recreation or commercial species is considered unlikely to occur, however if it did it is expected to be localised and low level with recovery expected. Consequently, the potential impacts and risks to commercially fished invertebrates from a LOWC event are considered to be Moderate (2), as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning.

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
			within the area predicted to be exposed to dissolved and entrained in-water hydrocarbons.	
Marine fauna	Fish	Injury / mortality to fauna	In-water exposure (dissolved or entrained) is only predicted to occur within the surface layers of the water column. Several fish communities in these areas are demersal and therefore more prevalent towards the seabed, as such, exposure to these species is not expected to occur. Any fish or shark species within the surface layers of the water column, may come into contact with the area of predicted exposure for in-water hydrocarbons. The Australian grayling spends most of its life in fresh water, with parts of the larval or juvenile stages spent in coastal marine waters, therefore it is not expected to be present in offshore waters in large numbers. There is a known distribution and foraging BIA for the white shark in the EMBA, however, it is not expected that this species spends a large amount of time close to the surface where thresholds may be highest.	Pelagic free-swimming fish and sharks are unlikely to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons in water are not expected to be sufficient to cause harm (ITOPF, 2010). Subsurface hydrocarbons could potentially result in acute exposure to marine biota such as juvenile fish, larvae, and planktonic organisms, although impacts are not expected cause population-level impacts. There is the potential for localised and short-term impacts to fish communities; the consequences are ranked as Moderate (2). Impacts on eggs and larvae entrained in the upper water column are not expected to be significant given the temporary period of water quality impairment, and the limited geographical extent of the spill. As egg/larvae dispersal is extensive in the upper layers of the water column and it is expected that current induced drift will rapidly replace any oil affected populations. Impacts are assessed as temporary and localised, and therefore considered to be Moderate (2).
	Marine mammals (pinnipeds)	Injury / mortality to fauna Change in fauna behaviour	Pinniped colonies are typically occupied year-round, with greater activity during breeding seasons. However, the nearest known breeding colony (Lady Julia Percy Island) is outside the predicted area of in-water hydrocarbon exposure. Localised parts of the foraging range for New Zealand fur-seals and Australian fur-seals may	Hydrocarbons in the water column or consumption of prey affected by the oil may cause sub-lethal impacts to pinnipeds, however given the localised nature of the spill, their widespread nature, no known breeding colony within the area of predicted ecological exposure (above time-based exposure concentrations), and the rapid loss of the volatile components of condensate in choppy and windy seas (such as that of the area exposed by moderate in-water hydrocarbon thresholds), impacts at a population level

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
			be potentially be exposed to in-water hydrocarbons. Noting that in-water exposure (dissolved or entrained) is only predicted to occur within the upper layers of the water column.	are considered very unlikely. Impact is assessed as temporary and localised and are considered Moderate (2).
	Marine mammals (whales and dolphins)	Injury / mortality to fauna Change in fauna behaviour	Several threatened, migratory and/or listed marine species have the potential to be migrating, resting or foraging within an area predicted to be exposed to in-water hydrocarbons. Known BIAs are present for foraging for pygmy blue whales and distribution for southern right whale in area exposed to moderate in-water thresholds, i.e. >50 ppb for dissolved and >100 ppb for entrained.	Cetacean exposure to entrained hydrocarbons can result in physical coating as well as ingestion (Geraci and St Aubin, 1988). Such impacts are associated with 'fresh' hydrocarbon; the risk of impact declines rapidly as the condensate weathers The potential for environmental impacts would be limited to a relatively short period following the release and would need to coincide with a seasonal foraging or aggregation event to result in exposure to a large number of individuals. However, such exposure is not anticipated to result in long-term population viability effects. A proportion of the foraging or distributed population of whales could be affected in the relatively localised area and water depth of the total foraging BIA for pygmy blue whales and distribution BIA for southern right whales, the risk of displacement to whales is considered low. Displacement behaviours could result in temporary and localised consequences, which are ranked as Moderate (2).

Table 7-15: Consequence evaluation to socio-economic receptors within the EMBA – in water

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
Human system	Commercial and recreational fisheries	Change in ecosystem dynamics Changes to the functions, interests or activities of other users	In-water exposure to in-water hydrocarbons may result in a reduction in commercially targeted marine species, resulting in impacts to commercial fishing and aquaculture.	Any acute impacts are expected to be limited to small numbers of juvenile fish, larvae, and planktonic organisms, which are not expected to affect population viability or recruitment. Impacts from

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
			Actual or potential contamination of seafood can affect commercial and recreational fishing and can impact seafood markets long after any actual risk to seafood from a spill has subsided (NOAA, 2002) which can have economic impacts to the industry. Several commercial fisheries operate in the EMBA and overlap the spatial extent of the water column hydrocarbon predictions.	entrained exposure are unlikely to manifest at a fish population viability level. Any exclusion zone established would be limited to the safety exclusion zone around the vicinity of the release point, and due to the rapid weathering of hydrocarbons would only be in place whilst well-kill activities are enacted, therefore physical displacement to vessels is unlikely to be a significant impact. The consequence to commercial and recreational fisheries is assessed as localised and short term and ranked as Moderate (2).
	Recreation and tourism	Change in water quality Changes to the functions, interests or activities of other users Change in aesthetic value	Tourism and recreation is also linked to the presence of marine fauna (e.g. whales), particular habitats and locations for recreational fishing. The area between Cape Otway and Port Campbell is frequented by tourists. It is a remote stretch of coastline dominated by cliffs with remote beaches subject to the high energy wave action. Access to the entire coastline is via a 7 to 8-day walking track from Apollo Bay ending at the Twelve Apostles. Recreation is also linked to the presence of marine fauna and direct impacts to marine fauna such as whales, birds, and pinnipeds can result in indirect impacts to recreational values. It is important to note that the impact from a public perception perspective may be even more conservative. This may deter tourists and locals from undertaking recreational activities. If this occurs, the attraction is temporarily closed, economic losses to the business are likely to eventuate. The extent of these losses would be dependent on how long the attraction remains closed	Any impact to receptors that provide nature-based tourism features (e.g. whales) may cause a subsequent negative impact to recreation and tourism activities. Refer also to: Fish Birds Pinnipeds Marine mammals (whales and dolphins) Marine invertebrates Recreational fisheries Any impact to receptors that provide nature-based tourism features (e.g. fish and marine mammals) may cause a subsequent negative impact to recreation and tourism activities. However, the relatively short duration, and distance from shore means there may be short-term and localised consequences, which are ranked as Moderate (2).

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
Natural system	State Marine Protected Areas	Change in ecosystem dynamics	State marine protected areas (e.g. Point Addis and Twelve Apostles Marine Park) occur within the area predicted to be exposed to in-water hydrocarbons. Conservation values for these areas include high marine fauna and flora diversity, including fish and invertebrate assemblages and benthic coverage (sponges, macroalgae).	Refer to: Marine invertebrates Macroalgae The consequence to conservation values in these protected marine areas is assessed as localised and short term and ranked as Moderate (2).
	Australian Marine Parks	Change in ecosystem dynamics Change in water quality	Stochastic modelling indicates in-water hydrocarbons at the instantaneous screening level of 50 ppb (dissolved) and 100 ppb (entrained) may extend to within the boundaries of the Apollo Marine Park. Conservation values for Apollo Marine Park include foraging habitat for seabirds, dolphins, seals and white sharks, and blue whales migrate through Bass Strait. A reduction in water quality will lead to a breach in management objectives for AMPs.	Refer to: Seabirds Marine mammals (cetaceans and pinnipeds) Fish Plankton The concentration at which the water column within Apollo Marine Park may be exposed is within the moderate thresholds for dissolved and entrained hydrocarbons. Given the nature of the exposure to foraging habitats, and transient nature of migrating and foraging marine fauna, the consequence is ranked as Moderate (2).
	KEF	Change in ecosystem dynamics	The West Tasmanian Canyons are located on the relatively narrow and steep continental slope west of Tasmania. Eight submarine canyons surveyed in Tasmania, Australia, by Williams et al., (2009) displayed depth-related patterns with regard to benthic fauna, in which the percentage occurrence of faunal coverage visible in underwater video peaked at 200-300 m water depth. In-water hydrocarbons was only predicted to expose the 10 to 20 m water depth of the West Tasmanian Canyons. Peak faunal coverage at 200 to 300 m water depth is not predicted to be exposed by in-water hydrocarbons.	Refer to: Marine invertebrates Plankton The consequence to KEFs is assessed as localised and short term and ranked as Moderate (2).

Receptor Group	Receptor Type	Impacts	Exposure Evaluation	Consequence Evaluation
			Potential in-water dissolved hydrocarbon exposure at the instantaneous moderate threshold does occur in the Bonney Coast Upwelling KEF. While hydrocarbon presence would not affect the upwelling itself, if the spill occurs at the time of an upwelling event, it may result in plankton being exposed to low instantaneous concentrations of in-water hydrocarbons. While these levels are not expected to cause lethal effects on the plankton, if this did occur there is the potential for flow on effects to whales or other marine fauna that use this as a food source (i.e. reduced prey availability).	

7.6.4 ALARP and acceptability assessment

Control, ALARP and acceptability assessment: Loss of well control	
ALARP Decision Context and Justification	**ALARP Decision Context: Type B** Drilling activities are common within the Otway offshore natural gas development for many years with no significant LOWC incident recorded to date. Drilling activities are highly regulated with associated control measures, well understood, and are implemented across the offshore industry. During stakeholder engagement, no concerns were raised regarding the acceptability of impacts from these events. However, a LOWC incident would likely attract public and media interest. Consequently, Beach believes that ALARP Decision Context B should be applied.
Control Measures	**Source of good practice control measures**
Preventative	
CM#10: Ongoing consultation	Under the *Navigation Act 2012*, the Australian Hydrographic Service (AHS) are responsible for maintaining and disseminating hydrographic and other nautical information and nautical publications such as Notices to Mariners. AMSA also issue AUSCOAST warnings. Relevant details in relation to the drilling activity will be provided to the AHS and AMSA and to relevant stakeholders to ensure the presence of the MODU is known in the area. See Section 9.7 (Ongoing Stakeholder Consultation).
CM#23: WECS	Beach have in place a Well Engineering and Construction Management System (WECS) that ensures Beach well activities are fit for purpose with operational risks managed to a level that is as low as reasonably practicable. It also ensures that changes are made in a controlled manner, that appropriate standards are adhered to, and that a sufficiently resourced and competent organisation is in place.
CM#24: NOPSEMA accepted WOMP	Under Part 5 of the Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011, NOPSEMA is required to accept a WOMP to enable well activities to be undertaken. The WOMP details well barriers and the integrity testing that will be in place for the program. Beach's NOPSEMA-accepted WOMP describes the minimum requirements for well barriers during drilling activities.
CM#25: NOPSEMA accepted MODU Safety Case	Under the Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009 (OPGGS(S)) set out the requirements for the contents of safety cases. The MODU requires and Australian Safety Case detailing the control in place to prevent a major accident event. The MODU Safety Case: • Identifies the hazards and risks • Describes how the risks are controlled • Describes the safety management system in place to ensure the controls are effectively and consistently applied.
CM#14: MO 30: Prevention of collisions	AMSA MO 30 [Prevention of collisions] requires that onboard navigation, radar equipment, and lighting meets industry standards.
CM#22: Preventative Maintenance	BOP routinely function and pressure tested in accordance with manufacturer's specifications and in alignment with Drilling Contractors preventative maintenance System.
Response	
CM#24: NOPSEMA accepted WOMP	Under Part 5 of the Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011, NOPSEMA is required to accept a WOMP to enable well activities to be undertaken. The WOMP details the controls in place to restore well integrity in the event of a LOWC incident.

CM#26: Source Control Contingency Plan (SCCP) inclusive of Relief Well Plan	A SCCP shall be developed consistent with International Oil and Gas Producers (IOGP) Report 594 - Subsea Well Source Control Emergency Response Planning Guide for Subsea Wells (Jan, 2019). Specifically detailing: • The structure and function of the Beach Wells Emergency Team (WET); • A timeline for the effective implementation of source control key events / actions; • Interface arrangements with the Beach corporate Crisis Management Plan (CMP); • A well-specific worst-case discharge (WCD analysis; • Casing design; • Structural integrity analysis; and • Gas plume study.		
	A relief well plan shall be developed in line with OGUK guidance to ensure that Beach has considered the response requirements in order to: • Reduce the time required to initiate relief well drilling operations in the event of a LOWC • Allow the relief well to be completed in the shortest time practicable. The relief well plan includes a detailed schedule with estimated times to: • Source, mobilise and position a rig • Drill and intercept the well • Complete the well kill successfully		
CM#27: NOPSEMA accepted OPEP	Under the OPGGS(E) Regulations, NOPSEMA require that the petroleum activity have an accepted Oil Pollution Emergency Plan (OPEP) in place before the activity commences. In the event of a LOWC, the OPEP will be implemented. The Offshore Victoria – Otway Basin OPEP was developed to support all Beach activities within the Otway Basin and includes response arrangements for a worst-case LOWC scenario at the Artisan-1 well. The OPEP also includes Tactical Response Plans (TRPs) for identified protection priority areas within the region.		
CM#28: NOPSEMA accepted OSMP	Under the OPGGS(E) Regulations, NOPSEMA require that the Implementation Strategy of the Environment Plan provides for monitoring of an oil pollution emergency. The Beach OSMP details: • Operational monitoring to inform response planning; and • Scientific monitoring to inform the extent of impacts from hydrocarbon exposure and potential remediation requirements.		
Additional Controls Assessed			
Control	**Control Type**	**Cost/Benefit Analysis**	**Control Implemented?**
Preventative			
Do not drill the Artisan-1 well	Elimination	Drilling the Artisan-1 forms part of the infill development for the Otway Basin to maintain gas supply to the Otway Gas Plant. Additionally, the exploratory drilling of Artisan-1 is required to fulfil the commitments under the petroleum title.	No
Undertake activity at a different time of year to reduce potential exposure of receptors to hydrocarbons	Substitute	Based upon the probability of exposure to various receptors, and the volatile nature of the gas condensate, there is no discernible benefit to be gained by drilling at a different time of year given the similarity in potential hydrocarbon exposure for both summer and winter seasons	No

CM#16: Rig safety zone established around the MODU during the drilling activity.	System	The drilling activity will be short in duration (approx. 35-55 days). The temporary exclusion of vessels from a 500 m radius of the MODU would not cause significant impact on socio-economic receptors, such as fisheries and shipping. By restricting the potential interactions between vessels and the MODU, the overall benefit in spill prevention is considered reasonable.	Yes
CM#17: Controlled access to rig safety exclusion zone	System	By the MODU controlling access into the 500 m rig safety zone, including approach directions and speed, the overall benefit in spill prevention is considered reasonable.	Yes
CM#18: Project support vessel on location at all times to guard MODU from errant vessels	System / Equipment	The overall benefit for a project support vessel to maintain guard on a 24-hour basis to prevent an errant vessel from impacting the MODU is considered reasonable.	Yes
Source Control			
Alternate MODU on standby	Equipment	Any MODU on location would require an in-force Safety Case to operate in Australian Commonwealth waters. The key benefit would be a reduction in the overall shoreline loading from weathered, residual fractions of the condensate. The predicted maximum length of shoreline potentially impacted by moderate thresholds of hydrocarbon is between 4-8km, with the average predicted being between 2-4 km. There is no predicted shoreline exposure at high thresholds. Having a MODU on standby would potentially halve the time to implement source control, therefore, the overall potential reduction in exposure to shorelines may halve. Halving the potential loading at moderate threshold would produce a marginal overall environment benefit given the nature of weathered condensate. Having another rig on standby would result in significant additional costs (approx. $800k / day) to the project that are considered grossly disproportionate to the level of environmental benefit gained given the relatively small level of potential shoreline oiling.	No
Capping Stack System (CCS)	Equipment	Well CCS is designed to stem the hydrocarbon flow prior to permanent plugging of the well. This option requires vertical access over the existing BOP/well. CCS systems have a theoretical deployment limit of 75 m water depth even with the use of offset installation equipment (OIE). Given the shallow water depth of Artisan-1 (approx. 71 m), this response option is not considered feasible to implement for a LOWC scenario (due to the release rates of gas and high likelihood of volatile organic compounds (VOCs) above a	No

		lower explosive limit (LEL) of 10% at the deployment site.	
Dispersant application	Equipment	Chemical dispersants are generally ineffective for gas-condensate hydrocarbon releases. However, dispersants may be effective to reduce VOCs at surface to below LELs. Given the installation of a capping stack is not a feasible response option for the Artisan-1 well, and a relief well would be offset to the release location, the potential benefit with applying subsea dispersants at the Artisan—1 well location relates to other surface mounted response strategies such as the deployment of an ROV to manually or hydraulically initiate BOP functioning	Yes

Consequence Rating	Serious (3)
Likelihood of Occurrence	Highly Unlikely (2)
Residual Risk	Medium
Acceptability Assessment	
Policy compliance	The proposed management of the impact is aligned with the Beach Environment Policy.
Management system compliance	Activities will be undertaken in accordance with the Implementation Strategy (Section 8).
Stakeholder engagement	No objections or claims have been raised during stakeholder consultation regarding the potential for a loss of well control incident
Laws and standards	Vessels will comply with: • MO 21 (Safety of navigation and emergency procedures); • MO 30 (Prevention of collisions); • MO 31 (Vessel surveys and certification); • MO 91 (Marine pollution prevention – oil); and • *Navigation Act 2012*. MODU operations will be in compliance with: • Part 5 of the Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011; • The Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009 (OPGGS(S)); • The Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)); • MO 21 (Safety of navigation and emergency procedures); and • MO 30 (Prevention of collisions)
Industry practice	Offshore exploratory drilling for gas field development is considered to be standard industry practice. Beach have a Well Engineering and Construction Management System (WECS) considered to be good practice. Beach align with OGUK guidance considered to be good practice. Beach align with International Oil and Gas Producers (IOGP) Report 594 - Subsea Well Source Control Emergency Response Planning Guide for Subsea Wells (Jan, 2019).
Environmental context	Thylacine condensate has a low density, a low pour point and a low dynamic viscosity (Table 4-7), indicating that this oil will spread quickly when spilled at sea and thin out to low thicknesses, increasing the rate of evaporation.

	The condensate comprises a significant portion of volatiles and semi to low volatiles (99% total) with very little residual components (<1%) (Table 4-8). This means that the condensate will evaporate readily when on the water surface, with limited persistent components to remain on the water surface over time. Rapid evaporation is expected to occur during the first 24 hours (while the condensate is still spilling) under all static wind conditions. Thylacine condensate is predicted to readily entrain into the water column under the higher wind speeds. Due to the high volatility of the condensate, little is predicted to remain on the water surface after the spill ceases Long-term impacts to physical, ecological and socio-economic receptors that come in contact with weathered condensate both on the sea surface and in-water are unlikely. Shoreline impacts are predicted, but not at high threshold concentrations.
Environmentally Sustainable Development principles	The activities were evaluated as having the potential to result in a Serious (3) consequence thus is not considered as having the potential to result in serious or irreversible environmental damage. Consequently, no further evaluation against the principles of ESD is required.
Monitoring and reporting	Impacts as a result of a hydrocarbon spill will be monitored and reported in accordance with the OSMP.
Acceptability outcome	**Acceptable**

7.7 Oil Spill Response

This section presents the risk assessment for oil spill response options as required by the OPGGS(E)R.

7.7.1 Response option selection

Not all response options and tactics are appropriate for every oil spill. Different oil types, spill locations, and volumes require different response options and tactics, or a combination of response options and tactics, to form an effective response strategy.

Table 7-16 provides an assessment of the available oil spill response options, their suitability to the potential spill scenarios and their recommended adoption for the identified events.

7.7.2 Hazards

The following activities have been identified for responding to a spill event:

- Mobilisation, use and demobilisation of spill response personnel, plant and equipment; and
- handling, treatment and/or relocation of affected fauna (oiled wildlife response).

Response option feasibility, effectiveness, strategic NEBA, identified risks and capability needs analysis.

Table 7-16: Response option feasibility, effectiveness, strategic NEBA, identified risks and capability needs analysis

Response Option	Response Description	Hydrocarbon Type	Feasibility & Effectiveness Analysis	Net Environmental Benefit	Capability Needs Analysis	Capability Assessment
Monitor and Evaluate	Visual – aerial & vessel Satellite Predictive modelling	Gas Condensate	Feasible. Effective – Gas condensate expected to spread to thin layers on the sea surface within 1km of the well location. Monitoring used to inform both response planning and monitoring requirements. Hydrocarbons likely visible on sea surface for duration of LOWC. Visual and satellite operational monitoring implemented during LOWC event. Scientific monitoring implemented to inform extent of impact and remediation requirements. Aerial surveillance is considered more effective than vessel to inform spill response and identify if oil has contacted shoreline or wildlife. Vessel surveillance limited in effectiveness in determining spread of oil.	Yes	Actionable on-water hydrocarbon thresholds limited to immediate vicinity of well site. Up to 8km of coastline subject to moderate oiling. 1 x plane & observer required and/or 1 x vessel & observer and / or Remote oil spill trajectory modelling (OSTM)	As detailed in OPEP: · Tracking buoys available via AMOSC · Fixed wing contract in place · Aerial observers available via AMOSC · Support vessels available for duration of drilling campaign · OSTM contract in place and available via AMOSC · Environmental monitoring consultants accessible Implement response as per OPEP and under direction of the State Control Agency (if in State waters) Capability in place and sufficient to implement timely response
	Visual – aerial and vessel	MDO	Effective - MDO rapidly spreads to thin layers on surface waters. Monitoring used to inform both response planning and monitoring requirements. Aerial surveillance is considered more effective than vessel to inform spill response and identify if oil has contacted shoreline or wildlife. Vessel surveillance limited in effectiveness in determining spread of oil. Scientific monitoring implemented to inform extent of impact and remediation requirements.	Yes		
Source Control	Relief well	Gas Condensate	Feasible. Effective – primary response strategy for LOWC scenario in accordance with NOPSEMA accepted WOMP and SCCP including well-specific relief well plan.	Yes	MODU – with Australian Safety Case Casing, drill pipe and consumables Support vessels Well control personnel	As detailed in OPEP and relief well plan: · Access to MODU · Contracts with Well Control Specialists · Relief well mobilisation strategy and schedule Implement response as per OPEP, SCCP and relief well plan Capability in place and sufficient to implement timely response
	Capping stack	Gas Condensate	Not feasible due to water depth of Artisan-1 well (approx. 71 m) Potentially effective at water depths greater than 75 m with offset installation equipment.	N/A	N/A	N/A
	Right stricken vessel Transfer MDO to secure tank	MDO	Effective – primary response strategy for all spills in accordance with vessel SMPEP/SOPEP.	Yes	Project support vessels	Project is serviced by multiple support vessels. Capability available at request of AMSA as Control Agency
Offshore Containment and Recovery	Booms and skimmers	Gas Condensate	Not feasible. Actionable surface thickness of 10 g/m^2 is expected in the vicinity of the release location (<1 km) for both seasons and within a response exclusion zone in the event of a LOWC scenario.	N/A	N/A	N/A
		MDO	Not feasible. MDO spreads rapidly to less than 10 g/m^2 and suitable thicknesses for recovery are only present for the first 36 hours for a large offshore spill, and there is insufficient mobilisation time to capture residues. In general, this method only recovers approximately 10-15% of total spill residue, creates significant levels of waste, requires significant manpower and suitable weather conditions (calm) to be deployed.			
Protection and Deflection	Booms and skimmer	Gas Condensate	Potentially feasible. Partially effective. The maximum length of actionable shoreline oil is approximately 8 km with initial shoreline contact predicted to occur within 3 days of the release with a maximum loading of 33 m^3 predicted. If operational monitoring indicates shorelines are potentially exposed to actionable levels of hydrocarbons and accessible to response personnel and equipment, protection and deflection may be an effective technique for reducing shoreline loadings.	Subject to operational NEBA	Response personnel Booms & skimmers Waste facilities	As detailed in OPEP: · Core responders and equipment available via AMOSC · Environmental monitoring consultants accessible · Waste contracts in place Tactical Response Plans developed for: · Aire River; · Princetown; · Port Campbell Bay; and · Curdies Inlet Implement response as per OPEP and under direction of the State Control Agency Capability in place and sufficient to implement timely response

Response Option	Response Description	Hydrocarbon Type	Feasibility & Effectiveness Analysis	Net Environmental Benefit	Capability Needs Analysis	Capability Assessment
		MDO	No shoreline contact predicted from an MDO spill at the Artisan-1 well location.	N/A	N/A	N/A
Shoreline Clean-up	The active removal and/or treatment of oiled sand and debris	Gas Condensate	Feasible. Unlikely to be effective in coastal environments of Cape Otway West. The maximum length of actionable shoreline oil is approximately 8 km with initial shoreline contact predicted to occur within 3 days of the release with a maximum loading of 33 m^3 predicted. If operational monitoring indicates shorelines are potentially exposed to actionable levels of hydrocarbons and accessible to response personnel and equipment, protection and deflection may be an effective technique for reducing shoreline loadings. The nature of condensate means that it is difficult to collect from shorelines and can easily be mobilised into lower layers of sand or saltmarsh as may be case in Cape Otway West.	Subject to operational NEBA – unlikely to present net benefit	Based up a clean-up rate of 1m^3 per day per person, a single clean-up team (10 persons) could clean 10 m^3 / day. Based on a waste generation (bulking) factor of 10:1, waste clean-up and recovery could take up to 1 month for a team of 10 people. This assumes that all 33 m^3 of stranded hydrocarbon is both accessible and retrievable. In reality, the total retrievable volume (if any) would be smaller.	As detailed in OPEP: · Core responders and equipment available via AMOSC · Waste contracts in place Tactical Response Plans developed for: · Aire River; · Princetown; · Port Campbell Bay; and · Curdies Inlet Implement response as per OPEP and under direction of the State Control Agency Capability in place and sufficient to implement timely response
		MDO	No shoreline contact predicted from an MDO spill at the Artisan-1 well location.	N/A	N/A	N/A
Oiled Wildlife Response (OWR)	Capture, cleaning and rehabilitation of oiled wildlife.	Gas Condensate	Feasible. Effective. At the conservative environmental impact threshold (10 g/m^2) the predicted exposure is limited to the vicinity of the release location (up to 12 km for diesel and 4 km for condensate). No exposure is predicted at the high threshold (25 g/m^2). It is unlikely that wildlife would be oiled within the offshore environment, but some oiling of wildlife may occur along the maximum predicted 8 km length of coast exposed to moderate loading thresholds.	Yes	Personnel Equipment Triage and waste facilities	As detailed in OPEP: · Core responders and equipment available via AMOSC DELWP are the State agency responsible for responding to wildlife affected by a marine pollution emergency in Victorian waters. DELWP's response to oiled wildlife is undertaken in accordance with the Victorian Wildlife Response Plan for Marine Pollution Emergencies. The Tasmanian Oiled Wildlife Response Plan (WildPlan) is administered by the Resource Management and Conservation Division of the DPIPWE. If an incident occurs in Commonwealth waters which affects wildlife, AMSA may request support from DELWP or DPIPWE to assess and lead a response if required. Both DELWP & DPIPWE have a number of first strike kits as well as access to AMOSC oiled wildlife equipment. Capability in place and sufficient to implement timely response
		MDO	Feasible. Effective. Unlikely to require shoreline oiled wildlife response given no predicted shoreline loading. Potential that individual birds could become oiled in the offshore environment.			
Chemical Dispersant Application	Application of chemical dispersants either surface or subsea	Gas Condensate	Feasible. Not recommended for Group I oils such as condensate due to the very low viscosity and high volatility – generally no environmental benefit gained by the application of dispersant on Group I oils. Subsea dispersant injection (SSDI) may reduce volatile organic compounds (VOCs) at sea surface within the response area, therefore creating a safer work environment for responders.	Potentially Subject to operational NEBA & only for VOC reduction	Personnel Subsea First Response Toolkit (SFRT) Subsea Dispersant Injection (SSDI) equipment Chemical Dispersant 100:1 dilution for direct injection Given its potential efficacy for gas and registration as an OSCA, Dasic Slickgone NS would be the primary dispersant given it's potential efficacy on gas/condensate and it's registration on the OSCA register. Other dispersants on the OSCA register may also be considered for use. Deployment vessel Operational and Scientific Monitoring Plan (OSMP)	As detailed in OPEP: · Support vessels available · Equipment available via AMOSC · Environmental monitoring consultants accessible The SFRT was engineered and built by Oceaneering Norway and bought by a number of AMOSC Member Companies in 2013. The equipment is located in Henderson WA and is currently stored and maintained by Oceaneering Australia. AMOSC owns this suite of equipment which includes 500m^3 of dispersant for Subsea Dispersant Injection (SSDI). As an AMOSC member company, Beach has access to the SFRT upon request to membership of the SFRT. There are several dispersant products stockpiled within Australia, and which are available through AMSA and AMOSC; these are referred to as oil spill control agents (OSCA's). Those which may potentially be effective on light oils include Dasic Slickgone NS and Dasic Slickgone EW; Dasic Slickgone NS is also currently selected in Australia for subsea applications (AMSA, 2019). Implement response as per OPEP.

Response Option	Response Description	Hydrocarbon Type	Feasibility & Effectiveness Analysis	Net Environmental Benefit	Capability Needs Analysis	Capability Assessment
						Monitor efficacy as per OSMP. Capability in place and sufficient to implement timely response
		MDO	Feasible. Although "conditional" for Group II oil, the size of potential spill volume and the natural tendency of spreading into very thin films is evidence that dispersant application will be an ineffective response. The dispersant droplets will penetrate through the thin oil layer and cause 'herding' of the oil which creates areas of clear water and should not be mistaken for successful dispersion (see ITOPF – Technical Information Paper No. 4: The Use of Chemical Dispersants to Treat Oil Spills).	No	N/A	N/A

7.7.3 Known and potential environmental impacts

Impacts and risks associated with monitoring and evaluation, source control and protection and deflection response strategies (in responding to a hydrocarbon spill) are similar to those discussed for routine vessel, ROV and MODU operations in Section 7. This section covers detailed impact and risk evaluations for oiled wildlife response, shoreline protection and clean-up and the application of chemical dispersants.

7.7.3.1 Oiled wildlife response

Untrained resources capturing and handling native fauna may cause distress, injury and death of the fauna. AMSA as the Control Agency for a vessel spill in Commonwealth waters will managed any OWR and Beach will only undertake OWR if directed by AMSA. Potential impacts are:

- Injury/Mortality of fauna
- Change in fauna behaviour

7.7.3.2 Shoreline Protection and Clean up

Sensitive/protected shoreline habitats may be degraded, or marine fauna and flora and other users of the land may be disturbed due to movement of human responders and removal of oiled material on shorelines. Potential impacts are:

- Change in fauna behaviour
- Injury/Mortality of fauna
- Change in habitat
- Changes to the functions, interests or activities of other users

7.7.3.3 Application of chemical dispersants

Use of non-assessed or incorrect chemical dispersants, or the excessive use of chemical dispersants, may lead to unnecessary addition of chemicals to the water column further reducing water quality. Positioning of subsea dispersant equipment on sea floor may lead to benthic disturbance. Potential impacts are:

- Change in fauna behaviour
- Injury/Mortality of fauna

7.7.4 Consequence Evaluation

This section assesses the impacts and risks specific to OWR, shoreline clean up and the application of chemical dispersant spill response strategies.

7.7.4.1 Oiled wildlife response

Oiled wildlife response includes pre-emptive techniques such as hazing, capturing and relocating of un-oiled fauna as well as post-oiling techniques such cleaning and rehabilitation. Deliberate disturbance of wildlife from known areas of ecological significance (e.g. resting, feeding, breeding or nesting areas) to limit contact of individuals with hydrocarbons may result in inhibiting these species from accessing preferred habitats or food sources. This approach may also result in additional disturbance/handling stress to the affected species with little benefit as many species tend to display site fidelity and return to the location from which they have been moved.

The incorrect handling of oiled fauna has also the potential to result in increased stress levels which has may result in increased fauna mortality. Although fauna interactions from oiled wildlife response and shoreline clean-up techniques are expected to be limited to the duration of the response, there is the potential that these effects may result in longer term impacts to local populations where a large proportion of the local population may be exposed to oil and subsequently oiled wildlife response.

Oiled wildlife preparedness and response shall be undertaken in accordance with the relevant Environmental Performance Outcomes (EPOs) and Environmental Performance Standards (EPSs) detailed within the Offshore Victoria – Otway Basin Oil Pollution Emergency Plan (CDN/ID S4100AH717907)

Oiled wildlife surveillance and wildlife impact studies are detailed within the Offshore Victoria Operational and Scientific Monitoring Plan (CDN/ID S4100AH717908)

7.7.4.2 Shoreline protection and clean up

Damage or removal of habitat (such as sand from beaches) from shoreline protection and clean-up techniques may expose shorelines to erosion processes or decrease in fauna and flora. Damage to intertidal shoreline habitats and communities may have indirect effects on ecosystem dynamics through impacts on food chains of the macrofauna communities which they support.

Shoreline clean-up or protection actions could affect significant stretches of coastline, with prolonged effects on areas and populations located with increased response effort (such as tourism sites). The presence of accumulated hydrocarbons on shorelines as well as the presence of clean-up operations will necessitate the implementation of exclusion zones (e.g. beach closures). The exclusion of local residents and tourists from coastal areas has the potential to impact local tourism businesses and local settlements. As exclusion zones may be in place for the entire duration of the spill and beyond to account for clean-up periods once the spill has been contained, impacts to tourism and local residents may last for extended periods of time

The movement of spill response personnel, vehicles and equipment through coastal areas has the potential to disturb or damage artefacts or sites of cultural heritage significance. Adverse effects are expected to be localised to the area of disturbance. For known recognised sites, relocation of artefacts or implementation of exclusion zones may be considered as part of the operational NEBA.

Shoreline protection and Clean up preparedness and response shall be undertaken in accordance with the relevant Environmental Performance Outcomes (EPOs) and Environmental Performance Standards (EPSs) detailed within the Offshore Victoria – Otway Basin Oil Pollution Emergency Plan (CDN/ID S4100AH717907)

Hydrocarbon on shorelines and shoreline sediment impacts studies are detailed within the Offshore Victoria Operational and Scientific Monitoring Plan (CDN/ID S4100AH717908)

7.7.4.3 Application of chemical dispersants

Studies indicate modern dispersants, such as those on the AMSA OSCA register, are less toxic than oils. A literature review undertaken in 2014 by the CSRIO discusses several studies that investigate the possible synergistic effects of dispersant and oil. Whilst there are various results reported in the literature, recent studies on fish embryos indicate that the combination of oil and dispersant do not add appreciably to toxic response when compared to oil alone (Hook & Lee 2015). There are also potential benefits associated with dispersing oil such as accelerating the oil degradation process and thereby reducing potential exposure times.

The additional volumes of condensate which might become dispersed the water column may increase the potential for pelagic organisms to be exposed to toxic levels of dispersed hydrocarbons in the short-term. These are not expected to add significantly to the water column impacts when compared to those assessed for dispersed oil fractions for a LOWC scenario.

Marine species potentially impacted by elevated in-water dispersant concentrations include pelagic fish and plankton. Demersal and benthic organisms are less likely to be exposed to high concentrations of dispersant given the buoyancy of dispersants and hydrocarbons from the flowing well relative to seawater; typically, relatively little oil reaches the seabed when compared to oil in the water column (Hook & Lee 2015, IPIECA 2015).

Secondary effects such as oxygen depletion (associated with biodegradation of the product) have the potential to impact marine communities, however, are considered unlikely given the water depths around the Artisan-1 well location and dynamic nature of the environment resulting in continual mixing within the water column and replenishment of oxygen.

Planktonic organisms could be impacted by dispersant via a number of pathways; studies of impacts to diatoms showed that cell membranes can be damaged, impacting survivability (Hook & Osbourne 2012). However, planktonic communities are widespread, and exposure to dispersants at toxic levels to plankton is expected in close proximity to the application site. Planktonic communities are naturally subject to fluctuation given environmental stressors, and recovery or replacement of plankton within the area of application would be expected shortly after the cessation of the spill.

Plankton are numerous and widespread; they contain a myriad of species at various life stages and is a key component of the marine food web

The potential impact to commercial fish species is expected to be limited to small numbers of juvenile fish, larvae, and planktonic organisms, which are not expected to affect population viability or recruitment. Given the primary purpose of subsea dispersant injection is to limit VOC's at surface, and the dispersants are largely ineffective and further entraining condensates, any increase to commercial fish stock to entrained hydrocarbons above what would be experience due to the LOWC event are considered negligible.

Given the low application rate when applying dispersants subsea, the focussed application of dispersants directly into the gas stream and the distance of the Artisan-1 from shore, the potential impacts to tourism and recreation are considered negligible. Should the application of dispersants subsea further entrain condensates within the water column (although not the primary objective for gas/condensate wells), there is potential that lower concentrations of condensate reach shorelines, therefore creating a net benefit with respect to shoreline exposure.

Given the transient nature of marine mammals in the region surrounding the Artisan-1 well, potential exposure and therefore impacts to marine mammals are not expected in relation to exposure to dispersant. Dispersants such as Dasic Slickgone are also not expected to persist, or accumulate up the food chain (Irving & Lee, 2015) Dasic, 2017, Dasic 2018); In a review of impacts from dispersants, Hook & Lee (2015) noted they did not review of the effects on marine mammals given dispersant use is accepted as providing a net benefit by reducing the probability of their exposure to surface oil slicks.

Chemical dispersant application preparedness and response shall be undertaken in accordance with the relevant Environmental Performance Outcomes (EPOs) and Environmental Performance Standards (EPSs) detailed within the Offshore Victoria – Otway Basin Oil Pollution Emergency Plan (CDN/ID S4100AH717907).

Dispersant efficacy and marine scientific monitoring studies are detailed within the Offshore Victoria Operational and Scientific Monitoring Plan (CDN/ID S4100AH717908)

7.7.5 Control measures, ALARP and acceptability assessment

Control, ALARP and acceptability assessment: Oil spill response			
ALARP Decision Context and Justification	**ALARP Decision Context: A** The purpose of implementing spill response activities is to reduce the severity of impacts from an oil spill to the environment. However, if the strategies do more harm than good (i.e. they are not having a net environmental benefit) then the spill response is not ALARP.		
Control Measures	**Source of good practice control measures**		
All spill response control measures and associated Environmental Performance Outcomes (EPOs) and Environmental Performance Standards (EPSs) are detailed within the Offshore Victoria – Otway Basin Oil Pollution Emergency Plan (CDN/ID S4100AH717907)			
All relevant operational and scientific monitoring studies are detailed within the Offshore Victoria Operational and Scientific Monitoring Plan (CDN/ID S4100AH717908)			
Additional Controls Assessed			
Control	**Control Type**	**Cost/Benefit Analysis**	**Control Implemented?**
Monitor and evaluate: AUVs	Engineering Risk Assessment	This control measure is not expected to provide significant environmental benefit as the Artisan-1 well is in close proximity to shore (32 km), and mobilisation of in-field monitoring or aerial surveillance may be implemented rapidly via existing contracts.	No
Monitor and evaluate: Night-time monitoring – infrared	Engineering Risk Assessment	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 nighttime, however the benefit is minimal given trajectory monitoring (and infield monitoring during daylight hours) will give good operational awareness. In addition to this, satellite imagery may be used at night to provide additional operational awareness.	No
OWR: Pre-positioning of oiled wildlife response resources.	Precautionary approach	Oiled wildlife response equipment containers for first strike activities are positioned in Geelong. Positioning the equipment any closer to the potential spill area is not considered to provide a considerable environmental benefit considering that any visible shoreline contact is not predicted until day 3 of the spill, therefore there is adequate time to deploy equipment positioned in Geelong. Additionally, spill modelling indicates potential (hypothetical) areas of exposure to hydrocarbons, post-spill operational monitoring would be required to predict actual or likely exposure locations, therefore determining an area to pre-position equipment may be inaccurate pre-spill.	No
Shoreline protection and clean up: Tactical Response Plans	Precautionary approach	Identified areas for priority protection have pre-populated tactical response plans to reduce	Yes

		response planning timeframes in the event of potential shoreline exposure. Refer to OPEP for TRPs.	
Chemical Dispersant: Pre-positioning of dispersant and application equipment.	Precautionary approach	No clear benefit identified as stockpiles of dispersant already available in Melbourne and elsewhere in Australia. Application equipment and dispersant can be readily mobilised to site, with no identified restriction on logistics pathways or response timing.	No

Consequence Rating	Moderate (2)
Residual Impact Category	Low
Acceptability Assessment	
Policy compliance	The proposed management of the impact is aligned with the Beach Environment Policy.
Management system compliance	Activities will be undertaken in accordance with the Implementation Strategy (Section 8).
Stakeholder engagement	No stakeholder concerns have been raised with regards to impacts of the spill response activities on relevant persons. During any spill response, a close working relationship with key regulatory bodies will occur and thus there will be ongoing consultation with relevant persons during response operations.
Laws and standards	Response has been developed in accordance with: • OPGGS Act; • AMSA Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities (AMSA, 2015); and • NOPSEMA (2017).
Industry practice	Proposed activities are consistent with industry practice and based on current NOPSEMA guidance notes. Australian Government Register of oil spill control agents (OSCA)
Environmental context	While some response strategies may pose additional risk to sensitive receptors, to not implement response activities may potentially result in greater negative impact to the receiving environment and a longer recovery period. Response activities will be undertaken in accordance with controls which reduce and/or prevent additional risks. The mutual interests of responding and protecting sensitive receptors from further impact due to response activities will be managed using a NEBA during response strategy planning in preparedness arrangements, as well as during a response.
Environmentally Sustainable Development principles	The activities were evaluated as having the potential to result in a Moderate (2) consequence thus is not considered as having the potential to result in serious or irreversible environmental damage. Consequently, no further evaluation against the principles of ESD is required.
Monitoring and reporting	Impacts will be monitored in accordance with Section 8.16.
Acceptability outcome	**Acceptable**

7.8 Environmental Performance Outcomes, Standards and Measurement Criteria

Beach uses the environmental performance outcomes (EPO), environmental performance standards (EPS) and measurement criteria to demonstrate it is managing its environmental impacts and risks. Outcomes have been developed for each of the identified environmental impacts and risks and have been based around the key identified controls from the control assessment and are aligned with Beach's HSE Policy (refer Figure 8-1). For each EPO an EPS has been developed in conjunction with measurement criteria. The EPOs, EPSs and measurement criteria for this activity are detailed below.

Table 7-17: Environmental Performance Outcomes, Standards and Measurement Criteria

Environmental Performance Outcome	Control Measure #	Environmental Performance Standard	Measurement Criteria	Responsible Person
Undertake the activity in a manner that will not: • Result in a substantial change in water and air quality which may adversely impact on biodiversity, ecological integrity; social amenity or human health.	CM#1: MO 97: Marine Pollution Prevention – Air Pollution	• Low-sulphur (<3.5% m/m) marine-grade diesel shall be used in support vessels. • Vessels with diesel engines>130 kW must be certified to emission standards (e.g. International Air Pollution Prevention [IAPP]). • Vessels shall implement their Ship Energy Efficiency Management Plan to monitor and reduce air emissions (as appropriate to vessel class).	Bunker receipts Ship Energy Efficiency Management Plan (SEEMP) records. Certification documentation.	Vessel Master
		• Low-sulphur (<3.5% m/m) marine-grade diesel shall be used for MODU power generation.	Bunker receipts	Drilling Contractor
	CM#2: Hazardous Materials Risk Assessment Process	• Chemicals used as a component of a planned drilling discharge will meet the drilling chemical acceptance criteria as per s8.21.2, including: i. Components of water-based drilling fluid (WBDF); ii. Components of synthetic-based drill fluid (SBDF); iii. Stock barite; iv. Cementing products; and v. Hydraulic control fluids	Completed and approved chemical assessment. Register of approved chemicals on location	Drill Fluids Specialist
	CM#3: Drill Fluid and Cuttings Management Plan	• No whole SBDF shall be discharged overboard	Daily drill reports	Drill Fluids Contractor
		• Discharge tank wash shall not exceed 2% base fluid content	Daily drill reports	Drill Fluids Contractor
	CM#4: Solids Control Equipment (SCE)	• SCE shall be used to recondition and recycle SBF and reduce the residual fluid on cuttings (ROC)% to ≤8% ROC (dry weight) per well section prior to overboard discharge.	Retort test results	Drill Fluids Contractor
		• ROC shall be monitored every 300m whilst drilling with SBDF or twice daily (whichever comes first)	Retort test records	Drill Fluids Contractor
	CM#5 Cementing procedure	• Detailed cementing procedures shall be developed including provision to mix only enough cement to complete the cementing operation with allowance for loss to formation and the monitoring and reconciliation of used quantities of cement against planned quantities for each cementing operation	Documented cementing procedure Monitoring and reconciliation records	Cementing Contractor
		• At the end of the drilling activity, excess dry bulk cement shall be used for subsequent drilling activities or returned to shore.	Backloading records	Cementing Contractor
	CM#6: *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*	• Oil contaminated water shall be treated via a MARPOL (or equivalent) approved oily water separator and only discharge if oil content less than 15 ppm. • Sewage discharged at sea shall be treated via a MARPOL (or equivalent) approved sewage treatment system. • Food waste only discharged when macerated to ≤25 mm and at distance greater than 3 Nm from land.	Oil record book. Garbage record book. Vessel inspection records.	Vessel Master / Drilling Contractor
	CM#7: Preventative Maintenance System	• Equipment used to treat planned discharges shall be maintained in accordance with preventative maintenance system. • Combustion equipment shall be maintained in accordance with preventative maintenance system.	PMS records.	Vessel Master / Drilling Contractor

Environmental Performance Outcome	Control Measure #	Environmental Performance Standard	Measurement Criteria	Responsible Person
	CM#8: MO 95: Marine Pollution Prevention - Garbage	• Waste with potential to be windblown shall be stored in covered containers.	HSE inspection records. Garbage record book. Incident report.	Vessel Master / Drilling Contractor
Undertake the activity in a manner that will not: • Lead to a long-term decrease in the size of a threatened or migratory listed species population; • Displace blue pygmy whales from the foraging BIA; or • Have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (for example, breeding, feeding, migration behaviour, life expectancy) and spatial distribution.	CM#9: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans	Vessels operators shall be advised to adhere to the distances and vessel management practices of EPBC Regulations (Part 8) and report vessel interactions with cetaceans.	Project induction EP transmittal Fauna interaction reports	Vessel Master
Undertake the activity in a manner that will not: • Interfere with other marine users to a greater extent than is necessary for the exercise of right conferred by the titles granted. • Adversely affect the sustainability of commercial fishing.	CM#10: Ongoing consultation	Notifications for any on-water activities and ongoing consultations shall be undertaken as per Section 9 Stakeholder Consultation.	Notification records.	Offshore Project Manager
Undertake the activity in a manner that will not: • Result in a spill of hydrocarbons to the marine environment.	CM#11: Spill containment	Materials and equipment that have the potential to spill onto the deck or marine environment shall be stored within a contained area.	MODU inspection.	Drilling Contractor
	CM#12: SMPEP, or equivalent	Support vessels shall have a SMPEP (or equivalent appropriate to class) which is: • Implemented in the event of a spill to deck or marine environment. • Tested as per the vessels test schedule. Spill response kits shall be available and routinely checked to ensure adequate stock is maintained.	Vessel SMPEP. Vessel inspection. Vessel exercise schedule.	Vessel Master
	CM#13: MO 21: Safety and emergency arrangements	Support vessels shall meet the safety measures and emergency procedures of the AMSA MO 21.	Vessel inspection.	Vessel Master
	CM#14: MO 30: Prevention of collisions	Support vessels shall meet the navigation equipment, watchkeeping and radar requirements of the AMSA MO 30.	Vessel inspection.	Vessel Master
	CM#15: Navigation & communication aids	The MODU and project support vessels shall be fitted with an automatic identification system (AIS) transceiver enabling the MODU/vessel to receive the data broadcasted by surrounding vessels, such as Maritime Mobile Service Identity (MMSI) number, IMO number, VHF call sign, speed, heading and course over ground. AIS shall be monitored 24 hours per day.	MODU / vessel inspection.	Drilling Contractor / Vessel Master
	CM#16: Rig safety exclusion zone established around the MODU during the drilling activity.	A 500 m rig safety exclusion zone shall be established around the MODU during the drilling activity.	AMSA NTM	Drilling Contractor
	CM#17: Controlled access to rig safety exclusion zone	Access into the 500 m rig safety exclusion zone, including approach directions and speed, shall be managed via the MODU control room	Control room records	Drilling Contractor Radio Operator
	CM#18: Project support vessel to act as guard vessel	At least one project support vessel shall be stationed near the MODU at all times to guard the MODU from errant vessels	Control room records	Vessel Master / Drilling Contractor Radio Operator
	CM#19: MO 31: Vessel surveys and certification	Support vessels will meet survey, maintenance and certification of regulated Australian vessels as per AMSA MO 31.	Vessel certification.	Vessel Master
	CM#20: Bunkering procedures	Chemical and hydrocarbon bunkering shall be undertaken in accordance with Drilling Contractor bunkering procedures.	JHA records Bunkering records	Drilling Contractor

Environmental Performance Outcome	Control Measure #	Environmental Performance Standard	Measurement Criteria	Responsible Person
	CM#21: Drain management	All overboard discharge points from mud pits, and areas containing potentially hazardous substances locked closed and only open under permit.	Permits issued	Drilling Contractor
	CM#22: Preventative Maintenance System	The BOP shall be routinely function and pressure tested in accordance with manufacturer's specifications and in alignment with Drilling Contractors preventative maintenance system.	BOP maintenance records	Drilling Contractor
	CM#23: WECS	The Beach WECS shall be applied to: manage operational risks associated with drilling to ALARP; document changes to drilling design and implementation; demonstrate alignment with relevant well design and drilling standards; and track organisational competency for Beach drilling personnel.	WECS records	Offshore & Special Projects Drilling Manager
	CM#24: NOPSEMA accepted WOMP	Well integrity shall be maintained in accordance with the NOPSEMA accepted WOMP	NOPSEMA accepted WOMP in place No LOWC event	Offshore & Special Projects Drilling Manager
	CM#25: NOPSEMA accepted MODU Safety Case	Beach shall validate that a NOPSEMA accepted MODU Safety Case is in place for MODU operations	NOPSEMA accepted MODU Safety Case in place	Drilling Contractor
	CM#26: Source Control Contingency Plan (SCCP) inclusive of Relief Well Plan	Emergency response capability to implement an effective well kill operation shall be maintained in accordance with well-specific SCCP inclusive of relief well plan	Outcomes of internal audits and tests demonstrate preparedness.	Offshore & Special Projects Drilling Manager
		The SCCP shall be consistent with the International Oil and Gas Producers (IOGP) Report 594 - Subsea Well Source Control Emergency Response Planning Guide for Subsea Wells (Jan, 2019), Specifically detailing: • The structure and function of the Beach Wells Emergency Team (WET); • A timeline for the effective implementation of source control key events / actions; • Interface arrangements with the Beach corporate Crisis Management Plan (CMP); • A well-specific worst-case discharge (WCD) analysis; • Casing design; • Structural integrity analysis; and • Gas plume study.	Documented SCCP in place and consistent with IOGP Report 594 prior to drilling	Offshore & Special Projects Drilling Manager
		A relief well plan shall be developed in line with OGUK guidance to ensure that Beach has considered the response requirements in order to: • Reduce the time required to initiate relief well drilling operations in the event of a LOWC • Allow the relief well to be completed in the shortest time practicable. The relief well plan shall include a detailed schedule with estimated times to: • Source, mobilise and position a rig • Drill and intercept the well • Complete the well kill successfully	Documented well-specific relief well plan developed in line with OGUK guidance prior to drilling	Offshore & Special Projects Drilling Manager
	CM#27: NOPSEMA accepted OPEP	Emergency spill response capability shall be maintained in accordance with the OPEP	Outcomes of internal audits and tests demonstrate preparedness.	Senior Crisis, Emergency & Security Advisor
	CM#28: NOPSEMA accepted OSMP	Operational & scientific monitoring capability shall be maintained in accordance with the OSMP	Outcomes of internal audits and tests demonstrate preparedness.	Senior Crisis, Emergency & Security Advisor
	CM#29: Permanent Petroleum Safety Zone (PSZ)	Should the Artisan-1 well be suspended for future production, a permanent PSZ shall be sought at the well location	PSZ establishment records	Offshore & Special Projects Drilling Manager

Environmental Performance Outcome	Control Measure #	Environmental Performance Standard	Measurement Criteria	Responsible Person
Undertake the activity in a manner that will not: • modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning.	CM#30: Site survey	Site survey undertaken prior to finalising MODU position and location of mooring equipment, and prior to installing or removing wellhead.	Survey records	Drilling Contractor
	CM#31: API RP 2SK	A mooring analysis shall be undertaken prior to anchoring.	Documented mooring analysis	Drilling Contractor
	CM#32: ISO 19901-7:2013	Mooring tension monitoring shall be undertaken while the MODU is anchored on location.	Control room logbook	Drilling Contractor
	CM#33: Mooring plan	All mooring equipment is anticipated to be within 2 km operational area of the well. Mooring equipment will not be deployed outside the area that has been survey as part of the site survey	Documented mooring plan	Drilling Contractor
	CM#34: OPGGS Act	Upon well abandonment, all subsea equipment shall be removed from sea floor, with wellheads cut below mudline and retrieved to surface.	Drilling Report	Offshore & Special Projects Drilling Manager
		Retrieval of all mooring equipment from the sea floor within 3 months following the drilling campaign		Offshore & Special Projects Drilling Manager
Undertake the activity in a manner that will not: • Result in a known or potential pest species becoming established.	CM#35: MO 98: Marine pollution – anti-fouling systems	Support vessels shall have a current anti-fouling certificate.	Vessel anti-fouling certificate.	Vessel Master
	CM#36: Australian Ballast Water Management Requirements	Support vessels shall have a valid Ballast Water Management Plan and ballast water management certificate	Ballast water records. Vessel Ballast Water Management Plan. Vessel Ballast Water Management certificate.	Vessel Master
		Prior to mobilisation to the Artisan-1 well location, Beach shall validate that the MODU is in compliance with the Australian Ballast water Requirements (Rev 7), specifically, ensuring the MODU has: • a valid Ballast Water Management Plan; • a ballast water management certificate: and • a ballast water record system with a minimum of 2 years records retained on board.	Ballast water records Vessel Ballast Water Management Plan. Vessel Ballast Water Management certificate.	Drilling Contractor
		Beach shall validate MODU ballast water has been exchanged outside 12 nm from the nearest land and in water depths greater than 50 m prior to undertaking drilling activities.	Ballast water records	Drilling Contractor
	CM#37: Australian Biosecurity Act 2015	Prior to arrival at the drilling location, Beach shall validate that the MODU has been issued a 'Letter of Determination' and a Biosecurity Status Document by Department of Agriculture and Water Resources (DAWR).	Letter of Determination issued by DAWR Biosecurity Status document issued by DAWR	Drilling Contractor
	CM#38: National Biofouling Management Guidance for the Petroleum Production and Exploration Industry	Rental anchors and/or mooring equipment shall be cleaned prior to deployment to field	In-water equipment checklist.	Offshore & Special Projects Drilling Manager
		Support vessels shall have a low-risk rating based on (or equivalent to) the WA Department of Fisheries Biofouling Risk Assessment Tool (in lieu of a Commonwealth or VIC specific tool).	Documented biofouling risk assessment indicating 'low-risk' rating	Vessel Master
Undertake oil spill response in a manner that will not: • Result in additional impacts to marine environment, coastal habitat and oiled wildlife.	CM#27: NOPSEMA accepted OPEP	Implement spill response in accordance with relevant EPOs and EPSs in the NOPSEMA accepted OPEP	EMT log	Beach EMT

8 Implementation Strategy

Regulation 14 of the OPGGS(E)R requires that the environment plan must contain an implementation strategy for the activity. Lattice is the titleholder, and the Lattice Health, Safety and Environment Management System (HSEMS) will be used for this project. The Lattice HSEMS is consistent with Beach's Environmental Policy (Figure 8-1).

The Implementation Strategy described in this section provides a summary of the Lattice HSEMS and how it will be applied to effectively implement the control measures detailed in this EP. Specifically, it describes:

- the HSEMS;
- environment-specific roles and responsibilities;
- arrangements for monitoring, review and reporting of environmental performance;
- preparedness for emergencies; and
- arrangements for ongoing consultation.

8.1 Health, Safety, Environmental Management System

The drilling activity will be undertaken in accordance with the Lattice HSEMS. The HSEMS documents the Environmental Policy, HSE Standards, HSE Directives and the key HSE processes and requirements for activities where Lattice 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 which best suits the business. The HSEMS is aligned with the requirements of recognised international and national standards including:

- ISO 14001 (Environmental Management);
- OHSAS 18001 (Occupational Health and Safety);
- ISO 31000 (Risk Management); and
- AS 4801 (Occupational Health and Safety Management Systems).

At the core of the HSEMS are 20 performance standards which detail specific performance requirements for the implementation of the HSE Environmental Policy and management of potential HSE impacts and risks (Table 8-1). Integral to each Performance Standard are a series of HSE Management Commitments and Processes including Directives, Procedures and other support documents which provide detailed information on requirements for implementation along with specific responsibilities. At the business level the system is complemented by asset and site procedures and plans such as this EP.

Whilst Lattice remains the Titleholder undertaking the petroleum activity, Diamond Offshore maintain operational control of the Ocean Onyx MODU in accordance with the requirements of the MODU-specific Safety Case as accepted by NOPSEMA and the Diamond Offshore Global Excellence Management System (GEMS).

The application of HSEMS Performance Standards relevant to the drilling activity are described in the following sections.

Table 8-1: Lattice HSEMS Performance Standards

No	Standard	No	Standard
1	Leadership and Commitment	11	Management of Change
2	Organisation, Accountability, Responsibility and Authority	12	Facilities Design, Construction and Commissioning – Well Engineering Construction Management System (WECS)
3	Planning, Objectives and Targets	13	Contractors, Suppliers, Partners and Visitors
4	Legal Requirements, Document Control and Information Management	14	Crisis and Emergency Management
5	Personnel, Competence, Training and Behaviours	15	Plant and Equipment
6	Communication, Consultation and Community Involvement	16	Monitoring the Work Environment
7	Hazard and Risk Management	17	Health and Fitness for Work
8	Incident Management	18	Environmental Effects and Management
9	Performance Measurement and Reporting	19	Product Stewardship, Conservation and Waste Management
10	Operations	20	Audits, Assessments and Review

Environmental Policy

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

To fulfil these objectives, to as far as is reasonably practicable, Beach will:

- Maintain and improve the HSE Management System including as appropriate developing applicable environmental standards and procedures;
- Establish environmental objectives and targets and implement programs to achieve them and report on their performance;
- Commit to and comply with relevant laws, regulations and environmental management plans for each activity as required by the appropriate regulating authority, and where adequate laws do not exist, adapting to and applying globally applicable corporate operating standards;
- Commit to identify, assess and control environmental impacts of our operations by achieving proactive management of activities;
- Avoid disturbance of known sites of archaeological, historical and natural significance and protect native flora and fauna in all areas of operation;
- Ensure that incidents, near misses, concerns and complaints are reported adequately, investigated and appropriate procedures implemented;
- Inform all employees and contractors of their environmental and cultural heritage responsibilities including consultation and distribution of appropriate environmental management guidelines, regulations and publications for all relevant activities; and
- Ensure Beach has the resources and the skills necessary to achieve its environmental commitments.
- Application of this policy resides with all employees and contractors sharing responsibility for its implementation.

Operative from:	1 September 2017
Review by:	1 September 2019

Figure 8-1: Beach’s Environmental Policy

8.2 Leadership and Commitment (HSEMS Standard 1)

The leadership and commitment standard states that the Board and Executive Management establish the HSE Policy, set expectations and provide resources for successful implementation of the HSE Policy and HSEMS.

All employees are expected to demonstrate commitment to HSE in all facets of their work. An effective method of showing leadership and commitment is by example. An explicit part of this process is to comply with Directive and Procedures associated with the HSEMS Standards and develop and implement effective HSE plans. These plans are aimed at driving the process of continual improvement in HSE performance.

Demonstratable compliance with this EP is a key commitment for Beach.

8.3 Organisation, Accountability, Responsibility and Authority (HSEMS Standard 2)

This standard states that for Directors, Managers, Supervisors and employees and contractors at all levels, their accountabilities, roles, responsibilities and authority relating to HSE are clearly defined, documented, communicated and understood.

The Beach Energy CEO has the ultimate responsibility for ensuring that Beach Energy has the appropriate organisation in place to meet the commitments established within this EP. However, the General Manager Well Engineering and Construction has the responsibility and delegated authority to ensure that adequate and appropriate resources are allocated to comply with the HSEMS and this EP.

The roles responsibilities for the implementation, management and review of this EP are detailed in Table 8.2 below.

Responsibility in the event of an oil pollution emergency is dependent on the response category level. For a Level 1 (MODU or vessel) spill, the Offshore Installation Manager or Vessel Master has the immediate responsibility. Roles and responsibilities for an oil pollution emergency response are clearly described in the OPEP (Appendix E).

The roles and responsibilities for the implementation, management and review for this EP are detailed in Table 8-2.

Table 8-2: Roles and responsibilities

Role	Responsibilities
Chief Executive Officer	Ensure: • Beach has the appropriate organisation in place to be compliant with regulatory and other requirements and this EP. • The HSEMS continues to meet the evolving needs of the organisation.
Offshore and Special Projects Drilling Manager	Ensure: • Compliance with regulatory and other requirements and this EP. • Records associated with the activity are maintained as per Section 8.5.2. • Personnel who have specific responsibilities pertaining to the implementation of this EP or Oil Pollution Emergency Plan (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 process detailed in Section 8.12. • Incidents are managed and reported as per Section 8.9. • The EP report is submitted to NOPSEMA not more than three months after the anniversary date of the EP acceptance.

Role	Responsibilities
	• 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 Management of Change process detailed in Section 8.12. • Oil spill response arrangements for the activity are tested as per Section 8.16.1. • Ensure audits and inspections are undertaken in accordance with Section 8.23.1.
Drilling Superintendent	• Report any event or incident which may result in a release of contaminant and/or impact upon the environment in relation to the project. • Report all incidents to the Offshore and Special Projects Drilling Manager • Notify the designated authority of all reportable incidents within the specified time frames. • Perform incident investigations.
Drill Site Manager (DSM) (field based)	• Ensure all workers are complying with HSE requirements. • Report all incidents to the Drilling Superintendent. • Implement and comply with this EP. • Provide support for audits and inspections in accordance with Section 8.22.1.
Drill Fluids Specialist	• Assess any chemicals that will be discharged offshore as per Section 8.21. • Establish and monitor procedural controls for the management and monitoring of Offshore chemical use, monitoring and discharge in alignment with relevant commitments within this EP. • Maintain records of all drill fluid chemicals stored and discharged offshore.
Drilling HSE Advisor (Office)	• Communicate regulatory and other requirements and the requirements in this EP to persons who have specific responsibilities pertaining to the implementation of this EP or OPEP. • Develop the environmental component of the activity induction. • Provide support in relation to incident management and reporting as per Section 8.9. • Develop the EP environmental performance report. • Review and document any new or change to an environmental impact or risk or a change that may impact the EP as per Section 8.12. • Provide support to ensure audits and inspections detailed in Section 8.23.1 are undertaken and any actions from non-conformances or improvement suggestions tracked. • Review and revise the EP as per the requirements in Section 8.23.2 and 8.23.3. • Weekly MODU inspections as detailed in Section 8.23.1 are undertaken to ensure ongoing compliance with the EP.
Community Relations Manager	• Undertake stakeholder consultation for the activity. • Record and report to the Activity Manager and Environment Advisor any objections or claims raised by relevant stakeholders. • Maintain a stakeholder consultation log.
Operations Manager (OM) (Office) – Drilling Contractor	• Ensure all regulatory requirements (Commonwealth & State) are met relating to: i. the mobilisation of the MODU to the drilling location from either international, national or State waters; and ii. the operation of the MODU whilst on the drilling location.
Offshore Installation Manager (OIM) – Drilling Contractor	• Operate the MODU in accordance with all relevant Diamond Offshore procedures. • Support Beach in the implementation of this EP, specifically with regards to commitments within this EP relating to the operation of the MODU.
Radio Operator – Drilling Contractor	• Maintain communication with other marine users in the area as required • Communicate with AHO and AMSA JRRC as per Table 9-3
HSE Advisor – Drilling Contractor	• Ensure HSE issues are communicated via systems such as the daily report and daily pre-start meetings.

Role	Responsibilities
	• Ensure emissions and discharges identified in Section 8.10.2 are recorded and provided to Beach on a monthly basis
Vessel Master	Ensure: • Vessel operations are carried out in accordance with regulatory requirements and this EP. • Vessel adheres to the distances and vessel management practices for seals as per the Wildlife (Marine Mammals) Regulations 2009 and whales and dolphins as per the EPBC Regulations (Part 8). • Environmental incidents are reported to the Drilling Superintendent within required timeframes as per Section 8.9 . • Oil spill response arrangements are in place and tested as per the vessel's SMPEP or equivalent.
Vessel personnel	• Complete activity induction. • Report hazards and/or incidents via company reporting processed. • Stop any task that they believe to be unsafe or will impact on the environment.

8.4 Planning, Objectives and Targets (HSEMS Standard 3)

This standard recognises that a systematic risk-based approach to the management of HSE is in place as an integral part of business planning, with HSE goals, objectives and targets established and measured. A philosophy of continuous improvement is applied to HSE.

EPOs and EPSs have been established to continually reduce potential environmental impacts and risks to ALARP and an acceptable level. EPOs, EPSs and the measurement criteria by which environmental performance for the activity shall be measured are detailed in Table 7-17

8.5 Legal Requirements, Document Control and Information Management (HSEMS Standard 4)

This standard specifies that relevant legal and regulatory requirements and voluntary commitments are identified, documented, made accessible, understood and complied with. Effective HSE document control systems are in place to ensure clarity of company expectations and to facilitate efficient and accurate information management.

8.5.1 Legal requirements

Section 3 of this EP details the legislation applicable to the activity and how it has been applied within this EP.

8.5.2 Document control and information management

In accordance with Regulation 27 of the OPGGS(E)R, documents and records relevant to the EP implementation will be stored and maintained for a period of five years in a way that makes retrieval practicable.

8.6 Personnel, Competence, Training and Behaviours (HSEMS Standard 5)

This standard recognises that employees' competence and appropriate behaviours are critical for the safe control of operations and general company success.

Each employee or contractor with responsibilities pertaining to the implementation of this EP shall have the appropriate competencies to fulfil their designated role.

To ensure that personnel are aware of the EP requirements for the activity all offshore personnel will complete an induction, as a minimum. Records of completion of the induction will be recorded and maintained as per Section 8.5.2. The induction will at a minimum cover:

- description of the environmental sensitivities and conservation values of the operational area and surrounding waters;
- 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.
- overview of emergency response and spill management plans; and
- fauna sighting and vessel interaction procedures.

In addition to the activity-specific induction, each employee or contractor 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.

8.7 Communication, Consultation and Community Involvement (HSEMS Standard 6)

This standard specifies that effective, transparent and open communication and consultation with stakeholders is valued and undertaken across the company.

The Offshore Installation Manager (OIM), Drill Site Manager (DSM) and vessel masters have responsibility for ensuring that systems are in place to facilitate the communication of HSE issues this is typically via the daily report and daily pre-start meetings. These pre-start (toolbox meetings) will have an HSE component and any relevant environmental issues will be discussed. All workers that participate in a job must attend a pre-start meeting. These workers must sign attendance at these meetings. Any worker not at the pre-start meeting may not work on that job until suitable training has been undertaken. During these pre-start meetings any worker can identify areas of HSE risk and are encouraged to consider areas where HSE performance can be improved.

Stakeholder consultation specific to the activity is detailed in Section 9

8.8 Hazard and Risk Management (HSEMS Standard 7)

This standard specifies that HSE hazards and risks associated with the company’s activities are identified, assessed and managed to prevent or reduce the likelihood and consequence of incidents.

Section 6 details the impact and risk assessment undertaken to identify and assess the environmental impacts and risks associated with the activity and the control measures that will be implemented to prevent or reduce the likelihood and consequence of incidents.

Risk management processes associated with environmental hazards are manged in accordance with the Environmental Related Risk Procedure and the Risk Management Directive.

As detailed in Section 8.23.2, Beach will undertake a review of this EP to ensure that any changes to activities, controls, regulatory requirements and information from research, stakeholders, industry bodies or any other sources to inform the EP are assessed using risk management tools nominated. The review will ensure that the environmental impacts and risks of the activity continue to be identified and reduced ALARP and an acceptable level.

Environmental risks and Major Environmental Events are assessed through project HAZID's. These ensure that all risks are identified, and suitable operational barriers are put in place. These also form part of the projects Standard Operating Procedures (SOPs) and Job Hazard Analyses.

If revision of this Environmental Management Plan is trigged though change in risk or controls the revision process shall be managed in accordance with Section 8.12 Management of Change.

8.9 Incident Management (HSEMS Standard 8)

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. Incidents shall be managed in accordance with the Incident Management Directive.

Incident reports and corrective actions are managed using the Beach Enterprise Incident Management System.

Notifiable incidents will be reported as detailed in Section 8.9.1.

8.9.1 Incident Reporting

Notification and reporting requirements for environmental incidents to external agencies are provided in Table 8-3.

Table 8-3: Regulatory incident reporting

Requirement	Timing	Contact	Responsible Person
Recordable incident As defined within the OPGGS(E)R a recordable environmental incident is a breach of an EPO or EPS in the EP that applies to the activity that is not a recordable incident.			
As a minimum, the written monthly recordable report must include a description of: • All recordable incidents which occurred during the calendar month; • All material facts and circumstances concerning the incidents that the operator knows or is able to reasonably find out; • Corrective actions taken to avoid or mitigate any adverse environmental impacts of the incident; and • Corrective actions that have been taken, or may be taken, to prevent a repeat of similar incidents occurring. Regulation 26B of the OPGGS(E)R requires a recordable incident report to be submitted if there is a recordable incident, thus nil reports are not required.	Before the 15th day of the following calendar month	• NOPSEMA - submissions@nopsema.gov.au	Drilling HSE Advisor (Office)
Reportable incident As defined within the OPGGS(E)R, a reportable incident is an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage. In the context of the Beach Environmental Risk Matrix moderate to significant environmental damage is defined as any incident of actual or potential consequence category Serious (3) or greater. These risks include: • Any loss of well control event. • Any vessel collision resulting in a loss of containment or otherwise.			

Requirement	Timing	Contact	Responsible Person
• Unauthorised entry of vessel into the 500m rig safety zone. Introduction of marine pests to the drilling location from MODU, support vessel or mooring equipment.			
Verbal notification The notification must contain: • All material facts and circumstances concerning the incident; • Any action taken to avoid or mitigate the adverse environmental impact of the incident; and • The corrective action that has been taken or is proposed to be taken to stop control or remedy the reportable incident.	Within two hours of becoming aware of incident	• NOPSEMA - 08 6461 7090 • NOPSEMA - submissions@nopsema.gov.au • DJPR - marine.pollution@ecodev.vic.gov.au<mailto:marine.pollution@ecodev.vic.gov.au (0409 858 715) • NOPTA – reporting@nopta.gov.au	Drilling Superintendent (or delegate)
Written notification Verbal notification of a reportable incident to the regulator must be followed by a written report. As a minimum, the written incident report will include: • The incident and all material facts and circumstances concerning the incident; • Actions taken to avoid or mitigate any adverse environmental impacts; • The corrective actions that have been taken, or may be taken, to prevent a recurrence of the incident; and • The action that has been taken or is proposed to be taken to prevent a similar incident occurring in the future.	Within 3 days of notification of incident	• NOPSEMA - submissions@nopsema.gov.au	Drilling HSE Advisor (Office)
Written incident reports to be submitted to NOPTA and DJPR (for incidents in Commonwealth waters).	Within 7 days of written report submission to NOPSEMA	• DJPR - marine.pollution@ecodev.vic.gov.au<mailto:marine.pollution@ecodev.vic.gov.au • NOPTA – reporting@nopta.gov.au	Drilling HSE Advisor (Office)
Vessel spill to marine environment All discharges /spills or probable discharges/spills to the marine environment of oil or oily mixtures, or noxious liquid substances in the marine environment from vessels. Reporting info: http://www.amsa.gov.au/forms-and-publications/AMSA1522.pdf.	Verbal notification ASAP	Immediate notification by the Vessel Master to AMSA. Follow-up with Marine Pollution Report (POLREP). • Ph: 1800 641 792 • Email: rccaus@amsa.gov.au • AMSA POLREP: https://amsa-forms.nogginoca.com/public/	Vessel Master
AMP - in the event an AMP may be exposed to hydrocarbons	Verbal notification ASAP	• Marine Park Compliance Duty Officer - 0419 293 465 Notification must be provided to the Director of National Parks and include: • titleholder details;	EMT Lead (or delegate)

Requirement	Timing	Contact	Responsible Person
		• time and location of the incident (including name of marine park likely to be affected); • proposed response arrangement; • confirmation of providing access to relevant monitoring and evaluation reports when available; and • contact details for the response coordinator.	
Vessel strike with cetacean	Within 72 hours	• DotEE - online National Ship Strike Database https://data.marinemammals.gov.au/report/shipstrike	Vessel Master / Drilling HSE Advisor (Office)
	ASAP for cetacean injury assistance	• Department of Environment, Land, Water and Planning (Whale and Dolphin Emergency Hotline) - 1300 136 017 • Seals, Penguins or Marine Turtles 136 186 (Mon-Fri 8am to 6pm) or AGL Marine Response Unit 1300 245 678.	Vessel Master / Drilling HSE Advisor (Office)
Injury to or death of EPBC Act-listed species	Within seven days	• DotEE - 1800 803 772 • EPBC.Permits@environment.gov.au	Drilling HSE Advisor (Office)
Suspected or confirmed Invasive Marine Species introduction	Verbal notification ASAP	• Department of Environment, Land, Water and Planning - 136 186	Drilling HSE Advisor (Office)
Identification of any historic shipwrecks, aircraft or relics	Written notification within 1 week	• Written notification via the notification of discovery of an historic shipwreck or relic online submission form.	Drilling HSE Advisor (Office)

8.10 Performance Measurement and Reporting (HSEMS Standard 9)

The performance measurement and reporting standard specifies that HSE performance data is collected, analysed and reported to monitor and evaluate ongoing HSE performance and drive continual improvement.

8.10.1 Annual Performance Report

In accordance with the OPGGS(E)R Regulation 14(2), Beach will submit a report on the environmental performance of the activity to NOPSEMA. Performance will be measured against the EPOs and EPSs described in this EP. The report will be submitted not more than three months after the anniversary date of the EP acceptance by NOPSEMA. The interval between reports will not be more than one year.

8.10.2 Emissions and Discharge Records

In accordance with the OPGGS(E)R Regulation 14(7) emissions and discharges shall be recorded for the duration of the activity. Table 8-4 details the types of emissions and discharges that shall be recorded including the monitoring method and frequency of reporting.

Table 8-4: Emissions and discharges monitoring requirements

Emission / Discharge	Monitoring Parameter	Monitoring Method	Reporting Frequency	Responsibility
Fuel - vessel	Volume used	Daily report	Monthly	Vessel Operator
Fuel - MODU	Volume used	Daily report	Monthly	Drilling Contractor
Bilge	Volume discharged	Daily report	Monthly	Drilling Contractor
Sewage	Volume discharged	Daily report	Monthly	Drilling Contractor
Putrescible food	Volume discharged	Daily report	Monthly	Drilling Contractor
Hydraulic control fluids	Chemical name Volume discharged	Daily report	Monthly	Drilling Contractor
Drill fluids and cuttings	Chemical name Chemical quantity Fluid type Fluid volume % ROC	Daily report	Monthly	Drill fluid Service Provider
Cement	Chemical name Chemical quantity	Daily report	Monthly	Cementing Service Provider
Spills to sea	Chemical / hydrocarbon type Volume discharged		As occurs	Drilling Contractor / Vessel Master

8.11 Operational Control (HSEMS Standard 10)

The intent of this standard is that all activities that have the potential to cause harm to the health and safety of people or the environment are carried out in accordance with plans and procedures to ensure safe work practices.

Whilst Lattice remains the Titleholder undertaking the petroleum activity, Diamond Offshore maintain operational control of the Ocean Onyx MODU in accordance with the requirements of the MODU-specific Safety Case as accepted by NOPSEMA and the Diamond Offshore Global Excellence Management System (GEMS).

The activity will be carried out in accordance with the implementation strategy (Section 8) and the EPOs and EPSs detailed in Section 7.8.

8.12 Management of Change (HSEMS Standard 11)

This standard requires that all temporary and permanent changes to the organisation, personnel, systems, critical 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 is in accordance with the Management of Change (MOC) Directive 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, 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 critical documented procedures where there is an HSE impact, regulatory documents and organisational changes that impact personnel in safety critical roles.

Not all changes will require a MoC. Each change will be assessed on a case by case basis. The potential environmental impacts will be reviewed by the Environment Manager to see if they warrant a full MoC process. This review will be documented and recorded. It will either for part of the MoC or will document why and MoC was not consider appropriate for managing the environmental risk.

Where risk and hazard review processes as nominated in Section 8.8 identify a change in hazards, controls, or risk (See Section 7) and triggers a regulator requirement to revise this EP, the revision shall be defined, endorsed, completed and communicated in accordance with the Management of Change Directive.

8.13 Facilities Design, Construction, Commissioning and Decommissioning (HSEMS Standard 12)

The intent of this standard is to ensure that the assessment and management of HSE risks is an integral part of project design, construction and commissioning to enable sound HSE performance throughout the construction and operational life of the facility. Decommissioning plans were not developed for this project due to the limited scope (one exploration well). The well head will either be removed (decommissioned) or left suspended for future use. This forms part of the 'facility' design and construction.

Section 6 details the assessment and management of environmental impacts and risks for the activity and Section 7 details how the activity will be managed to ensure that the impacts and risks are ALARP and an acceptable level.

8.14 Contractors, Suppliers, Partners and Visitors (HSEMS Standard 13)

The intent of this standard is that contractors, suppliers and partners are assessed for their capabilities and competencies to perform work on behalf of Beach, and to ensure their HSE performance is aligned with these Standards.

Section 8.23.1 details how the contractors will be assessed to ensure they have the capabilities and competencies to implement the control measures identified in Section 7.

All suppliers go through a detailed procurement process to ensure that they are capable of meeting the requirements of this project. This includes a review of their HSE performance.

8.15 Crisis and Emergency Management (HSEMS Standard 14)

The intent of the crisis and emergency response management standard is to ensure that plans, procedures and resources are in place to effectively respond to crisis and emergency situations, to protect the workforce, the environment, the public and customers, and to preserve the company's assets and reputation.

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 8-2. The responsibilities of the Emergency Response Team (ERT), Emergency Management Team (EMT), Wells Emergency Team (WET) and Crisis Management Team (CMT) are outlined in Table 8-5.

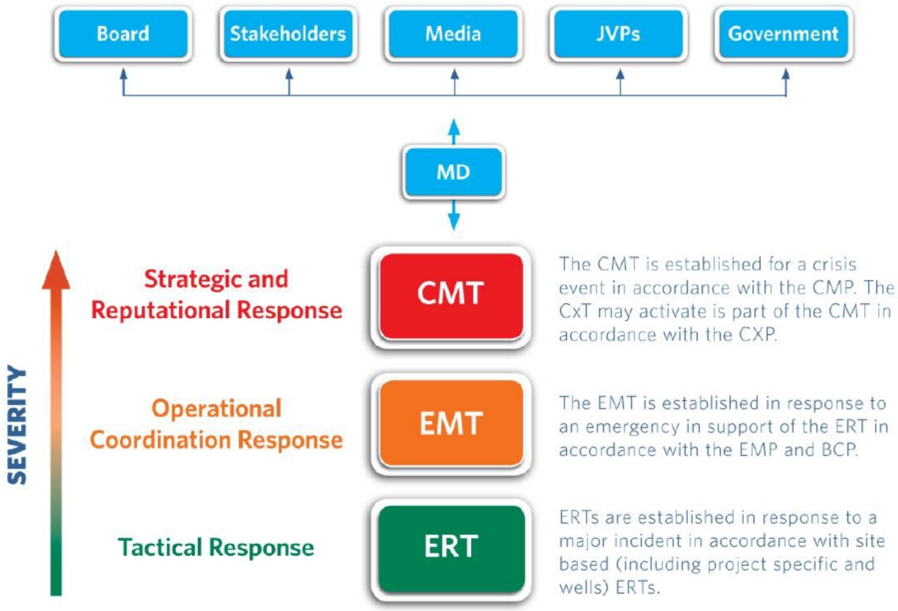


Figure 8-2: Beach Crisis and Emergency Management Framework

Table 8-5: Responsibilities of the Beach CMT, EMT, WET & ERT

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 Crisis Communication Team if required.
EMT	Adelaide, Melbourne	• 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 site-specific Emergency Response Plan. • Regulatory reporting.

Team	Base	Responsibilities
WET	Adelaide	• The WET interface with the MODU and implement Beach source control procedures in the event of a LOWC
ERT	Site	• Respond to the emergency in accordance with the site-specific ERP. • In the event of an emergency at Wells/Drilling site, the ERP of the Drilling Contractor is activated along-side that of the Beach Well Control Bridging document

8.16 Oil Pollution Emergency Plan

Oil spill response arrangements associated with this drilling activity are detailed within the Offshore Victoria – Otway Basin Oil Pollution Emergency Plan (OPEP) (CDN/ID S4100AH717907) (Appendix E).

8.16.1 Operational and Scientific Monitoring Plan

Operational and scientific monitoring arrangement associated with this drilling activity are detailed within the Offshore Victoria Operational and Scientific Monitoring Plan (OSMP) (CDN/ID S4100AH717908) (Appendix F).

Table 8-6 and Table 8-7 detail particular values and sensitivities that may require monitoring in the event of a worst-case discharge based upon conservative (low exposure) in-water thresholds, specifically: Australian Marine Parks (AMP), Marine National Parks (MNP), Marine Parks (MP), and RAMSAR wetlands. These identified values and sensitivities are not exhaustive, as other receptors may also require monitoring in the event of a L2 or L3 hydrocarbon spill but provide an indication of the potential extent of hydrocarbon contact to formally managed areas.

Table 8-6: Environment potentially exposure to low in-water thresholds – diesel release

		Summer				Winter			
		Probability (%) of instantaneous dissolved >6ppb	Maximum instantaneous dissolved hydrocarbon exposure (ppb)	Probability (%) of instantaneous entrained >10ppb	Maximum instantaneous entrained (ppb)	Probability (%) of instantaneous dissolved >6ppb	Maximum instantaneous dissolved hydrocarbon exposure (ppb)	Probability (%) of instantaneous entrained >10ppb	Maximum instantaneous entrained (ppb)
Receptor Type	**Receptor Name**								
AMP	Apollo	3	22	25	406	5	24	54	501
	Beagle	-	-	-	-	-	-	2	11
MNP	Discovery Bay	-	-	3	25	-	-	-	-
	Point Addis	-	-	-	-	-	-	2	17
	Port Philip Heads	-	-	-	-	-	-	4	19
	Twelve Apostles	-	-	26	278	-	-	15	283
	Wilsons Promontory	-	-	-	-	-	-	3	16
MP	Lower South East	-	-	2	22	-	-	-	-
RAMSAR	Port Philip Bay and Bellarine Peninsula	-	-	-	-	-	-	1	10

Table 8-7: Environment potentially exposure to low in-water thresholds – condensate release

		Summer				Winter			
		Probability (%) of instantaneous dissolved >6ppb	Maximum instantaneous dissolved hydrocarbon exposure (ppb)	Probability (%) of instantaneous entrained >10ppb	Maximum instantaneous entrained (ppb)	Probability (%) of instantaneous dissolved >6ppb	Maximum instantaneous dissolved hydrocarbon exposure (ppb)	Probability (%) of instantaneous entrained >10ppb	Maximum instantaneous entrained (ppb)
Receptor Type	**Receptor Name**								
AMP	Apollo	98	225	98	255	100	237	100	225
	Beagle	2	10	14	15	13	37	40	24
	Murray	-	-	1	10	-	-	-	-
	Nelson	3	18	-	-	-	-	-	-
	Zeehan	4	23	8	14	-	-	-	-
MNP	Bunurong	1	7	19	14	10	34	29	15
	Cape Howe	-	-	-	-	-	-	11	14
	Churhill Island	2	7	12	13	1	8	16	16
	Discovery Bay	15	41	20	17	-	-		
	Point Addis	14	34	49	41	41	51	72	38
	Port Philip Heads	7	21	49	35	8	15	59	30
	Twelve Apostles	99	217	100	302	100	155	100	230
	Wilsons Promontory	4	13	22	26	23	66	74	84
MP	Batemans	-	-	-	-	-	-	8	12
	Lower South East	3	16	16	13	-	-	-	-

		Summer				Winter			
		Probability (%) of instantaneous dissolved >6ppb	**Maximum instantaneous dissolved hydrocarbon exposure (ppb)**	**Probability (%) of instantaneous entrained >10ppb**	**Maximum instantaneous entrained (ppb)**	**Probability (%) of instantaneous dissolved >6ppb**	**Maximum instantaneous dissolved hydrocarbon exposure (ppb)**	**Probability (%) of instantaneous entrained >10ppb**	**Maximum instantaneous entrained (ppb)**
Receptor Type	**Receptor Name**								
RAMSAR	Corner Inlet	-	-	2	11			10	12
	Port Philip Bay and Bellarine Peninsula	4	31	39	25	2	14	27	23
	Western Port	2	12	19	24	2	22	30	21

8.16.2 Testing of spill response arrangements

In accordance with Regulation 14(8A)(8C) of the OPGGS(E)R and HSEMS Standard 16: Crisis and Emergency Preparedness and Response, the response arrangements will be tested:

- when they are introduced;
- when they are significantly amended; and
- not later than 12 months after the most recent test.;

Prior to commencing drilling activities, spill response arrangements applicable to a LOWC scenario will be tested as per Table 17 of the OPEP. The outcomes of the test will be documented to assess the effectiveness of the exercise against its objectives and to record any lessons and actions. Any actions will be recorded and tracked to completion.

8.17 Plant and Equipment (HSEMS Standard 15)

The intent of this performance standard is that Beach's facilities, plant, equipment, machinery and tools are purchased, designed, constructed, commissioned, operated, maintained, modified and decommissioned in a manner that ensures HSE risks are effectively managed.

Plant and equipment that have been identified as a control measure for the purposed of managing potential environmental impacts and risks from the activity have an associated environmental performance standard that details the performance required of the plant and/or equipment as detailed in Section 7.8.

8.18 Monitoring the Working Environment (HSEMS Standard 16)

The intent of this performance standard is that HSE risks to personnel associated within the working environment are eliminated or reduced to ALARP.

8.19 Health and Fitness for Work (HSEMS Standard 17)

Beach encourages a healthy lifestyle for its employees and provides formal programs to promote health and fitness.

8.20 Environment Effects and Management (HSEMS Standard 18)

The intent of this performance standard is that potential adverse environmental effects resulting from Beach's operations and activities are identified, assessed and monitored and as far as is reasonably practicable, eliminated or minimised.

Section 7 details the assessment undertaken of the activity to identify and assess potential impacts and risks and apply control measure to manages the impacts and risk to ALARP and an acceptable level.

8.21 Hazardous Materials Assessment Process

The Hazardous Materials and Secondary Containment Directive detail the process for the assessing and approving hazardous materials such as chemicals that are used on Beach sites or activities. The Directive requires that where a hazardous material will or may be discharged offshore a risk assessment is required. The risk assessment is documented using the Hazardous Material Risk Assessment Form

Figure 8-3 provides a summary of the Beach offshore chemical environmental risk assessment process. The risk assessment process considers aquatic toxicity, bioaccumulation and persistence data, along with the discharge concentration, duration, frequency, rate, and volume. The assessed level of risk determines the acceptance authority (in accordance with the Risk Management Plan) for approving the material for use. Approval is recorded on the Hazardous Material Risk Assessment Form.

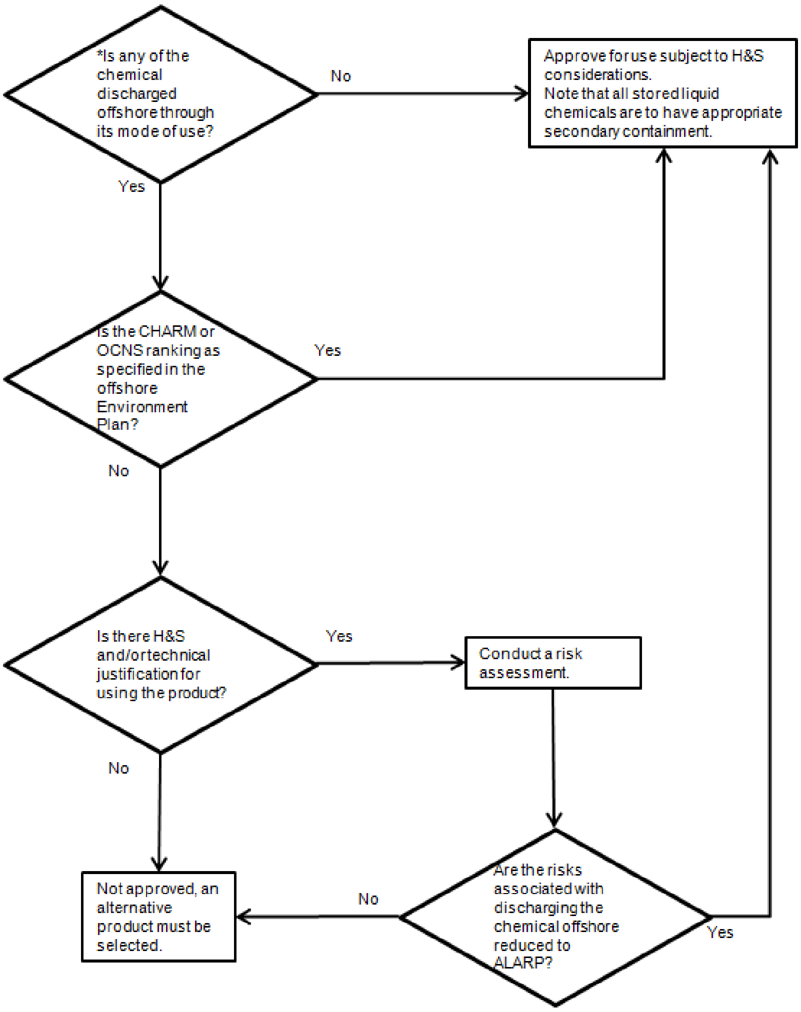


Figure 8-3: Beach offshore chemical environmental risk assessment process summary

8.21.1 Assessment of offshore drilling chemicals in alignment with OCNS and IFC recommendations

In terms of approving hazardous materials for use offshore, the procedure refers to the Offshore Chemical Notification Scheme (OCNS).

All production and drilling chemicals or products used in the North Sea offshore oil industry are evaluated under the requirements of international legislation established by the Oslo Paris (OSPAR) Convention 1992, in order to monitor their environmental impact. Under this Convention, organic-based compounds used in production and workovers are subject to the Chemical Hazard Assessment and Risk Management (CHARM) model which calculates the ratio of the Predicted Effect Concentration against the No Effect Concentration. This is expressed as a Hazard Quotient (HQ) and associated with a colour to rank the product and the level of hazard.

These results are then published on the Definitive Ranked Lists of Approved Products by the OCNS. The OCNS manages chemical use and discharge by the UK and Netherlands offshore petroleum industries. The scheme is regulated in the UK by the Department of Energy and Climate Change using scientific and environmental advice from CEFAS (the UK's Centre for Environment, Fisheries and Aquaculture Science) and Marine Scotland. In the absence of a similar system in Australia, the OCNS is utilised by Lattice to review the environmental acceptability of chemicals at Otway facilities as part of their chemical approval process as set out below.

The CHARM model requires biodegradation, bioaccumulation and toxicity of a product to be calculated. Testing is carried out on the effect of the product on three different species of aquatic organism: algae, crustaceans and fish.

Table 8-8: The OCNS CHARM Hazard Quotient and colour bands

Minimum HQ Value	Maximum HQ Value	Colour Banding	Hazard
>0	<1	**Gold**	Lowest Hazard
≥1	<30	**Silver**	
≥30	<100	**White**	
≥100	<300	**Blue**	
≥300	<1000	**Orange**	
≥1000		**Purple**	Highest Hazard

Products not applicable to the CHARM model (i.e., inorganic substances, hydraulic fluids or chemicals used only in pipelines) are assigned an OCNS grouping A – E, with 'A' being the greatest potential environmental hazard and 'E' being the least. Products that only contain substances termed PLONORs (Pose Little or No Risk) are given the OCNS 'E' grouping. Data used for the assessment includes toxicity, biodegradation and bioaccumulation.

Table 8-9: The OCNS Non-CHARM environmental ranking system for inorganic substances

OCNS Grouping	Results for Aquatic Toxicity (mg/L)	Results for Sediment Toxicity (mg/L)
A	<1	<10
B	>1-10	>10-100
C	>10-100	>100-1000
D	>100-1000	>1000-10000
E	>1000	>10000

OCNS incorporates "operational" chemicals/products which, through their mode of use, are expected in some proportion to be discharged. The scheme does not apply to chemicals that might otherwise be used on a ship, helicopter or other offshore structure. Products used solely within domestic accommodation areas - such as additives to potable water systems, paints and other coatings, fuels, lubricants, fire-fighting foams, hydraulic fluids used in cranes and other machinery - are also exempt.

The Hazardous Material Risk Assessment Form is used to ensure that the impacts and risks associated with offshore discharge are reduced to ALARP. The form includes a flow chart to assist in determining whether an environmental risk assessment is required to approve the material for use and discharge offshore.

The risk assessment process considers aquatic toxicity, bioaccumulation and persistence data, along with the discharge concentration, duration, frequency, rate, and volume. Approval is recorded in the Hazardous Materials Register – Offshore Drilling.

Beach also apply the following recommendation derived from the Environmental, Health, and Safety Guidelines for Offshore Oil and Gas Development (IFC, June 5, 2015):

- Drilling fluids to be discharged to sea (including as residual material on drilled cuttings) are subject to tests for toxicity, barite contamination, and oil content. Barite contamination by mercury (Hg) and cadmium (Cd) must be checked to ensure compliance with the discharge limits provided in Table 8-10. Suppliers should be asked to guarantee that barite quality meets this standard with pre-treatment, if necessary.

Table 8-10: Drill fluid and cuttings parameters (IFC, June, 2015)

Parameter	Guideline
Drill Fluids and Cuttings – WBDF & NADF	• Hg: max 1 mg/kg dry weight in stock barite; and • Cd: max 3 mg/kg dry weight in stock barite

- The following additional principles should be followed for the management of hazardous materials offshore:
  - Use chemical hazard assessment and risk management techniques to evaluate chemicals and their effects;
  - Select only those chemicals that have been previously tested for environmental hazards;
  - Select chemicals based on the OSPAR Harmonised Offshore Chemical Notification Format or similar internationally recognized system;
  - Select chemicals with the least hazard and lowest potential environmental and health risks, whenever possible;
  - Avoid chemicals suspected to cause taint or known endocrine disruptors; and
  - Avoid chemicals known to contain heavy metals of concern, in anything other than trace quantities

8.21.2 Drilling chemicals acceptance criteria

The following acceptance criteria shall be applied to all drilling chemicals:

- CHARM Gold or Silver or OCNS Category E (PLONAR) or D rated chemicals are acceptable for use
- Any rated or non-rated chemicals shall be risk assessed and those deemed 'Persistent', 'Bioaccumulative', and 'Toxic' (or 'very persistent' or 'very bioaccumulative') shall be deemed unacceptable for use, irrespective of concentration or proposed application volume.
- Any proposed chemical that is not listed on the listed on the Australian Inventory of Chemical Substances (AICS) under the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) shall be deemed unacceptable for use, irrespective of concentration or proposed application volume.
- Beach shall monitor the Centre for Environment, Fisheries and Aquaculture Science (Cefas) substation warning register to identify chemicals which are hazardous to the marine environment are subject to substitution warnings under the Harmonised Mandatory Control Scheme (HMCS). Chemicals identified for substitution shall be eliminated from the supply chain and remaining stock is exhausted.

- Stock barite shall have heavy metal concentrations no greater than:
  - Mercury – maximum 1 mg/kg dry weight in stock barite;
  - Cadmium – maximum 3 mg/kg dry weight in stock barite; and
  - Lead – maximum 1000 mg/kg dry weight in stock barite.

8.22 Product Stewardship, Conservation and Waste Management (HSEMS Standard 19)

This standard requires that the lifecycle HSE impacts of Beach's products and services are assessed and communicated to customers and users to enable responsible usage management. Consumption of resources and materials is minimised as far as reasonably practicable. Wastes are eliminated, reduced, recycled and/or reused as far as reasonably practicable or disposed of appropriately.

General and hazardous waste streams generated during the activity are backloaded to port for disposal to a licenced waste facility by a licenced waste handling contractor. Wastewater and putrescible wastes are managed as per MARPOL requirements as detailed in Section 7.

8.23 Audits, Assessments and Review (HSEMS Standard 20)

The audits, assessment and review standard is in place to ensure that HSE performance and systems are monitored and assessed through periodic reports and audits to identify trends, measure progress, assess conformance and drive continual improvement. Management system reviews are conducted to ensure the continuing suitability, adequacy and effectiveness of the HSEMS.

8.23.1 Audits and assessments

Environmental performance will be reviewed in several ways to ensure:

- EPSs to achieve the EPOs are being implemented and reviewed.
- Potential non-compliances and opportunities for continuous improvement are identified.
- Environmental monitoring and reporting requirements have been met.

An audit will be undertaken of the EPOs and EPSs in this EP and the requirements detailed in the implementation strategy. The audit will inform the annual performance report submitted to the relevant regulator as per Section 8.10.1.

For offshore activities undertaken by the vessel the following will be undertaken:

- Premobilisation inspection (desktop or site) to confirm the requirements of the EP will be met.

For offshore activities undertaken by the MODU the following will be undertaken:

- Weekly offshore inspections throughout the activity to ensure ongoing compliance with relevant EP requirements. Inspection will include, but not be limited to:
  - Spill preparedness such as spill kit checks;
  - Waste management;
  - Review of any new or changed chemicals that maybe discharged offshore; and
  - Compliance with procedural controls relevant to environmental management of the MODU and drilling activity such as: bunkering and drill fluids and cuttings management.

Non-compliances and opportunities for improvements identified via audits, inspections or other means are communicated to the appropriate supervisor and/or manager to report and action in a timely manner. Tracking of non-compliances and audit actions will be undertaken using Beach's incident management system which includes assigning a responsible person for ensuring the action is addressed and closed out.

Non-compliances are communicated via the daily report and pre-start meetings.

8.23.2 Environment Plan review

Beach may determine that a review of the EP is required when one or more of the following occurs:

- Changes to hazards and/or controls identified during the activity.
- Annual environmental performance reporting identifies issues in the EP that require review and/or updating.
- Implementation of corrective actions to address internal audits findings or external inspection recommendations.
- An environmental incident and subsequent investigation identify 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 to risk and controls identified through the Risk Management Processes as per Section 8.8.
- New information or changes in information from research, stakeholders, legal and other requirements, and any other sources used to inform the EP.

Where the EP is revised the changes are to be logged in the EP Revision Change Register in Appendix G. Any revisions to the EP are to be assessed against the criteria for submission of a revised EP to NOPSEMA as detailed in Table 8-11 and Management of Change as per Section 8.12 shall be evaluated.

8.23.3 Environment Plan revision

In accordance with Regulation 17 of the OPGGS(E)R, a revision of this EP shall be submitted to NOPSEMA as per the regulatory requirements in Table 8-11.

Table 8-11: Regulatory requirements for submission of a revised EP

OPGGS(E)R	EP Revision Submission Requirements
17(1)	With the regulator's approval before the commencement of a new activity
17(5)	Before the commencement of any significant modification or new stage of the activity that is not provided for in the EP as currently in force.
17(6)	Before, or as soon as practicable after, the occurrence of any significant new or significant increase in environmental impact or risk; or The occurrence of a series of new or a series of increases in existing environmental impacts or risks which, taken together, amount to the occurrence of a significant new or significant increase in environmental impact or risk.
17(7)	A change in titleholder that results in a change in the manner in which the environmental impacts and risks of an activity are managed.

9 Stakeholder Consultation

Stakeholder consultation was undertaken in line with current NOPSEMA guidelines on consultation requirements under the OPGGS(E)R.

Beach is committed to open, on-going and effective engagement with the communities in which it operates and providing information that is clear, relevant and easily understandable. Beach welcomes feedback and is continuously endeavouring to learn from experience in order to manage our risks.

9.1 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 as:

a) each Department or agency of the Commonwealth to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant;

b) each Department or agency of a State or the Northern Territory to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant;

c) the Department of the responsible State Minister, or the responsible Northern Territory Minister;

d) a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan;

e) any other person or organisation that the titleholder considers relevant.

Regulation 14(9) of the OPGGS(E)R also defines a requirement for ongoing consultation to be incorporated into the Implementation Strategy. In addition, Regulation 16(b) of the OPGGS(E)R requires that the EP contain a summary and full text of this consultation. It should be noted that the full text is not made publicly available for privacy reasons.

9.2 Stakeholder Consultation Objectives

The objectives of Beach's stakeholder consultation in preparation of the EP were to:

- Identify all relevant persons for stakeholder consultation.
- Engage with stakeholders and the community in an open, transparent, timely and responsive manner.
- Minimise community and stakeholders concern where practicable.
- Build and maintain trust with stakeholders and the local community.
- Demonstrate that stakeholders have been consulted in line with the requirements of the relevant regulations.

The objectives were achieved by:

- Identifying stakeholders whose functions, interests or activities may be affected by the activity.

- Confirming, through consultation, 'relevant persons' (stakeholders) and engaging them at the earliest opportunity.
- Providing sufficient information to allow relevant persons to make an informed assessment of the possible consequences of the activity on their functions, interests or activities.
- Ensuring relevant persons are informed about the process for consultation and their feedback is considered in the development of the EP.
- Ensuring that issues raised by relevant persons are adequately assessed, and where requested or relevant, responses to feedback are communicated back to them.
- Ensuring that relevant person sensitive information is not made publicly available.

9.3 Consultation approach

The approach Beach undertook for the activities was:

- Identify stakeholders that may be potentially affect by the activities by reviewing its stakeholder database and consulting with existing stakeholders to identify other relevant stakeholders. As Beach, through its subsidiary Lattice Energy, has operated in the area since the early 2000s, an extensive database of stakeholders has been built, and engagement has been undertaken in relation to both the current Operating assets and in executing projects such as the Enterprise 3D Transition Zone Marine Seismic survey in 2017 and the Crowes Foot Marine Seismic Survey in 2016.
- Determine the possible consequences of the activities on each stakeholders' functions, interests or activities from previous knowledge, reviewing any public statements by the stakeholder as to how they want to be engaged by oil and gas companies and/or consulting with stakeholders.
- Provide sufficient information, based on possible consequences and the way they would like to be consulted, for the stakeholder to be able to make an informed assessment of the possible consequences of the activity on their functions, interests or activities.
- Allow a reasonable period of time for the stakeholder to review and respond to any information provided, typically two to four weeks.
- Provide further information requested by the stakeholder or that became available during the consultation period and allowed a reasonable time for the stakeholder to review and respond. Depending on the information provided this was between one to four weeks.
- Ensure relevant stakeholders were informed about the consultation process and how their feedback, questions and concerns were considered in the EP.

9.3.1 Fishery specific consultation approach

From reviewing the existing environment, the main stakeholder group for the activity is commercial fishers. Beach, through its subsidiary Lattice Energy, has a substantial history of engagement with local fisheries. For the drilling activity the consultation strategy for potentially impacted fishers is as follows:

- Engage with Seafood Industry Victoria (SIV) to identify how best to consult with commercial fishers.
- Provide a short information sheet to SIV to mail to their members, including groups such as Victorian Rock Lobster Association and Port Campbell Professional Fishers association. The cover letter requested that fishers identify themselves to SIV if they thought they could be impacted by Beach's activities. The information sheet covered both seabed assessment and drilling programs and a more detailed version was published on Beach's website at https://www.beachenergy.com.au/vic-otway-basin/.
- The mailout was issued on 29 March, with a request that fishers respond by 19 April. To date four fishers have contacted SIV in relation to the Beach activities information.
- Beach also provided information to fishery groups and has been contacted directly by two fishers.
- Where fishers have identified that they may be potentially impacted by the activity the following is undertaken:

- For fishers who have contacted SIV, Beach will meet with SIV to gather information about the fishers fishing patterns and locations and to establish contact for ongoing consultation throughout the project.
- For fishers who have contacted Beach directly, Beach engaged its Fisheries Liaison Officer to meet with them and gather information about their fishing patterns and locations and to establish contact for ongoing consultation throughout the project.
- Where fishers are providing Beach with sensitive fishing data Beach will provide them Beach's privacy policy and obligations.

- Once the drilling schedule and final well location are confirmed (minimum of 4 weeks prior to commencement of the activity) it will be provided to fishers who have identified they fish in the area, SIV, VFA and other relevant fishing groups who have requested further information.
- Beach is conscious that the duration of drilling may change slightly (subject to operations), and these will be assessed by Beach to determine if they would materially change the information provided to fishers to identify if they would be potentially impacted by the activity. If there is no material change, in order to minimise confusion for fishers and the time required for engagement, Beach will inform relevant stakeholders of any changes a minimum will be 4 weeks prior to the commencement of the activity. If the changes are material, then updated information will be provided to relevant stakeholders.
- Beach will seek permission from the identified fishers to include them in their SMS messaging system. Once the activity commences, Beach will provide regular (most likely weekly) updates on the location of the MODU, progress of the drilling activity and the expected duration so fishers can plan their fishing activities with the least disruption.
- Beach's position is that the commercial fisheries cover a vast area and the drilling activity only requires access to a relatively small area (500m rig safety zone and 2 km cautionary zone) over a short period of time and so we aim to minimise impact to each other's activities. However, Beach has a stated position that fishers should not suffer an economic loss as a result of our activities. Should a fisher incur additional costs in order to work around our activities, or if they have lost catch or have damaged equipment Beach will assess the claim and ask for evidence of past fishing history and the loss incurred and, where the claim is genuine, will provide compensation. Beach will also ensure that the evidence required is not burdensome on the fisher while ensuring genuine claims are processed.

9.4 Stakeholder identification

Relevant stakeholders were identified by reviewing:

- Social receptors identified in the existing environment section.
- Existing stakeholders within Beach's stakeholder register.
- Reviewing consultation record for previous Otway Basin activities undertaken by Beach and Lattice.
- Commonwealth and State fisheries jurisdictions and fishing effort in the region.
- The Australian Government Guidance Offshore Petroleum and Greenhouse Gas Activities: Consultation with Australian Government agencies with responsibilities in the Commonwealth Marine Area.

The Otway Development commenced production in late February 2008. Woodside Energy, the titleholder at the time, undertook significant consultation with the community, non-government organisations and Government departments. Consultation has been ongoing through the change of titleholders to Origin and then Lattice.

Lattice has also undertaken three marine seismic surveys between 2014 and early 2017 and has had regular and detailed engagement with both fishing industry associations and individual fishers over this period. In 2017 Lattice commenced consultation in relation to the Otway Development Phase 4 and associated seabed assessment and drilling activities. Beach then commenced consultation with stakeholders in early 2019 when they decided to progress with the Otway

Development Phase 4. Consequently, Beach consider that they have effectively identified relevant stakeholders and have a good understanding of issues and areas of concern within the Otway Development area.

Table 9-1 details the relevant stakeholders identified and groups them by the categories listed under OPGGS(E)R Regulation 11A. It should be noted that no fishing effort by Tasmanian fisheries was identified within the operational area.

9.5 Provisions of Information

The OPGGS(E)R require titleholders to give each relevant person sufficient information to allow the relevant person to make an informed assessment of the possible consequences of the activity on the functions, interests or activities of the relevant person.

To determine the type of information to provide to a stakeholder an Information Category was developed and is detailed in Table 9-2.

Information has also been provided in relation to the broader Beach Otway Offshore Gas Development which included information on the activity via:

- Community Information Session held in Port Campbell on 13 February 2019.
- Information sheets and information available on the Beach website: https://www.beachenergy.com.au/our-communities/.

9.6 Summary of Stakeholder Consultation

Table 9-4 provides a summary of the stakeholder consultation undertaken as part of the development of the EP. The summary provides details of the information sent to stakeholders and any response received. It also details the assessment undertaken of any objection or claims. Where an objection or claim was substantiated via evidence such as publicly available credible information and/or scientific or fishing data, this were assessed as per the risk assessment process detail in Section 6 and controls applied where appropriate to ensure impacts and risks are managed to ALARP and an acceptable level.

To date, there have been no objections or claims made by any relevant Stakeholders during consultation. Should any objections or claims be made by relevant stakeholders during this activity, stakeholders shall be provided with feedback as to whether their objection or claim was substantiated, and if not why not, and if it was substantiated how it was assessed and if any additional controls were required to manage the impact or risk to ALARP and an acceptable level. The sections of the EP where any information provided or where any objections or claims has been incorporated shall be provided to the stakeholder for information.

Table 9-1: Relevant stakeholders for the activity (refer to Table 9-2 for information category definition)

Stakeholder	Relevance	Information Category
Department or agency of the Commonwealth to which the activities to be carried out under the EP may be relevant		
Australian Fisheries Management Authority (AFMA)	Australian Government agency responsible for the efficient management and sustainable use of Commonwealth fish resources. Activity is within a Commonwealth fishery area. AFMA expects petroleum operators to consult directly with fishing operators or via their fishing association body about all activities and projects which may affect day to day fishing activities.	1

Stakeholder	Relevance	Information Category
Australian Hydrological Office (AHO)	Australian Government agency responsible for issuing notices to mariners.	2
AMSA JRCC	Australian Government agency responsible for maritime safety, adherence to advice, protocols, regulations. Issue Auscoast warnings	2
Each Department or agency of a State or the Northern Territory to which the activities to be carried out under the EP may be relevant		
DJPR – Victorian Fishery Authority	Activity is within a Victorian fishery area or will impact or potentially impact a Victorian fishery area or resource.	1
The Department of the Responsible State or Northern Territory Minister		
Tasmanian DPIPWE	Regulatory body for oil and gas activities in Tasmanian waters. Required to be notified of reportable incidents. Commencement and cessation notifications are only required for drilling and seismic surveys.	2
DJPR - Earth Resources Regulation	Regulatory body for oil and gas activities in Victorian waters. Required to be notified of reportable incidents. Commencement and cessation notifications are only required for drilling and seismic surveys.	2
A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP		
Commonwealth Fisheries Association	Peak association representing commercial fishing in Commonwealth fisheries. Industry Association for the following Commonwealth fisheries that have catch effort within the operational area: • SESSF (Commonwealth South East Trawl Sector, Scalefish Hook Sector and the Shark Hook and Shark Gillnet Sectors). • Southern Squid Jig Fishery.	1
Port Campbell Professional Fisherman's Association	Association representing Port Campbell fishers, primarily rock lobster around Port Campbell and Peterborough. Engagement via SIV see Consultation Record #SIV 07.	1
Portland Professional Fishermen's Association	Association representing Portland fishermen.	1
South East Trawl Fishing Industry Association (SETFIA)	SETFIA represents businesses with a commercial interest in the SETF and the East Coast Deepwater Trawl Sector. SETFIA represent the following fisheries that have catch effort within the operational area: • SESSF (Commonwealth South East Trawl Sector, Scalefish Hook Sector and the Shark Hook and Shark Gillnet Sectors).	1
Seafood Industries Victoria (SIV)	Peak body representing professional fishing, seafood processors and exporters in Victoria. SIV primary contact for State fishers. SETFIA represent the following fisheries that have catch effort within the operational area: • SESSF (Commonwealth South East Trawl Sector, Scalefish Hook Sector and the Shark Hook and Shark Gillnet Sectors).	1
Southern Rock Lobster Limited South Australian Rock Lobster Advisory Council Inc. South Eastern Professional Fishermen's Association Inc.	Associations representing state-based commercial rock lobster fishers. Associations are represented by one consultancy and are therefore grouped.	1

Stakeholder	Relevance	Information Category
Tasmanian Rock Lobster Fishermen's Association		
Victorian Rock Lobster Association (VRLA)	VRLA represents Victorian rock lobster licence holders. Engagement via SIV see Consultation Record #SIV 07.	1
Warrnambool Professional Fishermen's Association	Association represents Warrnambool fishermen, primarily rock lobster on strip from Warrnambool to Port Campbell. Engagement via SIV see Consultation Record #SIV 07.	1
Any other person or organisation that the titleholder considers relevant		
Otway Gas Plant Community Reference Group	Community Reference Group established for the Otway Gas Plant. No impact to stakeholders' functions, interests or activities due to distance offshore. However, Beach maintain engagement in relation to activities within the Otway area.	3
Tasmanian Rock Lobster Fisherman's Association	The Tasmanian Rock Lobster Fishermen's Association is the peak commercial fishing body recognised under the Act for the rock lobster fishery. The Development Area does not overlap any Tasmanian rock lobster fishery where there is catch effort. However, Beach maintain engagement in relation to activities within the Otway area.	3
Tasmanian Seafood Industry Council (TSIC)	The TSIC is the peak body representing the interests of wild capture fishers, marine farmers and seafood processors in Tasmania. The Development Area does not overlap any Tasmanian fisheries where there is catch effort. However, Beach maintain engagement in relation to activities within the Otway area.	3

Table 9-2: Information category to determine information provided stakeholder

Information Category	Description	Information Type
1	Organisations or individuals whose functions, interests or activities may be impacted by the activity. Representative body for fishers who provide information to their members.	Information Sheet and/or provision of information as per organisations consultation guidance Provision of further information where required Meeting or phone call where required
2	Organisation who receive activity commencement and cessation notices.	Commencement and cessation notices.
3	Organisations or individuals whose functions, interests or activities will not be impacted by the activity but are kept up to date with Beach's activities in the Otway area.	Information Sheet

9.7 Ongoing Stakeholder Consultation

As the drilling activity will be undertaken over multiple weeks and successive months Beach will continue to consult with stakeholders to keep them informed of the final drilling schedule and well location coordinates as information becomes available. This will be done via ongoing consultation including commencement and cessation notifications and updates in relation to the drilling activity and broader Otway Offshore Gas Development project via one-on-one communications, mail outs and provision of information on the Beach website. Beach will use a message media system to provide weekly information on the drilling activity to stakeholders that have requested this service.

Table 9-4 details the ongoing stakeholder consultation requirements. Records of ongoing stakeholder engagement will be maintained as per Section 8.5.2 Records Management.

9.8 Ongoing Identification of Relevant Persons

New or changes to relevant persons will be identified through ongoing consultation with stakeholders including peak industry bodies. Should new relevant persons be identified they will be contacted and provided information about the activity relevant to their functions, interests or activities. If any objections or claims are raised these will be substantiated via evidence such as publicly available credible information and/or scientific or fishing data. Where the objection or claim is substantiated it will be assessed as per the risk assessment process detail in Section 6 and controls applied where appropriate to manage impacts and risks to ALARP and an acceptable level. Stakeholders will be provided with feedback as to whether their objection or claim was substantiated, and if not why not, and if it was substantiated how it was assessed and if any controls were put in place to manage the impact or risk to ALARP and an acceptable level. If the objection or claim triggers a revision of the EP this will be managed as per Section 8.22.2 and 8.22.3. This will also be communicated to the stakeholder.

Table 9-3: Ongoing stakeholder consultation requirements

Stakeholder	Ongoing Stakeholder Requirement	Timing
Relevant stakeholders	Ongoing engagement including: • stakeholder communication of information and addressing queries and concerns via email, phone or meeting; and • updates to Beach website.	As required
General	Public notice in local newspapers (i.e. Warrnambool Standard and The Cobden Timboon Coast Time). To include: • activity description; • activity location; • timing; • how to access the EP and project information; and • Beach contact person.	4 weeks prior to activity commencing
Relevant stakeholders	Stakeholder notification of activity commencement. Notification to include: • type of activity; • location of activity, coordinates and map; • timing of activity: start and finish date and duration; • MODU & vessel details including call sign and contact; and • Beach contact person. Note: coordinates to be provided as degrees and decimal minutes referenced to the WGS 84 datum.	4 weeks prior to activity commencing
AHO	Drilling Contractor to issue notification of activity for publication of notice to mariners. Information provided should detail: • type of activity; • geographical coordinates of the well location; • the 500 m rig safety exclusion zone & 2 km cautionary zone and requested clearance from other vessels; • period that NTM will cover (start and finish date);	3 weeks prior to activity commencing

Stakeholder	Ongoing Stakeholder Requirement	Timing
	• MODU and vessel details including vessel name, call-sign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), contact details and calls signs; and • Beach & Rig Contractor contact person. Only need to update AHO of changes including if activity start or finish date changes. Do not need to provide cessation notification as long as NTM covers period of activity.	
AMSA - JRRC	Drilling Contractor to issue notification of activity for publication of Auscoast warning. Information provided should detail: • type of activity; • geographical coordinates of the well location; • the 500 m rig safety exclusion zone & 2 km cautionary zone and requested clearance from other vessels; • period that warning will cover (start and finish date); • vessel and or rig details including vessel name, call-sign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), contact details and calls signs; and • Beach & Rig Contractor contact person. Only need to update JRCC of changes including if activity start of finish date changes. Do not need to provide cessation notification as long as Auscoast warning covers period of activity.	48 – 24 hrs prior to activity commencing
NOPSEMA DJPR DPIPWE	Regulatory notification of start of activity.	10 days prior to activity commencing
Relevant stakeholders who have requested MODU location information.	Weekly text message of MODU location to stakeholders who have requested the information.	During activity
NOPSEMA DJPR DPIPWE	Regulatory notification of cessation of activity.	Within 10 days of activity completion

Table 9-4: Summary of stakeholder consultation records and Beach assessment of objections and claims

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
Australian Communications and Media Authority (ACMA)	27/03/2019	ACMA 01 to ACMA 11	Request for Indigo Central submarine cable coordinates ACMA provided coordinates and a map showing that the cable is ~ 50 km from the Thylacine platform. Beach acknowledge information and note that the planned activities will not interfere with the cable.	Indigo Central Submarine Cable is ~ 65 km from the Artisan-1 well location and therefore out of the operational area for the drilling activity.
Australian Fisheries Management Authority (AFMA)	18/04/2019	AFMA 01 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Email: Introducing Beach Energy and provision of information on the 'Otway Offshore Project and a summary of Beach's review of Commonwealth fisheries in the project area. A review of the AFMA website identified that the operational area where the seabed assessments and drilling activities are planned to occur over the following Commonwealth fisheries: • Bass Strait Central Zone Scallop Fishery; • Eastern Tuna and Billfish Fishery; • Skipjack Tuna Fishery (Eastern); • Small Pelagic Fishery (Western sub-area); • SESSF (Commonwealth South East Trawl Sector, Scalefish Hook Sector and the Shark Hook and Shark Gillnet Sectors); • Southern Bluefin Tuna Fishery; and • Southern Squid Jig Fishery. However, a review of the ABARES Fishery Status Reports 2014 to 2018 identified that only the following have catch effort within the operational area: • SESSF (Commonwealth South East Trawl Sector, Scalefish Hook Sector and the Shark Hook and Shark Gillnet Sectors); and • Southern Squid Jig Fishery. Information has been provided to AFMA and the following fishing associations: • Scallop Fisherman's Association Inc.; • SIV – SIV have sent out the information sheet attached to their members; • Tuna Australia (ETBF Industry Association); and • SETFIA. The main concerns raised by commercial fishers are sound from the seabed assessment and displacement while the activities occur. Sound from the seabed assessment equipment is of significantly lower intensity than for seismic surveys. Sound modelling identified that the sound threshold level for fish was reached at a maximum distance of 1.6 m from the equipment and did not reach the impact threshold for invertebrates at the seafloor. The seabed assessment areas will take up to 12 days for the largest area. Drilling at each location will range from 35 to 90 days with fishers not being able to access a 500 m area around the drill rig. Thus, the area of displacement is small and not for a significant period of time.	Provision of information. No reply.
Australian Hydrographic Office (AHO)	29.03.2019	AHO 01	Rang AHO to clarify requirement for notice to mariners (NTM) requirements. Requirement to notify AHO a minimum of 3 week prior to commencement of the activity information needs to include activity location or area, vessel/rig details including contact details and calls signs, period that NTM will cover (start and finish date). Only need to update AHO if activity start of finish date changes. Do not need to provide cessation notification as long as NTM covers period of activity.	Section 9.7 Ongoing Consultation updated to include AHO requirements.
Commonwealth Fisheries Association	18/04/2019	CFA 01 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Email: Introducing Beach Energy and provision of information on the 'Otway Offshore Project and a summary of Beach's review of Commonwealth fisheries in the project area. A review of the AFMA website identified that the operational area where the drilling activity is planned to occur over the following Commonwealth fisheries: • Eastern Tuna and Billfish Fishery; • Small Pelagic Fishery (Western sub-area); • SESSF (Commonwealth South East Trawl Sector, Scalefish Hook Sector and the Shark Hook and Shark Gillnet Sectors); • Southern Bluefin Tuna Fishery; and • Southern Squid Jig Fishery. However, a review of the ABARES Fishery Status Reports 2014 to 2018 identified that only the following have catch effort within the operational area:	Provision of information. No reply. Drilling at the Artisan-1 well location is expected to take approximately 35-55 days, depending on the final work program and potential operational delays – within the period relayed to CFA.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
			• SESSF (Commonwealth South East Trawl Sector, Scalefish Hook Sector and the Shark Hook and Shark Gillnet Sectors); and • Southern Squid Jig Fishery. Information has been provided to AFMA and the following fishing associations: • Scallop Fisherman's Association Inc.; • SIV – SIV have sent out the information sheet attached to their members; • Tuna Australia (ETBF Industry Association); and • SETFIA. The main concerns raised by commercial fishers are sound from the seabed assessment and displacement while the activities occur. Sound from the seabed assessment equipment is of significantly lower intensity than for seismic surveys. Sound modelling identified that the sound threshold level for fish was reached at a maximum distance of 1.6 m from the equipment and did not reach the impact threshold for invertebrates at the seafloor. Drilling at each location will range from 35 to 90 days with fishers not being able to access a 500 m area around the drill rig. Thus, the area of displacement is small and not for a significant period of time.	
Commercial Rock Lobster Fisher	17/04/2019	CRLF 01	Commercial Rock Lobster Fisher rang as fishes around the Thylacine platform and in that region. He is concerned about the impact on his fishing during drilling as he fishes in the 40-50 fathoms region in the deeper water west of the platform. Is often there around January to February. He stops fishing in mid-September (when the rock lobster season ends). The season re-starts on 15th Nov. Beach explained that for the seabed assessments the vessel will be moving around and won't be in a particular area for very long. Beach can engage with him at the time and tell him the vessels location and where we are going to be so we can work around one another. Stakeholder is more concerned around the drill periods because we will be in the one spot for longer and he thinks the exclusion zone will be a few kilometres. Would like to meet with Beach to show where he fishes. Beach said there was time to catch up as the seabed assessments won't start before September and drilling until December.	Stakeholder raised concerns about impacts from exclusion to his fishing areas specifically in relation to drilling due to the period when he fishes (January and February and again starting 15th Nov. This period coincides with the proposed drilling activity.
Commercial Rock Lobster Fisher	18/04/2019 21/04/2019	CRLF 02 CRLF 03	Phones calls to arrange for Beach FLO to meet with stakeholder.	See Record CRLF 05
Commercial Rock Lobster Fisher	24/04/2019	CRLF 04	Meeting with FLO and stakeholder. Stakeholder and FLO covered Mapping of fishing grounds and seasonal pattern compared with planned works and transit routes by support vessels, displacement and financial loss concerns, neighbouring works by Cooper Energy, exclusion and advisory clearance zones, other fishing operators in area.	See Record CRLF 05 and 06 of letter to stakeholder of record of meeting and details of Beach's arrangements to manage impact to stakeholder to ALARP and an acceptable level.
Commercial Rock Lobster Fisher	9/05/2019	CRLF 05 CRLF 06	Letter from Beach to stakeholder detailing: • Beach's confidentiality/privacy policy. • That in future any coordinates supplied would be expressed in degrees and decimal minutes referenced to the WGS 84 datum, so they can immediately be entered on your GPS plotter. • When Beach activities plotted over the locations the stakeholder fished there is potential for interaction. • In order to minimise impacts to your fishing, Beach will let fishers know expected timings and more precise location coordinates closer to the start of each activity and will also update fishers on a regular (possibly daily) basis of project status and vessel movement. • Beach's aim is to work together to minimise impacts on each other's operational plans, however, should you or any fisher wish to make a claim for loss as a result of our activities to contact Beach – contact details provided. • Beach would validate that the fisher regularly works in that area as well as evidence of the additional costs they have incurred or the loss they have suffered. Beach will then work with them to validate the claim and assess any compensation required. Validation procedures will necessarily involve access to fishing records and other relevant information. • Beach are aware of the issue you raised regarding your colleague's engagement with another Oil & Gas Company's vessel. When our project becomes operational Beach will undertake discussions with our vessel masters so that impacts on fishing and vice versa are as low as reasonably practicable. Beach's FLO will contact you shortly to discuss access to your fishing data and confirm that you would like to be included on our updates about the location of our activities while we are operational.	Beach aims to undertake the activity in a manner that does not unduly impact on fishers. This EP has been updated in response to the claims from this stakeholder as per the following: • Table 9-3 Ongoing stakeholder consultation requirements updated to note that for notifications to stakeholder where coordinates are supplied coordinates are to be expressed in degrees and decimal minutes referenced to the WGS 84 datum. • Stakeholder provided with Beach contact person should they wish to make a claim for loss as a result of Beach's activities. How Beach will deal with any claims is details in Section 9.3.1 Fishery specific consultation approach. • Section 8.6 Personnel, Competence, Training and Behaviours updated to include requirements for interactions with fishers and/or fishing equipment in the activity induction that will be required to be undertaken by all vessel personnel. • Engagement will be ongoing with stakeholder to ensure any impacts can be management to ALARP and an acceptable level.
Commercial Rock Lobster Fisher	09/06/2019	CRLF 07	Meeting between stakeholder and FLO regarding seabed assessments and drilling to ascertain potential impacts and mitigations. Fisher discussed fishing pattern and the ability to work around Beach's operations in the area, noting the duration of assessment and drilling events.	Beach aims to undertake the activity in a manner that does not unduly impact on fishers. This EP has been updated in response to the claims from this stakeholder as per the following: • Table 9-3 Ongoing stakeholder consultation requirements updated to note that for notifications to AHO to issue NTM will specifically include:

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
			• Real time on water communications between project vessels and fisher best way to avoid adverse incidents as opposed to SMS message service. Stakeholder happy to receive text messages. • FLO informed stakeholder that due to anchors and cables around well site during drilling a 2km cautionary zone shall be established in addition to the 500m rig safety zone. • Stakeholder advised that timing the occurrence of drilling operations when fisher is not in these locations would be ideal. • The undertaking by Beach (9 May 2019) that fishers may claim for any validated loss was noted as was confidentiality of catch and effort information. • Advance notice of drilling: it takes up to a week to harvest from the reefs and so given the short duration of fishers need for access, advance notice of drilling will provide the opportunity to catch the annual harvest before drilling commences on these fields.	○ geographical coordinates of the well location; and ○ the 500 m rig safety exclusion zone & 2 km cautionary zone and requested clearance from other vessels • Stakeholder provided with Beach contact person should they wish to make a claim for loss as a result of Beach's activities. How Beach will deal with any claims is details in Section 9.3.1 Fishery specific consultation approach. • Stakeholder advised to contact channel 16 if they wish to communicate with the rig at any time. Rig will be stationary until moved to next location. • Rescheduling drilling operations to avoid times when fisher may be in the area is not a practicable option for the drilling program given the long lead times and detailed planning required to undertake the drilling activity. Stakeholder has the ability to fish in broader area irrespective of drilling activity.
Commercial Shark Fisher	28/04/2019	CSF 01	Stakeholder rang Beach 1800 number from Beach's Otway Offshore Program 2019 2pp Info Sheet. Stakeholder confirmed they were aware of Beach's upcoming activities. Fisher raised that a boat operating in the Otway area that had asked a shark fisher to pull his nets last week.	Beach provided information to the stakeholder in relation to the vessel that was not a Beach vessel. See Record CSF 02.
Commercial Shark Fisher	29/04/2019	CSF 02	Beach called stakeholder to provide an update on their comments about a boat operating in the Otway area that had asked a shark fisher to pull his nets last week. Beach informed stakeholder that Beach's vessel has not been operating in the region since April 15 and is now located near Wilson's Promontory. Another vessel was operating in the area but was not chartered by Beach. Beach informed stakeholder they had asked their Fisheries Liaison Officer (FLO) to meet with them to understand their fishing patterns and how they may overlap with Beach's proposed activities. Beach can't confirm specific locations and times as yet, but it will be helpful to understand where they fish and when. Stakeholder was comfortable with this as knew the FLO and had met with them before. FLO expected to be able to contact stakeholder by the end of this week (May 3).	Claim in relation to issue with boat operating in the Otway area was not relevant to Beach's activities. See Record CSF 05 for meeting details.
Commercial Shark Fisher	30/04/2019	CSF 03 CSF 04	Meeting coordinated between stakeholder and FLO for 3/05/2019.	See Record CSF 05.
Commercial Shark Fisher	3/05/2019	CSF 05	Meeting with FLO and stakeholder. Stakeholder concern is that Beach's activities would limit access to where he fishes and cause financial loss. If Beach wanted him to shift his fishing activities, Beach should pay him and he would stay out of their way. FLO explained that both Beach's and fishing activities across the same area was legal and that each were obliged under the Offshore Petroleum and Greenhouse Gas Storage Act 2006, to reduce their impact on each other to as low as reasonable practicable. Stakeholder said that to work around each other; good on water communications between his vessel and project vessels, and a common understanding of mandatory exclusion zones and advisory clearance distances around sites was needed. These were sometimes confused by support vessel masters and caused unnecessary displacement of fishing activities. Stakeholder asked does Beach have any arrangements so that he could claim and evidence a loss if that happened? The map in the information he received (BE_OFFSHORE Project 2pp_March_2019) showed the footprint of Beach's proposed work sites across the project lifetime, reference about the duration at each site and a preliminary calendar of events. More precise detail on start-up timing for each site would enable fisher to better assess likely impacts and fishing options at the time the work is taking place. An image of fisher's activities was provided to Beach.	See Record CSF 07 and 08 of letter to stakeholder of record of meeting and details of Beach's arrangements to manage impact to stakeholder to ALARP and an acceptable level.
Commercial Shark Fisher	3/05/2019	CSF 06	Stakeholder provided information to Beach in relation to the Electronic Catch Log System	NA
Commercial Shark Fisher	10/05/2019	CSF 07 CSF 08	Letter from Beach to stakeholder detailing: • Beach's confidentiality/privacy policy. • That in future any coordinates supplied would be expressed in degrees and decimal minutes referenced to the WGS 84 datum, so they can immediately be entered on your GPS plotter. • When Beach activities plotted over the locations the stakeholder fished there is potential for interaction. • In order to minimise impacts to your fishing, Beach will let fishers know expected timings and more precise location coordinates closer to the start of each activity and will also update fishers on a regular (possibly daily) basis of project status and vessel movement. • Beach's aim is to work together to minimise impacts on each other's operational plans, however, should you or any fisher wish to make a claim for loss as a result of our activities to contact Beach – contact details provided. • Beach would validate that the fisher regularly works in that area as well as evidence of the additional costs they have incurred or the loss they have suffered. Beach will then work with them to validate the claim and assess any compensation required. Validation procedures will necessarily involve access to fishing records and other relevant information.	Beach aims to undertake the activity in a manner that does not unduly impact on fishers. This EP has been updated in response to the claims from this stakeholder as per the following: • Table 9-3 Ongoing stakeholder consultation requirements updated to note that for notifications to stakeholder where coordinates are supplied coordinates are to be expressed in degrees and decimal minutes referenced to the WGS 84 datum. • Table 9-3 Ongoing stakeholder consultation requirements updated to note that for notifications to AHO to issue NTM will specifically include: ○ geographical coordinates of the well location; and ○ the 500 m rig safety exclusion zone & 2 km cautionary zone and requested clearance from other vessels • Stakeholder provided with Beach contact person should they wish to make a claim for loss as a result of Beach's activities. How Beach will deal with any claims is details in Section 9.3.1 Fishery specific consultation approach.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
			• Beach are aware of the issue you raised regarding your colleague's engagement with another Oil & Gas Company's vessel. When our project becomes operational Beach will undertake discussions with our vessel masters so that impacts on fishing and vice versa are as low as reasonably practicable. Transit routes between project sites and Portland are unlikely as our vessel will not be stationed there. • Beach's FLO will contact you shortly to discuss access to your fishing data and confirm that you would like to be included on our updates about the location of our activities while we are operational.	• Section 8.6 Personnel, Competence, Training and Behaviours updated to include requirements for interactions with fishers and/or fishing equipment in the activity induction that will be required to be undertaken by all vessel personnel. • Engagement will be ongoing with stakeholder to ensure any impacts can be management to ALARP and an acceptable level.
Commercial Shark Fisher	09/06/2019	CSF 09	Meeting between stakeholder and FLO regarding seabed assessments and drilling to ascertain potential impacts and mitigations. Fisher discussed fishing pattern and the ability to work around Beach's operations in the area, noting the duration of assessment and drilling events. Stakeholder informed FLO shark mesh netting favours smooth seafloor i.e., where drilling likely to occur. FLO informed stakeholder that due to anchors and cables around well site during drilling a 2km cautionary zone shall be established in addition to the 500m rig safety zone. Stakeholder advised FLO an estimated 80% of a stakeholder's trip consists of shortened duration "try" shots until higher catches were found. Fishers concern was if higher catches were found that continued targeting of the aggregation might be blocked by one of Beach's operations and cause an adverse financial result. In discussion with FLO it was recognised that the spatial constraints on Beach in the Otway Basin area were more than that of shark fishers. Whether or not an aggregation of shark continued on the other side of one of Beach's operations could not be determined until the event, however correspondence from Beach on 10 May 2019 that said fishers may claim for any validated loss was noted. Stakeholder advised FLO there would be some difficulty receiving texts advising of operational plans as the fishing vessel's phone did not take texts. Communications are usually achieved via "Messenger" to skippers personal phone. Sometimes it is possible to talk if in range, but the reach of "Messenger" is beyond that of talk on this service. For real time on-water communications, FLO advised stakeholder to call up on Ch 16 HF then go to a nominated working channel or with phone range ring up either of the numbers provided.	Beach aims to undertake the activity in a manner that does not unduly impact on fishers. This EP has been updated in response to the claims from this stakeholder as per the following: • Table 9-3 Ongoing stakeholder consultation requirements updated to note that for notifications to AHO to issue NTM will specifically include: ○ geographical coordinates of the well location; and ○ the 500 m rig safety exclusion zone & 2 km cautionary zone and requested clearance from other vessels • Stakeholder provided with Beach contact person should they wish to make a claim for loss as a result of Beach's activities. How Beach will deal with any claims is details in Section 9.3.1 Fishery specific consultation approach. • Stakeholder advised to contact channel 16 if they wish to communicate with the rig at any time. Rig will be stationary until moved to next location.
Corporate Alliance Enterprises	07/06/2019	CAE 02 OPOG19IS#1 & OPOG19IS#2	Beach email to CAE: As previously mentioned, the Otway Offshore Project will see up to 9 wells drilled offshore, consisting of exploration and production wells. Further activities in the Otway Basin will be carried out to ensure continued production at the Otway Gas Plant, including seabed site assessments, pre-drill activities, drilling of offshore gas wells, and subsea infrastructure installation. The first phase of the Seabed Site Assessments for the Otway Offshore Project will commence in September 2019. Please find attached an information sheet with the proposed seabed assessment locations and coordinates. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. The drilling component of the Otway Offshore Project will commence between December 2019 and February 2020. Please find attached an information sheet with the proposed drilling locations and coordinates, including an update exclusion zones for vessels. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. If you would like to be kept in touch via text message of confirmed locations, start dates and durations just prior to and during the activities, please let us know and we will add you to our distribution list. We will need you to provide your mobile phone number so we can include it on our list. Further details on the Otway Offshore Project are available by visiting our Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Information Sheet' link. We are consulting with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact us.	Provision of information.
Department of Jobs, Precincts and Regions (DJPR): Earth Resources Regulation	26/04/2019	DJPR-ERR 01 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email providing information on Beach's Otway Offshore Project including drilling activities. Drilling is expected to start around December 2019. Attached is a brief information sheet and further details are available on the Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. As part of our consultation we are engaging with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact me.	Provision of information.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
Department of Jobs, Precincts and Regions (DJPR): Marine Pollution	03/04/2019 – 03/05/2019	DJPR MP 01 DJPR MP 02 DJPR MP 03 DJPR MP 04	Meeting and OPEP assessment coordination between Beach and DJPR	See record DJPR MP 05
Department of Jobs, Precincts and Regions (DJPR): Marine Pollution	09/05/2019 & 13/05/2019	DJPR MP 05 DJPR MP 06 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1	Beach email following meeting held between Beach and DJPR: As discussed, we are planning to commence petroleum activities in Commonwealth waters from August/September this year with the drilling rig arriving in December 2019 (subject to regulatory approvals). I have attached an electronic copy of the information sheet provided at the meeting which includes a project timeline. Some of the key points from the meeting from our perspective are as follows: - DJPR Emergency Management Branch (EMB) Incident notification and contact email marine.pollution@ecodev.vic.gov.au and 24h phone is 0409 858 715 - Incident management room email semdincidentroom@ecodev.vic.gov.au - DJPR planning to consult with industry on a draft guidance note after Spillcon - DJPR EMB prefer to receive OPEPs prior to submission to NOPSEMA and will coordinate a response on behalf of government - Beach to provide a draft of the revised Otway OPEP for review this week with the aim of receiving comments from DJPR by 31 May - DJPR would like to participate in a Beach exercise with State content - Beach's incident management team based on an AIIMS structure - Beach are willing to participate or observe a State based training exercise coordinated by Victorian government - Beach have contracted the Diamond Ocean Onyx MODU which is to be dry towed from Singapore and offloaded in Pt Phillip Bay. DJPR interested in how biosecurity of the rig will be managed in particular biofouling. Let me know if you have any further comments.	Provision of information Beach have included DJPR EMB contact details within OPEP. Beach have committed to provide EMLO familiar with AIIMS structure to interface with DJPR in the event of a marine pollution incident. Beach provided a copy of draft OPEP to DJPR for coordination of State review (see DJPR MP 07). Biosecurity (including biofouling) managed by: • the Diamond Ocean Onyx MODU being dry-docked and cleaned and inspected in Singapore; • the Diamond Ocean Onyx MODU will be dry-towed to Australian Commonwealth / State waters, removing the potential for in-transit biofouling to occur; • Diamond Offshore to adhere to Australian Ballast Water Management Requirements Rev 7; and • Diamond Offshore to obtain DAWR clearance to enter Australian waters.
Department of Jobs, Precincts and Regions (DJPR): Marine Pollution	21/05/2019	DJPR MP 07 DJPR MP 08	Beach email providing copy of updated Offshore Victoria – Otway Basin Oil Pollution Emergency Plan (CDN/ID S4100AH717907) Rev D to DJPR for coordination of Vic State review. Beach requested response by 11th June 2019.	Provision of information.
Department of Jobs, Precincts and Regions (DJPR): Marine Pollution	07/06/2019	DJPR MP 09 DJPR MP 10 OPOG19IS#1 & OPOG19IS#2	The drilling component of the Otway Offshore Project will commence between December 2019 and February 2020. Please find attached an information sheet with the proposed drilling locations and coordinates, including exclusion zones for vessels. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. Unless otherwise requested, we will be in touch with confirmed locations, start dates and durations of Seabed Site Assessments and Drilling activities closer to the time. If you would like to be kept in touch via text message of confirmed locations, start dates and durations just prior to and during the activities, please let us know and we will add you to our distribution list. We will need you to provide your mobile phone number so we can include it on our list. Further details on the Otway Offshore Project are available by visiting our Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Information Sheet' link. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact us.	Provision of information
Department of Jobs, Precincts and Regions (DJPR): Marine Pollution	09/06/2019 – 11/06/2019	DJPR MP 11 DJPR MP 12 DJPR MP 13	OPEP assessment coordination between Beach and DJPR	See record DJPR MP 14
Department of Jobs, Precincts and Regions (DJPR): Marine Pollution	13/06/2019	DJPR MP 14 DJPR MP 15	DJPR provided consolidated comments on Offshore Victoria – Otway Basin Oil Pollution Emergency Plan (CDN/ID S4100AH717907) Rev D received from: • DELWP • DJPR ERR • DJPR Emergency Management Branch • EPA • Parks Victoria	All comments received from Victorian State government (via coordinated review) have been incorporated into the subsequent revision of the Offshore Victoria – Otway Basin Oil Pollution Emergency Plan (CDN/ID S4100AH717907) prior to submission to NOPSEMA for assessment.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
			Comments received related to: State expectations for joint industry and State oil spill response based upon draft guidance (yet to be published by DJPR); updated contact information; scientific monitoring requirements; and oiled wildlife response arrangements. Beach confirmed comments received and OPEP would be amended as required.	
Department of Jobs, Precincts and Regions (DJPR): Victorian Gas Project	07/06/2019	VGP 01 VGP 02 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 & OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	We would like to inform you that we're planning further development of our Otway offshore natural gas reserves within existing Commonwealth offshore exploration permits and production licenses. The Otway Offshore Project will see up to 9 wells drilled offshore, consisting of exploration and production wells. Further activities in the Otway Basin will be carried out to ensure continued production at the Otway Gas Plant, including seabed site assessments, pre-drill activities, drilling of offshore gas wells, and subsea infrastructure installation. The project is expected to start around September 2019, depending on regulatory approvals, weather windows and availability of contractors. Please find attached an information sheet summarising details on the project. Further details on the Otway Offshore Project are available by visiting our Otway Basin Victoria web page at https://www.beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. In preparation of our Environment Plans we are keen to understand if you have any questions, concerns or feedback or require any further consultation on the above projects. Please don't hesitate to contact us.	Provision of information
Otway Gas Plant Community Reference Group	18/04/2019	CRG 01 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1& Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email providing information on Beach's Otway Offshore Project including drilling activities. Drilling is expected to start around December 2019. Attached is a brief information sheet and further details are available on the Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. As part of our consultation we are engaging with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact me.	Provision of information.
Portland Professional Fishermen's Association	17/04/2019	PPFA 01 PPFA 02 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1& Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email providing information on Beach's Otway Offshore Project including drilling activities. Drilling is expected to start around December 2019. Attached is a brief information sheet and further details are available on the Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. As part of our consultation we are engaging with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact me.	Provision of information.
Seafood Industries Victoria (SIV)	19/02/2019	SIV 01 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 and Otway Offshore Map Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach and SIV meeting. Beach presented 2-page information on the upcoming Otway Offshore Project. Beach explained there would be a seabed assessment phase commencing in approx. September 2019 followed by a drilling phase which was expected to commence towards the end of the year and continue for approx. 18 months. Beach showed map to SIV and discussed locations. Beach asked what SIV's preferred way to consult with fishers was. SIV said if Beach provided the Information sheet SIV would arrange for it to be mailed to SIV members, under a cover letter. The letter would ask fishers who were affected or required further consultation to respond within 2 weeks so SIV can validate that they fish in the area and allow Beach to respond to any questions.	Provision of information and agreement to send information to SIV members via SIV.
Seafood Industries Victoria (SIV)	7/03/2019	SIV 02 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email of discussion at meeting held on the 19/02/2019 in relation to Beach's upcoming Offshore campaign. Beach presented a 2-page information on the upcoming Otway Offshore Project and explained there would be a seabed assessment phase commencing in approx. September 2019 followed by a drilling phase which was expected to commence towards the end of the year and continue for approx. 18 months. Map was shown and briefly discussed locations. Beach asked what SIV's preferred way to consult with fishers was. SIV said if Beach provided the Information sheet, they would arrange for it to be mailed to SIV members with a cover letter. SIV stated they would ask fishers who were affected or required further consultation to respond within 2 weeks so SIV can validate that they fish in the area and allow Beach to respond to any questions. Agreed that SIV would do a mailout of the attached 2-page information sheet and cover letter to SIV members. Beach provided 2-page information sheet and requested that cover letter ask fishers to contact Beach if they fish in the areas where we will be operating. Also, to let them know that further information will be available on our website at beachenergy.com.au/vic-otway-basin/. SIV recommenced two weeks for fishers to respond. Asked to review SIV cover letter prior to mailout.	Provision of information to SIV for mail out to members.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
Seafood Industries Victoria (SIV)	19/03/2019	SIV 03 SIV 04	SIV provided cover letter for Beach to review. Beach provided feedback on letter and asked to add a comment about 2 weeks to respond. Also requested to hold off mail out as information sheet was being updated.	Provision of information to SIV for mail out to members.
Seafood Industries Victoria (SIV)	19/03/2019	SIV 05 SIV 06	SIV reply: will include a comment about the 2 weeks but need to know when we are sending. SIV concern about two weeks and putting a specific timeframe on it is that this needs to be an open communication and ongoing consultation - it does not just stop. But we also have 3 other consultation processes going on - so if possible, for more time, then this will be crucial. Beach reply: We also expect the consultation to be open and ongoing. The 2-week timeframe is to allow us to get initial feedback and understand who may be fishing in the areas so that if we need to undertake more specific consultation with them, we understand who they are. We will provide further information closer to the time of the seabed assessments and again prior to commencing drilling. And of course, we will consult with any fisher that requires it during the life of the project.	Two-week timeframe is to allow for initial feedback and understand who may be fishing in the areas so that if required more specific consultation can be undertaken. Beach agrees that stakeholder consultation will be ongoing and stakeholders any issues or concerns raised prior or during the activity will be addressed as per Section 9.7. EP Section 9.7 details ongoing stakeholder engagement for the activity.
Seafood Industries Victoria (SIV)	22/03/2019	SIV 07	Beach update on status of the information sheet.	Provision of information to SIV for mail out to members.
Seafood Industries Victoria (SIV)	27/03/2019	SIV 08	Beach call to provide update on status of information sheet and also that there were now some additional survey areas, which were for potential tie-ins of wells to the seabed pipeline. SIV asked what this would cover - was VSP included? Beach said the surveys would use equipment such as echo sounders, may take seabed grabs and take core samples 6m below the seabed surface. VSP was not included in these surveys. Beach asked if Beach needed to separately email the information sheet to VRLA, Port Campbell Professional Fishers Association or similar organisations. SIV confirmed that they will handle this engagement.	Drilling activity does not include vertical seismic profiling (VSP).
Seafood Industries Victoria (SIV)	27/03/2019	SIV 09	Beach email to confirm delivery of the information sheets and if in the cover letter you can ask members to let us know if they want further consultation or fish in the affected area by 19th April. We will continue engagement after that time, but we'd like to understand who specifically may be impacted or has concerns so we can plan further engagement with them, and SIV.	Provision of information to SIV for mail out to members.
Seafood Industries Victoria (SIV)	28/03/2019	SIV 10 SIV 11 SIV 12	Organisation of information sheet for mail out to SIV members.	Provision of information to SIV for mail out to members.
Seafood Industries Victoria (SIV)	29/03/2019	SIV 14 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Letter and information sheet sent to approximately 300 SIV members. Dear Victorian Licence Holder and Operators RE: UPCOMING BEACH ENERGY OFFSHORE PROJECTS I am writing to you regarding recent discussions between Seafood Industry Victoria (SIV) and Beach Energy regarding a proposed Seabed Assessment and Drilling Program from 2019 – 2021. Beach Energy have provided SIV with the attached 2-page information sheet which provides detailed information on the activities proposed, the areas they intend to operate and timeframes for the proposed works. There is also further information available at: www.beachenergy.com.au/vic-otway-basin/. Beach Energy have sought SIV to correspond with you to seek your views and issues on the proposed areas, and their interaction with areas in which you operate. If you have any concerns, questions, comments or seek any further information please contact Beach Energy at community@beachenergy.com.au by the 19th April. Alternatively let us know at SIV and we can pass your comments through to Beach Energy. Thank you for your time reading and understanding this information and please do not hesitate to contact me if there are any queries.	Provision of information to SIV for mail out to members.
Seafood Industries Victoria (SIV)	2/04/2019	SIV 15 SIV 16	Emails between Beach and SIV confirming mail out sent.	NA
Seafood Industries Victoria (SIV)	16/04/2019	SIV 17	Beach phone call to see if any response to member mail out. Four fishers have stated they would be fishing out deeper this year, as a result of discussions in the quota meetings held recently. Can Beach provide information on where and when they will be operating? Beach replied it is too early for this information to be available, it will not be available until closer to the time of the activities. Seabed assessments will be undertaken in September and again in about March, with drilling scheduled to commence in December. Are fishers able to inform us of their plans so we can feed that into our planning – it may not be able to be considered but it's good to know so we are aware. SIV replied that could be arranged. The purpose of sending out the flyer was so we can work together, so this is what we expected. Beach - we would expect that, closer to the time, we would send the interested fishers text messages of where our activities are occurring on a regular basis. SIV – I'll discuss with them and come back to you with their plans.	Four fishers had contacted SIV in relation to the information sheet mail-out. These fishers will be fishing deeper this year and seek further information regarding location and timings. Beach met with SIV 3/05/2019 Record VFA 25 to further discuss Beach's activities. Beach will continue ongoing engagement with SIV and any affected fishers as per Section 9.7.1 Fishery specific consultation approach to ensure impacts to fishers are ALARP and an acceptable level.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
Seafood Industries Victoria (SIV)	29/04/2019 1/5/2019	SIV18 – SIV 21	Emails to obtain copy of cover letter sent to SIV members.	NA
Seafood Industries Victoria (SIV)	3/05/2019	VFA 25	Meeting between Beach, VFA and SIV. Beach provided VFA with an extract of the current draft of the Seabed Assessment EP chapters related to noise modelling and the identification of fisheries. Beach stepped VFA through the noise modelling at a high level and the conclusions that there was no unacceptable impact to marine fauna. VFA said it was good to have the report and that they would review it in more detail. Beach explained the consultation approach with fishers; engagement had been via SIV who undertook a mailout of a 2-page information sheet (which had also been provided to VFA) to their approx. 300 members. A cover letter had asked for fishers to identify if they felt they would be impacted by the activities. SIV had reported that 4 fishers had come forward and 2 others had contacted Beach directly. Beach will engage with these fishers and SIV as part of on-going consultation and specifically when details of the exact locations and timing of the seabed assessments and drilling were available. Beach would also provide regular/ daily information on the location of vessels and drill rigs to those who wanted to receive that information. VFA was comfortable with this approach. VFA asked about any permanent restrictions on fishing grounds, such as permanent exclusion zones, as this would reduce the available area for fishing. Beach explained that there may be a requirement for some wells to have exclusion zones around the infrastructure that will be installed on the seabed. At this stage the requirements for which wells and any details of the exclusion zones were not yet known. SIV joined the meeting and Beach gave a recap on the consultation that had been undertaken with commercial fishers. SIV was also provided with a copy of the draft Seabed Assessment EP extract. SIV informed VFA that they were happy with the way that Beach had undertaken the consultation and their plans for on-going consultation. Beach discussed with SIV a time when they could catch up to discuss the impacts on the four fishers that had identified themselves but no date was chosen due to current availability. SIV and VFA reviewed the fishing effort maps in the draft Seabed Assessment EP extract and queried the fishing activity for the giant crab map, in the grids located close to shore. Beach informed that the data had been provided by VFA.	Whilst Beach provided SIV with an extract of the current draft of the Seabed Assessment EP chapters related to noise modelling and the identification of fisheries, the provision of this information was not relevant to the scope of the Artisan-1 drilling EP. Beach will continue ongoing engagement with SIV and any affected fishers as per Section 9.7.1 Fishery specific consultation approach to ensure impacts to fishers are ALARP and an acceptable level. Beach has engaged directly with the fishers that contacted them. See Records for CRLF and CSF. VFA had raised concerns about loss of fishing area from permanent exclusion zones. During drilling activities, a temporary 500 m rig safety zone will be established, coinciding with the activity timing and duration (approximately 35-55days). Additionally, a 2 km cautionary zone will be relayed to fishers via the AHO NTM process. Upon completion of the drilling activity, the Artisan-1 well is to be plugged and abandoned, unless the well has been assessed as viable for future production. Should Artisan-1 well be assessed as viable for future production, the well will be suspended, and a permanent PSZ will be established around the well location. Updated rock lobster and giant crab fishery maps were sent to VFA and SIV. See Record SIV 22 and VFA 27.
Seafood Industries Victoria (SIV)	10/05/2019	SIV 22 – see VFA 27 for email record.	Beach email providing updated information as discussed at meeting on 3/5/2019 Record VFA 25. In the extract of the Seabed Assessment EP Beach provided VFA and SIV commented on the fishing effort maps. Beach have reviewed the maps we discussed and are including revised versions in the EP we are submitting shortly. The updated maps were provided which show only the areas where there has been catch effort for rock lobsters and giant crabs within the seabed survey operational area. We have also firmed up the sizes of the seabed assessment survey areas which vary slightly to what was communicated in the Otway Offshore Information Sheet we published. The revised sizes are in the table below. Site survey Survey Type Size in Km Artisan-1 Well 4.5 x 5 Geographe Well 4.5 x 5 La Bella Well 4.5 x 5 Thylacine Well 9 x 9 Artisan to Hot Tap Tee "Y" Pipeline 7 x 1 Artisan to Hot Tap Tee "X" Pipeline 6 x 1 Labella -Artisan Pipeline 18 x 1 Thylacine - Labella Pipeline 23 x 1 Artisan - Thylacine Pipeline 33 x 1 Don' hesitate to let me know if you have any questions. I will contact you next week about setting up a time to meet to discuss in more detail the program and the impacts on the fishers who have come forward as fishing in the area.	Updated rock lobster and giant crab fishery maps showing overlap of fishery effort with the operational area that are presented in this EP where provided to SIV and VFA. All matters relating to the intersection of commercial fisheries and survey locations have been addressed within the Site Survey EP and are not relevant to the drilling activity. Meeting will be set up with SIV to discuss the fishing effort of the four fishers who have raised with SIV that they fish in the area. Beach will continue ongoing engagement with SIV and any affected fishers as per Section 9.7.1 Fishery specific consultation approach to ensure impacts to fishers are ALARP and an acceptable level.
Seafood Industries Victoria (SIV)	21/05/2019 – 11/06/2019	SIV 24 SIV 25 SIV 26	Emails and phone communications between Beach and SIV to arrange meetings to discuss ongoing fisher engagement for the offshore program and confirm Fisher activity within the area. Meeting arranged for the 11/06/2019 and subsequently rescheduled for 13/06/2019.	NA
Seafood Industries Victoria (SIV)	12/06/2019	SIV 27 OPOG19IS#1 &	Beach email providing two information sheets, one of which included details of proposed drilling locations and timing (including that of Artisan-1 well) and raising an agenda for a forthcoming meeting. Agenda items relevant to Artisan-1 drilling included:	Provision of information

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
		OPOG19IS#2	Ongoing engagement with Fishers during the drilling program including lines of communication and frequency of updates; and The potential establishment of Petroleum Safety Zones for subsea infrastructure.	
Seafood Industries Victoria (SIV)	13/06/2019	SIV 28	Phone meeting conducted between Beach and SIV: Beach explained the information sheets (1 for seabed assessments and 1 for drilling) that had been emailed to SIV. SIV informed Beach that information sheets would be distributed to fishers who had come forward and have discussions with them regarding the impacts. Beach noted that two fishers had contacted Beach directly and they had been provided with the information sheets and Beach had met with them to discuss impacts. Names were exchanged so SIV could ensure no overlap with the fishers SIV engaging with. For the drilling program, Beach confirmed a 500m exclusion zone around the rig, overlaid with a 2km cautionary zone. Beach committed to ongoing engagement with fishers by providing the location of the rig when it moves and on a regular basis and asked SIV what timing/interval was appropriate. SIV confirmed a weekly update would be appropriate. SIV expects Beach to undertake normal on-water communications as had happened in the past. Beach informed SIV that Artisan, located at depth of 70m would be the first well to be drilled. SIV to await fishers response once information relayed via SIV. Beach informed SIV that when wells were ready for production seabed infrastructure would be installed to tie the well back to the pipeline or Thylacine platform. These will be protected by a Petroleum Special Zone - a 500m exclusion zone. Beach noted that each zone is approx. 500m radius and Beach were mapping the potential zones against the various fisheries in the area to see what percentage of the overall fishery is impacted. Beach noted that for Artisan-1 the PSZ would be by itself, the Geographe wells would most likely fit within the existing PSZ and the Thylacine wells are located closer together. SIV deferred discussion relating to PSZ.	Ongoing stakeholder engagement includes weekly updates to fishers on MODU location. During drilling activities, a temporary 500 m rig safety zone will be established, coinciding with the activity timing and duration (approximately 35-55days). Additionally, a 2 km cautionary zone will be relayed to fishers via the AHO NTM process. Upon completion of the drilling activity, the Artisan-1 well is to be plugged and abandoned, unless the well has been assessed as viable for future production. Should Artisan-1 well be assessed as viable for future production, the well will be suspended, and a permanent PSZ will be established around the well location.
Seafood Industries Victoria (SIV)	17/06/2019 – 20/06/2019	SIV 29 SIV 30 SIV 31 SIV 32	Series of communication between Beach and SIV regarding four fishers with potential to fish in development area. No contact made to date.	Whilst no contact made between fishers and SIV, ongoing stakeholder engagement includes weekly updates to fishers on MODU location.
SETFIA, SSIA, SPF Stakeholder groups represented by Atlantis Fisheries Group	17/04/2019	SETFIA, SSIA, SPF 01 SETFIA, SSIA, SPF 02 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email providing information on Beach's Otway Offshore Project including drilling activities. Drilling is expected to start around December 2019. Attached is a brief information sheet and further details are available on the Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. As part of our consultation we are engaging with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. Can you confirm that you are representing SETFIA, SSIA and Small Pelagic Fishery? I would also like to discuss with you whether you would like us to engage with any of members of the associations you represent and will call you tomorrow to discuss this. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact me.	Provision of information.
SETFIA, SSIA, SPF Stakeholder groups represented by Atlantis Fisheries Group	18/04/2019	SETFIA, SSIA, SPF 03 SETFIA, SSIA, SPF 04	Follow-up phone call and email.	No response.
SETFIA, SSIA, SPF Stakeholder groups represented by Atlantis Fisheries Group	04/06/2019 – 13/06/2019	SETFIA, SSIA, SPF 05 SETFIA, SSIA, SPF 06 OPOG19IS#1 & OPOG19IS#2 SETFIA, SSIA, SPF 07	Follow-up phone call and email. Beach email providing information: The drilling component of the Otway Offshore Project will commence between December 2019 and February 2020. Please find attached an information sheet with the proposed drilling locations and coordinates, including an update exclusion zones for vessels. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. If you would like to be kept in touch via text message of confirmed locations, start dates and durations just prior to and during the activities, please let us know and we will add you to our distribution list. We will need you to provide your mobile phone number so we can include it on our list.	Provision of information. No response.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
			Further details on the Otway Offshore Project are available by visiting our Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Information Sheet' link. We are consulting with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact us	
SETFIA, SSIA, SPF Stakeholder groups represented by Atlantis Fisheries Group	13/06/2019	SETFIA, SSIA, SPF 08	Email from SETFIA providing SETFIA's approach to consultation document and offer of meeting.	Information received.
SETFIA, SSIA, SPF Stakeholder groups represented by Atlantis Fisheries Group	13/06/2019	SETFIA, SSIA, SPF 09 SETFIA, SSIA, SPF 10 SETFIA, SSIA, SPF 11	Phone call between Beach and SETFIA: Beach contacted SETFIA following email in which SETFIA provided SETFIA's approach to consultation. SETFIA explained that considerable amounts of time had been spent consulting on behalf and with Oil & Gas proponents. The SETFIA Board have reviewed this position and they are now resourced to be able to undertake consultation, at the rates shown in the document 'SETFIA Proposal for Oil & Gas coys 28 May 2019_Gas Image'. SETFIA noted that Beach activities would not cover the Eastern Zone or Scallop fisheries. SETFIA asked whether Beach has obtained the data on the Commonwealth fisheries within the area. Beach explained that necessary (available) Commonwealth data had been obtained and the Victorian fishery data that had been obtained. SETFIA expanded on SETFIA's consultation approach and that they would look to Beach to agree to their fees. All activity after this email would be expected to be chargeable. Email received from SETFIA in follow-up to conversation. SETFIA emphasised importance of obtaining both Commonwealth and State fisheries data. SETFIA would love to get involved as per our proposal either to interpret data or to obtain the data (Vic and/or C'wealth). SETFIA explained their current workload.	Information provided and received.
SETFIA, SSIA, SPF Stakeholder groups represented by Atlantis Fisheries Group	20/06/2019	SETFIA, SSIA, SPF 12	Beach received email from SETFIA: SETFIA provided Beach with general proposal to maintain service. In order to engage properly we would need to understand the extent of trawling and gillnetting in the area (we have a formal strategic alliance with the gillnet association). As a first step please can you provide us with any data you have about COMMONWEALTH trawl or gillnet effort around your proposed wellheads.	Information received.
SETFIA, SSIA, SPF Stakeholder groups represented by Atlantis Fisheries Group	21/06/2019	SETFIA, SSIA, SPF 13 OPOG19IS#1 & OPOG19IS#2	Beach email to SETFIA: Thank you for your offer of assistance with gathering data, analysis and consultation for Beach's Otway Offshore Project. I've followed up with our team regarding the fishing effort data we have gathered for the Otway Offshore Project. A review of the AFMA website and ABARES reports (2013 – 2017) identified that the following Commonwealth managed fisheries potentially have catch effort over the survey areas. The data from the ABARES report show that it is a low level of fishing but the data is not granular enough to identify numbers. • Eastern Tuna and Billfish Fishery • Southern and Eastern Scalefish and Shark Fishery • Southern Squid Jig Fishery Could you provide Beach with a quote for you to undertake the following work for Beach: • Confirm the Commonwealth fisheries and level of fishing within the survey areas • Review the attached information sheets regarding the project and let me know of any questions you may have. Further details are available by visiting our Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. • Distribute the information sheet (s) to the relevant SETFIA members and collect any questions or feedback from them and pass them to us. • Distribution of SMS messages to the relevant fishers during the seabed assessment phase and the drilling phase, to inform them of the location of our boats and drill rig.	Provision of information and request for quotation for service.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
			We have already provided the attached information sheet to the following groups who are relevant to the Commonwealth fisheries: Commonwealth Fisheries Association, Victorian Fisheries Authority, Seafood Industry Victoria who have distributed to their members, Tuna Australia who are the industry association for ETBF and Sustainable Shark Fishing Inc. To date only one shark fishery has contacted Beach. I have also attached two further information sheets that provide more specific data related to the proposed location, duration and sequence of our activities. These will be updated as Beach works to finalise its plans however they may be useful to the fishers who fish in the area. If you would like to discuss please don't hesitate to call me, else I look forward to receiving your quote.	
Sustainable Shark Fishing Inc (SSFI)	9/04/2019	SSFI 01 SSFI 02 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email providing information on Beach's Otway Offshore Project including drilling activities. Drilling is expected to start around December 2019. Attached is a brief information sheet and further details are available on the Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. As part of our consultation we are engaging with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact me.	Provision of information.
Sustainable Shark Fishing Inc (SSFI)	07/06/2019	SSFI 03 OPOG19IS#1 & OPOG19IS#2	Beach email providing information: As previously mentioned, the Otway Offshore Project will see up to 9 wells drilled offshore, consisting of exploration and production wells. Further activities in the Otway Basin will be carried out to ensure continued production at the Otway Gas Plant, including seabed site assessments, pre-drill activities, drilling of offshore gas wells, and subsea infrastructure installation. The first phase of the Seabed Site Assessments for the Otway Offshore Project will commence in September 2019. Please find attached an information sheet with the proposed seabed assessment locations and coordinates. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. The drilling component of the Otway Offshore Project will commence between December 2019 and February 2020. Please find attached an information sheet with the proposed drilling locations and coordinates, including an update exclusion zones for vessels. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. If you would like to be kept in touch via text message of confirmed locations, start dates and durations just prior to and during the activities, please let us know and we will add you to our distribution list. We will need you to provide your mobile phone number so we can include it on our list. Further details on the Otway Offshore Project are available by visiting our Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Information Sheet' link. We are consulting with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact us	Provision of information.
Tasmanian Abalone Council Limited	9/04/2019	TACL 01 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1& Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email providing information on Beach's Otway Offshore Project including drilling activities. Drilling is expected to start around December 2019. Attached is a brief information sheet and further details are available on the Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. As part of our consultation we are engaging with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact me.	Provision of information.
Tasmanian Abalone Council Limited	07/06/2019	TACL 02 OPOG19IS#1 & OPOG19IS#2	Beach email providing information: As previously mentioned, the Otway Offshore Project will see up to 9 wells drilled offshore, consisting of exploration and production wells. Further activities in the Otway Basin will be carried out to ensure continued production at the Otway Gas Plant, including seabed site assessments, pre-drill activities, drilling of offshore gas wells, and subsea infrastructure installation. The first phase of the Seabed Site Assessments for the Otway Offshore Project will commence in September 2019. Please find attached an information sheet with the proposed seabed assessment locations and coordinates. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions.	Provision of information.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
			The drilling component of the Otway Offshore Project will commence between December 2019 and February 2020. Please find attached an information sheet with the proposed drilling locations and coordinates, including an update exclusion zones for vessels. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. If you would like to be kept in touch via text message of confirmed locations, start dates and durations just prior to and during the activities, please let us know and we will add you to our distribution list. We will need you to provide your mobile phone number so we can include it on our list. Further details on the Otway Offshore Project are available by visiting our Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Information Sheet' link. We are consulting with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact us	
Tasmania Parks and Wildlife Service for Tasmanian Department of Primary Industries, Parks, Water and Environment	26/04/2019	TD 03 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email providing information on Beach's Otway Offshore Project including drilling activities. In January 2018, Beach Energy acquired Origin Energy's gas exploration and production assets in Victoria, Western Australia and New Zealand. With its head office in Adelaide, Beach Energy has been operating in Australia for over 50 years and has extensive experience in the gas industry. We would like to inform you that we're planning further development of our Otway offshore natural gas reserves within existing Commonwealth offshore exploration permits and production licenses. The 'Otway Offshore Project' will see up to 9 wells drilled offshore, consisting of exploration and production wells. Further activities in the Otway Basin will be carried out to ensure continued production at the Otway Gas Plant, including seabed site assessments, pre-drill activities, drilling of offshore gas wells, and subsea infrastructure installation. The project is expected to start around September 2019, depending on regulatory approvals, weather windows and availability of contractors. I've attached a brief information sheet and further details are available by visiting our Otway Basin Victoria web page at https://www.beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact us.	Provision of information.
Tasmania Parks and Wildlife Service for Tasmanian Department of Primary Industries, Parks, Water and Environment / EPA Tasmania	21/05/2019	TD 04 – TD 09	Beach email providing copy of updated Offshore Victoria – Otway Basin Oil Pollution Emergency Plan (CDN/ID S4100AH717907) Rev D for Tas State review. Beach requested response by 11th June 2019. Series of communications prior to formal feedback on draft OPEP on 05/06/2019.	Provision of information.
Tasmania Parks and Wildlife Service for Tasmanian Department of Primary Industries, Parks, Water and Environment / EPA Tasmania	05/06/2019	TD 11 – TD 12	Beach email providing follow up to confirm key points discussed via telephone regarding Tas Sate review of Offshore Victoria – Otway Basin Oil Pollution Emergency Plan (CDN/ID S4100AH717907) Rev D. Email response from DPIPWE Marine Pollution Officer confirming key points correct as per telephone conversation and further providing contact details and reporting protocols: The whale hotline is 0427942537. However our protocol is that the EPA 24 hour number is called to notify of the spill, then our officer does an assessment and contacts our wildlife people directly. Our EPA Pollution hotline number is 1800 005171.	Confirmation of emergency spill response arrangements as discussed verbally. All comments received from Tasmanian State government have been incorporated into the subsequent revision of the Offshore Victoria – Otway Basin Oil Pollution Emergency Plan (CDN/ID S4100AH717907) prior to submission to NOPSEMA for assessment
Tasmania Parks and Wildlife Service for Tasmanian Department of Primary Industries, Parks, Water and Environment / EPA Tasmania	07/06/2019	TD 13 OPOG19IS#1 & OPOG19IS#2	Beach email providing further updates to the Otway Offshore Project. The drilling component of the Otway Offshore Project will commence between December 2019 and February 2020. Please find attached an information sheet with the proposed drilling locations and coordinates, including exclusion zones for vessels. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. Unless otherwise requested, we will be in touch with confirmed locations, start dates and durations of Seabed Site Assessments and Drilling activities closer to the time. If you would like to be kept in touch via text message of confirmed locations, start dates and durations just prior to and during the activities, please let us know and we will add you to our distribution list. We will need you to provide your mobile phone number so we can include it on our list.	Provision of information.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
			Further details on the Otway Offshore Project are available by visiting our Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Information Sheet' link. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact us.	
Tasmanian Rock Lobster Fisherman's Association	9/04/2019	TRLFA 01 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email providing information on Beach's Otway Offshore Project including drilling activities. Drilling is expected to start around December 2019. Attached is a brief information sheet and further details are available on the Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. As part of our consultation we are engaging with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact me.	Provision of information.
Tasmanian Rock Lobster Fisherman's Association	07/06/2019	TRLFA 02 OPOG19IS#1 & OPOG19IS#2	Beach email providing information: As previously mentioned, the Otway Offshore Project will see up to 9 wells drilled offshore, consisting of exploration and production wells. Further activities in the Otway Basin will be carried out to ensure continued production at the Otway Gas Plant, including seabed site assessments, pre-drill activities, drilling of offshore gas wells, and subsea infrastructure installation. The first phase of the Seabed Site Assessments for the Otway Offshore Project will commence in September 2019. Please find attached an information sheet with the proposed seabed assessment locations and coordinates. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. The drilling component of the Otway Offshore Project will commence between December 2019 and February 2020. Please find attached an information sheet with the proposed drilling locations and coordinates, including an update exclusion zones for vessels. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. If you would like to be kept in touch via text message of confirmed locations, start dates and durations just prior to and during the activities, please let us know and we will add you to our distribution list. We will need you to provide your mobile phone number so we can include it on our list. Further details on the Otway Offshore Project are available by visiting our Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Information Sheet' link. We are consulting with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact us	Provision of information.
Tasmanian Seafood Industry Council (TISC)	9/04/2019	TSIC 01 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email providing information on Beach's Otway Offshore Project including drilling activities. The project is expected to start around December 2019. Attached is a brief information sheet and further details are available on the Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. As part of our consultation we are engaging with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact me.	Provision of information.
Tasmanian Seafood Industry Council (TISC)	07/06/2019	TSIC 02 OPOG19IS#1 & OPOG19IS#2	Beach email providing information: As previously mentioned, the Otway Offshore Project will see up to 9 wells drilled offshore, consisting of exploration and production wells. Further activities in the Otway Basin will be carried out to ensure continued production at the Otway Gas Plant, including seabed site assessments, pre-drill activities, drilling of offshore gas wells, and subsea infrastructure installation. The first phase of the Seabed Site Assessments for the Otway Offshore Project will commence in September 2019. Please find attached an information sheet with the proposed seabed assessment locations and coordinates. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. The drilling component of the Otway Offshore Project will commence between December 2019 and February 2020. Please find attached an information sheet with the proposed drilling locations and coordinates, including an update exclusion zones for vessels. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. If you would like to be kept in touch via text message of confirmed locations, start dates and durations just prior to and during the activities, please let us know and we will add you to our distribution list. We will need you to provide your mobile phone number so we can include it on our list.	Provision of information.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
			Further details on the Otway Offshore Project are available by visiting our Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Information Sheet' link. We are consulting with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact us	
Tuna Australia (ETBF Industry Association)	17/04/2019	TA 01 TA 02 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email providing information on Beach's Otway Offshore Project including drilling activities. The project is expected to start around December 2019. Attached is a brief information sheet and further details are available on the Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. As part of our consultation we are engaging with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact me.	Provision of information.
Tuna Australia (ETBF Industry Association)	07/06/2019	TA 03 OPOG19IS#1 & OPOG19IS#2	Beach email providing information: As previously mentioned, the Otway Offshore Project will see up to 9 wells drilled offshore, consisting of exploration and production wells. Further activities in the Otway Basin will be carried out to ensure continued production at the Otway Gas Plant, including seabed site assessments, pre-drill activities, drilling of offshore gas wells, and subsea infrastructure installation. The first phase of the Seabed Site Assessments for the Otway Offshore Project will commence in September 2019. Please find attached an information sheet with the proposed seabed assessment locations and coordinates. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. The drilling component of the Otway Offshore Project will commence between December 2019 and February 2020. Please find attached an information sheet with the proposed drilling locations and coordinates, including an update exclusion zones for vessels. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. If you would like to be kept in touch via text message of confirmed locations, start dates and durations just prior to and during the activities, please let us know and we will add you to our distribution list. We will need you to provide your mobile phone number so we can include it on our list. Further details on the Otway Offshore Project are available by visiting our Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Information Sheet' link. We are consulting with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact us	Provision of information.
Victorian Fisheries Authority (VFA)	5/02/2019 – 11/02/2019	VFA 01 VFA 02 VFA 03 - 06	Beach email to set up a time to meet. VFA email of acknowledgement. Emails to set up meeting.	NA
Victorian Fisheries Authority (VFA)	25/02/2019	VFA 07	Beach email providing overview of upcoming activities in Victoria including drilling activities, details include: Offshore activities including: seabed assessments over a series of 4 x 4 km areas; drilling and construction of exploration and production wells; installation of seabed infrastructure for successful wells. The activities will require safe operating zones around each seabed assessment and the drill rig. We will send an information sheet on this project in the next week or so. To enable us to prepare our different environment plans, including any impacts on commercial fishing activity and mitigation plans that may be required, we need to assess fishing effort in Commonwealth and State managed fisheries. As such we are seeking VFA's support to provide data on Victorian State managed fisheries as follows: Catch data in each of the requested blocks/per block: • By month of year, for the last five years. • By species caught / tonnage of each. • By number of vessels operating. • If number of fishers < 5, return a "yes" in output field.	Request for information. It is noted that since this email was sent the areas of the seabed assessment have increased (See Section 4.1.1 Operational Area for details). The updates areas are within the fishing grids requested so updated information was not required from VFA.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
			• If no fishers, return a "no" in output field.	
Victorian Fisheries Authority (VFA)	4/03/2019	VFA 08	Beach follow-up email in relation to data request in VFA 07 and request to meet with VFA.	Follow-up of request for information.
Victorian Fisheries Authority (VFA)	6/03/2019	VFA 09 VFA 10 VFA 11	VFA email confirming data request had been sent and emails between Beach and VFA to arrange meeting on 12/03/19.	Follow-up of request for information.
Victorian Fisheries Authority (VFA)	12/03/2019	VFA 12	Meeting. Beach explained proposed offshore activities, discussed information sheet and map. Thanked VFA for providing fishing data and discussed low level of State managed (VFA) fishing activity in the vicinity. General discussion on Total Allowable Commercial Catch (TACC) and new harvest strategy. Beach asked if VFA could advise of any new strategies or research that may be relevant to assessment of any impacts from our operations. Also, that their website does not always show the latest TACC levels or strategies. VFA advised that they won't have much involvement in engagement regarding Beach's activities and mentioned industry representatives. Beach explained ongoing relationship with Seafood Industry Victoria (SIV), and Victorian Rock Lobster Association (VRLA), and that meeting SIV today.	VFA highlighted consultation with industry representatives. Beach is undertaking consultation with industry representatives including SIV, SETFIA and Victorian Rock Lobster Association.
Victorian Fisheries Authority (VFA)	18/04/2019	VFA 13 VFA 14 VFA 15 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email: Provision of information on the 'Otway Offshore Project and upcoming activities including drilling activities. In January 2018, Beach Energy acquired Origin Energy's gas exploration and production assets in Victoria, Western Australia and New Zealand. With its head office in Adelaide, Beach Energy has been operating in Australia for over 50 years and has extensive experience in the gas industry. We would like to inform you that we're planning further development of our Otway offshore natural gas reserves within existing Commonwealth offshore exploration permits and production licenses. The 'Otway Offshore Project' will see up to 9 wells drilled offshore, consisting of exploration and production wells. Further activities in the Otway Basin will be carried out to ensure continued production at the Otway Gas Plant, including seabed site assessments, pre-drill activities, drilling of offshore gas wells, and subsea infrastructure installation. The project is expected to start around September 2019, depending on regulatory approvals, weather windows and availability of contractors. I've attached a brief information sheet and further details are available by visiting our Otway Basin Victoria web page at https://www.beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact us	Provision of information.
Victorian Fisheries Authority (VFA)	29/04/2019	VFA 16	Email from VFA: There is significant overlap with Victoria's rock lobster and giant crab fisheries. There has been approximately 18t of Giant crab and 40t of Southern Rock lobster taken from within the boundaries of the survey grid provided over past 10 years. Can you please also confirm "coordinates of all locations will be made available to relevant stakeholders after completion of planning" to advise of further overlap with fishing activity. I would also like to be kept informed with the outcomes and recommendations from this section: In preparation of Environment Plans a noise assessment on marine fauna will be completed to identify any potential impacts and mitigation plans that may be required. This will include assessment of any Vertical Seismic Profiling (VSP) as this may be required to validate one exploration well. Please also provide the EP for comment when available.	Beach provided VFA with an extract of the current draft of the Seabed Assessment EP chapters related to noise modelling and the identification of fisheries. See Record VFA 25. No Vertical Seismic Profiling (VSP) to be undertaken at the Artisan-1 well location. This extract provided the information in EP Section Appendix B.4.8 Victorian managed fisheries which details: • Based on information from Seafood Industry Victoria approximately 40 t of southern rock lobster has been caught within the operational area of the last 10 years. This equates to between 1.5 – 1.7% of the total catch over the 10 year period. • Based on information from Seafood Industry Victoria approximately 18 t of giant crab has been caught within the operational area of the last 10 years. The total catch over the last 10 years has been 157.8 t so 18 t equates to This equates to 11% of the total catch being caught in the operational area. A meeting was held with VFA to further discuss Beach's Otway development activities. See Record VFA 25.
Victorian Fisheries Authority (VFA)	30/04/2019 1/05/2019	VFA 17 VFA 18 VFA 19 VFA 20	Emails between Beach and VFA to arrange meeting. Meeting set for 3/5/2019.	See Record VFA 25.
Victorian Fisheries Authority (VFA)	2/05/2019	VFA 21 VFA 22	Beach email: Prior to tomorrow's meeting, can you clarify what you wanted in relation to the noise assessment? Is it just for VSP?	See Record VFA 25 for details of the information provided to VFA. No Vertical Seismic Profiling (VSP) to be undertaken at the Artisan-1 well location.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
		VFA 23 VFA 24	VFA email: I am interested in the assessment and mitigation recommendations that follow. What are the outcomes for rock lobster and giant crab? Does this consider the studies that have indicated effects on RL? Beach email: Is the noise assessment (assessment and mitigations) just for the VSP activities? VFA email: I am interested in the assessment for all activities and their impacts.	
Victorian Fisheries Authority (VFA)	3/05/2019	VFA 25	Meeting between Beach, VFA and SIV. Beach provided VFA with an extract of the current draft of the Seabed Assessment EP chapters related to noise modelling and the identification of fisheries. Beach stepped VFA through the noise modelling at a high level and the conclusions that there was no unacceptable impact to marine fauna. VFA said it was good to have the report and that they would review it in more detail. Beach explained the consultation approach with fishers; engagement had been via SIV who undertook a mailout of a 2-page information sheet (which had also been provided to VFA) to their approx. 300 members. A cover letter had asked for fishers to identify if they felt they would be impacted by the activities. SIV had reported that 4 fishers had come forward and 2 others had contacted Beach directly. Beach will engage with these fishers and SIV as part of on-going consultation and specifically when details of the exact locations and timing of the seabed assessments and drilling were available. Beach would also provide regular information on the location of vessels and drill rigs to those who wanted to receive that information. VFA was comfortable with this approach. VFA asked about any permanent restrictions on fishing grounds, such as permanent exclusion zones, as this would reduce the available area for fishing. Beach explained that there may be a requirement for some wells to have exclusion zones around the infrastructure that will be installed on the seabed. At this stage the requirements for which wells and any details of the exclusion zones were not yet known. SIV joined the meeting and Beach gave a recap on the consultation that had been undertaken with commercial fishers. SIV was also provided with a copy of the draft EP extract. SIV informed VFA that they were happy with the way that Beach had undertaken the consultation and their plans for on-going consultation. Beach discussed with SIV a time when they could catch up to discuss the impacts on the four fishers that had identified themselves but no date was chosen due to current availability. SIV and VFA reviewed the fishing effort maps in the draft Seabed Assessment EP extract and queried the fishing activity for the giant crab map, in the grids located close to shore. Beach informed that the data had been provided by VFA.	Beach provided VFA with an extract of the current draft of the Seabed Assessment EP chapters related to noise modelling and the identification of fisheries. Beach will continue ongoing engagement with SIV and any affected fishers as per Section 9.7.1 Fishery specific consultation approach to ensure impacts to fishers are ALARP and an acceptable level. Beach has engaged directly with the fishers that contacted them. See Records for CRLF and CSF. VFA had raised concerns about loss of fishing area from permanent exclusion zones. During drilling activities, a temporary 500 m rig safety zone will be established, coinciding with the activity timing and duration (approximately 35-55 days). Additionally, a 2 km cautionary zone will be relayed to fishers via the AHO NTM process. Upon completion of the drilling activity, the Artisan-1 well is to be plugged and abandoned, unless the well has been assessed as viable for future production. Should Artisan-1 well be assessed as viable for future production, the well will be suspended, and a permanent PSZ will be established around the well location. Updated rock lobster and giant crab fishery maps were sent to VFA and SIV. See Record SIV 22 and VFA 27.
Victorian Fisheries Authority (VFA)	9/05/2019	VFA 26	Beach email requesting further fisheries data for grid L13.	Request for information.
Victorian Fisheries Authority (VFA)	10/05/2019	VFA 27	Beach email providing updated information as discussed at meeting on 3/5/2019 Record VFA 25. In the extract of the EP Beach provided VFA and SIV commented on the fishing effort maps. Beach have reviewed the maps we discussed and are including revised versions in the EP we are submitting shortly. The updated maps were provided which show only the areas where there has been catch effort for rock lobsters and giant crabs within the seabed survey operational area. We have also firmed up the sizes of the seabed assessment survey areas which vary slightly to what was communicated in the Otway Offshore Information Sheet we published. The revised sizes are in the table below. Site survey Survey Type Size in Km Artisan-1 Well 4.5 x 5 Geographe Well 4.5 x 5 La Bella Well 4.5 x 5 Thylacine Well 9 x 9 Artisan to Hot Tap Tee "Y" Pipeline 7 x 1 Artisan to Hot Tap Tee "X" Pipeline 6 x 1 Labella -Artisan Pipeline 18 x 1 Thylacine - Labella Pipeline 23 x 1 Artisan - Thylacine Pipeline 33 x 1 Don't hesitate to let me know if you have any questions.	Updated rock lobster and giant crab fishery maps showing overlap of fishery effort with the operational area that are presented in this EP where provided to SIV and VFA. Site survey area increases are not material as only a small increase in area compared to that provided by SIV via the information sheet to fishers (Record SIV 14). As the fisher's fish over a large area compared to the seabed assessment areas, it is unlikely that this small increase would exclude fishers who may be impact from identifying themselves to SIV based on the information sheet provided. Meeting will be set up with SIV to discuss the fishing effort of the four fishers who have raised with SIV that they fish in the area. Beach will continue ongoing engagement with SIV and any affected fishers as per Section 9.7.1 Fishery specific consultation approach to ensure impacts to fishers are ALARP and an acceptable level.
Victorian Fisheries Authority (VFA)		VFA 28 – VFA 40	Various emails requesting catch data information. Beach email requesting meeting. Meeting scheduled for 03/06/2019 – record VFA 41	Request for information
Victorian Fisheries Authority (VFA)	03/06/2019	VFA 41 OPOG19IS#1 &	Meeting between Beach and VFA held at VFA office, Melbourne. Beach presented 2 x short information sheets which show the locations of the seabed assessment with coordinates and expected durations and sequence on the back. Similar sheet has been produced for drilling phase.	Ongoing stakeholder engagement commitment within EP to regularly update Fishers by text.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
		OPOG19IS#2	The information sheets will help fishers plan around our activities. Beach offered to keep Fishers informed by text message of the location of the vessel on a regular basis to minimise impacts on each other. Beach offered compensation for damaged lines or rock lobster pots (attributable to Beach activities). There will be a 500m exclusion zone around the drill rig overlaid with a 2km cautionary zone so fishers know where we are. Petroleum Safety Zones (Otway Offshore Project): A potential PSZ has a 500m radius. There will be a few PSZs created around the Thylacine wells and Beach is mapping these to see what they look like as a group. They won't be applied for yet until after the production wells are drilled. Generally, the infrastructure is located on a sandy sea bottom but the 500m zone may overlap some reefy areas. We will know more once we have the information from the seabed assessments to see what areas are included in the zones. Beach will come back to VFA once we have more information. VFA thanked Beach for coming to meet with them.	During drilling activities, a temporary 500 m rig safety zone will be established, coinciding with the activity timing and duration (approximately 35-55 days). Additionally, a 2 km cautionary zone will be relayed to fishers via the AHO NTM process. Upon completion of the drilling activity, the Artisan-1 well is to be plugged and abandoned, unless the well has been assessed as viable for future production. Should Artisan-1 well be assessed as viable for future production, the well will be suspended, and a permanent PSZ will be established around the well location.
Victorian Fisheries Authority (VFA)	07/06/2019	VFA 42 OPOG19IS#1 & OPOG19IS#2	Beach email providing update information: The drilling component of the Otway Offshore Project will commence between December 2019 and February 2020. Please find attached an information sheet with the proposed drilling locations and coordinates, including exclusion zones for vessels. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. Unless otherwise requested, we will be in touch with confirmed locations, start dates and durations of Seabed Site Assessments and Drilling activities closer to the time. If you would like to be kept in touch via text message of confirmed locations, start dates and durations just prior to and during the activities, please let us know and we will add you to our distribution list. We will need you to provide your mobile phone number so we can include it on our list.	Provision of information
Victorian Fisheries Authority (VFA)	20/06/2019	VFA 43	Beach email requesting further fisheries data for grid L13.	Request for information
Victorian Recreational Fishing Peak Body (VR Fish)	9/04/2019	VRFISH 01 VRFISH 02 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email providing information on Beach's Otway Offshore Project including drilling activities. The project is expected to start around December 2019. Attached is a brief information sheet and further details are available on the Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. As part of our consultation we are engaging with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact me.	Provision of information.
Victorian Recreational Fishing Peak Body (VR Fish)	07/06/2019	VRFISH 03 OPOG19IS#1 & OPOG19IS#2	Beach email providing information: As previously mentioned, the Otway Offshore Project will see up to 9 wells drilled offshore, consisting of exploration and production wells. Further activities in the Otway Basin will be carried out to ensure continued production at the Otway Gas Plant, including seabed site assessments, pre-drill activities, drilling of offshore gas wells, and subsea infrastructure installation. The first phase of the Seabed Site Assessments for the Otway Offshore Project will commence in September 2019. Please find attached an information sheet with the proposed seabed assessment locations and coordinates. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. The drilling component of the Otway Offshore Project will commence between December 2019 and February 2020. Please find attached an information sheet with the proposed drilling locations and coordinates, including an update exclusion zones for vessels. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. If you would like to be kept in touch via text message of confirmed locations, start dates and durations just prior to and during the activities, please let us know and we will add you to our distribution list. We will need you to provide your mobile phone number so we can include it on our list. Further details on the Otway Offshore Project are available by visiting our Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Information Sheet' link. We are consulting with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact us	Provision of information.

Stakeholder Name	Date	Record #	Description	Assessment of Objection or Claim
Victorian Rock Lobster Association (VRLA)	129/03/2019	VRLA 01 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	VRLA was included in Seafood Industry Victoria's mail-out of 2pp fact sheet to approx. 300 SIV members.	Provision of information. See Record SIV 14.
Victorian Scallop Fishermen's Association Inc	17/04/2019	VSFA 01 VSFA 02 OP19IS#1 - Otway Offshore Program 2019 2pp Info Sheet #1 Link to: OP19IS#2 - Otway Offshore Program 2019 10pp Info Sheet #2	Beach email providing information on Beach's Otway Offshore Project including drilling activities. The project is expected to start around December 2019. Attached is a brief information sheet and further details are available on the Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Project Information Sheet' link. As part of our consultation we are engaging with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact me.	Provision of information.
Victorian Scallop Fishermen's Association Inc	07/06/2019	VSFA 03 OPOG19IS#1 & OPOG19IS#2	Beach email providing information: As previously mentioned, the Otway Offshore Project will see up to 9 wells drilled offshore, consisting of exploration and production wells. Further activities in the Otway Basin will be carried out to ensure continued production at the Otway Gas Plant, including seabed site assessments, pre-drill activities, drilling of offshore gas wells, and subsea infrastructure installation. The first phase of the Seabed Site Assessments for the Otway Offshore Project will commence in September 2019. Please find attached an information sheet with the proposed seabed assessment locations and coordinates. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. The drilling component of the Otway Offshore Project will commence between December 2019 and February 2020. Please find attached an information sheet with the proposed drilling locations and coordinates, including an update exclusion zones for vessels. The order in which each location will be accessed will be confirmed as the activities progress. All dates are subject to fair sea state conditions. If you would like to be kept in touch via text message of confirmed locations, start dates and durations just prior to and during the activities, please let us know and we will add you to our distribution list. We will need you to provide your mobile phone number so we can include it on our list. Further details on the Otway Offshore Project are available by visiting our Otway Basin Victoria web page at beachenergy.com.au/vic-otway-basin/ and clicking on the 'Otway Offshore Information Sheet' link. We are consulting with commercial fishing associations on arrangements to ensure each other's operational plans are understood, helping to minimise any impacts to fishing activities and to Beach's offshore development program. In preparation of our Environment Plan we are keen to understand if you have any questions, concerns or feedback or require any further consultation. Please don't hesitate to contact us	Provision of information.

Appendix A EPBC Act Protected Matters Search Report

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

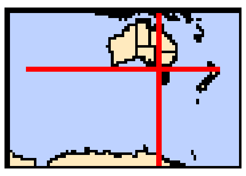
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 22/05/19 17:45:14

Coordinates
Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	3
Wetlands of International Importance:	6
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	7
Listed Threatened Species:	104
Listed Migratory Species:	76

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	7
Commonwealth Heritage Places:	8
Listed Marine Species:	129
Whales and Other Cetaceans:	30
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	5

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	68
Regional Forest Agreements:	3
Invasive Species:	56
Nationally Important Wetlands:	10
Key Ecological Features (Marine)	3

Details

Matters of National Environmental Significance

National Heritage Properties [Resource Information]

Name	State	Status
Historic		
Great Ocean Road and Scenic Environs	VIC	Listed place
Point Nepean Defence Sites and Quarantine Station Area	VIC	Listed place
Quarantine Station and Surrounds	VIC	Within listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Corner inlet	Within 10km of Ramsar
Glenelg estuary and discovery bay wetlands	Within Ramsar site
Lavinia	Within Ramsar site
Piccaninnie ponds karst wetlands	Within 10km of Ramsar
Port phillip bay (western shoreline) and bellarine peninsula	Within Ramsar site
Western port	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community	Endangered	Community likely to occur within area
Giant Kelp Marine Forests of South East Australia	Endangered	Community may occur within area
Grassy Eucalypt Woodland of the Victorian Volcanic Plain	Critically Endangered	Community likely to occur within area
Natural Damp Grassland of the Victorian Coastal Plains	Critically Endangered	Community likely to occur within area
Natural Temperate Grassland of the Victorian Volcanic Plain	Critically Endangered	Community may occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		

Name	Status	Type of Presence
Acanthiza pusilla archibaldi King Island Brown Thornbill, Brown Thornbill (King Island) [59430]	Endangered	Species or species habitat likely to occur within area
Acanthornis magna greeniana King Island Scrubtit, Scrubtit (King Island) [82329]	Critically Endangered	Species or species habitat known to occur within area
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Aquila audax fleayi Tasmanian Wedge-tailed Eagle, Wedge-tailed Eagle (Tasmanian) [64435]	Endangered	Species or species habitat likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Ceyx azureus diemenensis Tasmanian Azure Kingfisher [25977]	Endangered	Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Pedionomus torquatus Plains-wanderer [906]	Critically Endangered	Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Platycercus caledonicus brownii Green Rosella (King Island) [67041]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Strepera fuliginosa colei Black Currawong (King Island) [67113]	Vulnerable	Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Thalassarche cauta steadi		
White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma		
Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita		
Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis rubricollis		
Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Crustaceans		
Euastacus bispinosus		
Glenelg Spiny Freshwater Crayfish, Pricklyback [81552]	Endangered	Species or species habitat may occur within area
Fish		
Galaxiella pusilla		
Eastern Dwarf Galaxias, Dwarf Galaxias [56790]	Vulnerable	Species or species habitat known to occur within area
Maccullochella peelii		
Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Nannoperca obscura		
Yarra Pygmy Perch [26177]	Vulnerable	Species or species habitat likely to occur within area
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat known to occur within area
Frogs		
Litoria raniformis		
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog [1828]	Vulnerable	Species or species habitat known to occur within area
Insects		
Synemon plana		
Golden Sun Moth [25234]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Antechinus minimus maritimus		
Swamp Antechinus (mainland) [83086]	Vulnerable	Species or species habitat known to occur within area
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Isoodon obesulus obesulus Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat known to occur within area
Mastacomys fuscus mordicus Broad-toothed Rat (mainland), Tooarrana [87617]	Vulnerable	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Miniopterus orianae bassanii Southern Bent-wing Bat [87645]	Critically Endangered	Roosting known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys fumeus Smoky Mouse, Konoom [88]	Endangered	Species or species habitat likely to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys shortridgei Heath Mouse, Dayang, Heath Rat [77]	Endangered	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Amphibromus fluitans River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat known to occur within area
Caladenia calcicola Limestone Spider-orchid [10065]	Vulnerable	Species or species habitat likely to occur within area
Caladenia colorata Coloured Spider-orchid, Small Western Spider-orchid, Painted Spider-orchid [54999]	Endangered	Species or species habitat likely to occur within area
Caladenia hastata Melblom's Spider-orchid [16118]	Endangered	Species or species habitat likely to occur within area
Caladenia insularis French Island Spider-orchid [24372]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Caladenia orientalis Eastern Spider Orchid [83410]	Endangered	Species or species habitat known to occur within area
Caladenia robinsonii Frankston Spider-orchid [24375]	Endangered	Species or species habitat likely to occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat known to occur within area
Euphrasia collina subsp. muelleri Purple Eyebright, Mueller's Eyebright [16151]	Endangered	Species or species habitat known to occur within area
Glycine latrobeana Clover Glycine, Purple Clover [13910]	Vulnerable	Species or species habitat known to occur within area
Grevillea infecunda Anglesea Grevillea [22026]	Vulnerable	Species or species habitat likely to occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat known to occur within area
Hypolepis distans Scrambling Ground-fern [2148]	Endangered	Species or species habitat likely to occur within area
Ixodia achillaeoides subsp. arenicola Sand Ixodia, Ixodia [21474]	Vulnerable	Species or species habitat known to occur within area
Lachnagrostis adamsonii Adamson's Blown-grass, Adamson's Blowngrass [76211]	Endangered	Species or species habitat may occur within area
Leiocarpa gatesii Wrinkled Buttons [76212]	Vulnerable	Species or species habitat likely to occur within area
Leucochrysum albicans var. tricolor Hoary Sunray, Grassland Paper-daisy [56204]	Endangered	Species or species habitat may occur within area
Pimelea spinescens subsp. spinescens Plains Rice-flower, Spiny Rice-flower, Prickly Pimelea [21980]	Critically Endangered	Species or species habitat likely to occur within area
Pomaderris halmaturina subsp. halmaturina Kangaroo Island Pomaderris [21964]	Vulnerable	Species or species habitat known to occur within area
Prasophyllum frenchii Maroon Leek-orchid, Slaty Leek-orchid, Stout Leek-orchid, French's Leek-orchid, Swamp Leek-orchid [9704]	Endangered	Species or species habitat likely to occur within area
Prasophyllum spicatum Dense Leek-orchid [55146]	Vulnerable	Species or species habitat known to occur within area
Pterostylis chlorogramma Green-striped Greenhood [56510]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis cucullata Leafy Greenhood [15459]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Pterostylis tenuissima Swamp Greenhood, Dainty Swamp Orchid [13139]	Vulnerable	Species or species habitat known to occur within area
Pterostylis ziegeleri Grassland Greenhood, Cape Portland Greenhood [64971]	Vulnerable	Species or species habitat may occur within area
Senecio psilocarpus Swamp Fireweed, Smooth-fruited Groundsel [64976]	Vulnerable	Species or species habitat likely to occur within area
Taraxacum cygnorum Coast Dandelion [2508]	Vulnerable	Species or species habitat likely to occur within area
Thelymitra epipactoides Metallic Sun-orchid [11896]	Endangered	Species or species habitat known to occur within area
Thelymitra matthewsii Spiral Sun-orchid [4168]	Vulnerable	Species or species habitat likely to occur within area
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat known to occur within area
Ardenna tenuirostris Short-tailed Shearwater [82652]		Breeding known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Breeding known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Thalasseus bergii Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa incana Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Defence - CROWS NEST CAMP - QUEENSCLIFF
Defence - HMAS CERBERUS
Defence - STAFF COLLEGE-FORT QUEENSCLIFF
Defence - SWAN ISLAND TRAINING AREA
Defence - TRAINING CENTRE (Norris Barracks) - Portsea
Defence - WEST HEAD GUNNERY RANGE

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
HMAS Cerberus Marine and Coastal Area	VIC	Listed place
Swan Island and Naval Waters	VIC	Listed place
Historic		
Cape Wickham Lighthouse	TAS	Listed place
Fort Queenscliff	VIC	Listed place
HMAS Cerberus Central Area Group	VIC	Listed place
Sorrento Post Office	VIC	Listed place
Swan Island Defence Precinct	VIC	Listed place
Wilsons Promontory Lighthouse	VIC	Listed place

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Breeding known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Larus dominicanus Kelp Gull [809]		Breeding known to occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Morus capensis Cape Gannet [59569]		Breeding known to occur within area
Morus serrator Australasian Gannet [1020]		Breeding known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding known to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Pelecanoides urinatrix Common Diving-Petrel [1018]		Breeding known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding known to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Roosting known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur

Name	Threatened	Type of Presence
		within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Foraging, feeding or related behaviour known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat known to occur within area
Puffinus tenuirostris Short-tailed Shearwater [1029]		Breeding known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Sterna nereis Fairy Tern [796]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys tryoni Tryon's Pipefish [66193]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus minotaur Bullneck Seahorse [66705]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Kimblaeus bassensis Trawl Pipefish, Bass Strait Pipefish [66247]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
[Leptoichthys fistularius](#) Brushtail Pipefish [66248]		Species or species habitat may occur within area
[Lissocampus caudalis](#) Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
[Lissocampus runa](#) Javelin Pipefish [66251]		Species or species habitat may occur within area
[Maroubra perserrata](#) Sawtooth Pipefish [66252]		Species or species habitat may occur within area
[Mitotichthys mollisoni](#) Mollison's Pipefish [66260]		Species or species habitat may occur within area
[Mitotichthys semistriatus](#) Halfbanded Pipefish [66261]		Species or species habitat may occur within area
[Mitotichthys tuckeri](#) Tucker's Pipefish [66262]		Species or species habitat may occur within area
[Notiocampus ruber](#) Red Pipefish [66265]		Species or species habitat may occur within area
[Phycodurus eques](#) Leafy Seadragon [66267]		Species or species habitat may occur within area
[Phyllopteryx taeniolatus](#) Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
[Pugnaso curtirostris](#) Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
[Solegnathus robustus](#) Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
[Solegnathus spinosissimus](#) Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
[Stigmatopora argus](#) Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
[Stigmatopora nigra](#) Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
[Stipecampus cristatus](#) Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
[Syngnathoides biaculeatus](#) Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
[Urocampus carinirostris](#) Hairy Pipefish [66282]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Vanacampus vercoi Verco's Pipefish [66286]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area

Name	Status	Type of Presence
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
[Pseudorca crassidens](#) False Killer Whale [48]		Species or species habitat likely to occur within area
[Tursiops aduncus](#) Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
[Tursiops truncatus s. str.](#) Bottlenose Dolphin [68417]		Species or species habitat may occur within area
[Ziphius cavirostris](#) Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Apollo	Multiple Use Zone (IUCN VI)
Beagle	Multiple Use Zone (IUCN VI)
Murray	Multiple Use Zone (IUCN VI)
Nelson	Special Purpose Zone (IUCN VI)
Zeehan	Special Purpose Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Aire River	VIC
Aireys Inlet B.R.	VIC
Anglesea B.R.	VIC
Anglesea Heath	VIC
Anser Island	VIC
Bay of Islands Coastal Park	VIC
Bucks Lake	SA
Canunda	SA
Cape Liptrap Coastal Park	VIC
Cape Nelson	VIC
Cape Patterson N.C.R	VIC
Cape Wickham	TAS
Cape Wickham	TAS
Carpenter Rocks	SA
Cone Islet	TAS
Crib Point G228 B.R.	VIC
Crib Point G229 B.R.	VIC
Curtis Island	TAS
Devils Tower	TAS
Disappointment Bay	TAS
Discovery Bay Coastal Park	VIC
Douglas Point	SA
East Moncoeur Island	TAS
Edna Bowman N.C.R.	VIC
Fingal B.R	VIC
Flinders G234 B.R.	VIC
Flinders N.F.R.	VIC
French Island G230 B.R	VIC
French Island National Park	VIC
Great Otway National Park	VIC
Hogan Group	TAS
Kilcunda N.C.R.	VIC
Lady Julia Percy Island W.R.	VIC
Lake Connewarre W.R	VIC
Lake Flannigan	TAS
Latrobe B.R.	VIC
Lavinia	TAS

Name	State
Lawrence Rocks W.R.	VIC
Lily Pond B.R.	VIC
Lonsdale Lakes W.R	VIC
Marengo N.C.R.	VIC
Merricks Creek B.R.	VIC
Mornington Peninsula National Park	VIC
Mount Vereker Creek	VIC
Nene Valley	SA
North East Islet	TAS
Parker River	VIC
Phillip Island Nature Park	VIC
Point Nepean National Park	VIC
Port Campbell National Park	VIC
Princetown W.R	VIC
Queenscliff N.F.R	VIC
Reef Island and Bass River Mouth N.C.R	VIC
Rodondo Island	TAS
Rosebud B.R.	VIC
Seal Islands W.R.	VIC
Southern Wilsons Promontory	VIC
Stony Creek (Otways)	VIC
Swan Bay - Edwards Point W.R	VIC
Unnamed (No.HA26)	SA
Ventnor B.R.	VIC
Vereker Creek	VIC
Warrengine Creek SS.R.	VIC
West Moncoeur Island	TAS
Wilsons Promontory	VIC
Wilsons Promontory Islands	VIC
Wilsons Promontory National Park	VIC
Wonthaggi Heathlands N.C.R	VIC

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
Gippsland RFA	Victoria
Tasmania RFA	Tasmania
West Victoria RFA	Victoria

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Callipepla californica California Quail [59451]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Gallus gallus Red Junglefowl, Domestic Fowl [917]		Species or species habitat likely to occur within area
Meleagris gallopavo Wild Turkey [64380]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pavo cristatus Indian Peafowl, Peacock [919]		Species or species habitat likely to occur within area
Phasianus colchicus Common Pheasant [920]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Turdus philomelos Song Thrush [597]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus scandens Asparagus Fern, Climbing Asparagus Fern [23255]		Species or species habitat likely to occur within area
Austrocylindropuntia spp. Prickly Pears [85132]		Species or species habitat likely to occur within area
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Anderson Inlet	VIC
Lake Connewarre State Wildlife Reserve	VIC
Lake Flannigan	TAS
Lavinia Nature Reserve	TAS
Lower Aire River Wetlands	VIC
Mud Islands	VIC
Powlett River Mouth	VIC
Princetown Wetlands	VIC
Swan Bay & Swan Island	VIC

Name	State
Western Port	VIC

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Bonney Coast Upwelling	South-east
Upwelling East of Eden	South-east
West Tasmania Canyons	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-38.8428 143.5383,-38.7126 143.7366,-38.5023 144.002,-38.3574 144.2852,-38.1751 144.7888,-38.362 144.9108,-38.4825 144.9108,-38.293 145.2239,-38.4865 145.428,-38.6681 145.622,-38.674 145.827,-38.8843 145.9514,-39.1399 146.3834,-38.9745 146.2708,-38.9361 146.8688,-38.6257 147.4575,-38.0947 148.1286,-39.2583 147.1622,-39.5083 146.637,-39.3863 145.0864,-39.9321 144.3422,-39.6229 144.0166,-39.6679 143.0985,-40.1452 142.6635,-38.1752 139.2053,-36.7803 138.1301,-37.6875 140.1321,-37.9495 140.4363,-38.0705 140.6391,-38.0964 141.0461,-38.4018 141.5279,-38.395 142.1668,-38.4546 142.6148,-38.6539 143.0869,-38.8428 143.5383

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-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix B Existing Environment

The physical, ecological and socio-economic environment within the area that may be contacted by low-threshold concentrations of hydrocarbons are described in this section, with any values or sensitivities identified.

A search of the EPBC Protected Matters Search Tool (PMST) was undertaken on 5 May 2019 to identify the conservation values within the low-threshold EMBA. The full PMST report is included in Appendix A and key information included in Table 5-1 to Table 5-2.

Appendix B.1 Conservation values and sensitivities

The following section details the conservation values and sensitivities identified within the EMBA.

Appendix B.1.1 Australian Marine Parks

The South-east Commonwealth Marine Reserves Network was designed to include examples of each of the provincial bioregions and the different sea-floor 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 SEMR are represented in the network. As there is a lack of detailed information on the biodiversity of the deep ocean environment, sea-floor features were used as surrogates for biodiversity to design the Marine Reserves Network. The SEMR network contains representative examples of the 17 sea-floor features found in the Commonwealth waters of the region.

The PMST Report identified five Australian Marine Parks (AMPs) within the EMBA but not the operational area:

- Apollo
- Beagle
- Murray
- Nelson
- Zeehan

All of the reserves, in whole or part, are classified as IUCN VI – Multiple Use Zones, in which a wide range of sustainable activities are allowed as long as they do not significantly impact on benthic (seafloor) habitats or have an unacceptable impact on the values of the area. Allowable activities include commercial fishing, general use, recreational fishing, defence and emergency response. Some forms of commercial fishing, excluding demersal trawl, Danish seine, gill netting (below 183 m) and scallop dredging, are allowed, provided that the operator has approval from the Director of National Parks and abides by the conditions of that approval.

The Zeehan Commonwealth Marine Reserve also has an IUCN VI - Special Purpose Zone, which allows for limited mining and low-level extraction of natural resources. Permitted activities are similar to Multiple Use Zones; however, commercial fishing is not permitted.

The South-east Marine Reserves are managed under the South-east Marine Reserves Management Plan (DNP, 2013).

Appendix B.1.1.1 Apollo AMP

The Apollo AMP is located off Apollo Bay on Victoria's west coast in waters 80 m to 120 m deep on the continental shelf. The reserve covers 1,184 km2 of Commonwealth ocean territory (DNP, 2013). The reserve encompasses the continental shelf ecosystem of the major biological zone that extends from South Australia to the west of Tasmania. The area includes the Otway Depression, an undersea valley that joins the Bass Basin to the open ocean. Apollo AMP is a relatively shallow reserve with big waves and strong tidal flows; the rough seas provide habitats for fur seals and school sharks (DNP, 2013).

The major conservation values of the Apollo AMP are:

- Ecosystems, habitats and communities associated with the Western Bass Strait Shelf Transition and the Bass Strait Shelf Province and associated with the sea-floor features: deep/hole/valley and shelf
- Important migration area for blue, fin, sei and humpback whales
- Important foraging area for black-browed and shy albatross, Australasian gannet, short-tailed shearwater and crested tern
- Cultural and heritage site - wreck of the MV City of Rayville (DNP, 2013).

Appendix B.1.1.2 Beagle AMP

The Beagle AMP is an area in shallow continental shelf depths of about 50 m to 70 m, which extends around south-eastern Australia to Tasmania covering an area of 2,928 km2 (DNP, 2013). The reserve includes the fauna of central Bass Strait; an area known for its high biodiversity. The deeper water habitats are likely to include rocky reefs supporting beds of encrusting, erect and branching sponges, and sediment composed of shell grit with patches of large sponges and sparse sponge habitats.

The reserve includes islands that are important breeding colonies for seabirds and the Australian fur seal, and waters that are important foraging areas for these species. The species-rich waters also attract top predators such as killer whales and great white sharks.

The major conservation values of the Beagle AMP are:

- Ecosystems, habitats and communities associated with the Southeast Shelf Transition and associated with the sea-floor features: basin, plateau, shelf and sill
- Important migration and resting areas for southern right whales
- It provides important foraging habitat for the Australian fur seal, killer whale, great white shark, shy albatross, Australasian gannet, short-tailed shearwater, Pacific and silver gulls, crested tern, common diving petrel, fairy prion, black-faced cormorant and little penguin
- Cultural and heritage sites including the wreck of the steamship SS Cambridge and the wreck of the ketch Eliza Davies (DNP, 2013).

Appendix B.1.1.3 Murray AMP

The Murray AMP lies south of the mouth of the Murray River, off the South Australian coast and stretches out to Australia's exclusive economic zone limit, more than 400 km out to sea, covering an area of 25,803 km^2 (DNP, 2013). It spans an extensive area across the Lacepede Shelf, continental slope and deeper water ecosystems that extend from South Australia to Tasmania. The reserve contains the Murray Canyon, which is considered one of the most spectacular geological formations on the Australian continent margin. The reserve is important for many marine species, including those migrating through its inshore waters. The southern right whale uses the inshore area of the reserve to nurse its young. Offshore, many seabird species can be seen foraging.

The major conservation values of the Murray AMP are:

- Examples of ecosystems, habitats and communities associated with: the Spencer Gulf Shelf Province, the Southern Province, the West Tasmanian Transition and associated with sea-floor features: abyssal plain/deep ocean floor, canyon, escarpment, knoll/abyssal hill, shelf, slope, terrace

- Features with high biodiversity and productivity: Bonney coast upwelling, shelf rocky reefs and hard substrate
- Important foraging areas for: blue, sei and fin whales, Australian sea lion, wandering, black-browed, yellow-nosed and shy albatrosses, great-winged petrels, flesh-footed and short-tailed shearwaters, and white-faced storm petrel
- Important breeding area for the southern right whale and important migration area for the humpback whale (DNP, 2013)

Appendix B.1.1.4 Nelson AMP

The Nelson AMP spans the deep water ecosystems (greater than 3,000 m depth) extending from South Australia to the west of Tasmania (DNP, 2013). The reserve spans a range of geological features including plateaus, knolls, canyons and the abyssal plain (a large area of extremely flat or gently sloping ocean floor just offshore from the continent). The knoll features provide a rocky substrate above the abyssal plain. Little is known about the benthic biodiversity of this reserve; however, marine mammals are known to occur here.

The major conservation values of the Nelson AMP are:

- Examples of ecosystems, habitats and communities associated with the West Tasmanian Transition and associated with the sea-floor features including the abyssal plain/deep ocean floor, canyon, knoll/abyssal hill, plateau and slope
- Important migration area for humpback, blue, fin and sei whales (DNP, 2013).

Appendix B.1.1.5 Zeehan AMP

The Zeehan AMP covers an area of 19,897 km^2 to the west and south-west of King Island in Commonwealth waters surrounding north-western Tasmania (DNP, 2013). It covers a broad depth range from the shallow continental shelf depth of 50 m to the abyssal plain which is over 3,000 m deep. The reserve spans the continental shelf, continental slope and deeper water ecosystems of the major biological zone that extends from South Australia to the west of Tasmania. Four submarine canyons incise the continental slope, extending from the shelf edge to the abyssal plains. A rich community made up of large sponges and other permanently attached or fixed invertebrates is present on the continental shelf, including giant crab (Pseudocarcinus gigas). Concentrations of larval blue wahoo (Seriolella brama) and ocean perch (Helicolenus spp.) demonstrate the role of the area as a nursery ground.

Rocky limestone banks provide important seabed habitats for a variety of commercial fish and crustacean species including the giant crab. The area is also a foraging area for a variety of seabirds such as fairy prion, shy albatross, silver gull, and short tail shearwater (DNP, 2013).

The major conservation values for the Zeehan AMP are:

- Examples of ecosystems, habitats and communities associated with the Tasmania Province, the West Tasmania Transition and the Western Bass Strait Shelf Transition and associated with the sea-floor features: abyssal plain/deep ocean floor, canyon, deep/hole/valley, knoll/abyssal hill, shelf and slope
- Important migration area for blue and humpback whales
- Important foraging habitat for black-browed, wandering and shy albatrosses, and great-winged and cape petrels (DNP, 2013).

Appendix B.1.2 Commonwealth Heritage Places

The PMST Report identified eight Commonwealth Heritage Places in the EMBA, most of which are historic heritage places located on land and therefore are outside the EMBA. The eight heritage places are:

- HMAS Cerberus Marine and Coastal Area (Natural, Listed place)
- Swan Island and Naval Waters (Natural, Listed place)

- Cape Wickham Lighthouse (Historic, Listed place)
- Fort Queenscliff (Historic, Listed place)
- HMAS Cerberus Central Area Group (Historic, Listed place)
- Sorrento Post Office VIC (Historic, Listed place)
- Swan Island Defence Precinct (Historic, Listed place)
- Wilsons Promontory Lighthouse (Historic, Listed place)

Two of these heritage places include natural coastal areas within the EMBA; HMAS Cerberus Marine and Coastal Area and Swan Island (and Naval Waters). These are discussed below.

Appendix B.1.2.1 HMAS Cerberus Marine and Coastal Area

The Sandy Point/H.M.A.S Cerberus area has high geomorphological, botanical and zoological significance. Sandy Point is one of the largest spit systems on the Victorian coast and one of the State's most dynamic shorelines. Western Port as a whole is a wetland of international significance listed under the Ramsar Convention on Wetlands. It is recognised as the third most important site for migratory and resident waders in Victoria behind Corner Inlet and Swan Bay. The official values of the area include (DotEE, 2004a):

- Relict spits in Hanns Inlet indicate that the sediment regime at the site has changed rapidly, possibly due to the extension of Sandy Point.
- Sandy Point supports some of the best remaining examples of Coastal Banksia Woodland, Coastal Grassy Forest, and Coastal Dune Scrub in the Greater Melbourne region. These communities have been extensively cleared and degraded in the Westernport Catchment and on the Mornington Peninsula.
- Sandy Point is one of the largest spit systems on the Victorian coast and one of the States most dynamic shorelines.
- Continuing shoreline progradation at Sandy Point reveals several stages in sand dune succession.

Appendix B.1.2.2 Swan Island (and Naval Waters)

Swan Island is the largest emergent sand accumulation feature in Port Phillip Bay. The island, which has been built principally by wave actions rather than by aeolian forces, has played a major role in determining the pattern of sedimentation in Swan Bay and preserves geomorphological evidence of changing Quaternary sea levels. The eastern and northern shores of the eastern arm of Swan Island are of regional significance as an example of active coastal depositional and erosional processes (DotEE, 2004b).

Sand Island is the most important high tide roosting area in Swan Bay and at high tide regularly supports half of the shorebirds in the Swan Bay - Mud Islands complex. Sand Island maintains a regular breeding population of the fairy tern (*Sterna nereis*) and provides the main roosting habitat in Swan Bay for the nationally endangered little tern (*Sterna albifrons*) (DotEE, 2004b).

Appendix B.1.3 World Heritage Properties

There are no marine or coastal World Heritage Areas in the vicinity of the EMBA, as described in the PMST Report.

Appendix B.1.4 National Heritage Places

The places of National Heritage that were identified by the PMST Report are located onshore; outside the EMBA and do not have marine or coastal components. These are:

- Great Ocean Road and Scenic Environs (historic)
- Point Nepean Defence Sites and Quarantine Station Area (historic)

- Quarantine Station and Surrounds (historic).

Appendix B.1.5 Wetlands of International Importance

There are six marine or coastal Wetlands of International Importance (Ramsar-listed wetlands) in the EMBA. These are described in the following sections.

Appendix B.1.5.1 Corner Inlet

The Corner Inlet Ramsar Site is located approximately 250 km south-east of Melbourne and includes Corner Inlet and Nooramunga Marine and Coastal Parks, and the Corner Inlet Marine National Park. It covers 67,192 ha and represents the most southerly marine embayment and intertidal system of mainland Australia. It is protected by the Corner Inlet Ramsar Site Management Plan (WGCMA, 2014), which identifies the key values as including:

- A substantially unmodified wetland which supports a range of estuarine habitats (seagrass, mud and sand flats, mangroves, saltmarsh and permanent marine shallow water).
- Presence of nationally threatened species including orange-bellied parrot, Australian grayling, fairy tern and growling grass frog.
- Non-breeding habitats for migratory shorebird species and breeding habitat for variety of waterbirds including several threatened species.
- Important habitats, feeding areas, dispersal and migratory pathways and spawning sites for numerous fish species of direct or indirect fisheries significance.
- Over 390 species of indigenous flora (15 listed species) and 160 species of indigenous terrestrial fauna (22 threatened species) and over 390 species of marine invertebrates.
- A wide variety of marine mammals including bottlenose dolphins and Australian fur seals, as well as occasional records of common dolphins, New Zealand fur seals, leopard seals and southern right whales.
- Significant areas of mangrove and saltmarsh which are listed nationally as vulnerable ecological communities and provide foraging, nesting and nursery habitat for many species.
- Sand and mudflats, when exposed at low tide, which provide important feeding grounds for migratory and resident birds and at high tide provide food for aquatic organisms including commercial fish species (CSIRO, 2005).
- Ports and harbours – The four main ports (Port Albert, Port Franklin, Port Welshpool and Barry’s Beach) service the commercial fishing industry, minor coastal trade, offshore oil and gas production and boating visitors.
- Fishing – The area supports the third largest commercial bay and inlet fishery in Victoria, including 18 licensed commercial fishermen, within an economic value of between 5 and 8 million dollars annually (DPI, 2008).
- Recreation and tourism – Corner Inlet provides important terrestrial and aquatic environments for tourism and recreational activities such as fishing, boating, sightseeing, horse riding, scuba diving, bird watching and bushwalking. Corner Inlet attracts at least 150,000 visitors each year (DNRE, 2002).
- Cultural significance to the Gunaikurnai people, with the Corner Inlet and Nooramunga area located on the traditional lands of the Brataualung people who form part of the Gunaikurnai Nation. The area has a large number of cultural heritage sites that provide significant information for the Gunaikurnai people of today about their history. The Bunurong and the Boon Wurrung peoples also have areas of cultural significance in this region.
- Thirty-one shipwrecks are present in the site.
- Research and education – The wildlife, marine ecosystems, geomorphological processes and various assemblages of aquatic and terrestrial vegetation within the Corner Inlet Ramsar Site provide a range of opportunities for education and interpretation.

Appendix B.1.5.2 Port Philip Bay (western shoreline) and Bellarine Peninsula

The Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site is located in the western portion of Port Phillip Bay, near the city of Geelong in Victoria.

The Port Phillip Bay Ramsar site consists of a number of component areas that include: parts of the shoreline, intertidal zone and adjacent wetlands of western Port Phillip Bay, extending from Altona south to Limeburners Bay; and parts of the shoreline, intertidal zone and adjacent wetlands of the Bellarine Peninsula, extending from Edwards Point to Barwon Heads and including the lower Barwon River. It is protected under the Port Phillip Bay (Western Shoreline) & Bellarine Peninsula Ramsar Site Strategic Management Plan (DSE, 2003), which defines the key values as;

- Representativeness – it includes all eight wetlands types
- Natural function – the interactions of physical, biological and chemical components of wetlands that enable them to perform certain natural functions and making them a vital element of the landscape
- Flora and fauna – contains the genetic and ecological diversity of the flora and fauna of the region, with at least 332 floral species (22 state threatened species) and 304 species of fauna (29 threatened species)
- Waterbirds – provides habitat for migratory shorebirds, including some of international and national importance
- Cultural heritage – many aboriginal sites, particularly shell middens and artefact scatters have been found at the site
- Scenic – provide vistas of open water and marshland in a comparatively pristine condition
- Economic – use of natural resources in agriculture, fisheries, recreation and tourism
- Education and interpretation – offers a wide range of opportunities for education and interpretation of wildlife, marine ecosystems, geomorphological processes and various assemblages of aquatic and terrestrial vegetation
- Recreation and tourism – provides activities such as recreational fishing, birdwatching, hunting, boating, swimming, sea kayaking and camping and activities by commercial operators
- Scientific – site for long-term monitoring of waterbirds and waders.

Appendix B.1.5.3 Western Port

Western Port is protected under the Western Port Ramsar Site Management Plan (DELWP, 2017a), which describes the values as;

- Supports a diversity and abundance of fish and recreational fishing
- The soft sediment and reef habitats support a diversity and abundance of marine invertebrates
- Supports bird species, including 115 waterbird species, of which 12 are migratory waders of international significance
- Provides important breeding habitat for waterbirds, including listed threatened species
- Provides habitat to six species of bird and one fish species that are listed as threatened under the EPBC Act
- Rocky reefs comprises a small area within the Ramsar site, but includes the intertidal and subtidal reefs at San Remo, which support a high diversity, threatened community and Crawfish Rock, which supports 600 species (Shapiro, 1975)
- The Western Port Ramsar Site has three Marine National Parks, one National Park and has been designated as a Biosphere Reserve under the UNESCO's Man and the Biosphere program
- The Ramsar site is within the traditional lands of the Boonwurrung, who maintain strong connections to the land and waters
- The site contains the commercial Port of Hastings that services around 75 ships per year and contributes around $67 million annually to the region's economy.

Appendix B.1.5.4 Glenelg estuary and discovery bay wetlands

The Glenelg Estuary is a large estuarine system consisting of the main channel of the Glenelg River and a side lagoon called the Oxbow. The physical features of the area include a geological setting of Quaternary lacustrine, paludal, alluvial and coastal sediments on Quaternary aeolian sediments (DotEE, 2017a).

The Glenelg Estuary is a high value wetland for its ecological features. This wetland is of special geomorphological interest, being the only estuarine lagoon system in Victoria developed within a framework of dune calcarenite ridges. The Glenelg estuary contains the only remaining relatively undisturbed salt marsh community in western Victoria. Spits at river mouths such as those at Glenelg River provide valuable breeding sites for the Little Tern. This area is one of the few sites where Little Tern breed in Victoria.

The western end of Discovery Bay Coastal Park at the Glenelg Estuary is popular for fishing, boating, walking and other activities. The Major Mitchell Trail meets the coast here: the river mouth marks the end of Major Mitchell's expedition of 1836. The Great South West Walk traverses the estuary. Aboriginal culture: Several shell middens and surface scatters exist at Glenelg Estuary (DotEE, 2017a).

Appendix B.1.5.5 Lavinia

The Lavinia Ramsar site is located on the north-east coast of King Island, Tasmania. The boundary of the site forms the Lavinia State Reserve, with major wetlands in the reserve including the Sea Elephant River estuary area, Lake Martha Lavinia, Penny's Lagoon, and the Nook Swamps. It is subject to the Lavinia Nature Reserve Management Plan (2000) (in draft).

The shifting sands of the Sea Elephant River's mouth have caused a large back-up of brackish water in the Ramsar site, creating the saltmarsh which extends up to five kilometres inland. The present landscape is the result of several distinct periods of dune formation. The extensive Nook Swamps, which run roughly parallel to the coast, occupy a flat depression between the newer parallel dunes to the east of the site and the older dunes further inland. Water flows into the wetlands from the catchment through surface channels and groundwater and leaves mainly from the bar at the mouth of the Sea Elephant River and seepage through the young dune systems emerging as beach springs.

The Lavinia State Reserve is one of the few largely unaltered areas of the island and contains much of the remaining native vegetation on King Island. The vegetation communities include Succulent Saline Herbland, Coastal Grass and Herbfield, Coastal Scrub and King Island Eucalyptus globulus Woodland. The freshwater areas of the Nook Swamps are dominated by swamp forest. Nook Swamps and the surrounding wetlands contain extensive peatlands.

The site is an important refuge for a collection of regional and nationally threatened species, including the nationally endangered orange-bellied parrot. This parrot is heavily dependent upon the samphire plant, which occurs in the saltmarsh, for food during migration. They also roost at night in the trees and scrub surrounding the Sea Elephant River estuary.

Several species of birds which use the reserve are rarely observed on the Tasmanian mainland, including the dusky moorhen, nankeen kestrel, rufous night heron and the golden-headed cisticola.

The site is currently used for conservation and recreation, including boating, fishing, camping and off-road driving. There are artefacts of Indigenous Australian occupation on King Island that date back to the last ice age when the island was connected to Tasmania and mainland Australia via the Bassian Plain.

Appendix B.1.5.6 Piccaninnie ponds karst wetlands

The Piccaninnie Ponds Karst Wetlands are an example of karst spring wetlands, with the largest and deepest of the springs reaching a depth of more than 110 m. The majority of the water comes from an unconfined regional aquifer and is consistently 14-15°C. The karst springs support unique macrophyte and algal associations, with macrophyte growth extending to 15 m below the surface as a result of exceptional water clarity. A number of different wetland types exist on the site, including a large area of peat fens.

There are four distinct areas of the Ramsar site. Piccaninnie Ponds (also known as Main Ponds) consists of three interconnected bodies of water - First Pond, The Chasm and Turtle Pond - rounded by an area of shrub dominated swamp. Western Wetland consists of dense closed tea-tree and paperbark shrubland over shallow dark clay on limestone soils. Eastern Wetland includes the spring-fed Hammerhead Pond. Pick Swamp, on the extreme west of the site, includes areas of fen, marshes and sedgelands as well as the spring-fed Crescent Pond on peat soils.

The system is an important remnant of an extensive system of wetlands that once occupied much of the south-east of South Australia. The major groundwater discharge points are Main Ponds, Hammerhead Pond and Crescent Pond. Water principally leaves the site via Outlet Creek and the Pick Swamp drain outlet, which connect the site to the sea. There are a number of fresh groundwater beach springs located on the site.

The geomorphic and hydrological features of the site produce a complex and biologically diverse ecosystem which supports considerable biodiversity, including a significant number of species of national and/or international conservation value. These include the Orange-bellied Parrot, Australasian Bittern and Yarra Pygmy Perch.

The site attracts 20,000 visitors annually for cave diving, snorkelling, bushwalking, educational activities and birdwatching. The site also has spiritual and cultural value. The Traditional Owners of the land, the Bunganditj (Boandik) and local Indigenous people have a strong connection with the site. Traditionally the site provided a good source of food and fresh water, and evidence of previous occupation still exists (DotEE, 2017b).

Appendix B.1.6 Victorian Protected Areas – Marine

Victoria has a representative system of 13 Marine National Parks and 11 Marine Sanctuaries established under the National Parks Act 1975 (Vic). Five of these Marine National Parks and seven of the marine sanctuaries are located within the EMBA.

Appendix B.1.6.1 Bunurong Marine National Park

The Bunurong Marine National Park and Bunurong Marine Park are managed through the Bunurong Marine National Park Management Plan (Parks Victoria, 2006a). The Plan identifies the key values of the Parks as;

- Extensive intertidal rock platforms and subtidal rocky reefs with a geology and form that is uncommon along the Victorian coast
- Abundant and diverse marine flora and fauna including over 22 species of marine flora and fauna recorded, or presumed to be, at their eastern or western distributional limits (Plummer et al., 2003)
- Highest diversity of intertidal and shallow subtidal invertebrate fauna recorded in Victoria on sandstone (ECC 2000).
- A high proportion of the common invertebrates occurring along the Victorian coast
- High diversity of vegetation communities, many of which are considered rare, depleted or endangered within the region (WGCMA, 2003; Carr, 2003)
- Important coastal habitat for several threatened species
- Spectacular coastal scenery, featuring rugged sandstone cliffs, rocky headlands, intertidal rock platforms and sandy cove
- Eagles Nest, a prominent rock stack, recognised as a site of national geological and geomorphological significance (Buckley 1993)
- One of the richest Mesozoic fossil areas in Victoria
- Landscape and seascape of cultural significance to Indigenous people.
- Numerous places and objects of significance to Indigenous people.
- A European history rich in diversity, including sites associated with shipping, coal mining, holidaying and living on the coast.
- Two historical shipwrecks listed on the Victorian Heritage Register (Heritage Victoria, 2004).

- Opportunities for cultural values investigation in an area protected from human disturbance.
- Extensive subtidal reefs with magnificent underwater seascapes, offering numerous opportunities for diving and snorkelling.
- Highly accessible intertidal rock platforms offering opportunities for rock-pooling, marine education and interpretation.
- Spectacular coastal drive, with numerous lookouts and panoramic views of the coast and surrounding waters.
- Coastline offering opportunities for swimming, surfing, boating, fishing and rock-pooling in a natural setting.

Appendix B.1.6.2 Discovery Bay Marine National Park

The Discovery Bay Marine National Park is situated 20 km west of Portland and covering 2,770 ha and covers part of the largest coastal basalt formation in western Victoria. In deep water (30 - 60 m) there are low reefs forms from ancient shorelines or dunes. There is a rich diversity of marine life within this park due to the cold, nutrient rich waters of the area. The deep calcarenite reefs support diverse sponge gardens whilst the shallower reefs support the brown alga Ecklonia radiata. The offshore waters support a diverse array of invertebrates including southern rock lobster, black-lip abalone and gorgonians. The waters also support great white sharks and blue whales during the summer breeding season. The Discovery Bay National Park is protected as part of the NgootyoongGunditj Ngootyoong Mara South West Management Plan (Parks Victoria, 2015) which covers over 116,000 ha of public land and freehold Gunditjmaraland in south-western Victoria. The Plan (Parks Victoria, 2015) describes some key values of the Discovery Bay (which includes the National Park and the coastal reserve), namely;

- Recognised roosting, feeding and nesting area for birds such as the hooded plover
- Important habitat for the orange-bellied parrot
- Subtidal reefs with giant kelp forest communities (a TEC)
- A foredune and dune complex that was formerly recognised on the National Estate
- Surfing, boating and passive recreation
- Tourism such as dune buggy tours.

Appendix B.1.6.3 Point Addis Marine National Park

Point Addis Marine National Park lies east of Anglesea and covers 4,600 hectares. This park protects representative samples of subtidal soft sediments, subtidal rocky reef, rhodolith beds and intertidal rocky reef habitats. The park also provides habitat for a range of invertebrates, fish, algae, birds and wildlife. The world-famous surfing destination of Bells Beach is within Point Addis Marine National Park.

It is managed under the Management Plan for Point Addis Marine National Park, Point Danger Marine Sanctuary and Eagle Rock Marine Sanctuary (Parks Victoria, 2005a). The Plan identifies the following environmental, cultural and social values for the parks and sanctuaries;

- Sandy beaches, subtidal soft sediments, subtidal rocky reefs, rhodolith beds and intertidal reefs.
- A high diversity of algal, invertebrate and fish species.
- A high diversity of sea slugs (opisthobranchs) and other invertebrate communities within Point Danger Marine Sanctuary.
- Evidence of a long history of Indigenous use, including many Indigenous places and objects adjacent to the park and sanctuaries near dunes, headlands, estuaries and creeks.
- Surf breaks, including those at Bells Beach, which are culturally important to many people associated with surfing.
- Coastal seascapes of significance for many who live in the area or visit.
- Recreational and tourism values
- Spectacular underwater scenery for snorkelling and scuba diving.
- Intertidal areas for exploring rock pools.

- Opportunities for a range of recreational activities.
- A spectacular seascape complementing well-known visitor experiences on the Great Ocean Road.

Appendix B.1.6.4 Twelve Apostles Marine National Park

The Twelve Apostles Marine National Park (75 km^2) is located 7 km east of Port Campbell and covers 16 km of coastline from east of Broken Head to Pebble Point and extends offshore to 5.5 km (Plummer et al, 2003).

The area is representative of the Otway Bioregion and is characterised by a submarine network of towering canyons, caves, arches and walls with a large variety of seaweed and sponge gardens plus resident schools of reef fish. The park contains areas of calcarenite reef supporting the highest diversity of intertidal and sub-tidal invertebrates found on that rock type in Victoria (DSE, 2012).

The park includes large sandy sub-tidal areas consisting of predominantly fine sand with some medium to coarse sand and shell fragment (Plummer et al, 2003). Benthic sampling undertaken within the park in soft sediment habitats at 10 m, 20 m and 40 m water depths identified 31, 29 and 32 species respectively based upon a sample area of 0.1 m^2. These species were predominantly polychaetes, crustaceans and nematodes with the mean number of individuals decreasing with water depth (Heisler & Parry, 2007). No visible macroalgae species were present within these soft sediment areas (Plummer et al, 2003; Holmes et al, 2007). These sandy expanses support high abundances of smaller animals such as worms, small molluscs and crustaceans; larger animals are less common.

The Twelve Apostles Marine Park is managed in conjunction with the Arches Marine Sanctuary under the Management Plan for Twelve Apostles Marine National Park and The Arches Marine Sanctuary (Parks Victoria, 2006b). The Plan describes the key environmental, cultural and social values as;

- unique limestone rock formations, including the Twelve Apostles
- a range of marine habitats representative of the Otway marine bioregion
- Indigenous culture based on spiritual connection to sea country and a history of marine resource use
- the wreck of the Loch Ard (shipwreck)
- underwater limestone formations of arches and canyons
- a diverse range of encrusting invertebrates
- a spectacular dive site (Parks Victoria, 2006b).

Appendix B.1.6.5 Wilsons Promontory Marine National Park

Wilsons Promontory National Park is in South Gippsland, about 200 km south-east of Melbourne and at 15,550 ha is Victoria's largest Marine Protected Area. It extends along 17 km of mainland coastline around the southern tip of Wilsons Promontory and is managed through the Wilsons Promontory Marine National Park and Wilsons Promontory Marine Park Management Plan May 2006 (Parks Victoria, 2006a). The Plan describes the key environmental, cultural and social values as;

- granite habitats, which are unusual in Victorian marine waters, including extensive heavy reefs with smooth surfaces, boulders and rubble and low-profile reefs
- biological communities with distinct biogeographic patterns, including shallow subtidal reefs, deep subtidal reefs,
- intertidal rocky shores, sandy beaches, seagrass and subtidal soft substrates
- abundant and diverse marine flora and fauna, including hundreds of fish species and invertebrates such as sponges, ascidians, sea whips and bryozoans
- 68 species of marine flora and fauna recorded, or presumed to be, at their eastern or western distributional limits
- important breeding sites for a significant colony of Australian fur seals

- important habitat for several threatened shorebird species, including species listed under international migratory bird agreements
- outstanding landscapes, seascapes and spectacular underwater scenery
- seascape, cultural places and objects of high traditional and cultural significance to Indigenous people
- Indigenous cultural lore and interest maintained by the Gunai / Kurnai and Boonwurrung people
- important maritime and other history
- historic shipwrecks, many of which are listed on the Victorian Heritage Register (Parks Victoria, 2006a).

Appendix B.1.6.6 Marengo Marine Sanctuary

The Marengo Reefs Marine Sanctuary (12 ha) is in Victorian State waters near Marengo and Apollo Bay, which are on the Great Ocean Road, approximately 220 km south-west of Melbourne. The sanctuary protects two small reefs and a wide variety of microhabitats. Protected conditions on the leeward side of the reefs are unusual on this high wave energy coastline and allow for dense growths of bull kelps and other seaweed. There is an abundance of soft corals, sponges, and other marine invertebrates, and over 56 species of fish have been recorded in and around the sanctuary. Seals rest on the outer island of the reef and there are two shipwrecks (the Grange and Woolamai) in the sanctuary (Parks Victoria, 2007a).

The Marengo Reefs Marine Sanctuary Management Plan (Parks Victoria, 2007a) identifies the environmental, cultural and social values as;

- Subtidal soft sediments, subtidal rocky reefs and intertidal reefs.
- A high diversity of algal, invertebrate and fish species.
- An Australian fur seal haul out area.
- Evidence of a long history of Indigenous use, including many Indigenous places and objects nearby.
- Wrecks of coastal and international trade vessels in the vicinity of the sanctuary.
- Spectacular underwater scenery for snorkelling and scuba diving.
- Intertidal areas for exploring rock pools.
- Opportunities for a range of aquatic recreational activities including seal watching.

Appendix B.1.6.7 The Arches Marine Sanctuary

The Arches Marine Sanctuary protects 45 ha of ocean directly south of Port Campbell. It has a spectacular dive site of limestone formations, rocky arches and canyons. The sanctuary is also ecologically significant, supporting habitats such as kelp forests and a diverse range of sessile invertebrates on the arches and canyons. These habitats support schools of reef fish, seals and a range of invertebrates such as lobster, abalone and sea urchins. The Arches Marine Sanctuary is managed in conjunction with the Twelve Apostles Marine Park under the Management Plan for Twelve Apostles Marine National Park and The Arches Marine Sanctuary (see Appendix B.1.6.4).

Appendix B.1.6.8 Barwon Bluff Marine Sanctuary

Barwon Bluff Marine Sanctuary (17 ha) is located at Barwon Heads, approximately 100 kilometres south-west of Melbourne. The Barwon Bluff Marine Sanctuary Management Plan (Parks Victoria, 2007b) identifies the environmental, cultural and social values as;

- Intertidal reef platforms with a high diversity of invertebrate fauna and flora.
- Subtidal reefs that support diverse and abundant flora, including kelps, other brown algae, and green and red algae.
- Calcarenite and basalt reefs extending from The Bluff that are of regional geological significance.
- Intertidal habitats that support resident and migratory shorebirds, including threatened species.
- Subtidal habitats that support sedentary and mobile fish and are also used by migratory marine mammals.

- Marine habitats and species that are of scientific interest and valuable for marine education
- Opportunities for underwater recreation, including visits to subtidal communities that are easily accessible from the shore.
- Outstanding coastal vistas, seascapes and underwater scenery.
- An important landmark and area for gathering fish and shellfish for the Wathaurong people.
- A strong historic and ongoing connection with marine education.
- Remnants from the Earl of Charlemont, a heritage-listed shipwreck.

Appendix B.1.6.9 Eagle Rock Marine Sanctuary

Eagle Rock Marine Sanctuary (17 ha) is about 40 km south-west of Geelong, close to Aireys Inlet. The sanctuary extends from high water mark around Split Point between Castle Rock and Sentinel Rock. It extends offshore for about 300 m and includes Eagle Rock and Table Rock. The main habitats protected by the sanctuary include intertidal and subtidal soft sediment, intertidal and subtidal reefs, and the water column. It is managed in conjunction with Point Addis Marine National Park and Point Danger Marine Sanctuary (see Appendix B.1.6.3).

Appendix B.1.6.10 Merri Marine Sanctuary

The Merri Marine Sanctuary is on the Victorian south-west coast near Warrnambool, approximately 260 km west of Melbourne. Merri Reefs Marine Sanctuary (25 ha) is located at the mouth of the Merri River, west of Warrnambool Harbour. Merri Marine Sanctuary contains a mixture of habitats, including intertidal reef, sand, shallow reef and rocky overhang. These areas provide a nursery for many fish species and a habitat for many algae species, hardy invertebrates and shorebirds. Bottlenose dolphins and fur seals are regular visitors to the shore (Parks Victoria, 2007c).

The Sanctuary is protected with the Merri Marine Sanctuary Management Plan (Parks Victoria, 2007c) identifies the environmental, cultural and social values as;

- Culturally significant to indigenous communities that have a long association with the area
- Merri River, wetlands and islands and headlands provide a variety of habitats
- Provision of nursery for many fish species and habitat for algal species, hardy invertebrates and shorebirds.

Appendix B.1.6.11 Mushroom Reef Marine Sanctuary

The Mushroom Reef Marine Sanctuary is on the Bass Strait coast at Flinders near the western entrance to Western Port, 92 km by road south of Melbourne. The sanctuary (80 ha) abuts the Mornington Peninsula National Parkland extends from the high-water mark to approximately 1 km offshore. The sanctuary is protected under the Mushroom Reef Marine Sanctuary Management Plan (Parks Victoria, 2005b) which identifies the environmental, cultural and social values as;

- Numerous subtidal pools and boulders in the intertidal area that provide a high complexity of intertidal basalt substrates and a rich variety of microhabitats.
- Subtidal reefs that support diverse and abundant flora including kelps, other brown algae, and green and red algae.
- Sandy bottoms habitats that support large beds of Amphibolis seagrass and patches of green algae.
- Diverse habitats that support sedentary and migratory fish species.
- A range of reef habitats that support invertebrates including gorgonian fans, seastars, anemones, ascidians, barnacles and soft corals.
- A distinctive basalt causeway that provides habitat for numerous crabs, seastars and gastropod species.
- Intertidal habitats that support resident and migratory shorebird species including threatened species.
- An important landmark and area for gathering fish and shellfish for the Boonwurrung people.

- Excellent opportunities for underwater recreation activities such as diving and snorkelling among accessible subtidal reefs.

Appendix B.1.6.12 Point Danger Marine Sanctuary

Point Danger Marine Sanctuary (25 ha) is 20 km south-west of Geelong, close to the township of Torquay and nearby Jan Juc. It extends from the high-water mark at Point Danger offshore for approximately 600 m east and 400 m south, encompassing an offshore rock platform. It is managed in conjunction with Point Addis Marine National Park and Eagle Rock Marine Sanctuary (see Appendix B.1.6.3).

Appendix B.1.7 Victorian Protected Areas – Terrestrial

There are a number of National Parks and Coastal Parks that are present in the EMBA.

Appendix B.1.7.1 Port Campbell National Park

The Port Campbell National Park covers approximately 27 km of coastline stretching from the eastern side of Curdies Inlet (at Peterborough) to Princetown, covering 1,830 ha. Port Campbell National Park is world famous for its extraordinary collection of wave-sculpted rock formations and the Twelve Apostles that can be seen from the park. Loch Ard Gorge, site of the 19th century shipwreck Loch Ard, as well as the Island Archway and London Bridge (which collapsed in 2009) are other features of the park (Parks Victoria, 1998).

This park protects the terrestrial environment above the low water mark of this coastline. The Port Campbell National Park and Bay of Islands Coastal Park Management Plan (Parks Victoria, 1998) defines the values of the Parks. In this EP, our focus is the existing environment of EMBA and therefore this applies to the intertidal zone of this Park. The relevant values are;

- A stretch of coastline where the wild Southern Ocean meets rugged limestone cliffs, which are being rapidly and spectacularly eroded.
- Significant fauna species, including the hooded plover.
- World-renowned and highly-accessible coastal scenery, including the Twelve Apostles, one of Australia's tourism icons.
- Several of the major attractions of the Great Ocean Road touring route.
- A wide variety of visitor experiences, ranging from quick views of outstanding scenery at key visitor destinations to isolated, more remote and less-developed sections of the Parks.
- Impressive natural forces observable in the dramatic scenery, changeable weather and pounding seas.
- A variety of recreational experiences, including walking, swimming, surfing, fishing and sightseeing (Parks Victoria, 1998).

Appendix B.1.7.2 Bay of Islands Coastal Park

This coastal park has outstanding ocean views and geological features and covers an extensive area of the coastline (~32 km in length and 950 ha), stretching east from Warrnambool to Peterborough. Sheer cliffs and rock stacks dominate the bays, and the heathlands contain wildflowers. Beaches are accessible at some points (Parks Victoria, 1998).

This park protects the terrestrial environment above the low water mark of this coastline. This Coastal Park is protected under the Port Campbell National Park and Bay of Islands Coastal Park Management Plan (Parks Victoria, 1998) and detail on relevant values are given in Appendix B.1.7.1 (above).

Appendix B.1.7.3 Great Otway National Park

The Great Otway National Park (103,185 ha) is located near Cape Otway and stretches from the low water mark inland on an intermittent basis from Princetown to Apollo Bay (approximately 100 km).

Landscapes within the park are characterised by tall forests and hilly terrain extending to the sea with cliffs, steep and rocky coasts, coastal terraces, landslips, dunes and bluffs, beaches and river mouths. There is a concentration of archaeological sites along the coast, coastal rivers and reefs. The park contains many sites of international and national geological and geomorphological significance including Dinosaur Cove (internationally significant dinosaur fossil site), Lion Headland and Moonlight Head to Milanesia Beach (internationally significant coastal geology and fossils).

The park provides habitats for the conservation of the rufous bristlebird, hooded plover, white-bellied sea eagle, fairy tern, caspian tern and Lewin's rail and native fish such as the Australian grayling.

The park contains significant Aboriginal cultural sites adjacent to rivers, streams and the coastline including over 100 registered archaeological sites, particularly shell middens along the coast, as well as non-physical aspects such as massacre sites, song lines, family links and stories. The park also contains four sites listed on the Victorian Heritage Register including the Cape Otway Light Station and several shipwreck features along the coast (i.e. anchors) (Parks Victoria and DSE, 2009).

This park protects the terrestrial environment above the low water mark of this coastline. The Park is protected under the Great Otway National Park and Otway Forest Park Management Plan (Parks Victoria and DSE, 2009) and relevant values are;

- A large area of essentially unmodified coastline, linking the land to marine ecosystems and marine national parks.
- A diverse range of lifestyle and recreation opportunities for communities adjacent to the parks – for local permanent residents and holiday homeowners Regionally, nationally and internationally.
- Significant tourist attractions, close to access routes and accommodation, such as spectacular coastal scenery along the Great Ocean Road, access to beautiful beaches, clifftop lookouts, picnic areas, historic sites, waterfalls and walking tracks such as the Great Ocean Walk.
- The basis for continued growth of nature-based tourism associated with the parks and the region, providing economic opportunities for accommodation providers, food and services providers, and recreation, tourism and education operators.

Appendix B.1.7.4 Mornington Peninsula National Park

Mornington Peninsula National Park is situated about 70 km south of Melbourne. Mornington Peninsula National Park runs along the coast from Point Nepean, at the western tip of the Mornington Peninsula, to Bushrangers Bay, where it turns inland along the Main Creek valley, still as a narrow band, until it joins the more expansive Greens Bush section of the Park. The Park is managed under the Mornington Peninsula National Park and Arthurs Seat State Park Management Plan, which has identified the key environmental, social and cultural values as (Parks Victoria, 2013):

- Largest and most significant remaining areas of native vegetation on the Mornington Peninsula. Numerous sites and features of geomorphic significance, particularly along the coast (cliffed calcarenite coast sandy forelands and basalt shore platforms).
- Only representation in the Victorian conservation reserve system of four land systems formed within the Southern Victorian Coastal Plains and the Southern Victorian Uplands.
- Many significant native plants and vegetation communities, especially in Greens Bush and former McKellar Flora Reserve, and the most extensive remnant coastal grassy forest habitat on the Mornington Peninsula.

- Highly scenic landscape values along the ocean coast and at Port Phillip heads and the prominent landscape feature of Arthurs Seat.
- Many significant fauna species, including populations of the nationally significant hooded plover, over 30 species of State significance and many species of regional significance.
- High quality marine and intertidal habitats, with some pristine areas within Point Nepean.
- Nationally significant and fascinating historic sites at Point Nepean.
- The historic Seawinds Gardens in Arthurs Seat State Park.
- One of the highest recorded densities of Aboriginal archaeological sites along the Victorian Coast
- South Channel Fort is an important component of the historic fortification defence system of Port Phillip (and an important bird nesting and roosting site).
- Spectacular scenery and popular surf beaches associated with a wild and rugged coastline.
- Local and regional economic benefits.
- Intensively used recreational nodes, e.g. at Portsea, Sorrento, Cape Schanck and Arthurs Seat.

This park protects the terrestrial environment above the low water mark of this coastline.

Appendix B.1.7.5 Wilsons Promontory National Park

The Wilsons Promontory National Park is in South Gippsland, about 200 km southeast of Melbourne and includes the Wilsons Promontory Wilderness Zone, Southern Wilsons Promontory Remote and Natural Area and Wilsons Promontory Islands. It is managed under the Wilsons Promontory National Park Management Plan. The Plan identifies the key environmental, social and cultural values as (Parks Victoria, 2002):

- Entire promontory of national, geological and geomorphological significance containing a number of sites of State and regional significance.
- Diverse vegetation communities, including warm temperate and cool temperate rainforest, tall open forests, woodlands, heathlands, and swamp and coastal communities.
- Unmodified rivers and streams with no introduced fish species.
- Half of Victoria's bird species.
- Intertidal mudflats, which are an internationally important habitat for migratory wading birds.
- The largest coastal wilderness area in Victoria.
- Numerous middens and other significant Aboriginal sites.
- Remains of sites of several small European settlements and past uses including timber milling, mining and grazing.
- A number of shipwrecks in the waters around Wilsons Promontory.
- The heritage buildings of Wilsons Promontory Light Station.
- Outstanding natural landscapes including spectacular and diverse coastal scenery.

This park protects the terrestrial environment above the low water mark of this coastline.

Appendix B.1.7.6 Cape Liptrap Coastal Park

Cape Liptrap Coastal Park is located in South Gippsland, 180 km south-east of Melbourne. It is protected under the Cape Liptrap Coastal Park Management Plan (Parks Victoria, 2003), which identifies the environmental, cultural and social values as:

- extensive heathland and coastal forest vegetation communities
- the occurrence of about 270 species of flowering plants, including 27 orchid species
- thirty threatened fauna species, including ten species listed as threatened under the Flora and Fauna Guarantee Act 1988 (Vic.), 17 migratory bird species and ten threatened flora species
- one of the most interesting and complex geological sequences in the State, ranging from ancient Cambrian rocks to Recent sands
- spectacular coastal landforms at Cape Liptrap, Arch Rock and at Walkerville

- numerous middens and other significant Aboriginal sites
- relics of the lime-burning industry at Walkerville
- Cape Liptrap lighthouse
- spectacular and diverse coastal scenery
- opportunities for fishing, nature observation, camping, and walking in natural settings

This park protects the terrestrial environment above the low water mark of this coastline.

Appendix B.1.7.7 Discovery Bay Coastal Park

The Discovery Bay Coastal Park is protected as part of the NgootyoongGunditj Ngootyoong Mara South West Management Plan (Parks Victoria, 2015) which covers over 116,000 hectares of public land and freehold Gunditjmaraland in south-west Victoria. It is described in Appendix B.1.6.2.

This park protects the terrestrial environment above the low water mark of this coastline.

Appendix B.1.7.8 Lady Julia Percy Island Wildlife Reserve

Lady Julia Percy Island is off the coast of Victoria near Port Fairy. It is one of the two largest breeding sites for the Australian fur seal species in Australia (DoE, 2017a) and provides habitat to migratory seabirds. There is no management plan for Lady Julia Percy Island Wildlife Reserve.

Appendix B.1.7.9 Lake Connewarre Wildlife Reserve

Lake Connewarre Wildlife Reserve is a large, shallow estuarine wetland which is located in the lower reaches of the Barwon River (Parks Victoria, 2017). It has a wetland of international significance and provides habitat for a number of threatened migratory bird species (Parks Victoria, 2017). The reserve is also a State Game Reserve, with designated areas for duck and quail hunting in the open season. Other recreational activities such as fishing, boating and walking are carried out in the reserve. There is no management plan for Lake Connewarre Wildlife Reserve.

Appendix B.1.7.10 Lawrence Rocks Wildlife Reserve

Lawrence Rocks is off the coast of Victoria, south of Portland. Lawrence Rocks is a nationally significant seabird breeding area and has the largest Australasian gannet colony in Australia (DELWP, 2015). There is no management plan for Lawrence Rocks Wildlife Reserve.

Appendix B.1.7.11 Phillip Island Nature Park

Phillip Island is east of Melbourne and forms a natural breakwater for the shallow waters of Western Port. Phillip Island is Biologically Important Area (BIA) for the little penguin, with breeding and foraging sites present (Commonwealth of Australia, 2015). There is no management plan for Phillip Island Nature Park.

Appendix B.1.7.12 Seal Island Wildlife Reserve

Seal Islands is east of Wilsons Promontory. Seal Island is one of the two largest breeding sites for the Australian fur seal (Commonwealth of Australia, 2015). There is no management plan for Seal Islands Wildlife Reserve.

Appendix B.1.8 Tasmanian Protected Areas - Marine

Appendix B.1.8.1 Cape Wickham Conservation Area

The Cape Wickham Conservation Area is on the northern tip of King Island and contains Cape Wickham lighthouse and the gravesites of the crew of Loch Leven, a ship that was wrecked nearby. It is designated as IUCN Category V which is a protected landscape/seascape. There is no management plan for the Cape Wickham Conservation Area.

Appendix B.1.8.2 Christmas Island Nature Reserve

Christmas Island is located off the west coast of King Island. It is designated IUCN 1a which is a strict nature reserve, which allows minimal human use (DPIPWE, 2015). It is a BIA for both breeding and foraging for the little penguin (Commonwealth of Australia, 2015). There is no management plan for the Christmas Island Nature Reserve.

Appendix B.1.8.3 City of Melbourne Bay Conservation Area

The City of Melbourne Bay Conservation Area is on the south-east coast of King Island. It is designated as IUCN Category V which is a protected landscape/seascape. There is no management plan for the City of Melbourne Bay Conservation Area.

Appendix B.1.8.4 Cone Islet Conservation Area

Cone Islet is a small granite island in the Curtis Group, which is located in the Bass Strait between Wilsons Promontory and Tasmania. The Cone Islet Conservation Area is designated as IUCN Category V which is a protected landscape/seascape. There is no management plan for the Cone Islet Conservation Area.

Appendix B.1.8.5 Curtis Island Nature Reserve

Curtis Island is located in the Bass Strait between Wilsons Promontory and Tasmania. It is designated IUCN 1a which is a strict nature reserve, which allows minimal human use (DPIPWE, 2015). It has a large population of breeding seabirds and waders (Carlyon et al, 2011). It is also a recognised BIA for breeding and feeding for little penguins (Commonwealth of Australia, 2015). There is no management plan for the Curtis Island Nature Reserve.

Appendix B.1.8.6 Devils Tower Nature Reserve

Devils Tower are two small granite islands which are part of the Curtis Group and are located in the Bass Strait between Wilsons Promontory and Tasmania. It is designated IUCN 1a which is a strict nature reserve, which allows minimal human use (DPIPWE, 2015) and is noted as being important for breeding seabirds and waders. There is no management plan for the Curtis Island Nature Reserve.

Appendix B.1.8.7 Disappointment Bay State Reserve

The Disappointment Bay State Reserve is located on the north coast of King Island. It is designated IUCN II which is a national park (DPIPWE, 2015). There is no management plan for the Disappointment Bay State Reserve.

Appendix B.1.8.8 East Moncoeur Island Conservation Area

East Moncoeur Island is part of Tasmania's Rodondo Group, Appendix B.1.9.15. It is designated as IUCN Category V which is a protected landscape/seascape. There is no management plan for the East Moncoeur Island Conservation Area.

Appendix B.1.8.9 Hogan Group Conservation Area

The Hogan Group is in Bass Strait south of Wilsons Promontory. The Hogan archipelago is an important seabird location and supports major breeding colonies of many species (Carlyon et al, 2011). It is designated as IUCN Category IV which is habitat/species management area. There is no management plan for the Hogan Group Conservation Area.

Appendix B.1.8.10 Kent Group National Park

The Kent Group National Park is an archipelago of five main islands and associated offshore rocks, with a total area of 2,374 ha. It is isolated from mainland Tasmania on the northern side of Bass Strait and the terrestrial portion is protected under the Kent Group National Park Management Plan to the low water mark (PWST, 2005). The marine area around the Kent Group National Park is designated as the Kent Group Marine Protected Area. The relevant values of the Kent Group National Park are:

- Breeding ground for migratory seabirds
- Fur seal breeding ground.

Appendix B.1.8.11 Lavinia State Reserve

Lavinia State Reserve is located on the north-east coast of King Island. The reserve contains a number of rare birds, including the endangered orange-bellied parrot (DPIPWE, 2013). It includes the Lavinia Ramsar site (Appendix B.1.5.5) and two freshwater lakes. Lavinia Beach is a popular location for surfing and fishing.

Appendix B.1.8.12 New Year Island Game Reserve

New Year Island is located on the north-west coast of King Island. It is a game reserve for the muttonbird (short-tailed shearwater), with non-commercial harvesting of the species permitted during the open season.

Appendix B.1.8.13 North East Islet Nature Reserve

North East Islet (or Boundary Islet) is part of the Hogan Island Group (Appendix B.1.9.9). It is a haul-out site for the Australia fur seal (Carlyon et al, 2011).

Appendix B.1.8.14 Red Hut Point Conservation Area

Red Hut Point Conservation Area on the south-coast of King Island. It is designated as IUCN Category V which is a protected landscape/seascape. There is no management plan for the Red Hut Point Conservation Area.

Appendix B.1.8.15 Rodondo Island Nature Reserve

Rodondo Island is located in Bass Strait, approximately 10 km south of Wilsons Promontory. Both Australian and long-nosed fur seal have haul-out sites on Rodondo Island (Carlyon et al, 2015). It hosts a number of breeding seabirds, with the short-tailed shearwater being the most common (Carlyon et al, 2015).

Appendix B.1.8.16 Seal Rocks State Reserve

The Seal Rocks State Reserve is in the south-west of King Island. It contains the 7,000 year old calcified forest and cliffs at Seal Rocks (DPIPWE, 2013). It is designated as IUCN Category V which is a protected landscape/seascape. There is no management plan for the Seal Rocks State Reserve.

Appendix B.1.8.17 Stokes Point Conservation Area

Stokes Point is the most southern tip of King Island. It is designated as IUCN Category V which is a protected landscape/seascape. There is no management plan for the Stokes Point Conservation Area.

Appendix B.1.8.18 West Moncoeur Island Nature Reserve

West Moncoeur is part of the Rodondo Group (Appendix B.1.9.15). It supports large breeding colonies of Australia fur seals (Carlyon et al, 2015).

Appendix B.1.9 Tasmanian Protected Areas – Terrestrial

Appendix B.1.9.1 Cape Wickham Conservation Area

The Cape Wickham Conservation Area is on the northern tip of King Island and contains Cape Wickham lighthouse and the gravesites of the crew of Loch Leven, a ship that was wrecked nearby. It is designated as IUCN Category V which is a protected landscape/seascape. There is no management plan for the Cape Wickham Conservation Area.

Appendix B.1.9.2 Christmas Island Nature Reserve

Christmas Island is located off the west coast of King Island. It is designated IUCN 1a which is a strict nature reserve, which allows minimal human use (DPIPWE, 2015). It is a BIA for both breeding and foraging for the little penguin (Commonwealth of Australia, 2015). There is no management plan for the Christmas Island Nature Reserve.

Appendix B.1.9.3 City of Melbourne Bay Conservation Area

The City of Melbourne Bay Conservation Area is on the south-east coast of King Island. It is designated as IUCN Category V which is a protected landscape/seascape. There is no management plan for the City of Melbourne Bay Conservation Area.

Appendix B.1.9.4 Cone Islet Conservation Area

Cone Islet is a small granite island in the Curtis Group, which is located in the Bass Strait between Wilsons Promontory and Tasmania. The Cone Islet Conservation Area is designated as IUCN Category V which is a protected landscape/seascape. There is no management plan for the Cone Islet Conservation Area.

Appendix B.1.9.5 Curtis Island Nature Reserve

Curtis Island is located in the Bass Strait between Wilsons Promontory and Tasmania. It is designated IUCN 1a which is a strict nature reserve, which allows minimal human use (DPIPWE, 2015). It has a large population of breeding seabirds and waders (Carlyon et al, 2011). It is also a recognised BIA for breeding and feeding for little penguins (Commonwealth of Australia, 2015). There is no management plan for the Curtis Island Nature Reserve.

Appendix B.1.9.6 Devils Tower Nature Reserve

Devils Tower are two small granite islands which are part of the Curtis Group and are located in the Bass Strait between Wilsons Promontory and Tasmania. It is designated IUCN 1a which is a strict nature reserve, which allows minimal human use (DPIPWE, 2015) and is noted as being important for breeding seabirds and waders. There is no management plan for the Curtis Island Nature Reserve.

Appendix B.1.9.7 Disappointment Bay State Reserve

The Disappointment Bay State Reserve is located on the north coast of King Island. It is designated IUCN II which is a national park (DPIPWE, 2015). There is no management plan for the Disappointment Bay State Reserve.

Appendix B.1.9.8 East Moncoeur Island Conservation Area

East Moncoeur Island is part of Tasmania's Rodondo Group, Appendix B.1.9.15. It is designated as IUCN Category V which is a protected landscape/seascape. There is no management plan for the East Moncoeur Island Conservation Area.

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Appendix B.1.9.16 Seal Rocks State Reserve

The Seal Rocks State Reserve is in the south-west of King Island. It contains the 7,000-year-old calcified forest and cliffs at Seal Rocks (DPIPWE, 2013). It is designated as IUCN Category V which is a protected landscape/seascape. There is no management plan for the Seal Rocks State Reserve.

Appendix B.1.9.17 Stokes Point Conservation Area

Stokes Point is the most southern tip of King Island. It is designated as IUCN Category V which is a protected landscape/seascape. There is no management plan for the Stokes Point Conservation Area.

Appendix B.1.9.18 West Moncoeur Island Nature Reserve

West Moncoeur is part of the Rodondo Group (Appendix B.1.9.15). It supports large breeding colonies of Australia fur seals (Carlyon et al, 2015).

Appendix B.1.10 Key Ecological Features

The PMST Report identified the Key Ecological Features (KEFs) within the EMBA.

KEFs are elements of the marine environment, based on current scientific understanding, are considered to be of regional importance for either the region's biodiversity or ecosystem function and integrity of a Commonwealth Marine Area.

The KEFs in the EMBA are:

- the Bonney Coast Upwelling
- Upwelling East of Eden
- the West Tasmanian Marine Canyons
- Shelf Rocky Reefs and Hard Substrates
- Bass Cascade

Appendix B.1.10.1 Bonney Coast Upwelling

The Bonney Upwelling is an area of high productivity and aggregations of marine life. It is a predictable, seasonal upwelling which brings of cold, nutrient rich water to the sea surface typically occurs in the summer and autumn along the narrow continental shelf between Robe, SA, and Portland, Victoria. Surface expression of the upwelling is only intermittent further to the southeast where the shelf is wider. Nonetheless the upwelling can extend to at least as far as Origin's Thylacine gas platform (Levings & Gill 2010), This Bonney Upwelling phenomenon generally starts in the eastern part of the Great Australian Bight in November/December and spreads eastwards to the Otway Basin around February (Gill et al, 2011) as the latitudinal high pressure belt migrates southward. The upwelling occurs via Ekman dynamics, where the ocean surface experiences a steady wind stress which results in a net transport of water at right angles to the left of the wind direction.

Ecological importance

The primary ecological importance of the Bonney Upwelling is as a feeding area for the blue whale (Balaenoptera musculus). The upwelled nutrient-rich re-heated Antarctic intermediate water promotes blooms of coastal krill, Nyctiphanes australis, which in turn attracts blue whales to the region to feed.

The Bonney Coast Upwelling is one of only two identified seasonal feeding areas for blue whales in Australian coastal waters and is one 12 known blue whale feeding aggregation areas globally. Sightings of the sei whale in the upwelling indicate this is potentially an important feeding ground for the species (Gill et al, 2015). There have also been sightings of the fin whale, which indicate this could potentially be an important feeding ground (Morrice et al, 2004)

The high productivity of the Bonney Upwelling also leads to other attributes such as algal diversity and its productivity as a fishery. This productivity is also capitalised on by other higher predator species such as little penguins and fur seals feeding on baitfish. Robinson et al., (2008) postulated that upwelling waters may bring fish prey of Australian fur seals to surface waters, which are then flushed into Bass Strait within foraging range of seals.

Variability

While the general characteristics of the Bonney Coast upwelling are broadly understood virtually nothing is known of the longer-term variability of the phenomenon. Alongshore wind is the predominant mechanism in the upwelling, which is, therefore, directly impacted by any changes to the strength or frequency of these winds. However, it should be noted, that not all favourable upwelling winds lead to an upwelling event.

The El Niño – Southern Oscillation (ENSO) has been identified by some authors as a potential driver of upwelling strength along the south Australian coast. The ENSO is the dominant global mode of inter-annual climate variability, is a major contributor to Australia’s climate and influences Australia’s marine waters to varying degrees around the coast. The two phases of ENSO, El Niño and La Niña, produce distinct and different changes to the climate.

Middleton et al., (2007) examined meteorological and oceanographic data and output from a global ocean model. The authors concluded that El Niño events lead to enhanced upwelling along Australia’s southern shelves. However, it has been found that relationships between ENSO events and upwelling and production indices off southern Australia are weak due to the high interannual and inter-seasonal variability in these indices.

Linkages between climate, upwelling strength and blue whale abundance

The complex interaction between climatic conditions, upwelling strength and seasonal blue whale distribution and abundance within the Bonney Upwelling is currently poorly understood other than at a general level. Factors to be resolved to enable a more detailed understanding include observations that not all strong upwelling-favourable winds necessarily lead to strong upwelling events (Griffin et al., 1997) and that increased upwelling does not necessarily equate to increased productivity as conditions may be less optimal for plankton growth. Further an increase in plankton biomass does not necessarily coincide with the presence of the blue whales.

Review of pygmy blue whale aerial observation data from Gill et al., (2011) from the 2001-02 to 2006-07 seasons, and additional surveys in the Otway Basin commissioned by Origin during Feb 2011 and Nov-Dec 2012 (described in detail in Appendix B.3.5.3) did not find a significant positive correlation between El Niño conditions and pygmy blue whale abundance. Such a positive correlation could be expected if El Niño conditions caused stronger upwelling, stronger upwelling led to increased planktonic productivity and blue whales were more likely to be present when productivity is higher.

Two of the six seasons subject to aerial surveys in the eastern section of the Otway Basin (Gill et al, 2011) were determined by the Bureau of Meteorology to demonstrate weak to moderate El Nino conditions. The remainder of the years were assessed to be neutral. The two El Nino seasons (2002-03 and 2006-07) corresponded with the lowest observation frequencies (sightings/1,000km) for pygmy blue whales of all the yearly surveys.

Aerial surveys commissioned by Origin undertaken during Feb 2011 and Nov-Dec 2012 were undertaken during La Nina events classified by the BOM as very strong and strong respectively. Although observation frequencies are not available, the absolute numbers of pygmy blue whales observed was substantially higher than during the 2001-01 to 2006-07 surveys. Also, of note is that pygmy blue whales observed during Feb 2011 were congregated along the seaward edge of a plume of terrestrial runoff, potentially suggesting use of this plume as a feeding resource, which has no relationship to upwelling.

As such, the interactions between climate and ecology for this upwelling system are complex and no definitive linkages between climatic events, upwelling strength and blue whale abundance have yet been described. Given this, development of management strategies for petroleum activities in the area using prevailing climatic conditions as a predictor of seasonal blue whale abundance is not currently feasible.

Appendix B.1.10.2 Upwelling East of Eden

The Upwelling East of Eden is valued for having high productivity and aggregations of marine life. In this region, dynamic eddies of the East Australian Current cause episodic productivity events when they interact with the continental shelf and headlands. The episodic mixing and nutrient enrichment events drive phytoplankton blooms that are the basis of productive food chains including zooplankton, copepods, krill and small pelagic fish.

The upwelling supports regionally high primary productivity that supports fisheries and biodiversity, including top order predators, marine mammals and seabirds.

This area is one of two feeding areas for blue whales and humpback whales, known to arrive when significant krill aggregations form. The area is also important for seals, other cetaceans, sharks and seabirds.

Appendix B.1.10.3 West Tasmanian Canyons

The West Tasmanian Canyons are located on the relatively narrow and steep continental slope west of Tasmania. This location has the greatest density of canyons within Australian waters where 72 submarine canyons have incised a 500 km-long section of slope (Heap & Harris 2008). The canyons in the Zeehan AMP are relatively small on a regional basis, each less than 2.5 km wide and with an average area of 34 km2 shallower than 1,500 m (Adams et al., 2009). The Zeehan canyons are typically gently sloping and mud-filled with less exposed rocky bottoms compared with other canyons in the south-east marine region (e.g. Big Horseshoe Canyon).

Submarine canyons modify local circulation patterns by interrupting, accelerating, or redirecting current flows that are generally parallel with depth contours. Their size, complexity and configuration of features determine the degree to which the currents are modified and therefore their influences on local nutrients, prey, dispersal of eggs, larvae and juveniles and benthic diversity with subsequent effects which extend up the food chain.

Eight submarine canyons surveyed in Tasmania, Australia, by Williams et al (2009) displayed depth-related patterns with regard to benthic fauna, in which the percentage occurrence of faunal coverage visible in underwater video peaked at 200-300 m water depth, with averages of over 40% faunal coverage. Coverage was reduced to less than 10% below 400 m depth. Species present consisted of low-relief bryozoan thicket and diverse sponge communities containing rare but small species in 150 to 300 m water depth.

Sponges are concentrated near the canyon heads, with the greatest diversity between 200 m and 350 m depth. Sponges are associated with abundance of fishes and the canyons support a diversity of sponges comparable to that of seamounts. Based upon this enhanced productivity, the West Tasmanian canyon system includes fish nurseries (blue wahoo and ocean perch), foraging seabirds (albatross and petrels), white shark and foraging blue and humpback whales (DoEE, 2017e).

Appendix B.1.10.4 Shelf Rocky Reefs and Hard Substrates

Rocky reefs and hard grounds are located in all areas of the South-east Marine Region continental shelf including Bass Strait, from the sub-tidal zone shore to the continental shelf break. The continental shelf break generally occurs in 50 m to 150–220 m water depth. The shallowest depth at which the rocky reefs occur in Commonwealth waters is approximately 50 m.

On the continental shelf, rocky reefs and hard grounds provide attachment sites for macroalgae and sessile invertebrates, increasing the structural diversity of shelf ecosystems. The reefs provide habitat and shelter for fish and are important for aggregations of biodiversity and enhanced productivity.

The Shelf rocky reefs and hard substrates are defined as a key ecological feature as they are an area of high productivity and aggregations of marine life. This KEF has not yet been spatially defined (DoE, 2015a).

Appendix B.1.10.5 Bass Cascade

The Bass Cascade refers to the "underwater waterfall" effect brought about by the northward flow of Bass Strait waters in winter which are more saline and slightly warmer than surrounding Tasman Sea waters. As the water approaches the mainland in the area of the Bass Canyon group it forms an undercurrent that flows down the continental slope. The cascading water has a displacing effect causing nutrient rich waters to rise, which in turn leads to increased primary productivity in those areas. The cascading water also concentrates nutrients and some fish and whales are known to aggregate along its leading edge.

Bass Cascade is defined as a key ecological feature as it is an area of high productivity. The Bass Cascade occurs during winter months only and has not yet been spatially defined (DoE, 2015a).

Appendix B.2 Physical environment

The physical marine environment of the Otway region is characterised by very steep to moderate offshore gradients, high wave energy and temperate waters subject to upwelling events.

Appendix B.2.1 Otway assessments and surveys

A comprehensive assessment of the coast to continental shelf margin has been undertaken. Roughly 4 km^2 of bathymetric data and video footage was collected of the pipeline right-of-way options from the Otway Gas Project EIS (Woodside, 2003) (refer to Table B-9-5 to Table B-9-9). These data have been supplemented by numerous benthic sampling events; however, data for this assessment have been referenced primarily from Boreen et al., (1993), and the Otway Gas Project EIS (Woodside, 2003).

In 2002, 2003 and 2004, Fugro undertook a number of bathymetric surveys of the two proposed pipeline rights of way: one constructed for the Thylacine Geographe pipeline and one extending from the completed Geographe A well to Flaxman's Hill.

A review of the available geotechnical data was carried out in March 2011 for the Geographe location (Advanced Geomatics, 2011). Overall, the seabed in the Otway operational area slopes to the south at a gentle average gradient of less than 1. However, the local topography is predominantly irregular in nature, varying from gently undulating and locally smooth in areas of increased sediment deposition, to areas of outcropping cemented calcrete features that are from smooth to jagged relief. These areas are covered in marine growth. ROV video survey confirmed the presence of a shallow hard underlying substrate at a depth of 50 mm below the sediment in areas of marine growth (JP Kenny, 2012).

The Flaxman's Hill alignment traverses the Thistle drilling area and the Thylacine Geographe pipeline runs parallel and north east of this area. During 2003, bathymetric data was collected, and the right of way was assessed and recorded using an underwater video camera (CEE Consultants Pty Ltd, 2003).

The Flaxman's Hill pipeline route travels approximately 68 km from the Geographe gas field to the shoreline. Visual assessment of the sea floor was undertaken from a water depth of 99 m to 16 m terminating at Flaxman's Hill. The seabed and indicative biological communities at both areas are detailed in Table B-9-5 to Table B-9-9.

Table B-9-5: Otway margin geomorphology (Boreen et al., 1993)

Zone	Depth (m)	Width (m/km)	Gradient	Features
Shallow Shelf	30 - 70	4 - 28	1.5 - 10	Drops rapidly from strandline to depths of 30 m, characterised by rugged but subdued topography
Middle Shelf	70 - 130	7 - 65	1 - 8.5	Generally smooth topography with occasional rock out crops

Table B-9-6: Thylacine to Geographe seabed morphology and benthic assemblages (CEE Consultants Pty Ltd, 2003)

Depth (m)	Seabed morphology	Benthic assemblage
92	High profile reef stone with deep sand gutters.	Diverse, high density sessile: sponge, coral dominated crinoids common and mobile species
88	Low profile with areas of high profile limestone ridges; incomplete sand veneer.	Diverse, high density sessile: sponge, dominated and mobile species

Table B-9-7: Geographe to Flaxman's Hill seabed morphology and benthic assemblages (CEE Consultants Pty Ltd, 2003)

Depth (m)	Seabed morphology	Benthic assemblage
82	Low profile with areas of high profile limestone ridges; incomplete sand veneer	Medium density sessile: sponge, dominated low density mobile species. (small shark)
82	Equal % of exposed low profile limestone and sand. Two reef outcrops. Low profile with areas of high profile limestone ridges; incomplete sand veneer.	Medium density, sessile: sponge, dominated
78	Low profile with areas of high profile limestone ridges; incomplete sand veneer	Medium density, sessile: sponge, dominated Motile: sea urchins dominated
76		Medium density, sessile: sponge, dominated
76		Low - Medium density, sessile: sponge, dominated
70		Diverse, med density sessile, sponge dominated
68		Medium density, sessile: sponge, dominated
65		Diverse, med density sessile, sponge dominated
60		Medium density, sessile: sponge, dominated

Table B-9-8: Geographe to Rifle Range seabed morphology and benthic assemblages (CEE Consultants Pty Ltd, 2003)

Depth (m)	Seabed morphology	Benthic assemblage
82	Low profile with areas of high profile limestone ridges; incomplete sand veneer	Very low density sessile; large sponge.
79		Diverse, low – high density sessile
75	Low profile with areas of high profile limestone ridges; incomplete sand veneer	Medium density, sessile: sponge, dominated. Motile: sea urchins dominated
74		Medium density, sessile: sponge, dominated
70		Low - Medium density, sessile: sponge, dominated
67		Diverse, med density sessile, sponge dominated

Depth (m)	Seabed morphology	Benthic assemblage
66	Low profile limestone with sand gutters	Medium density, sessile: sponge, dominated
66	Low profile with areas of high profile limestone ridges; incomplete sand veneer	Diverse, med density sessile, sponge dominated
70	(Pock marks) Data not documented.	Medium density, sessile: sponge, dominated
63	Corse gravel to fine sand	High density sessile: micro algae dominated

Table B-9-9: Nearshore seabed morphology and benthic assemblages

Depth (m)	Seabed morphology	Benthic assemblage
53	Sand	None observed
45		Only sea pens noted
16-30	Very high profile l/stone reef to sand	High density, sessile: sponge, macroalgae (Bull Kelp common)

Appendix B.2.2 Geomorphology, geology, bathymetry and sediments

The south-eastern section of Australia's continental margin comprises the Otway Shelf and the Bonney Coast, Bass Strait, and the western shelf of Tasmania. The 400 km long Otway Shelf lies between 37° and 43.5°S and 139.5°E (Cape Jaffa) and 143.5°E (Cape Otway). The narrowest point is off Portland, where the shelf is less than 20 km wide. It broadens progressively westward, to 60 km of Robe, SA, and eastward to 80 km of Warrnambool. The Otway shelf is comprised of Miocene limestone below a thin veneer of younger sediments.

Boreen et al., (1993) examined 259 sediment samples collected over the Otway Basin and the Sorell Basin of the west Tasmanian margin. Samples were taken during two research cruises (January/February 1987 and March/April 1988) on the *R.V. Rig Seismic* using dredges, corers, grabs and a heat flow probe. Based on assessment of the sampled sediments the authors concluded the Otway continental margin is a swell-dominated, open, cool-water, carbonate platform. A conceptual model was developed which divided the Otway continental margin into five depth-related zones – shallow shelf, middle shelf, deep shelf, shelf edge and upper slope (Figure B-9-1).

In the shallow shelf are exhumed limestone substrates that host dense encrusting mollusc, sponge, bryozoan and red algae assemblages. The middle shelf is a zone of swell-wave shoaling and production of mega-rippled bryozoan sands. The deep shelf is described as having accumulations of intensely bioturbated, fine, bio clastic sands. At the shelf edge and top of slope, nutrient-rich upwelling currents support extensive, aphotic bryozoan/sponge/coral communities. The upper slope sediments are a bioturbated mixture of periplatform bioclastic debris and pelleted foraminiferal/nanno-fossil mud. The lower slope is described as crosscut by gullies with low accumulation rates, and finally, at the base of the slope the sediments consist of shelf-derived, coarse-grain turbidites and pelagic ooze.

Additional data on superficial sediments in the vicinity of the area are also available from studies conducted by the Victorian Museum and environmental studies undertaken for the Otway projects, as described below.

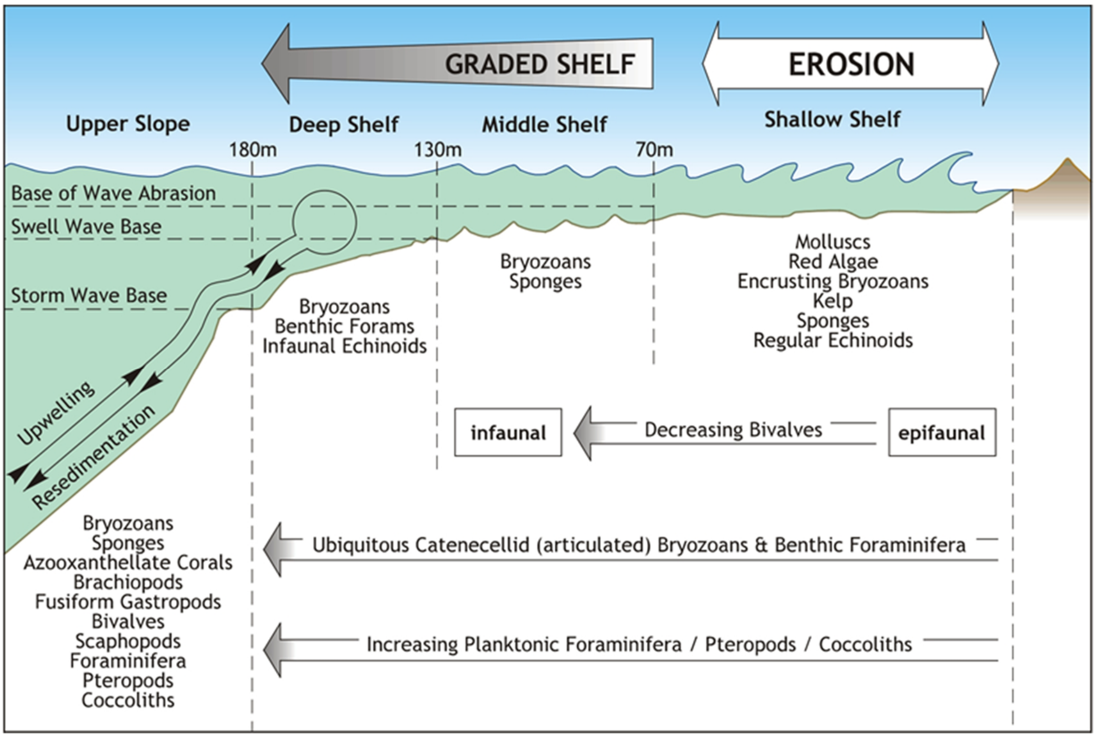


Figure B-9-1: Model of the geomorphology of the Otway Shelf

A sampling survey of the surficial sediments, benthic invertebrates and demersal fishes of Bass Strait was undertaken by the Victorian Museum between 1979 and 1983 (Wilson and Poore, 1987) (Figure B-9-2).

More than 200 sites were sampled with sites 51 through 61, 118, 119, 120, 121, 183, 186 and 192 representative of the area. Sediments were described in the field from a visual impression or according to the classification of Shepard (Shepard, 1954). Carbonate percentage of sediments was also assessed. These samples indicate that surficial sediments throughout the area are dominated by carbonate rich medium to coarse sands (Table B-9-10). Data on benthic invertebrates and demersal fishers has not been summarised and published.

A video survey of the seabed at selected sites along proposed offshore pipeline routes for the Otway Gas Project was undertaken by BBG during 2003 (BBG, 2003) (Figure B-9-3).

BBG (2003) found that the substrate in water depths that predominate in the operational area (between 82 and 66 m) area was predominantly low profile limestone with an incomplete sand veneer that supported a low to medium density, sponge dominated filter feeding community. Fish and other motile organisms were uncommon.

In shallower depths of between 63 and 30 m, the video surveys showed a rippled, sand or sand/pebble substrate with minor sponge dominated benthic communities. The epibenthic organisms were generally attached to outcropping or sub-outcropping limestone pavements. Only in waters shallower than approximately 20 m, was an area of significant, high profile reef and associated high density macroalgae dominated epibenthos encountered. Details of the seabed and benthic epifaunal assemblage are provided in Table B-9-11.

The sampling data from the BSS survey and Otway projects broadly support the findings of Boreen et al., (1993) concerning the subsea features and biological communities likely to dominate the operational area. In summary the seabed of the EMBA can be characterised as a carbonate mid shelf and deeper sections (60 – 70 m) of the shallow shelf with surficial sediments of carbonate rich coarse to medium sands with areas of exposed limestone substrate. The epifauna is dominated by low density, sessile sponge assemblages. Six basalt rises occur in the eastern and south-eastern section of the operational area, the largest of which is the 'Big Reef'.

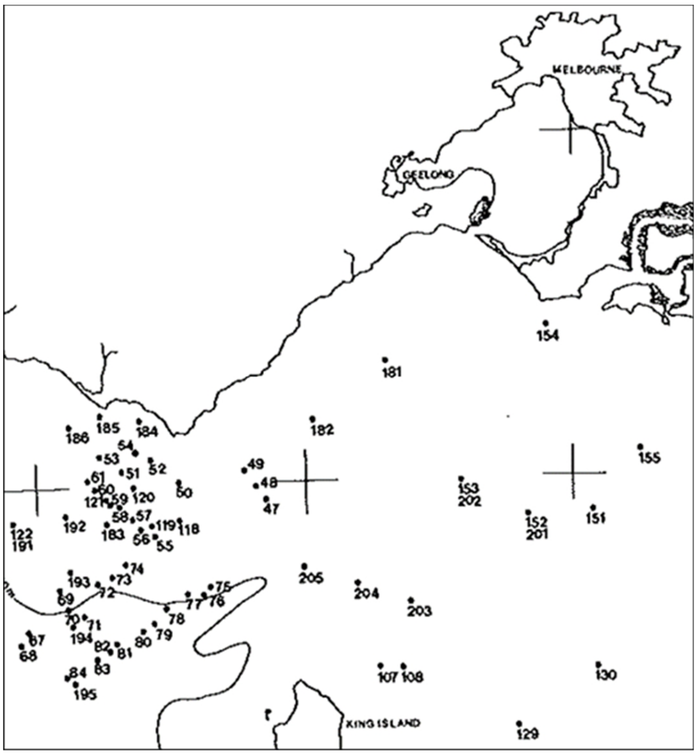


Figure B-9-2: Sampling sites for the Bass Straight survey in the region of the EMBA (Wilson and Poore, 1987)

Table B-9-10: Classification of surficial sediments sampled during the Bass Straight survey in the vicinity of the EMBA (Wilson and Poore, 1987)

Site No.	Depth (m)	Surficial sediments	Carbonate % by weight
51	67	Medium sand	ND
52	49	Coarse sand	72
53	67	Medium sand	45
54	70	Very coarse shelly sand	70
55	85	Coarse carbonate sand	93
56	77	Medium sand	ND
57	59	Coarse sand	97
58	47	Coarse sand	92
59	70	Coarse sand	89
60	79	Medium carbonate sand	100
61	68	Coarse sand	ND
118	95	Fine sand	96
119	92	Fine sand	99

Site No.	Depth (m)	Surficial sediments	Carbonate % by weight
120	84	Medium sand	90
121	84	Medium sand	ND
183	84	Coarse sand	99
186	69	Fine sand	ND
192	81	Medium sand	100

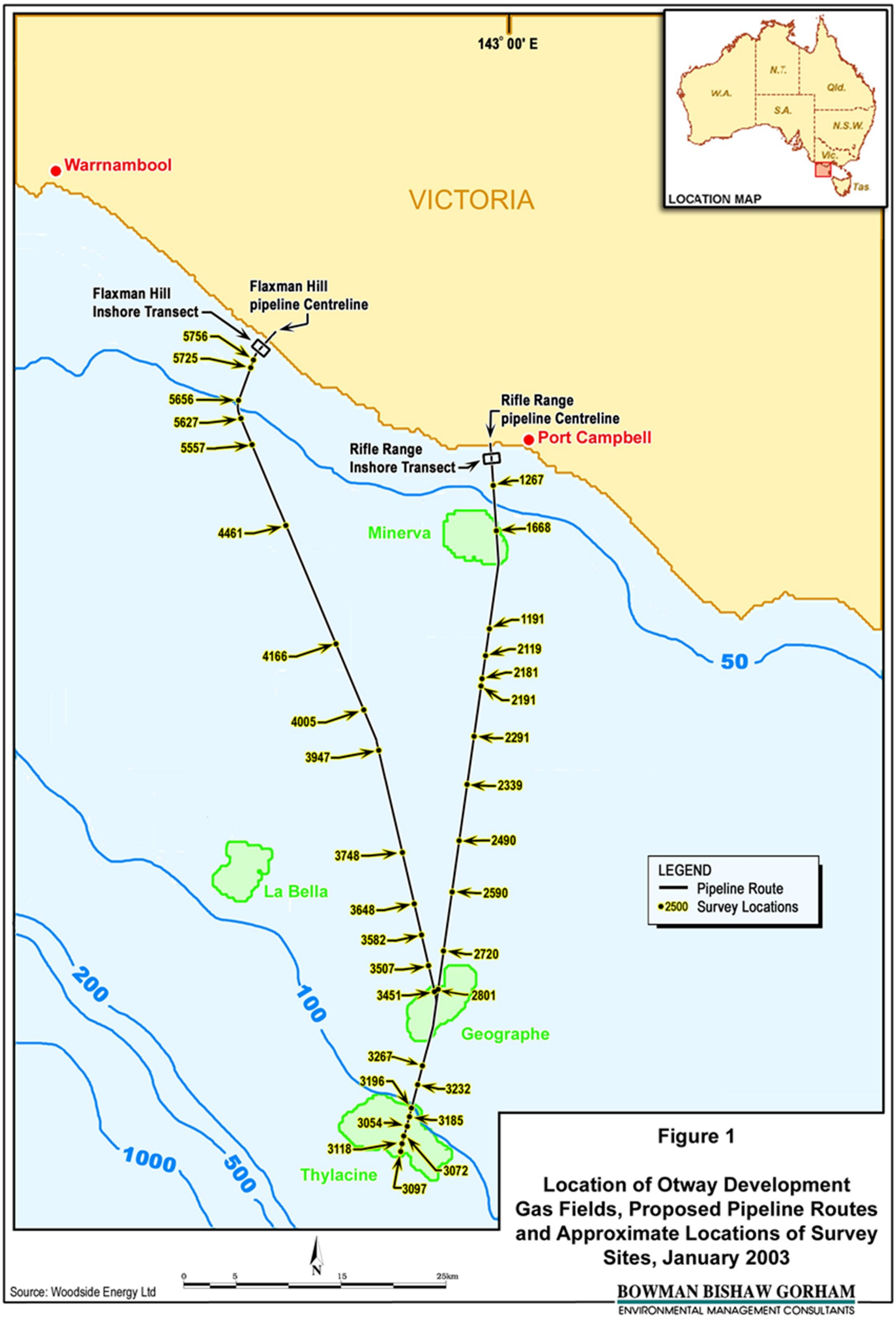


Figure B-9-3: Seabed sites assessed by video survey during 2003 (BBG, 2003)

Table B-9-11: Seabed characteristics and epifaunal assemblage at video survey sites (BBG, 2003)

Site No.	Depth (m)	Seabed type	Benthic Assemblage
3097	99	Bare rippled sand; minor limestone outcrops	Low density sessile; small sponge dominated
3118	99	Low profile limestone reef with sand veneer; isolated areas of raised l/stone	Low density sessile; sponge dominated
3084	99	Low profile limestone reef with incomplete sand veneer	Low density sessile; sponge dominated
3072	99	Low profile limestone reef with incomplete sand veneer	Low density sessile; sponge dominated
3054	98	Mix of low and high profile l/stone; shallow and deep sand	Low density sessile on low l/stone; high density sessile on high l/stone plus fish; sponge dominated
3185	95	Low profile limestone reef with incomplete sand veneer	Low density sessile; sponge dominated
3196	94	Low profile limestone reef with incomplete sand veneer	Low density sessile; sponge dominated
3232	92	High profile reef stone with deep sand gutters.	Diverse, high density sessile: sponge, coral dominated crinoids common and mobile species
3267	88	Low profile with areas of high profile limestone ridges; incomplete sand veneer.	Diverse, high density sessile: sponge, dominated and mobile species
2801	82	Low profile with areas of high profile limestone ridges; incomplete sand veneer	Very low density sessile; large sponge.
2720	79		Diverse, low – high density sessile
2590	75	Low profile with areas of high profile limestone ridges; incomplete sand veneer	Medium density, sessile: sponge, dominated. Motile: sea urchins dominated
2490	74		Medium density, sessile: sponge, dominated
2339	70		Low - Medium density, sessile: sponge, dominated
2291	67		Diverse, med density sessile, sponge dominated
2191	66	Low profile limestone with sand gutters	Medium density, sessile: sponge, dominated
2181	66	Low profile with areas of high profile limestone ridges; incomplete sand veneer	Diverse, med density sessile, sponge dominated
1191	63	Coarse gravel to find sand	High density sessile: micro algae dominated
1668	53	Sand	None observed

Appendix B.2.3 Metocean conditions

Appendix B.2.3.1 Climate

The area is typical of a cool temperate region with cold, wet winters and warm dry summers. The regional climate is dominated by sub-tropical high-pressure systems in summer and sub-polar low pressure systems in winter. The low-pressure systems are accompanied by strong westerly winds and rain-bearing cold fronts that move from south-west to north-east across the region, producing strong winds from the west, north-west and south-west.

The day-to-day variation in weather conditions is caused by the continual movement of the highs from west to east across the Australian continent roughly once every 10 days.

Appendix B.2.3.2 Winds

Bass Strait is located on the northern edge of the westerly wind belt known as the Roaring Forties. In winter, when the subtropical ridge moves northwards over the Australian continent, cold fronts generally create sustained west to south-westerly winds and frequent rainfall in the region (McInnes and Hubbert, 2003). In summer, frontal systems are often shallower and occur between two ridges of high pressure, bringing more variable winds and rainfall.

Winds in this section of the Otway basin and western Bass Strait generally exceed 13 knots (23.4 km/h) for 50% of the time. Winds contribute to the predominant moderate to high wave-energy environment of area and are predominantly south-westerly cycling to north-westerly. September is the windiest month, with average wind speeds of 29 km/h (Figure B-9-4).

Appendix B.2.3.3 Tides

Tides are semi-diurnal with some diurnal inequalities (Jones and Padman, 1983), generating tidal currents along a north-east/south-west axis, with speeds generally ranging from 0.1 to 2.5 m/s (Fandry, 1983). The maximum range of spring tides in western Bass Strait is approximately 1.2 m. Sea level variation in the area can arise from storm surges and wave set up (Santos, 2004).

Appendix B.2.3.4 Ocean currents

Ocean currents in Bass Strait are primarily driven by tides, winds and density-driven flows (Figure B-9-5). During winter, the South Australian current moves dense, salty warmer water eastward from the Great Australian Bight into the western margin of the Bass Straight. In winter and spring, waters within the straight are well mixed with no obvious stratification, while during summer the central regions of the straight become stratified.

Furthermore, during winter, the Bass Strait cascade occurs, a wintertime downwelling caused by cooling of the shallow waters of Bass Strait in the Gippsland Basin. Downwelling currents that originate in the shallow eastern waters of Bass Strait flow down the continental slope to depths of several hundred meters or more into the Tasman Sea. Lateral flushing within the strait results from inflows from the South Australian Current, East Australian Current, and sub-Antarctic surface waters.

Surface currents within the permit area have been modelled by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2009 – 2013 inclusive to produce monthly surface currents. These show a rotational aspect because of inflow and outflow to Bass Strait. Although unimodal the currents are stronger from the west in all months excepting February when the currents from the east are the strongest. Minimum currents have been derived as 0.2-0.4 m/s and maximum currents as 0.8-2.0 m/s, with the strongest currents during the months July to October.

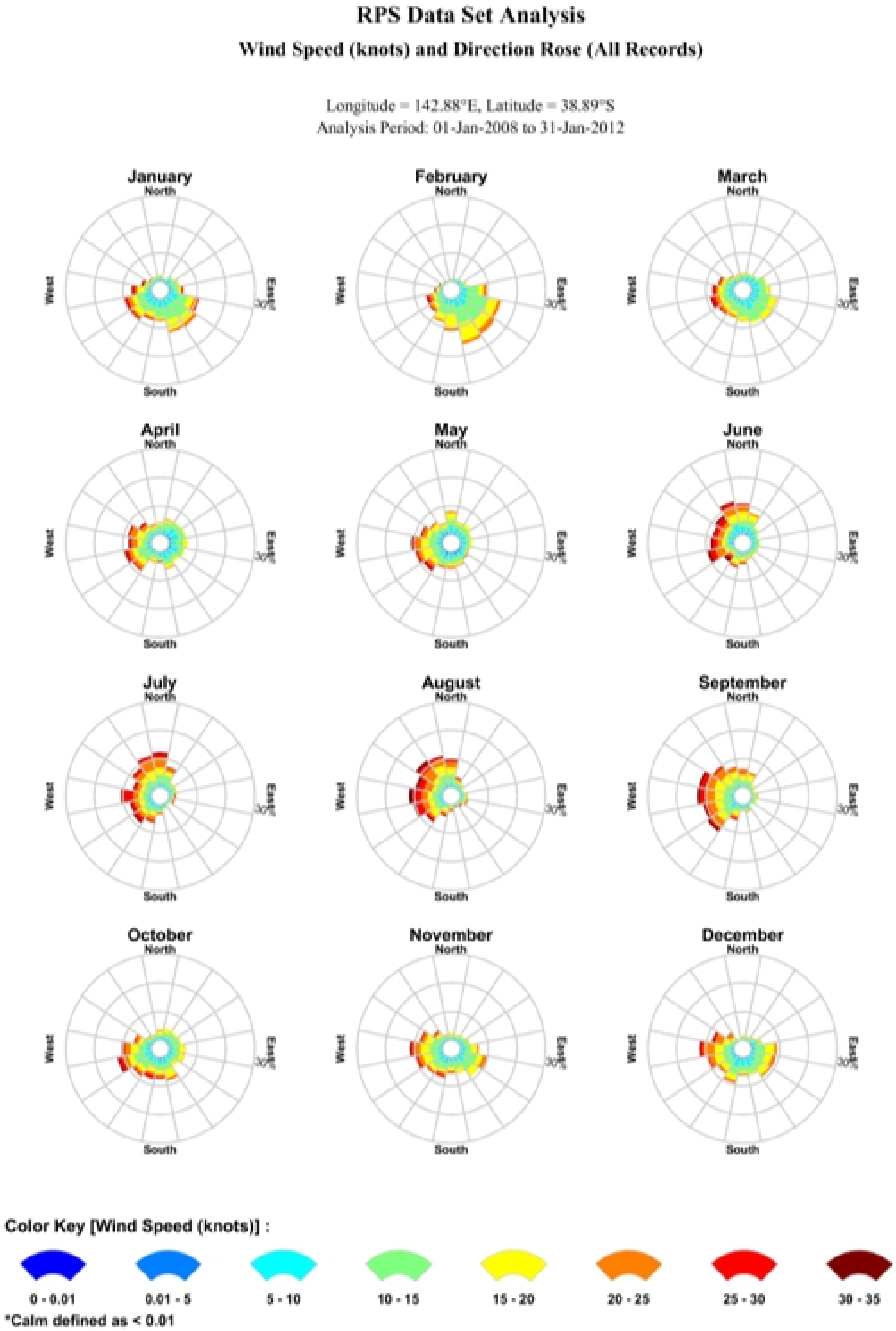


Figure B-9-4: Modelled monthly wind rose distributions (RPS, 2019)

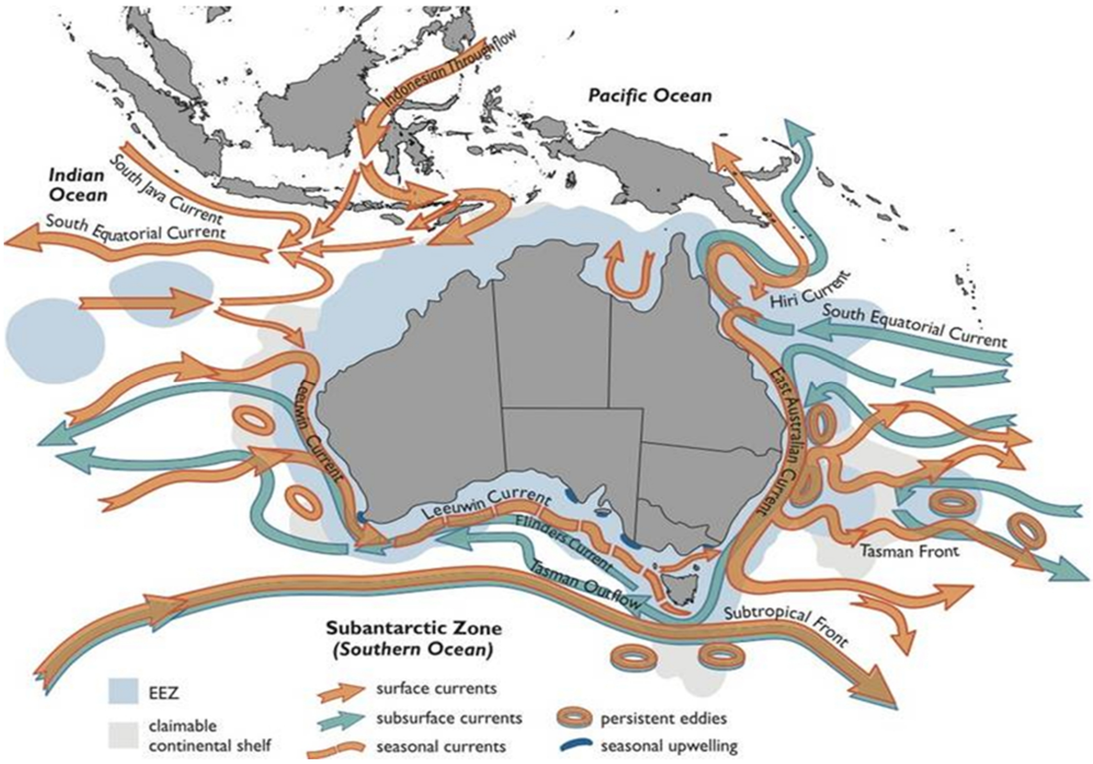


Figure B-9-5: Australian ocean currents

Appendix B.2.3.5 Waves

There are two principal sources of wave energy in the Otway Basin:

- From the westerly swell from the Great Australian Bight and Southern Ocean; and
- From locally generated winds, generally from the west and east.

The Otway area is fully exposed to long period 13 second average south-westerly swell from the Southern Ocean as well as periodic shorter 8 second average period waves from the east. Wave heights from these winds generally range from 1.5 m to 2 m, although waves heights to 10 m can occur during storm events and a combination of wind forcing against tidal currents can cause greater turbulence. The largest waves are associated with eastward-moving low pressure and frontal systems that cross the site every 4 to 6 days in winter.

Appendix B.2.3.6 Sea temperature

The waters have average surface temperatures ranging from 14°C in winter to 21°C in summer. However, subductions of cooler nutrient-rich water (upwellings) occur along the seafloor during mid to late summer, though this is usually masked in satellite images by a warmer surface layer.

The upwelled water is an extension of the regional Bonney Upwelling system, which affects southern Australia because of south-east winds forcing surface water offshore thus triggering a compensatory subduction along the bottom. If the wind is strong enough the water sometimes shoals against the coast. The water originates from a subsurface water flow called the Flinders current and has the characteristics of reheated Antarctic Intermediate Water (Levings and Gill, 2010).

During winter and spring onshore winds cycling from the southwest to northwest mound the surface layer against the land and cause a south-easterly flow along the coast that fills the shelf from the shore outwards to a depth of 500 m deep. Shelf water temperatures at these times range from between 18°C to 14°C with seafloor temperatures warmer in winter than in summer.

Appendix B.2.4 Ambient sound levels

McCauley and Duncan (2001) undertook a desktop review of natural and man-made sea sound sources likely to be encountered in the Otway Basin. They concluded that natural sea sound sources are dominated by wind noise, but also include rain noise, biological noise and the sporadic noise of earthquakes. Man-made underwater sound sources in the region comprise shipping and small vessel traffic, petroleum production and exploration drilling activities and sporadic petroleum seismic surveys.

Ambient sound levels in the Otway Basin have been measured as part of impact assessment activities for the petroleum industry. Acoustic monitoring prior to the development of the Thylacine wells and platform, recorded broadband underwater sound of 93 to 97 dB re 1 µPa (Santos, 2004). An acoustic monitoring program was also undertaken during exploratory drilling of the Casino-3 well in the EMBA. A sound logger located 28.03 km from the drill site did not detect drilling noise and recorded ambient noise that ranged between 90 and 110 dB re 1 µPa (McCauley, 2004). Passive acoustic monitoring commissioned by Origin from April 2012 to January 2013, 5 km offshore from the coastline east of Warrnambool, identified that ambient underwater noise in coastal areas are generally higher than further offshore, with a mean of 110 dB re 1 µPa and maximum of 161 dB re 1 µPa (Duncan et al., 2013).

Recent work using ocean sound recordings stations has also shown that sound from iceberg calving, shoaling and disintegration in Antarctic waters is a major contributor to the overall sound budget of the Southern Ocean. Annually tens of thousands of icebergs drift out from Antarctica into the open waters of the Southern Ocean, creating a ubiquitous natural source of low frequency sound as they calve, shoal and disintegrate (Matsumoto et al., 2014).

For example, Dziak et al., (2013) measured the sounds from the iceberg A53a (~ 55 × 25 km) as it drifted out of the Weddell Sea and through Bransfield Strait during April–June 2007. Sound levels during disintegration of this iceberg were estimated to average ~ 220 dB re 1 µPa. Chapp et al. (2005) acoustically located iceberg B15d (215 km^2) within the Indian Ocean in 2005 and estimated a maximum source level of 245 dB re 1mPa for its tremor signals, generated when the icebergs shoal or collide with other icebergs.

Matsumoto et al., (2014) tracked the sound propagation of two large icebergs, B15a and C19a, which calved off the Ross Ice Shelf in the early 2000s and drifted eastward to the warmer South Pacific Ocean in late 2007. From 2008 to early 2009, the disintegration of B15a and C19a continuously projected loud, low-frequency sounds into the water column which propagated efficiently to lower latitudes, influencing the soundscape of the entire South Pacific basin. The icebergs' sounds were recorded at Juan Fernández Islands (34°S, 79°W) and by a deep-water hydrophone in the northern hemisphere (8°N, 110°W) approximately 10,000 km from the icebergs.

More broadly Matsumoto et al., (2014) concluded that seasonal variations in ocean noise, which are characterized by austral summer-highs and winter-lows, appear to be modulated by the annual cycle of Antarctic iceberg drift and subsequent disintegration. This seasonal pattern is observed in all three Oceans of the Southern Hemisphere.

Spectrogram plotting shows that icebergs' sounds dominate the frequency range below 100 Hz (Matsumoto et al., 2014). Notably this frequency range encompasses the dominant frequencies at which baleen whales vocalize.

Appendix B.2.5 Air quality

Historical air quality data for the region is available from the Environment Protection Authority (EPA) Victoria air quality monitoring stations, and Cape Grim Baseline Air Pollution Station on Tasmania's west coast, which is one of the three premier baseline air pollution stations in the World Meteorological Organisation-Global Atmosphere Watch (WMO-GAW) network, measuring greenhouse and ozone depleting gases and aerosols in clean air environments.

The Victorian air quality data is collected at 15 performance monitoring stations representing predominantly urban and industrial environments in the Port Phillip and Latrobe Valley regions of Victoria. Results are assessed against the requirements of the National Environment Protection (Ambient Air Quality) Measure for the pollutants carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), lead (Pb), particles less than 10 micrometres in diameter (PM10) and particles less than 2.5 micrometres in diameter (PM2.5). The most recent annual air monitoring report shows Victoria's air quality in 2015 was generally good with AAQ NEPM goals and standards being met for carbon monoxide (CO), nitrogen dioxide (NO_2), Ozone (O_3) and sulfur dioxide (SO_2). There were some exceedances for particles.

The Geelong monitoring station is the closest to the EMBA; however, it is situated in an urban environment and is not representative of the clean air environment over the majority of the EMBA. The Cape Grim Baseline Air Pollution Station data is likely a more reliable point of reference for air quality in the EMBA as the air sampled arrives at Cape Grim after long trajectories over the Southern Ocean and is representative of a large area unaffected by regional pollution sources (cities or industry) (CSIRO, 2017). The Cape Grim station monitors greenhouse gases (GHGs), including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and synthetic GHGs such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF6).

Historical air quality data from Cape Grim show that most GHGs have shown continuous increases in concentration since the mid-to-late 1970s with carbon dioxide levels increasing by more than 15% since 1976, and concentrations of methane and nitrous oxide increasing by around 20% and 8% respectively since 1978. The increase in methane levels however has slowed recently and CFCs and halons are in decline. Increases have been attributed to anthropogenic causes, for example, fossil fuel consumption and agricultural practices (CSIRO, 2017).

Appendix B.3 Ecological environment

To characterise the ecological environment in which the seabed assessment is to be conducted, a literature search and online resources and databases have been reviewed to identify and assess flora and fauna species known to be present or potentially present in the EMBA. The following information sources were reviewed to assure consistency with previous assessments and to develop an up-to-date overview of the existing environment.

- Online government databases, publications, and interactive mapping tools, such as the SPRAT database provided by the Department of the Environment and Energy (DotEE).
- The DotEE PMST for Matters of National Environmental Significance (MNES) protected under the EPBC Act.
- Published observations, data and statistics on marine mammals.
- Reports from scientific experts and institutions, marine biologist and experts in blue whale and southern right whale populations in the Otway area.
- Woodside's Otway Gas Project Environmental Effects Statement/Environmental Impact Assessment (EES/EIS) (2003) (Woodside, 2003).

- Santos Casino Gas Field Development Environmental Report (2004) (Santos, 2004).
- BHP Billiton's Minerva Environmental Impact Statement and Environmental Effects Statement and Associated Supplemental Environmental Monitoring published research papers (BHP Billiton, 1999).
- Origin Energy's Environment Plans for previous activities in the region.
- The National Conservation Values Atlas (Commonwealth of Australia, 2015).
- Relevant environmental guidelines and publicly available scientific literature on individual species.

Appendix B.3.1 Benthic habitats and species assemblages

The Otway continental margin is a swell-dominated, open, cool-water carbonate platform which can be divided into depth-related zones (Boreen et al., 1993):

- Shallow Shelf: Consisting of exhumed limestone substrates that host encrusting mollusc, sponge, bryozoan and red algae assemblages.
- Middle Shelf: A zone of swell wave shoaling and production of mega-rippled bryozoans sands.
- Deep Shelf: Accumulations of intensely bioturbated, fine bioclastic sands.
- Shelf edge/top of Slope: Nutrient-rich upwelling currents support extensive, aphotic bryozoan/sponge/coral communities.

The dominant benthic habitat throughout the area, as indicated by the sampling and video studies outlined in Appendix B.2.2 is medium to coarse carbonate sands with areas of low relief exposed limestone. A series of basaltic rises occur in the south eastern corner of the operational area. The benthic species assemblages known or likely to be associated with these habitats are described in the following sections.

Appendix B.3.1.1 Mangroves

Mangroves grow in intertidal mud and sand, with specially adapted aerial roots (pneumatophores) that provide for gas exchange during low tide (McClatchie et al., 2006). Mangrove forests are important in helping stabilise coastal sediments, providing a nursery ground for many species of fish and crustacean, and providing shelter or nesting areas for seabirds (McClatchie et al., 2006).

The mangroves in Victoria are the most southerly extent of mangroves found in the world and are located mostly along sheltered sections of the coast within inlets or bays (MESA, 2015). There is only one species of mangrove found in Victoria, the white or grey mangrove (*Avicennia marina*), which is known to occur at Western Port and Corner Inlet, and also at larger estuaries like the Yarran and Barwon Rivers.

Appendix B.3.1.2 Saltmarsh

Saltmarshes are terrestrial halophytic (salt-adapted) ecosystems that mostly occur in the upper-intertidal zone and are widespread along the coast. Saltmarshes are typically dominated by dense stands of halophytic plants such as herbs, grasses and low shrubs. In contrast to mangroves, the diversity of saltmarsh plant species increases with increasing latitude. The vegetation in these environments is essential to the stability of the saltmarsh, as they trap and bind sediments. The sediments are generally sandy silts and clays, and can often have high organic material content.

Saltmarshes provide a habitat for a wide range of both marine and terrestrial fauna, including infauna and epifaunal invertebrates, fish and birds.

Saltmarsh is found along many parts of the Victorian coast, although is most extensive in western Port Phillip Bay, northern Western Port, within the Corner Inlet-Nooramunga complex, and behind the sand dunes of Ninety Mile Beach in Gippsland (Boon et al., 2011).

Appendix B.3.1.3 Soft Sediment

Unvegetated soft sediments are a widespread habitat in both intertidal and subtidal areas, particularly in areas beyond the photic zone. Factors such as depth, light, temperature and the type of sediment present can vary the biodiversity and productivity of soft sediment habitat.

The substrate across Bass Strait comprises a variety of sediment types, with sediment particle size associated with tidal currents and wave energy. In general, the near-shore sediments consist of coarse sands with isolated areas of gravels, shells and pebbles; and then become progressively finer further offshore (Esso, 2009). The inshore seabed of Bass Strait consists of symmetrical, wave-generated sandy ripples, becoming shelly in troughs as the depth increases. Finer, muddy sands occur further offshore in the mid-shelf regions (Esso, 2009).

Scientific surveys have shown that some shallow Victorian sandy environments have the highest levels of animal diversity in the sea ever recorded (Parks Victoria, 2016a). Some of the larger animals found in these soft sediment environments in Victoria include Smooth Stingray (Dasyatis brevicaudata), Pipi (Plebidonax deltoids), Dumpling Squid (Euprymna tasmanica), Common Stargazer (Kathetostoma leave) and Heart Urchin (Echinocardium cordatum) (Parks Victoria, 2016a).

Appendix B.3.1.4 Seagrass

Seagrasses are marine flowering plants, with around 30 species found in Australian waters (Huisman, 2000). While seagrass meadows are present throughout southern and eastern Australia, the proportion of seagrass habitat within the south-eastern sector is not high compared to the rest of Australia (in particular with parts of South Australia and Western Australia) (Kirkham, 1997).

Seagrass generally grows in soft sediments within intertidal and shallow subtidal waters where there is sufficient light, and are common in sheltered coastal areas such as bays, lees of islands and fringing coastal reefs (McClatchie et al., 2006; McLeay et al., 2003). Known seagrass meadows within the EMBA include Corner Inlet, Port Phillip Bay and Western Port Bay. Seagrass meadows are important in stabilising seabed sediments, and providing nursery grounds for fish and crustaceans, and a protective habitat for the juvenile fish and invertebrates species (Huisman, 2000; Kirkham, 1997).

Appendix B.3.1.5 Algae

Benthic microalgae are present in areas where sunlight reaches the sediment surface. Benthic microalgae are important in assisting with the exchange of nutrients across the sediment-water interface; and in sediment stabilisation due to the secretion of extracellular polymetric substances (Ansell *et al.*, 1999). Benthic microalgae can also provide a food source to grazers such as gastropod and amphipods (Ansell *et al.*, 1999).

Macroalgae communities occur throughout the Australian coast and are generally found on intertidal and shallow subtidal rocky substrates. Macroalgal systems are an important source of food and shelter for many ocean species; including in their unattached drift or wrack forms (McClatchie *et al.*, 2006). Macroalgae are divided into three groups: Phaeophyceae (brown algae), Rhodophyta (red algae), and Chlorophyta (green algae). Brown algae are typically the most visually dominant and form canopy layers (McClatchie *et al.*, 2006). The presence and growth of macroalgae are affected by the principal physical factors of temperature, nutrients, water motion, light, salinity, substratum, sedimentation and pollution (Sanderson, 1997). Macroalgae assemblages vary, but *Ecklonia radiata* and *Sargassum* sp. are typically common in deeper areas. Known areas of macroalgae communities within the EMBA include Port Philip Bay.

Appendix B.3.1.6 Coral

Corals are generally divided into two broad groups: the zooxanthellate ('reef-building', 'hermatypic' or 'hard') corals, which contain symbiotic microalgae (zooxanthellae) that enhance growth and allow the coral to secrete large amounts of calcium carbonate; and the azooxanthellate ('ahermatypic' or 'soft') corals, which are generally smaller and often solitary (Tzioumis and Keable, 2007). Hard corals are generally found in shallower (<50 m) waters while the soft corals are found at most depths, particularly those below 50 m (Tzioumis and Keable, 2007).

Corals do not occur as a dominant habitat type within the EMBA, however their presence has been recorded around areas such as Wilsons Promontory National Park and Cape Otway. Reef development by hard corals does not occur further south than Queensland (Tzioumis and Keable, 2007). Soft corals are typically present in deeper waters throughout the continental shelf, slope and offslope regions, to well below the limit of light penetration.

Reproduction methods for cold water corals are not as well understood as warm water corals such as those of the Great Barrier Reef, but it is likely that some are still broadcast spawners (like their tropical counterparts), while others brood and release formed larvae (Roberts *et al.*, 2009).

Appendix B.3.1.7 Carbonate sands and exposed limestone

Boreen et al., (1993) reported that carbonate sands in the Otway middle shelf support a benthic fauna dominated by bryozoans, infaunal echinoids and assemblages of sponges. Other components include bivalves (commonly *Mysella donaciformis* and *Legrandina bernadi*), *Chlamys* sp. scallops and small gastropods. The sand octopus (*Octopus kaurna*) also inhabits sandy sediments. This description is broadly supported by video footage of the Otway pipeline, which also indicates that hard substrates in mid shelf areas in the west of the operational support low to medium density sponge dominated communities.

Within the inner shelf, Boreen et al., (1993) reported that the benthic communities associated with hard limestone substrates were comprised of sponges, encrustlng and branching corailine algae, poysonellid algae, bryozoa, benthic forams, robust sarpullds, brachiopods, bivalves, gastropods, fleshy red algae and kelp.

A benthic survey of inner shelf sediments in the vicinity of the Minerva Gas Field development, directly inshore from the operational area, found the seafloor was composed of course, well-sorted sand (Currie and Jenkins, 1994). This survey identified 196 species and a total of 5,035 individuals comprised of 63% crustaceans, 15% polychaetes, 8% molluscs and 5% echinoderms. The most abundant species were the bivalve *Katlysia* sp. (12.4 individuals/m^2), the sarconid *Triloculina affinis* (8.9 individuals/m^2), the tanaid isopod *Apsuedes* sp. (8.3 individuals/m^2) and the spionid polychaete *Prionospio coorilla* (4.8 individuals/m^2) (Currie, 1995).

Demersal fishes likely to be associated with carbonate sands on the middle and inner shelf include (LCC, 1993) eastern stargazer (*Kathetostoma laeve*), elephant shark (*Callorhynchus milli*), greenback flounder (*Rhombosolea taoarina*), gummy shark (*Mustelus antarcticus*), long-snouted flounder (*Ammotretis rostraus*), saw shark (*Pristiophorus nudipinnis*), southern sand flathead (*Platycephalus bassensis*) and southern school whiting (*Sillago bassensis*).

Appendix B.3.1.8 Basalt rises

There is no published information on the species assemblages of the basalt rises in the south east and east of the operational area, other than general information on their importance as a southern rock lobster fishing area. Following the classification system of Hutchinson et al., (2010) these rises can be classified as deep reefs, defined as rocky habitat at depths greater than 20 m.

In general, deep reef biota is typified by invertebrate animals rather than algae, usually in the form of sessile, filter feeding fauna. Organisms such as sponges, octocorals, bryozoans and ascidians usually dominate rock faces on deep reefs (Hutchison et al., 2010). This is partly due to the ability of species such as sponges to survive in low light conditions that algae is unable to survive in. The most common algae present on deep reefs are encrusting coralline red algae which is able to tolerate low levels of penetrating light (Hutchison et al., 2010).

The distribution of fish fauna is governed by biologically formed habitat structure as well as by food. Fish assemblages typically begin to change at depths greater than 20 m, with the loss of the kelp- associated wrasses and leatherjackets, and the appearance of deeper water fishes such as boarfishes (family Pentacerotidae), splendid perch (*Callanthias australis*) and banded seaperch (*Hypoplectrodes nigroruber*). Schools of barber perch (*Caesioperca razor*) are replaced by the related butterfly perch (*Caesioperca lepidoptera*) (O'Hara et al., 1999). While fish present on shallow subtidal reefs include algavores, omnivores and carnivores, those on deep reefs are typically carnivorous as algae are typically not abundant at depth.

Although common on rocky reefs, sponges, hydrozoans, anthozoans, bryozoans, and ascidians are thought to be largely unpalatable to reef fish. It is therefore likely that fish at these depths are feeding on associated mobile invertebrate fauna. Edmunds et al., (2006) suggests that mobile invertebrate organisms play an ecologically significant role, providing food for carnivorous fishes on deep reefs in Port Phillip Bay, and are likely to include a variety of crustaceans and molluscs.

Information from the few specific studies of specific deep reef habitats in Bass Strait can be assessed to draw broad conclusions about the species assemblages likely to occur on the basalt rises, noting that assemblages of reef species are likely to differ based on geology, habitat structure, exposure to tidal and wave motion and nutrient availability. These studies are generally limited to one off video surveys with little or no temporal replication. More generally little is known about deep reefs in the Bass Strait, or the biology and ecology of organisms that live on them, due in part to difficulties associated with conducting observational work or manipulative experiments in situ.

Beaman et al., (2005) undertook video surveys of the New Zealand Star Bank in the eastern Bass Strait, approximately 600 km east of the operational area. This feature is comprised of granite outcrops between approximately 30 to 40 m water depth, rising from the surrounding relatively flat seabed of mainly unconsolidated quartz sands with variable amounts of shell debris.

Underwater video footage revealed a structurally complex surface of crevices and steep slopes, which is densely covered in erect large and small sponges and encrusting calcareous red algae. Encrusting red algae are usually the greatest occupier of space due to tolerance of low light conditions (< 1% of surface) found at these depths (Andrew, 1999). Mobile benthos observed were crinoids within crevices and the black sea urchin (*Centrostephanus rodgersii*) in low numbers on high slope surfaces and dense encrustations on low relief lower slopes. Underwater video showed a Draughtboard shark (*Cephaloscyllium laticeps*) cruising above the crevices of high-relief granite outcrop as well as schools of butterfly perch feeding on plankton in the water column above the bank.

This study demonstrated a significant difference between communities that live on hard-ground granite outcrops of the New Zealand Star Bank and those which exist on soft substrate surrounding the rocky bank. These granite outcrops support a diverse sessile fauna of large and small sponges, bryozoans, hydroids and ascidians which prefer stable attachment surfaces (Underwood et al., 1991; Andrew 1999; Andrew and O'Neill, 2000). It is likely that similar species assemblages occur within the operational area between the flat carbonate sands of the seabed and the basalt rises.

Edmunds et al., (2006) investigated assemblages of benthic fauna at near shore deep reefs within Central Victoria (Point Addis and Wilsons Promontory) and Port Phillip Bay. The Port Phillip Bay deep reef assemblages were dominated by sponges, occupying 70 to 90% of the rocky substratum. The Point Addis assemblage was dominated by upright sponges (arborescent, massive and flabellate growth forms), but cnidarians including hydroids were entirely absent. Wilson's Promontory had a low coverage of encrusting sponges and hydroids, with high abundances of red and brown algae and the gorgonian fan *Pteronisis* sp. The Port Phillip Heads assemblage was dominated by encrusting sponges, hydroids, ascidians and bryozoans.

In summary, the species assemblages associated with the basalt rises in the south-east and east of the operational area are likely to be significantly different to the species assemblages of the surrounding flat seabed supporting carbonate sands. The depth of the basalt rises is likely to preclude significantly algal growth, with red algae likely to be most abundant. Sponges, hydrozoans, anthozoans, bryozoans, and ascidians are likely to occur though the relative abundances of these groups are not known. Targeting of the rises for rock lobster fishing indicates presence of this species in relatively high densities. The trophic effects of long term targeting of this species at these rises is not known. Site attached fishes are not likely to include kelp-associated wrasses and leatherjackets. Further statements cannot be made with sufficient confidence as site specific data for these rises are not available.

Appendix B.3.2 Plankton

Plankton species are the key component of the food web and support nearly all marine life. Copepods are the most common zooplankton and are some of the most abundant animals on earth. Plankton communities are highly diverse, with members from almost all phyla. Phytoplankton are photosynthetic organisms that drift with ocean currents and are mostly microscopic; however, some gelatinous plankton can be up to 2 m in diameter. Phytoplankton is grazed by zooplankton such as small protozoa, copepods, decapods, krill and gelatinous zooplankton.

The carrying capacity of marine ecosystems (the mass of fish resources) and recruitment of individual stocks is strongly related to plankton abundance, timing and composition. In the EMBA, the seasonal Bonney Coast upwelling is a productivity hotspot, with high densities of zooplankton and are important for fish and whales. Of particular importance in the region is the coastal krill, *Nyctiphanes australis*, which swarms throughout the water column of continental shelf waters primarily in summer and autumn, feeding on microalgae and providing an important link in the blue whale food chain. The fisheries in this region account for half of Australia's total annual catch and the main fishery in the region is sardine, which feeds on plankton, which illustrates the interdependence of the fishing industry on plankton.

There have been relatively few studies of plankton populations in the Otway and Bass Strait regions, with most concentrating on zooplankton. Watson and Chaloupka (1982) reported a high diversity of zooplankton in eastern Bass Strait, with over 170 species recorded. However, Kimmerer and McKinnon (1984) reported only 80 species in their surveys of western and central Bass Strait.

Plankton distribution is dependent upon prevailing ocean currents including the East Australia Current, flows into and from Bass Strait and Southern Ocean water masses. Plankton distribution in the EMBA is expected to be highly variable both spatially and temporally and are likely to comprise characteristics of tropical, southern Australian, central Bass Strait and Tasman Sea distributions.

Appendix B.3.3 Invertebrates

There is a very large number of marine invertebrates in deep waters around Australia. Knowledge of the species in different habitats is extremely patchy; the number of deep-water benthic fauna is large but almost unknown. Throughout the region, a variety of seabed habits support a range of animal communities such as sparse sponges to extensive 'thickets" of lace corals and sponges, polychaete worms and filter feeders (Director of National Parks, 2013).

Characteristics of large species of Crustacea, such as lobster, prawn and crab, which are significant commercial species in southern Australia, are well known. Mollusc species, such as oysters, scallops and abalone are also commercially fished and their biology and abundance are well known. Major fisheries for the blacklip and to a lesser extent, greenlip abalone and scallops have been founded. The cooler waters of southern Australia also support the Maori octopus commercial fishery, which is one of the largest octopuses in Australia (with arm spans longer than 3 m and weighing more than 10 kg.

Other molluscs are abundant in southern Australia and Tasmania such as the sea-slug with more than 500 species. Volutes and cowries represent a relic fauna in southern Australia, with several species being very rare and can be highly sought after by collectors.

Echinoderms, such as sea stars, sea urchins and sea cucumbers are also an important fauna species of the southern Australian and Tasmanian waters, with several species at risk of extinction (DPIPWE, 2016)

Studies by the Museum of Victoria found that invertebrate diversity was high in southern Australian waters although the distribution of species was patchy, with little evidence of any distinct biogeographic regions (Wilson and Poore, 1987). Results of sampling in shallower inshore sediments reported high diversity and patchy distribution (Parry et al., 1990). In these areas crustaceans, polychaetes and molluscs were dominant.

Appendix B.3.4 Threatened ecological communities

Threatened Ecological Communities (TECs) provide wildlife corridors or refugia for many plant and animal species, and listing a TEC provides a form of landscape or systems-level conservation (including threatened species). The following TECs were identified as potentially occurring in the EMBA in the PMST Report contained in Appendix A and given below;

- Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community
- Giant Kelp Marine Forests of South East Australia
- Grassy Eucalypt Woodland of the Victorian Volcanic Plain
- Natural Damp Grassland of the Victorian Coastal Plains
- Natural Temperate Grassland of the Victorian Volcanic Plain
- Subtropical and Temperate Coastal Saltmarsh
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

Of the TECs listed above, only the Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community, the giant kelp marine forests of South East Australia and the Subtropical and Temperate Coastal Saltmarsh Vulnerable Community have potential to be impacted by an oil spill associated with the development, as the rest are terrestrial listings.

Appendix B.3.4.1 Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community

This ecological community is the assemblage of native plants, animals and micro-organisms associated with the dynamic salt-wedge estuary systems that occur within the temperate climate, microtidal regime (< 2 m), high wave energy coastline of western and central Victoria. The ecological community currently encompasses 25 estuaries in the region defined by the border between South Australia and Victoria and the most southerly point of Wilsons Promontory (TSSC, 2018).

Salt-wedge estuaries are usually highly stratified, with saline bottom waters forming a ‘saltwedge’ below the inflowing freshwater layer of riverine waters. The dynamic nature of salt-wedge estuaries has important implications for their inherent physical and chemical parameters, and ultimately for their biological structure and ecological functioning. Some assemblages of biota are dependent on the dynamics of these salt-wedge estuaries for their existence, refuge, increased productivity and reproductive success. The ecological community is characterised by a core component of obligate estuarine taxa, with associated components of coastal, estuarine, brackish and freshwater taxa that may reside in the estuary for periods of time and/or utilise the estuary for specific purposes (e.g. reproduction, feeding, refuge, migration) (TSSC, 2018).

Appendix B.3.4.2 Giant Kelp Marine Forests of South East Australia

Giant kelp (*Macrocystis pyrifera*) is a large brown algae that grows on rocky reefs in cold temperate waters off south east Australia. The kelp grows up from the sea floor 8 m below the sea surface and deeper, vertically toward the water surface. It is the foundation species of this TEC in shallow coastal marine ecological communities. The kelp species itself is not protected, rather, it is communities of closed or semi-closed giant kelp canopy at or below the sea surface that are protected (DSEWPaC, 2012).

Giant kelp is the largest and fastest growing marine plant. Their presence on a rocky reef adds vertical structure to the marine environment that creates significant habitat for marine fauna, increasing local marine biodiversity. Species known to shelter within the kelp forests include weedy sea dragons (*Phyllopteryx taeniolatus*), six-spined leather jacket (*Mesuchenia freycineti*), brittle stars (ophiuroids), sea urchins, sponges, blacklip abalone (*Tosia spp*) and southern rock lobsters (*Jasus edwardsii*). The large biomass and productivity of the giant kelp plants also provides a range of ecosystem services to the coastal environment.

Giant kelp requires clear, shallow water no deeper than approximately 35 metres deep (Edyvane, 2003; Shepherd and Edgar, 2012; cited in DoE, 2012). They are photo-autotrophic organisms that depend on photosynthetic capacity to supply the necessary organic materials and energy for growth. O'Hara (in Andrew, 1999) reported that giant kelp communities in Tasmanian coastal waters occur at depths of 5-25 m.

The largest extent of the ecological community is in Tasmanian coastal waters. Some patches may also be found in Victoria and South Australia.

James et al (2013) undertook extensive surveys of macroalgal communities along the Otway Shelf from Warrnambool to Portland in south-west Victoria. Sites were adjacent to shore or on offshore rocky reefs covering a depth range of 0 to 36 meters water depth. These surveys did not locate giant kelp at any site but identified that other brown algae species (Durvillaea, Ecklonia, Phyllospora, Cystophora, and Sargassum) are prolific to around 20 m water depth. Brown algae tend to be replaced by red algae in deeper waters.

Surveys of The Arches Marine Sanctuary (Edmunds et al. 2010) and Twelve Apostles Marine National Park (Holmes et al. 2007 cited in [Barton et al. 2012]) have not located giant kelp. The species has been recorded in Discovery Bay National Park forming part of a mixed brown algae community (Ball and Blake, 2007) (not part of the TEC), on basalt rocky reefs. An assemblage dominated by the species has been recorded from Merri Marine Sanctuary occupying a very small area (0.2 ha) of rocky reef (Barton et al. 2012).

Appendix B.3.4.3 Subtropical and Temperate Coastal Saltmarsh

The Subtropical and Temperate Coastal Saltmarsh TEC occurs in a relatively narrow strip along the Australian coast, within the boundary along 23°37' latitude along the east coast and south from Shark Bay on the west coast (Threatened Species Scientific Committee, 2013). The community is found in coastal areas which have an intermittent or regular tidal influence.

The coastal saltmarsh community consists mainly of salt-tolerant vegetation including grasses, herbs, sedges, rushes and shrubs. Succulent herbs, shrubs and grasses generally dominate and vegetation is generally less than 0.5 m in height (Adam, 1990). In Australia, the vascular saltmarsh flora may include many species, but is dominated by relatively few families, with a high level of endism at the species level.

The saltmarsh community is inhabited by a wide range of infaunal and epifaunal invertebrates and low and high tide visitors such as fish, birds and prawns (Adam, 1990). It is often important nursery habitat for fish and prawn species. Insects are also abundance and an important food source for other fauna. The dominant marine residents are benthic invertebrates, including molluscs and crabs (Ross et al, 2009).

The coastal saltmarsh community provides extensive ecosystem services such as the filtering of surface water, coastal productivity and the provision of food and nutrients for a wide range of adjacent marine and estuarine communities and stabilising the coastline and providing a buffer from waves and storms. Most importantly, the saltmarshes are one of the most efficient ecosystems globally in sequestering carbon, due to the biogeochemical conditions in the tidal wetlands being conducive to long-term carbon retention. A concern with the loss of saltmarsh habitat is that it could release the huge pool of stored carbon to the atmosphere.

Appendix B.3.5 Threatened and Migratory species

The EPBC PMST report identified the listed Threatened and Migratory species that may be present in the EMBA (Appendix A). A total of 104 Threatened species and 76 Migratory species were identified in the PMST report as potentially occurring within the EMBA. There were also 129 marine species and 30 cetaceans listed under the Act that were identified as potentially occurring within the EMBA.

Appendix B.3.5.1 Birds

A diverse array of seabirds and terrestrial birds utilise the Otway region and may potentially forage within or fly over the EMBA, resting on islands during their migration. Infrequently and often associated with storm events, birds that do not normally cross the ocean are sometimes observed over the Otway shelf, suggesting the birds have been blown off their normal course or are migrating.

Bird species listed by the EPBC Act PMST, as possibly or known to be occurring in EMBA (this includes species or species habitat), are shown in Table B-9-12 and described further in this section.

Table B-9-12: Listed bird species identified in the PMST search

Common name	Species name	EPBC Act status			Likely presence	BIA
		Listed Threatened	Listed Migratory	Listed marine		
King Island Brown Thornbill	*Acanthiza pusilla archibaldi*	E	-	-	SHL	
King Island Scrubtit	*Acanthornis magna greeniana*	CE	-	-	SHK	
Common sandpiper	*Actitius hypoleucos*	-	W	L	SHK	
Common Noddy	*Anous stolidus*	-	M	L	SHL	
Magpie Goose	*Anseranas semipalmata*	-	-	L	SHM	
Regent Honeyeater	*Anthochaera Phrygia*	CE	-	-	FL	
Fork-tailed swift	*Apus pacificus*	-	M	L	SHL	
Tasmanian Wedge-tailed Eagle	*Aquila audax fleayi*	E	-	-	SHL	

Common name	Species name	EPBC Act status			Likely presence	BIA
		Listed Threatened	Listed Migratory	Listed marine		
Great Egret	*Ardea alba*	-	-	L	BK	
Cattle Egret	*Ardea ibis*	-	-	L	SHM	
Flesh-footed shearwater	*Ardenna carneipes*	-	M	L	SHK	
Short-tailed Shearwater	*Ardenna tenuirostris*	-	M	L	BK	Foraging
Ruddy Turnstone	*Arenaria interpres*	-	W	L	RK	
Australasian bittern	*Botaurus poiciloptilus*	E	-	-	SHK	
Sharp-tailed sandpiper	*Calidris acuminata*	-	W	L	RK	
Sanderling	*Calidris alba*	-	W	L	RK	
Red knot	*Calidris canutus*	E	W	L	SHK	
Curlew sandpiper	*Calidris ferruginea*	CE	W	L	SHK	
Pectoral sandpiper	*Calidris melanotos*	-	W	L	SHK	
Red-necked Stint	*Calidris ruficollis*	-	W	L	RK	
Great Knot	*Calidris tenuirostris*	CE	W	L	RK	
Great skua	*Catharacta skua*	-	-	L	SHM	
Tasmanian Azure Kingfisher	*Ceyx azureus diemenensis*	E	-	-	SHM	
Double-banded Plover	*Charadrius bicinctus*	-	W	L	RK	
Greater Sand Plover	*Charadrius leschenaultia*	V	W	L	RK	
Lesser Sand Plover	*Charadrius mongolus*	E	W	L	RK	
Red-capped Plover	*Charadrius ruficapillus*	-	-	L	RK	
Black-eared Cuckoo	*Chrysococcyx osculans*	-	-	L	SHK	
Antipodean albatross	*Diomedea antipodensis*	V	M	L	FL	Foraging
Gibson's Albatross	*Diomedea antipodensis gibsoni*	V	-	L	FL	
Southern royal albatross	*Diomedea epomophora*	V	M	L	FL	
Wandering albatross	*Diomedea exulans*	V	M	L	FL	Foraging

Common name	Species name	EPBC Act status			Likely presence	BIA
		Listed Threatened	Listed Migratory	Listed marine		
Northern royal albatross	*Diomedea sanfordi*	E	M	L	FL	
Little Penguin	*Eudyptula minor*	-	-	L	BK	Breeding, Foraging
White-bellied Storm-Petrel	*Fregetta grallaria grallaria*	V	-	-	SHL	
Latham's Snipe	*Gallinago hardwickii*	-	W	L	RK	
Swinhoe's Snipe	*Gallinago megala*	-	W	L	RL	
Pin-tailed Snipe	*Gallinago stenura*	-	W	L	RL	
Painted Honeyeater	*Grantiella picta*	V	-	-	SHL	
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	-	-	L	BK	
Blue petrel	*Halobaena caerulea*	V	-	L	SHM	
Pied Stilt	*Himantopus himantopus*	-	-	L	RK	
White-throated Needletail	*Hirundapus caudacutus*	-	T	L	SHK	
Caspian Tern	*Hydroprogne caspia*	-	M	L	BK	
Swift Parrot	*Lathamus discolour*	CE	-	-	SHK	
Kelp Gull	*Larus dominicanus*	-	-	L	BK	
Silver Gull	*Larus novaehollandiae*	-	-	L	BK	
Pacific Gull	*Larus pacificus*	-	-	L	BK	
Broad-billed Sandpiper	*Limicola falcinellus*	-	W	L	RK	
Bar-tailed Godwit	*Limosa lapponica bauera*	V	W	L	SHK	
Black-tailed Godwit	*Limosa limosa*	-	W	L	RK	
Northern Siberian Bar-tailed Godwit	*Limosa lapponica menzbieri*	CE	-	-	SHM	
Southern giant-petrel	*Macronectes giganteus*	E	M	L	SHL	
Northern giant-petrel	*Macronectes halli*	V	M	L	SHM	
Rainbow Bee-eater	*Merops ornatus*	-	-	L	SHM	
Black-faced Monarch	*Monarcha melanopsis*	-	T	L	SHK	
Cape Gannet	*Morus capensis*	-	-	L	BK	

Common name	Species name	EPBC Act status			Likely presence	BIA
		Listed Threatened	Listed Migratory	Listed marine		
Australasian Gannet	*Morus serrator*	-	-	L	BK	Foraging
Yellow Wagtail	*Motacilla flava*	-	T	L	SHM	
Satin Flycatcher	*Myiagra cyanoleuca*	-	T	L	BK	
Orange-bellied parrot	*Neophema chrysogaster*	CE	-	L	MK	
Eastern curlew	*Numenius madagacariensis*	CE	W	L	SHK	
Little Curlew	*Numenius minutus*	-	W	L	RL	
Whimbrel	*Numenius phaeopus*	-	W	L	RK	
Fairy prion	*Pachyptila turtur subantactica*	V	-	L	SHK	
Osprey	*Pandion haliaetus*	-	W	L	SHK	
Plains-wanderer	*Pedionomus torquatus*	CE	-	-	SHL	
White-faced Storm-Petrel	*Pelagodroma marina*	-	-	L	BK	Foraging
Common Diving-Petrel	*Pelecanoides urinatrix*	-	-	L	BK	Foraging
Black-faced Cormorant	*Phalacrocorax fuscescens*	-	-	L	BK	
Red-necked Phalarope	*Phalaropus lobatus*	-	W	L	RK	
Ruff (Reeve)	*Philomachus pugnax*	-	M	L	SHL	
Sooty albatross	*Phoebetris fusca*	V	M	L	SHL	
Green Rosella	*Platycercus caledonicus brownie*	V	-	-	SHL	
Pacific Golden Plover	*Pluvialis fulva*	-	W	L	RK	
Grey Plover	*Pluvialis squatarola*	-	W	L	RK	
Gould's petrel	*Pterodroma leucoptera*	E	-	-	SHM	
Soft-plumaged petrel	*Pterodroma mollis*	V	-	L	FL	
Red-necked Avocet	*Recurvirostra novaehollandiae*	-	-	L	RK	
Rufous Fantail	*Rhipidura rufifrons*	-	T	L	SHK	
Australian Painted-snipe	*Rostratula australis*	E	-	-	SHL	
Painted Snipe	*Rostratula benghalensis (sensu lato)*	E	-	L	SHL	
Little Tern	*Sternula albifrons*	-	M	L	BK	

Common name	Species name	EPBC Act status			Likely presence	BIA
		Listed Threatened	Listed Migratory	Listed marine		
Caspian Tern	*Sterna caspia*	-	-	L	BK	
Sooty Tern	*Sterna fuscata*	-	-	L	BK	
Australian fairy tern	*Sternula nereis*	V	-	-	BK	
Black Currawong	*Strepera fuliginosa colei*	V	-	-	BL	
Crested Tern	*Thalasseus bergii*	-	W	L	BK	
Buller's albatross	*Thalassarche bulleri*	V	M	L	FL	Foraging
Northern Buller's albatross	*Thalassarche bulleri platei*	V	-	-	FL	
Tasmanian Shy Albatross	*Thalassarche cauta*	V	M	L	FL	
Shy albatross	*Thalassarche cauta cauta*	V	M	L	FL	Foraging
White-capped albatross	*Thalassarche cauti steadi*	V	M	-	FL	
Grey-headed albatross	*Thalassarche chrysostoma*	E	M	L	SHM	
Chatham Albatross	*Thalassarche eremita*	E	M	L	FL	
Campbell albatross	*Thalassarche impavida*	V	M	L	FL	Foraging
Black-browed albatross	*Thalassarche melanophris*	V	M	L	FL	Foraging
Salvin's albatross	*Thalassarche salvini*	V	M	L	FL	
Hooded Plover	*Thinornis rubricollis rubricollis*	V	-	L	SHK	
White-capped albatross	*Thalassarche steadi*	V	M	L	FL	
Grey-tailed Tattler	*Tringa brevipes*	-	W	-	RK	
Wood Sandpiper	*Tringa glareola*	-	W	L	RK	
Wandering Tattler	*Tringa incana*	-	W	-	RK	
Common Greenshank	*Tringa nebularia*	-	W	L	SHK	
Marsh Sandpiper	*Tringa stagnatilis*	-	W	L	RK	
Terek Sandpiper	*Xenus cinereus*	-	W	L	RK	

Common name	Species name	EPBC Act status			Likely presence	BIA
		Listed Threatened	Listed Migratory	Listed marine		

Listed Threatened
- CE: Critically Endangered
- E: Endangered
- V: Vulnerable

Listed Migratory
- M: Migratory

Listed Marine
- L: Listed

Likely Presence
- SHM: Species or species habitat may occur within area.
- SHL: Species or species habitat likely to occur within area.
- SHK: Species or species habitat known to occur within area.
- FL: Foraging, feeding or related behaviour likely to occur within area.
- RK: Roosting known to occur within area.
- ML: Migratory route likely to occur in area.

Albatrosses and giant-petrels are among the most dispersive and oceanic of all birds, spending more than 95% of their time foraging at sea in search of prey and usually only returning to land (remote islands) to breed. The National Recovery Plan for threatened albatross and giant petrels (DSEWPaC, 2011a). Only seven species of albatross and the southern and northern giant petrel are known to breed within Australia. Breeding within Australian territory occurs on the isolated islands of Antarctica (Giganteus Island, Hawker Island and Frazier islands) and the Southern Ocean (Heard Island, McDonald Island, Macquarie Island, Bishop and Clerk Islands), as well as islands off the south coast of Tasmania and Albatross Island off the north-west coast of Tasmania in Bass Strait (DSEWPaC, 2011). There are no islands with colonies of threatened marine seabirds within the EMBA. Albatross Island, supporting a breeding population of approximately 5,000 shy albatross (*Thallassarche cauta*), is the closest breeding colony of threatened seabirds to the EMBA.

Albatross and giant petrel species exhibit a broad range of diets and foraging behaviours, hence their at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is those waters south of 25 degrees where most species spend most of their foraging time. The wandering albatross, antipodean albatross, Buller's albatross, shy albatross, black-browed albatross and Campbell albatross have BIAs for foraging that overlap the EMBA. This BIA is either most or all the South-East Marine Region (Commonwealth of Australia, 2015). Therefore, it is likely that these will be present and forage in the EMBA.

Orange-bellied parrot (*Neophema chrysogaster*) (listed as critically endangered under the EPBC Act) breeds in Tasmania during summer, migrates north across Bass Strait in autumn and spends winters on the mainland. The migration route includes the west coast of Tasmania and King Island. 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 and Davies, 1996).

The orange-bellied parrot is protected under the National Recovery Plan for the Orange-bellied Parrot (DELWP, 2016). The parrot's breeding habitat is restricted to south-west Tasmania, where breeding occurs from November to mid-January mainly within 30 km of the coast. The species forage on the ground or in low vegetation (Loyn et al., 1986). During winter, on mainland Australia, orange-bellied parrots are found mostly within 3 km of the coast. In Victoria, they mostly occur in sheltered coastal habitats, such as bays, lagoons and estuaries. 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*) (DotEE, 2019a). There are also non-breeding orange-bellied parrots on mainland Australia, between Goolwa in Australia and Corner Inlet in Victoria.

The orange bellied parrot may overfly the coastal waters of the EMBA however the west coast of King Islands and coastal Victoria has been identified as resting and feeding areas. However, parrots rarely land or forage out at sea.

Flesh-footed shearwater is a trans-equatorial migrant widely distributed across the south-western Pacific during breeding season (early September to early May) and is a common visitor to the waters of the continental shelf/slope and occasionally inshore waters. The species breeds in burrows on sloping ground in coastal forest, scrubland, shrubland or grassland. Thirty-nine of the 41 islands on which the species breeds lie off the coast of southern Western Australia, with the remaining two islands being Smith Island (SA) and Lord Howe Island. The flesh-footed shearwater feeds on small fish, cephalopod molluscs (squid, cuttlefish, nautilus and argonauts), crustaceans (barnacles and shrimp), other soft-bodied invertebrates (such as Velella) and offal. The species forages almost entirely at sea and very rarely on land. It obtains most of its food by surface plunging or pursuit plunging. It also regularly forages by settling on the surface of the ocean and snatching prey from the surface ('surface seizing'), momentarily submerging onto prey beneath the surface ('surface diving') or diving and pursuing prey beneath the surface by swimming ('pursuit diving'). Birds have also been observed flying low over the ocean and pattering the water with their feet while picking food items from the surface (termed 'pattering') (DotEE, 2014). This species is likely to be an uncommon visitor to the EMBA.

The Little Penguin is the smallest species of penguin in the world and are permanent residents on a number of inshore and offshore islands. The Australian population is large but not thought to exceed one million birds (DoE, 2015a). Bass Strait has the largest proportion (approximately 60%) of the known breeding colonies in Australia; however, breeding populations are also found on the New South Wales coast. Individuals exhibit strong site fidelity, returning to the same breeding colony each year to breed in the winter and spring months (Gillanders *et al.*, 2013). The diet of a Little Penguin includes small school fish, squid and krill. Prey is typically caught with rapid jabs of the beak and swallowed whole. A BIA for breeding and foraging, has been identified for breeding and foraging of the Little Penguin within the EMBA. Little penguins are also an important component of the Australian and New Zealand fur-seals' diet (Parliament of South Australia, 2011).

The Australasian Gannet generally feeds over the continental shelf or inshore waters. Their diet is comprised mainly of pelagic fish, but also squid and garfish. Prey is caught mainly by plunge-diving, but it is also seen regularly attending trawlers. Breeding is highly seasonal (October–May), nesting on the ground in small but dense colonies (DoE, 2015a). Important breeding locations for the Australian Gannet within the Environment Sectors include Pedra Branca, Eddystone Rocks, Sidmouth Rocks, and Black Pyramid (Tasmania) and Lawrence Rocks (Victoria). A BIA, for foraging, has been established in the EMBA.

Both the Common Diving-Petrel and the White-faced Storm Petrel are not listed as threatened species under the EPBC Act, and have large populations within Australia, accounting for 5% and 25% respectively of the global population (DoE, 2015a). The Common Diving-Petrel breeds on islands off south-east Australia and Tasmania; there are 30 sites with significant breeding colonies (defined as more than 1,000 breeding pairs) known in Tasmania, and 12 sites in Victoria (including Seal Island, Wilson's Promontory and Lady Julia Percy Island) (DoE, 2015a). There are 15 sites with significant breeding colonies in Tasmania, and three sites with Victoria, for the White-faced Storm Petrel (DoE, 2015a). A BIA for foraging has been identified for both the common Diving-Petrel and the White-faced Storm Petrel within the EMBA.

A number of species listed in Table B-9-12 use coastal shoreline habitats such as Australian fairy tern, Fairy prion, Red knot, Pectoral sandpiper, Fork-tailed swift, Sharp-tailed sandpiper, Curlew sandpiper, Eastern curlew and Australasian bittern. These species are commonly found on coastal shores including beaches and rocky shores and either feed at low tide on worms, crustaceans and molluscs or fish species or feed on aquatic biota (Parks Victoria, 2016). This species are unlikely to be present in the EMBA due to the distance offshore.

Appendix B.3.5.2 Fish

Fish species present in the EMBA 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 report identified 30 listed fish species that were potentially occurring in the EMBA. Table B-9-13 details the listed fish species identified in the PMST.

Table B-9-13: Listed fish species identified in the PMST search

Common name	Species name	EPBC Act status			Likely presence	BIA
		Listed Threatened	Listed Migratory	Listed marine		
Fish						
Australian grayling	*Prototroctes maraena*	V	-	-	SHK	
Whale Shark	*Rhincodon typus*	V	M	-	SHM	
Sharks and rays						
White shark	*Carcharodon carcharias*	V	M	-	BK	Distribution
Shortfin mako	*Isurus oxyrinchus*	-	M	-	SHL	
Porbeagle, mackerel shark	*Lamna nasus*	-	M	-	SHL	
Pipefish, seahorse, seadragons						
Southern Pygmy Pipehorse	*Acentronura austral*	-	-	L	SHM	
Tryon's Pipefish	*Campichthys tryoni*	-	-	L	SHM	
Upside-down Pipefish	*Heraldia nocturna*	-	-	L	SHM	
Bigbelly seahorse	*Hippocampus abdominalis*	-	-	L	SHM	
Short-head seahorse	*Hippocampus breviceps*	-	-	L	SHM	
Bullneck Seahorse	*Hippocampus minotaur*	-	-	L	SHM	
Briggs' crested pipefish	*Histiogamphelus briggsii*	-	-	L	SHM	
Rhino pipefish	*Histiogamphelus cristatus*	-	-	L	SHM	
Knife-snouted pipefish	*Hypselognathus rostratus*	-	-	L	SHM	
Deep-bodied pipefish	*Kaupus costatus*	-	-	L	SHM	
Trawl Pipefish	*Kimblaeus bassensis*	-	-	L	SHM	
Brushtail pipefish	*Leptoichthys fistularius*	-	-	L	SHM	
Australian smooth pipefish	*Lissocampus caudalis*	-	-	L	SHM	
Javelin pipefish	*Lissocampus runa*	-	-	L	SHM	
Sawtooth pipefish	*Maroubra perserrata*	-	-	L	SHM	
Mollison's Pipefish	*Mitotichthys mollisoni*	-	-	L	SHM	

Common name	Species name	EPBC Act status			Likely presence	BIA
		Listed Threatened	Listed Migratory	Listed marine		
Half-banded pipefish	*Mitotichthys semistriatus*	-	-	L	SHM	
Tucker's pipefish	*Mitotichthys tuckeri*	-	-	L	SHM	
Red pipefish	*Notiocampus ruber*	-	-	L	SHM	
Leafy seadragon	*Phycodurus eques*	-	-	L	SHM	
Common seadragon	*Phyllopteryx taeniolatus*	-	-	L	SHM	
Pug-nosed pipefish	*Pugnaso curtirostris*	-	-	L	SHM	
Robust pipehorse	*Solegnathus robustus*	-	-	L	SHM	
Spiny pipehorse,	*Solegnathus spinosissimus*	-	-	L	SHM	
Spotted pipefish	*Stigmatopora argus*	-	-	L	SHM	
Black pipefish	*Stigmatopora nigra*	-	-	L	SHM	
Ring-backed pipefish	*Stipecampus cristatus*	-	-	L	SHM	
Double-end Pipehorse	*Syngnathoides biaculeatus*	-	-	L	SHM	
Hairy pipefish	*Urocampus carinirostris*	-	-	L	SHM	
Mother-of-pearl pipefish	*Vanacampus margaritifer*	-	-	L	SHM	
Port Phillip pipefish	*Vanacampus phillipi*	-	-	L	SHM	
Australian long-snout pipefish	*Vanacampus poecilolaemus*	-	-	L	SHM	
Verco's Pipefish	*Vanacampus vercoi*	-	-	L	SHM	

Listed Threatened
V: Vulnerable
Listed Migratory
M: Migratory
Listed Marine
L: Listed

Likely Presence
SHM: Species or species habitat may occur within area.
SHL: Species or species habitat likely to occur within area.
SHK: Species or species habitat known to occur within area.
BK: Breeding known to occur within area.

White shark

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 (DotEE, 2010). Studies of white sharks indicate that they are largely transient. However, individuals are known to return to feeding grounds on a seasonal basis (Klimley and Anderson, 1996). Observations of adult sharks are more frequent around fur seal and sea lion colonies, including Wilsons Promontory and the Skerries. Juveniles are known to congregate in certain key areas including the Ninety Mile Beach area (including Corner Inlet and Lakes Entrance) in eastern Victoria and the Portland area of western Victoria).

The distribution BIA for the white shark intersects the EMBA. The known distribution is on the coastal shelf/upper slope waters out to 1000 m and the broader area where they are likely to occur extends from Barrow Island in WA to Yeppoon in NSW. They are more likely to be found between the 60–120 m depth contours than in the deeper waters. There is a known nursery area at Corner Inlet, and they are known to forage in waters off pinniped colonies throughout the SEMR. It is likely that white sharks will be present in the EMBA.

Shortfin mako shark

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 in low numbers.

Porbeagle shark

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, but does make occasional forays close to shore or into the open ocean, down to depths of approximately 1,300 m. 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 in low numbers.

Australian grayling

The Australian grayling (*Prototroctes maraena*) is a dark brown to olive-green fish attaining 19 cm in length. The species typically inhabits the coastal streams of New South Wales, Victoria and Tasmania, migrating between streams and the ocean. Spawning occurs in freshwater, with timing dependant on many variables including latitude and temperature regimes. Most of its life is spent in fresh water, with parts of the larval or juvenile stages spent in coastal marine waters (Department of Sustainability and Environment, 2008a), though its precise marine habitat requirements remain unknown (Department of Sustainability and Environment, 2008b). They are a short-lived species, usually dying after their second year soon after spawning (a small proportion may reach four or five years) (Department of Sustainability and Environment, 2008a).

Australian grayling has been recorded from the Gellibrand River (Department of Sustainability and Environment, 2008b), making it likely that it occurs in coastal waters. As marine waters are not part of the species' spawning grounds, the EMBA is are not likely to represent critical habitat for the species.

Syngnathids

All of the marine ray-finned fish species identified in the EPBC PMST Report are syngnathids, which includes seahorses and their relatives (sea dragon, pipehorse and pipefish). The majority of these fish species are associated with seagrass meadows, macroalgal seabed habitats, rocky reefs and sponge gardens located in shallow, inshore waters (e.g., protected coastal bays, harbours and jetties) less than 50 m deep (Fishes of Australia, 2015). They are sometimes recorded in deeper offshore waters, where they depend on the protection of sponges and rafts of floating seaweed such as Sargassum.

Of the 26 species of syngnathids identified in the EPBC PMST Report, only one (*Hippocampus abdominalis*, big-belly seahorse) has a documented species profile 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 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.

Appendix B.3.5.3 Cetaceans

The PMST report identified a number of cetaceans that potentially occur in the EMBA (Table B-9-14). Details of these cetaceans are discussed further in this section.

Table B-9-14: Listed cetacean species identified in the PMST

Common name	Species name	EPBC Act status			Likely presence	BIA
		Listed threatened	Listed migratory	Listed marine		
Whales						
Southern right whale	*Balaena glacialis australis*	E	M	L	BK	Aggregation, Migration
Minke whale	*Balaenoptera acutorostrata*	-	-	L	SHM	
Antarctic minke whale	*Balaenoptera bonaerensis*	-	M	L	SHL	
Sei whale	*Balaenoptera borealis*	V	M	L	FK	
Bryde's Whale	*Balaenoptera edeni*	-	M	L	SHM	
Blue whale	*Balaenoptera musculus*	E	M	L	FK	Foraging
Fin whale	*Balaenoptera physalus*	V	M	L	FK	
Arnoux's beaked whale	*Berardius arnuxii*	-	-	L	SHM	
Pygmy right whale	*Caperea marginata*	-	M	L	FL	
Short-finned pilot whale	*Globicephala macrorhynchus*	-	-	L	SHM	
Long-finned pilot whale	*Globicephala melas*	-	-	L	SHM	
Pygmy sperm whale	*Kogia breviceps*	-	-	L	SHM	
Dwarf sperm whale	*Kogia simus*	-	-	L	SHM	
Humpback whale	*Megaptera novaeangliae*	V	M	L	SHK	

Common name	Species name	EPBC Act status			Likely presence	BIA
		Listed threatened	Listed migratory	Listed marine		
Andrew's beaked whale	*Mesoplodon bowdoini*	-	-	L	SHM	
Blainville's beaked whale	*Mesoplodon desirostris*	-	-	L	SHM	
Gray's Beaked Whale	*Mesoplodon grayi*	-	-	L	SHM	
Hector's beaked whale	*Mesoplodon hectori*	-	-	L	SHM	
Strap-toothed beaked whale	*Mesoplodon layardii*	-	-	L	SHM	
True's beaked whale	*Mesoplodon mirus*	-	-	L	SHM	
Killer whale, orca	*Orcinus orca*	-	M	L	SHL	
Sperm whale	*Physeter macrocephalus*	-	M	L	SHM	
False killer whale	*Pseudorca crassidens*	-	-	L	SHL	
Curvier's Beaked Whale	*Ziphius cavirostris*	-	-	L	SHM	
Dolphins						
Common dolphin	*Delphinus delphis*	-	-	L	SHM	
Risso's dolphin	*Grampus griseus*	-	-	L	SHM	
Dusky dolphin	*Lagenorhynchus obscures*	-	M	L	SHL	
Southern right whale dolphin	*Lissodelphis peronii*	-	-	L	SHM	
Indian Ocean bottlenose dolphin	*Tursiops aduncus*	-	-	L	SHL	
Bottlenose dolphin	*Tursiops truncates*	-	-	L	SHM	

Listed Threatened
E: Endangered
V: Vulnerable
Listed Migratory
M: Migratory
Listed Marine
L: Listed

Likely Presence
SHM: Species or species habitat may occur within area.
SHL: Species or species habitat likely to occur within area.
SHK: Species or species habitat known to occur within area.
FK: Foraging, feeding or related behaviour known to occur within area.
FL: Foraging, feeding or related behaviour likely to occur within area.
FM: Foraging, feeding or related behaviour may to occur within area.

Gill et al. (2015) summarised cetacean sightings from 123 systematic aerial surveys undertaken over western Bass Strait and the eastern Great Australian Bight between 2002 and 2013. This paper does not include sighting data for blue whales, which has previously been reported in Gill et al. (2011).

These surveys recorded 133 sightings of 15 identified cetacean species consisting of seven mysticete (baleen) whale species, eight odontocete (toothed) species and 384 sightings of dolphins (Table B-9-15 and Table B-9-16). Survey effort was biased toward coverage of upwelling seasons, corresponding with pygmy blue whales' seasonal occurrence (November to April; 103 of 123 surveys), and relatively little survey effort occurred during 2008–2011. Cetacean species sighted within the region are described in the following sections.

Table B-9-15: Cetacean species recorded during aerial surveys 2002–2013 in southern Australia

Taxon	Common name	Species group*	Sightings	Individual	Mean group size (+/- SD)
Baleen whales					
Eubalaena australis	Southern right whale	SRW	12	52	4.2 +/- 4.2
Caperea marginata	Pygmy right whale		1	100	100
Balaenoptera physalus	Fin and like fin whale	ROR	7	8	1.1 +/- 0.4
B. borealis	Sei and like sei whale	ROR	12	14	1.3 +/- 0.5
B. acutorostrata	Dwarf minke whale	ROR	1	1	1
B. bonaerensis	like Antarctic minke whale	ROR	1	1	1
Megaptera novaeangliae	Humpback whale	ROR	10	18	1.8 +/- 1.0
Toothed whales					
Physeter macrocephalus	Sperm whale	ODO	34	66	1.9 +/- 2.2
Mesoplodon spp.	Unidentified beaked whales	ODO	1	20	20
Orcinus orca	Killer whale	ODO	6	21	3.5 +/- 2.8
Globicephala melas	Long-finned pilot	ODO	40	1853	46.3 +/- 46.7
Grampus griseus	Risso's dolphin	ODO	1	40	40
Lissodelphis peronii	Southern right whale dolphin	ODO	1	120	120
Tursiops spp.	Bottlenose dolphin	DOL	4	363	90.8 +/- 140.1
	Dolphins	DOL	384	22169	58 +/- 129.6
Unidentified large whales			3	3	1
Unidentified small whales			2	2	1

SRW = southern right whales; ROR = rorquals; ODO = other odontocetes; DOL = dolphins.

Gill et al. (2015) encountered southern right and humpback whales most often from May to September, despite low survey effort in those months. Southern right whales were not recorded between October and May. Fin, Sei, and Pilot whales were sighted only from November to May (upwelling season), although this may be an artefact of their relative scarcity overall and low survey effort at other times of year. Dolphins were sighted most consistently across years. The authors caution that few conclusions about temporal occurrence can be drawn because of unequal effort distribution across seasons and the rarity of most species.

Species of cetacean sighted in the period 31 October to 19 December 2010 during the Speculant 3D Transitions Zone Seismic Survey (3DTZSS) undertaken by Origin Energy, recorded species of common dolphin (*Delphinus spp*.), bottlenose dolphin (*Tursiops spp*.), unidentified small cetaceans and fur seals.

Cetacean species sighted within the region are described in the following sections.

Table B-9-16: Temporal occurrence across months of cetaceans sighted during aerial surveys from November 2002 to March 2013 in southern Australia

Species	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Southern right whale	0	0	0	0	0	0	0	0	0.8	3.1	6.8	8.8
Pygmy right whale*	0	0	0	0	0	0	0	0	19.8	0	0	0
Fin whale	0	0.10	0.14	0.07	0.08	0	0	0	0	0	0	0
Sei whale	0	0.25	0.07	0.04	0.08	0.19	0	0.21	0	0	0	0
Minke whale*	0	0	0.02	0	0	0	0.12	0	0	0	0	0
Humpback whale	0	0.05	0.07	0	0	0	0	0.11	0.99	1.0	0	0.35
Sperm whale	1.7	1.2	0.23	0.53	0.08	0.13	0.75	0.85	0	0	0	0
Unidentified beaked whale*	0	0	0.47	0	0	0	0	0	0	0	0	0
Killer whale	0	0	0.19	0	0	5.0	0	6.0	0	0.68	0	0
Pilot whale	0	59.6	7.0	19.3	4.0	39.5	0	26.3	0	0	0	0
Southern right whale dolphin*	0	59.6	0	0	0	0	0	0	0	0	0	0
Risso's dolphin*	0	0	0	0	1.7	0	0	0	0	0	0	0
Bottlenose dolphin	0	1.5	7.7	0	0	0	0	0	0	0	0	1.1
Dolphins	545.1	120.3	105.0	151.8	105.6	233.4	26.9	257.6	155.8	2.7	0	0

*Species sighted 2 or fewer times.

Note: Numbers denote animals sighted per 1,000 km survey distance for each month, pooled for all years (i.e. the 12-month period from Oct–Sep).

The Bass Strait and the Otway Basin is considered an important migratory path for Humpback, Blue, Southern right, and to some extent the Fin and Sei whales. The whales use the Otway region to migrate to and from the north-eastern

Australian coast and the sub-Antarctic. Of particular environmental importance in the Otway is the Bonney Upwelling, the eastward flow of cool nutrient rich water across the continental shelf of the southern coast of Australia that promotes blooms of krill and attracts baleen whales during the summer months.

Origin Energy conducted a survey for cetaceans focused on Origin operations and permit in the Otway basin from June 2012 through March of 2013. Table B-9-17 lists the species present in the area Origin surveyed.

Table B-9-17: Observed cetaceans in Otway Basin

Species	Jun	Jul	Aug	Sep *	Oct	Nov	Dec	Jan	Feb	Mar	Total
Blue whale	0	0	0	0	0	23	70	17	8	2	120
Southern right whale	2	0	12	13	0	0	0	0	0	0	39*
Humpback whale	3	2	0	1	0	1	0	0	0	0	7
Sperm whale	2	0	0	0	4	0	0	3	1	0	10
Pilot whale	0	0	0	0	0	70	0	0	55	0	125
Dolphins	13	298	0	33	54	620	80	672	1526	21	3317
Southern right whale	0	0	0	0	0	120	0	0	0	0	120

*September values averaged over two surveys on 1 and 11 September 2012. Totals include individuals from both September surveys

Blue whale

The blue whale (*Balaenoptera musculus*) is currently listed as an endangered species under the EPBC Act. There are two subspecies of Blue whales that use Australian waters (including Australian Antarctic waters), the pygmy blue whale (*B. m. brevicauda*) and the Antarctic blue whale (*B. m. intermedia*). The Antarctic blue whale subspecies remains severely depleted from historic whaling and its numbers are recovering slowly. For the pygmy blue whale there is uncertainty in the number's pre-exploitation, and their current numbers are not known. The Blue whale has a recovery plan that identifies threats and establishes actions for assisting the recovery of Blue whale populations using Australian waters (Commonwealth of Australia, 2017a).

The blue whale is a cosmopolitan species, found in all oceans except the Arctic, but absent from some regional seas such as the Mediterranean, Okhotsk and Bering seas.

The pygmy blue whale is mostly found north of 55°S, while Antarctic blue whales are mainly sighted south of 60°S. Pygmy blue whales are most abundant in the southern Indian Ocean on the Madagascar plateau, and off South Australia and Western Australia, where they form part of a more or less continuous distribution from Tasmania to Indonesia. Acoustic monitoring has found the presence of Antarctic blue whales in the Otway region to be rare (Gavrilov, 2012). Both sub-species of Blue whale may, however, be found in Australian waters and reference to Blue whale unless otherwise specified is synonymous to both species.

The Antarctic blue whale was extremely abundant in the past. Approximately 341,830 blue whales were recorded as taken by whaling in the Antarctic and sub-Antarctic in the 20th century, of which 12,618 were identified as pygmy blue whales or are assumed to have been so from their location (Branch et al., 2004). The current global population of blue whales is uncertain but is plausibly in the range of 10,000 to 25,000, corresponding to about 3-11% of the 1911 population size. The global population is listed as Endangered on the IUCN Red List.

Previous observations that the Otway region is an important migratory and feeding corridor for Blue whales arriving from and departing to the east have been confirmed by passive acoustic monitoring and aerial surveys.

Sighting data indicates that Blue whales are seasonally distributed. They concentrate between the Great Australian Bight and Cape Nelson in November, spread eastwards in December and occur widely in the Otway region from January to April and then decrease between May and June show pooled, all seasons Blue whale sightings for each month from November to May for central and eastern areas; these are overlaid on a grid representing the aerial survey effort (10 km x 10 km squares). The aerial survey is displayed as minutes flown per grid square. Thick solid lines represent 50% and 95% probability contours for Blue whale distribution from density kernel analysis. Dashed lines are central and eastern boundaries.

A number of marine noise assessments of the Otway Basin have been conducted. From February to October 2011 Origin located an array of marine loggers east of the Thylacine platform to document nearby ambient marine noise, detect cetaceans and measure acoustics associated with the Origin 3D Bellerive Marine Seismic Survey. Pygmy and Antarctic blue whales were acoustically detected in the monitored area. Pygmy blue whales were observed from early February to early June being abundant from March to mid-May. Rare calls from Antarctic blue whales were observed in June.

The migratory period for the blue whales into Bass Strait generally commences in November or December (Gill et al., 2011). There had been fewer than 50 sightings of Blue whales in Bass Strait up to the year 1999, but since that time feeding blue whales have been more regularly observed in the Discovery Bay area and more generally along the Bonney coast from Robe to Cape Otway.

The time and location of the appearance of Blue whales in the east generally coincides with the upwelling of cold water in summer and autumn along this coast (the Bonney Upwelling) and the associated aggregations of krill that they feed on (Gill and Morrice, 2003). 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 subtropical high-pressure cell creates upwelling favourable winds.

BIAs for the pygmy blue whale have been identified around Australia with the foraging BIA intersecting the EMBA. The known and likely migration routes of the highly mobile pygmy blue whale are also shown in Figure B-9-6. The EMBA intersects a likely migration route (DotEE, 2019b). Breeding occurs in low latitudes (including Indonesia) during the austral winter although there may be more than one breeding habitat given observed females with small calves recorded seasonally moving through Geographe Bay (WA) from September to December (DotEE, 2019b).

Gill et al. (2011) undertook 69 seasonal aerial surveys for blue whales between Cape Jaffa and Cape Otway over six seasons (2001-02 to 2006-07). This study found that the general pattern of seasonal movement of blue whales is from west to east, with whales foraging in between the Great Australian Bight and Cape Nelson in November and spreading further east in December. As shown in Figure B-9-7 the whales are typically widely distributed throughout Otway shelf waters from January through to April (Gill et al., 2011).

Gill et al. (2011) found that across the eastern zone (Cape Nelson to Cape Otway), there were no blue whale sightings in November of any season despite significant effort. Pooled monthly encounter rates increased from 1.6 whales 1,000 km–1 in December, peaked at 9.8 whales 1,000 km–1 in February, dropped slightly to 8.8 whales 1,000 km–1 in March, then declined sharply to a single sighting for May (0.4 whales 1,000 km–1) (Figure B-9-7).

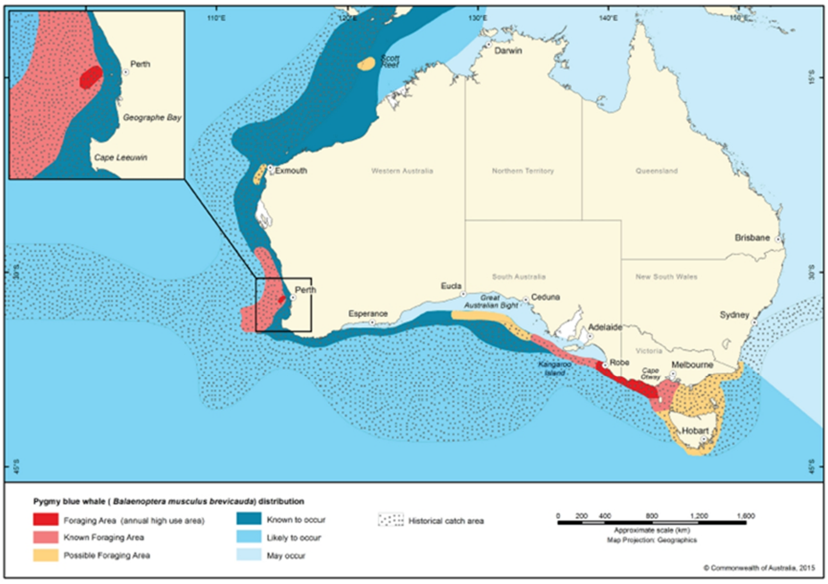
Sighting data are presented geographically in Figure B-9-8 and Figure B-9-9. Data is pooled for all seasons, for central and eastern areas, overlaid on gridded aerial survey effort (10 X 10 km squares), represented as minutes flown per grid square (key, upper right). Thick solid lines represent 50% and 95% probability contours for blue whale distribution from density kernel analysis. Dashed lines are central and eastern boundaries (Gill et al., 2011).

These data indicate that, within the EMBA, blue whales are statistically most likely to first appear during December/January and reach peak number during February/March.

Gill et al. (2011) also identified that 80% of blue whale sightings are encountered in water depths between 50 and 150 m; 93% of sightings occurred in water depths <200 m and 10% of sightings occurred within 5 km of the 200 m isobath in the eastern and central zones. A mean blue whale group size of 1.3±0.6 was observed per sighting with cow-calf pairs observed in 2.5% of the sightings.

Within this broad context it is also important to note that each season seems to have a unique upwelling signature and pattern of blue whale abundance and distribution. Inter-seasonal and inter-area variability in both upwelling intensity and blue whale density can be high and the exact timing and location of first appearance of blue whales in the area can be difficult to predict. Aerial surveys commissioned by Origin undertaken during 2011 and 2012 by the Blue Whale Study found that:

- Between 8 and 25 February 2011, 56 blue whales were sighted during five aerial surveys. Most of the sightings were at inshore areas between Moonlight Head to Port Fairy with whales apparently aggregating along and offshore of the boundary between the runoff plume from major flooding prevalent at the time and adjacent seawater.
- Blue whales were common in the eastern upwelling zone during November and December 2012, months when mean encounter rates over the preceding six seasons were zero (November) or low (December). During November, an estimated 21 individual blue whales were sighted, with most sightings near the 100m isobath or deeper. December 2012 surveys identified 70 blue whales foraging along the edge of the continental shelf west of King Island. This was the largest recorded aggregation of blue whales during any aerial surveys of the Bonney Upwelling since 1999.
- There were no confirmed sightings of blue whales during Origin's Speculant 3DTZDD undertaken during November and December 2010, the Astrolabe 3D seismic survey undertaken during early November 2013 (RPS, 2014) and the Enterprise 3D seismic survey undertaken during late October and early November 2014 (RPS, 2014).
- It is likely that blue whales will be present in the EMBA. The likelihood and extent of the interaction is dependent on broad scale environmental factors affecting the abundance and distribution of blue whale feeding resources.



Foraging Area (Annual high use area)	Blue whales are regularly observed feeding on a seasonal basis	Known to occur	Blue whales are known to occur based on direct observations, satellite tagged whales or based on acoustic detections
Known Foraging Area	Known foraging occurs in these areas but is highly variable both between and within seasons	Likely to occur	Blue whales are likely to occur based on occasional observations in the area and nearby areas
Possible Foraging Area	Evidence for feeding is based on limited direct observations or through indirect evidence, such as occurrence of krill in close proximity of whales, or satellite tagged whales showing circling tracks. Blue whales travel through on a seasonal basis, possibly as part of their migratory route	May occur	Evidence for the presence of blue whales through strandings or rare observations
		Historical catch area	Blue whales were caught during the whaling period based on whaling data

Figure B-9-6: Pygmy blue whale foraging areas around Australia

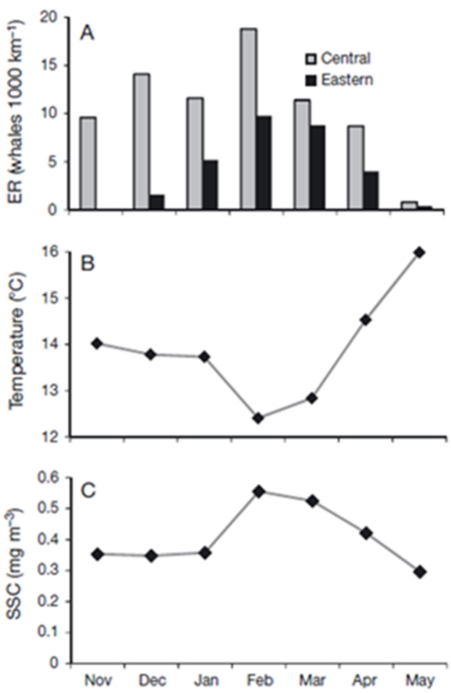


Figure B-9-7: Blue whale encounter rates in the central and eastern study (Cape Nelson to Cape Otway) area by month (Gill et al., 2011)

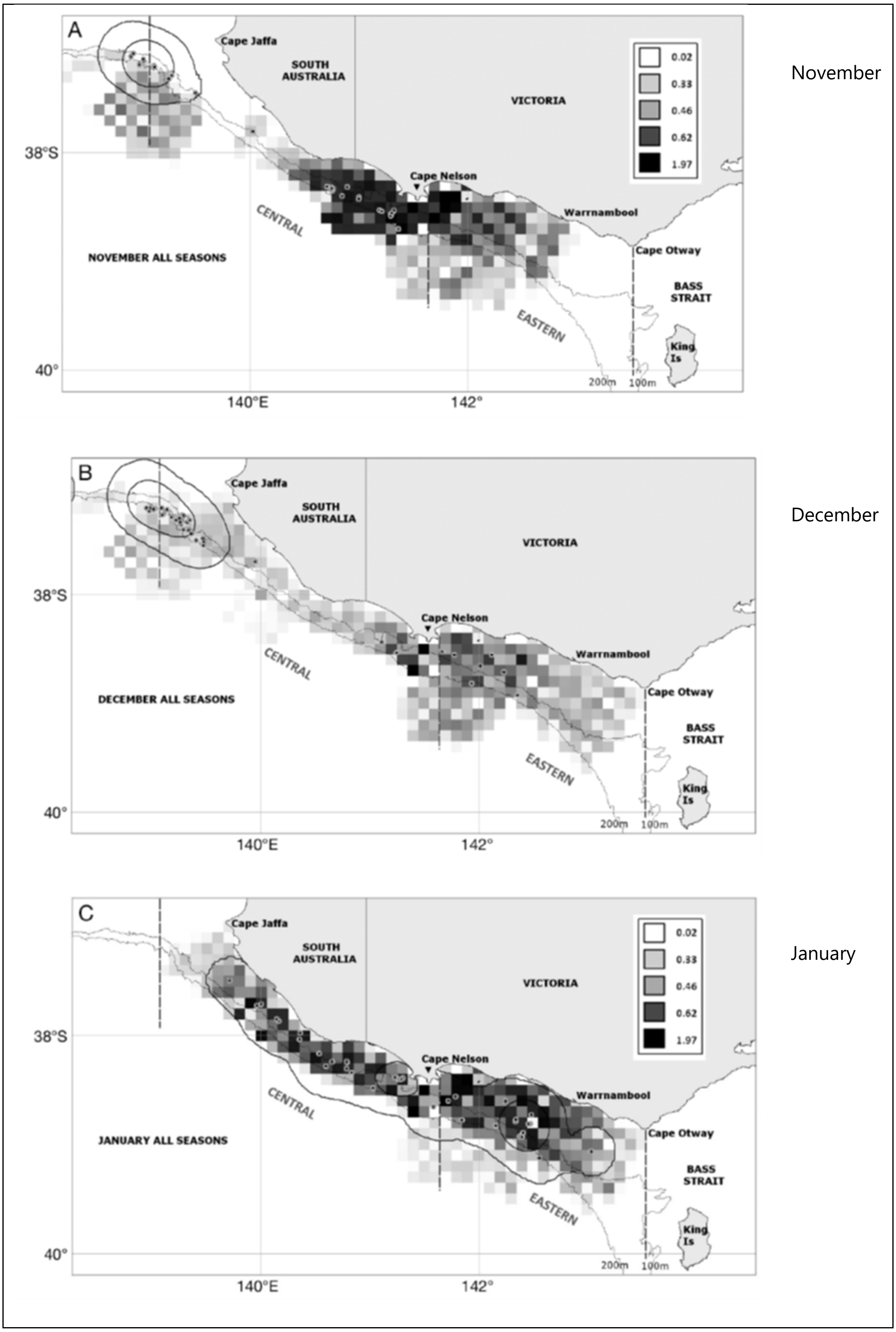


Figure B-9-8: Blue whale sightings in the Otway Basin (Nov, Dec, Jan) (Gill et al., 2011)

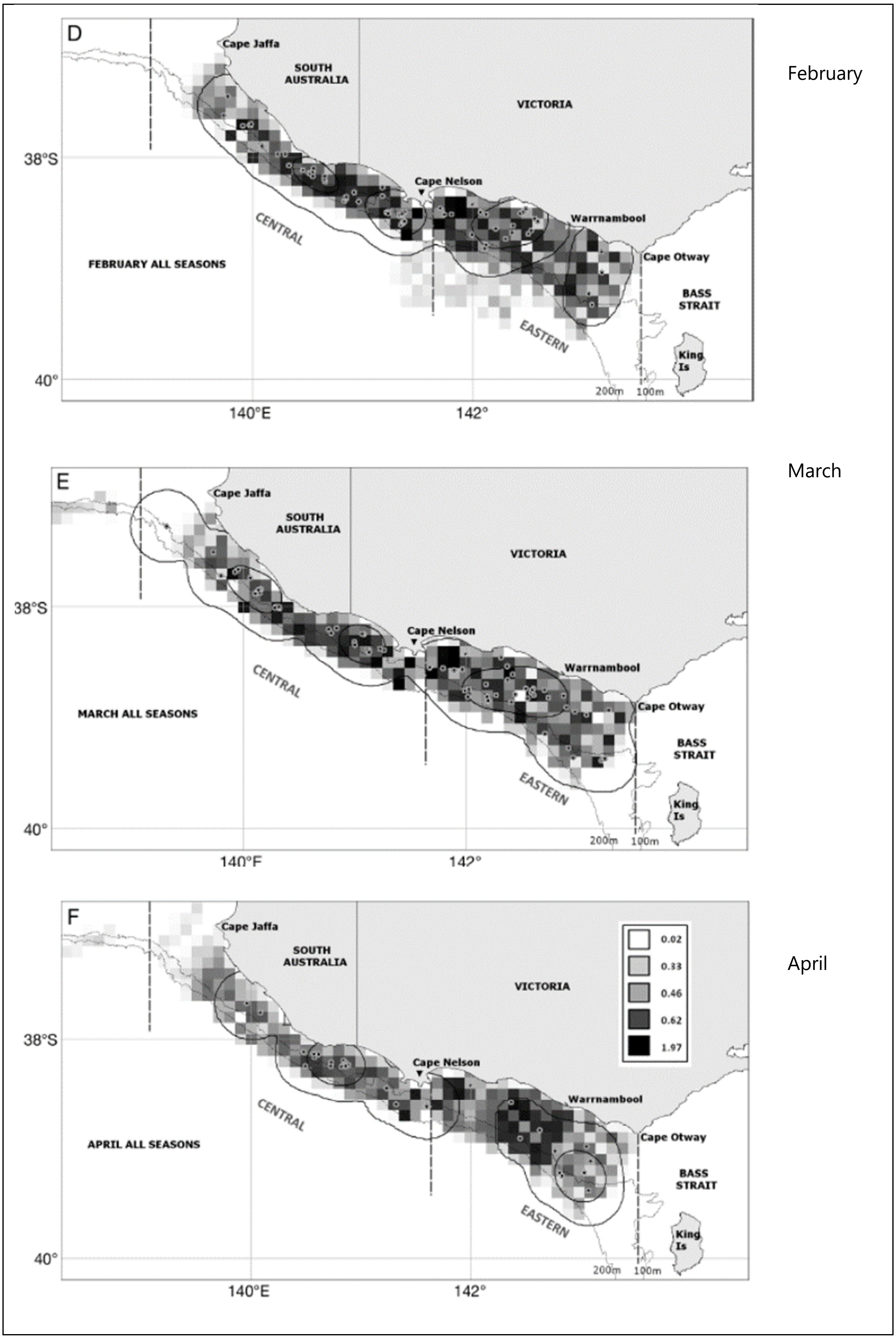


Figure B-9-9: Blue whale sightings in the Otway Basin (Feb, Mar, Apr) (Gill et al., 2011)

Southern right whale

The Southern right whale (*Eubalaena australis*) is listed as endangered under the EPBC Act because they have undergone a severe reduction in numbers as a result of commercial whaling. An initial recovery plan for southern right whales was developed for the period 2005 to 2010; however, a review found that occupancy and abundance are still lower than historic records. Currently the southern right whale has a recovery plan to prioritise research and better predict impacts (Commonwealth of Australia, 2012).

Southern right whales (*Eubalaena australis*) are distributed in the southern hemisphere with a circumpolar distribution between latitudes of 16°S and at least 65°S. The species is pelagic in summer foraging in the open Southern Ocean (Bannister et al., 1996) between 40° and 65°S (Commonwealth of Australia, 2012) and migrates from the subantarctic to lower latitude coastal waters during winter to calve and mate (Mustoe and Ross, 2004). The distribution in winter, at least of the breeding component of the population, is concentrated near coastlines in the northern part of the range.

Southern right whales were hunted extensively by pre-modern whaling starting in the early 17th century, but especially in the 18th and 19th centuries by American and European whalers. The total number processed between 1770 and 1900 is conservatively estimated at about 150,000, of which 48,000-60,000 were taken in the 1830s alone. By the start of modern whaling at the beginning of the 20th century, the species was already rare, and catches thereafter until right whales were legally protected in 1935 totalled only about 1,600 individuals. The hemispheric population in 1770 is estimated at 55,000-70,000 and is estimated to have been depleted to a low of about 300 animals by the 1920s.

Several breeding populations (Argentina/Brazil, South Africa, and Australia) of Southern right whales have shown evidence of strong recovery post whaling, with a doubling time of 10-12 years (Bannister, 2001, Best et al., 2001, Cooke et al., 2001). Recent estimated population sizes (1,600 mature females in 1997, and approximately twice that number in 2007) and the strong observed rate of increase in some well-studied parts of the range, indicate the species, although still scarce relative to its historic abundance, is not considered under threat at the hemispheric level. The population is estimated to be higher now than it was three generations (87 years, assuming a generation time of 29 years; Taylor et al., 2007) ago. The IUCN Red List categorisation for the species is Least Concern.

Major current breeding areas are nearshore off southern Australia, New Zealand (particularly Auckland Islands and Campbell Islands), Atlantic coast of South America (Argentina and Brazil), and southern Africa (mainly South Africa). Small numbers are also seen off central Chile, Peru, Tristan da Cunha (British Overseas Territory), and the east coast of Madagascar (Rosenbaum et al., 2001). The species are regularly present on the Australian coast during winter and spring (Commonwealth of Australia, 2012).

Peak periods for mating in Australian coastal waters are from mid-July through August (Commonwealth of Australia, 2012). Pregnant females generally arrive during late May/early June and calving/nursery grounds are generally occupied until October (occasionally as early as April and as late as November), but not at other times. Calving takes place very close to the coast in Australia, usually in waters less than 10 metres deep.

Female southern right whales show calving site fidelity, generally returning to the same location to give birth and nurse offspring. Female-calf pairs generally stay within the calving ground for 2–3 months. Other population classes stay in coastal areas for shorter and more variable periods, and generally depart the coast earlier then female-calf pairs (Commonwealth of Australia, 2012).

In Australian coastal waters, southern right whales occur along the southern coastline including Tasmania, generally as far north as Sydney (33°53’S, 151°13’E) on the east coast and Perth (31°55’S, 115°50’E) on the west coast. There are occasional occurrences further north, with the extremities of their range recorded as Hervey Bay (25°00’S, 152°50’E) and Exmouth (22°23’S, 114°07’E). Southern right whales generally occur within two kilometres offshore and tend to be distinctly clumped in aggregation areas (Commonwealth of Australia, 2012). Aggregation areas are well known with the largest being (Figure B-9-10):

- Doubtful Island Bay area in WA (38°15'S, 119°32'E)
- Israelite Bay area in WA (33°37'S, 123°53'E)
- Head of Bight in SA (31°28'S, 131°08'E).

Several smaller established areas (regularly occupied) occur at:

- Yokinup Bay in WA (33°53'S, 123°05'E)
- The Warrnambool region in Victoria (38° 25'S, 142°30'E).

Emerging aggregation areas (sporadically used at present) occur at:

- Flinders Bay in WA (34°20'S, 115°15'E)
- Hassell Beach in WA (34°49'S, 118°24'E)
- Cheyne/Wray Bays in WA (34°32'S, 118°55'E)
- Twilight Cove in WA (32°17'S, 126°02'E)
- Fowlers Bay in WA (31°59' 132°28'E)
- Encounter Bay in SA (35°35'S, 138°40'E) (DSEWPaC, 2012).

A number of additional 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.

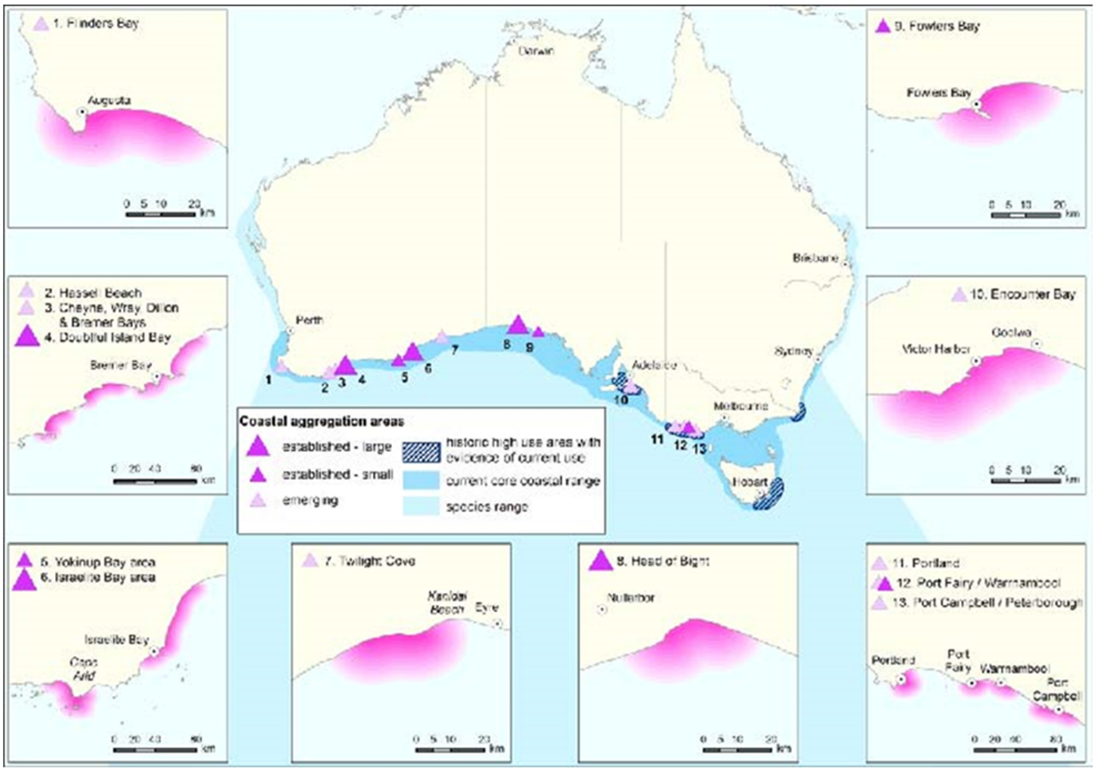


Figure B-9-10: Aggregation areas for southern right whales (DSEWPaC, 2012)

Southern right whales in Australian waters were until recently considered to be one population. It is possible, based on differentiation in mtDNA haplotype but not nuclear gene frequencies, that south-east Australian right whales may be demographically separate from those in south-west Australia, although some genetic transfer is known to occur. The ‘western’ Australian sub-population occupies areas between Cape Leeuwin in Western Australia and Ceduna in South Australia, with an estimated population size of 2,500 individuals. The ‘eastern’ sub-population, consisting of fewer than 300 individuals, can be found along the south eastern coast, including Tasmania and rarely further north than Sydney. Despite the ‘western’ sub-population showing signs of recovery, the ‘eastern’ sub-population is not (Charlton, 2014).

Southern right whales have few natural predators. Calves, juveniles or weakened adults may be killed by sharks, which are common in some Australian calving grounds, or killer whales. Adult southern right whales rarely strand, but small numbers of calves are regularly found dead or stranded near calving grounds (Commonwealth of Australia, 2012).

The foraging ecology of southern right whales is poorly understood, and observations of feeding whales are rare. Southern right whales from Australian populations probably forage between about 40°S and 65°S, generally south of Australia. Feeding whales have been observed in the region of the Sub-Tropical Front 41–44°S in January and December. In that region they mainly consume copepods, while at higher latitudes (south of 50°S), krill is the main prey item. Coastal Australian waters are not generally used for feeding.

As a highly mobile migratory species, southern right whales travel thousands of kilometres between habitats used for essential life functions. Movements along the Australian coast are reasonably well understood, but little is known of migration travel, non-coastal movements and offshore habitat use. Exactly where southern right whales approach and leave the Australian coast from, and to, offshore areas remain unknown (Gill et al., 2015). A defined near-shore coastal migration corridor is unlikely given the absence of any predictable directional movement of southern right whales such as that observed for humpback whales. A predominance of westward movements amongst long-range photo-identification re-sightings may indicate a seasonal westward movement in coastal habitat. More-or-less direct approaches and departures to the coast are also likely. Southern right whales are thought to be solitary during migration or accompanied by a dependent calf or occasionally a yearling offspring.

On the Australian coast, individual southern right whales use widely separated coastal areas (200–1,500 km apart) within a season, indicating substantial coast-wide movement. The longest movements are undertaken by non-calving whales, though calving whales have also been recorded at locations up to 700 km apart within a single season. Such movements indicate that connectivity of coastal habitat is important for southern right whales. Both non-calving and calving whales also move occasionally between Australia and sub-Antarctic New Zealand coastal habitat between years. The winter distribution of whales not appearing on the Australian coast is unknown. It is thought that fewer than 10% of females calving on the coast in any one year use the waters off Victoria, South Australia, NSW and Tasmania (DotEE, 2019c).

Aerial surveys of western Bass Strait and eastern Great Australian Bight undertaken by Gill et al., (2015) detected southern right whales between May and September. A survey in early November 2010 did not observe any whales in the Warrnambool area and it was assumed that cows and calves had already left the calving and aggregation areas (M. Watson, pers. comm., 2010). No southern right whales were encountered during Origin's Enterprise 3D seismic survey undertaken during November 2014 (RPS, 2014), or during spotter flights of the coastline undertaken prior to the survey in late October 2014.

Humpback whale

Humpback whales (*Megaptera novaeangliae*) are present around the Australian coast in winter and spring. Humpbacks undertake an annual migration between the summer feeding grounds in Antarctica to their winter breeding and calving grounds in northern tropical waters. Along the southeast coast of Australia, the northern migration starts in April and May while the southern migration peaks around November and December (DotEE, 2019l). A discrete population of humpback whales have been observed to migrate along the west coast of Tasmania and through Bass Strait, and these animals may pass through the operational area. The exact timing of the migration period varies between years in accordance with variations in water temperature, extent of sea ice, abundance of prey, and location of feeding grounds (DotEE, 2019l). Feeding occurs where there is a high krill density, and during the migration this primarily occurs in Southern Ocean waters south of 55°S (DotEE, 2019l).

Known feeding, resting or calving grounds for humpback whales in the EMBA, although feeding may occur opportunistically where sufficient krill density is present (Commonwealth of Australia, 2015). The nearest BIA which is important habitat for migrating humpback whales is Twofold Bay, a resting area off the NSW coast (Commonwealth of Australia, 2015).

During Origin's Enterprise 3D seismic survey undertaken during early November 2014, 16 humpback whales were sighted (RPS, 2014).

The recovery of humpback whale populations following whaling has been rapid. The Australian east coast humpback whale population, which was hunted to near-extinction in the 1950s and early 1960s, had increased to 7,090±660 (95% CI) whales by 2004 with an annual rate of increase of 10.6±0.5% (95% CI) between 1987–2004 (Noad et al., 2011). The available estimates for the global population total more than 60,000 animals, and global population is categorised on the IUCN Red List as Least Concern.

Sei whale

Sei whales are considered a cosmopolitan species, ranging from polar to tropical waters, but tend to be found more offshore than other species of large whales. They show well defined migratory movements between polar, temperate and tropical waters. Migratory movements are essentially north-south with little longitudinal dispersion. Sei whales do not penetrate the polar waters as far as the blue, fin, humpback and minke whales (Horwood, 1987), although they have been observed very close to the Antarctic continent.

Sei whales move between Australian waters and Antarctic feeding areas; subantarctic feeding areas (e.g. Subtropical Front); and tropical and subtropical breeding areas. The proportion of the global population in Australian waters is unknown as there are no estimates for sei whales in Australian waters.

Sei whales feed intensively between the Antarctic and subtropical convergences and mature animals may also feed in higher latitudes. Sei whales feed on planktonic crustaceans, in particular copepods and amphipods. Below the Antarctic convergence sei whales feed exclusively upon Antarctic krill (*Euphausia superba*).

Sei whales have been infrequently recorded in Australian waters. Sei whales have been sighted 20–60 km offshore on the continental shelf in the Bonney Upwelling (Miller et al., 2012) where opportunistic feeding has been observed between November and May (Gill et al., 2015). Sei whales were reported 200 nautical miles (Nm) south-west of Port Lincoln in December 1995 and a concentration of sei whales were reported at the western end of Bass Strait (Kato et al., 1996). There are no known mating or calving areas in Australian waters. The sei whale is likely to be an uncommon visitor to the EMBA.

The sei whale has been infrequently recorded between November and May (but not during April) during aerial surveys in the region (Gill et al., 2015). There are no known mating or calving areas in Australian waters.

Fin whale

Fin whales are considered a cosmopolitan species and occur from polar to tropical waters and are rarely in inshore waters. They show well defined migratory movements between polar, temperate and tropical waters. Migratory movements are essentially north–south with little longitudinal dispersion. Fin whales regularly enter polar waters. Unlike blue whales and minke whales, fin whales are rarely seen close to ice, although recent sightings have occurred near the ice edge of Antarctica.

There are stranding records of this species from most Australian states, but they are considered rare in Australian waters (Bannister et al., 1996). The fin whale has been infrequently recorded between November and Feb during aerial surveys in the region (Gill et al., 2015).

Fin whales have been sighted inshore in the proximity of the Bonney Upwelling, Victoria, along the continental shelf in summer and autumn months (Gill 2002). Fin whales in the Bonney Upwelling are sometimes seen in the vicinity of blue whales and sei whales.

Fin whales were sighted, and feeding was observed between November-May (upwelling season) during aerial surveys conducted between 2002-2013 in South Australia (Gill et al., 2015). This is one of the first documented records these whales feeding in Australian waters, suggesting that the region may be used for opportunistic baleen whale feeding (Gill et al., 2015).

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 (Morrice et al., 2004). However, there are no defined mating or calving areas in Australia waters.

As there are no BIAs for the fin whale in the EMBA, they are likely to be uncommon visitors to the EMBA.

Pygmy right whale

The pygmy right whale (*Caperea marginata*) is a little-studied baleen whale species that is found in temperate and sub-Antarctic waters in oceanic and inshore locations. The species, which has never been hunted commercially, is thought to have a circumpolar distribution in the Southern Hemisphere between about 30°S and 55°S. Distribution appears limited by the surface water temperature as they are almost always found in waters with temperatures ranging from 5° to 20°C (Baker, 1985) and staying north of the Antarctic Convergence. There are few confirmed sightings of pygmy right whales at sea (Reilly et al., 2008). The largest reported group was sighted (100+) just south-west of Portland in June 2007 (Gill et al., 2008).

Species distribution in Australia is found close to coastal upwellings and further offshore it appears that the Subtropical Convergence may be important for regulating distribution (Bannister et al., 1996). Key locations include south-east Tasmania, Kangaroo Island (SA) and southern Eyre Peninsula (SA) close to upwelling habitats rich in marine life and zooplankton upon which it feeds (Bannister et al., 1996).

The pygmy right whale has been observed in surveys in the region however Origin Energy did not observe it during the 2010 Speculant MSS and 2014 Enterprise MSS. Also, there are no BIAs identified in the EMBA. Therefore, it is likely to be an uncommon visitor in the EMBA.

Killer whale

Killer whales (*Orcinus orca*) are thought to be the most cosmopolitan of all cetaceans and appear to be more common in cold, deep waters; however, they have often been observed along the continental slope and shelf particularly near seal colonies (Bannister et al., 1996). The killer whale is widely distributed from polar to equatorial regions and has been recorded in all Australian waters with concentrations around Tasmania. The only recognised key locality in Australia is Macquarie Island and Heard Island in the Southern Ocean (Bannister et al., 1996). The habitat of killer whales includes oceanic, pelagic and neritic (relatively shallow waters over the continental shelf) regions, in both warm and cold waters (DotEE, 2019d).

Killer whales are top-level carnivores. Their diet varies seasonally and regionally. The specific diet of Australian killer whales is not known, but there are reports of attacks on dolphins, young humpback whales, blue whales, sperm whales, dugongs and Australian sea lions (Bannister et al., 1996). In Victoria, sightings peak in June/July, where they have been observed feeding on sharks, sunfish, and Australian fur seals (Morrice et al., 2004; Mustoe, 2008).

The breeding season is variable, and the species moves seasonally to areas of food supply (Bannister et al., 1996; Morrice et al., 2004).

The killer whale has been observed within the region however there are no BIAs in the EMBA. Therefore, it is likely that they would be uncommon visitors in the EMBA.

Minke whale

The minke whale (*Balaenoptera acutorostrata*) is a widely distributed baleen whale that has been recorded in all Australian waters except the Northern Territory. The whales can be found inshore although they generally prefer deeper waters. In summer they are abundant feeding throughout the Antarctic south of 60°S but appear to migrate to tropical breeding grounds between 10°S and 20°S during the Southern Hemisphere winter (Kasamatru, 1998; Reilly et al., 2008). Although the exact location of breeding grounds is unknown, mating occurs between August to September with calving between May and July (Bannister et al., 1996). A few animals have been sighted during aerial surveys of the Bonney upwelling. The minke whale has been observed within the region however there are no BIAs in the EMBA. Therefore, it is likely that they would be uncommon visitors in the EMBA.

Antarctic minke whale

The Antarctic minke whale (*Balaenoptera bonaerensis*) has been found in all Australian states except the Northern Territory and occupies cold temperate to Antarctic offshore and pelagic habitats between 21°S and 65°S (Bannister et al., 1996). In summer the species is found in pelagic waters from 55°S to the Antarctic ice edge. During winter the species retreat to breeding grounds between 10-30°S, occupying oceanic waters exceeding 600 m depth and beyond the continental shelf break (DotEE, 2019e). Mating occurs from June through December, with a peak in August and September and calving occurs during late May and early June in warmer waters north of the Antarctic Convergence (DotEE, 2019e). The species primarily feeds in the Antarctic during summer on Antarctic krill and does not appear to feed much while in the breeding grounds of lower latitudes (DotEE, 2019e).

The Antarctic minke whale has been observed within the region however there are no BIAs in the EMBA. Therefore, it is likely that they would be uncommon visitors in the EMBA.

Long-finned pilot whale

The long-finned pilot whale (*Globicephala melas*) is distributed throughout the northern and southern hemispheres in circumpolar oceanic temperate and subantarctic waters containing zones of higher productivity along the continental slope. They sometimes venture into the shallower waters of the shelf (<200 m) in pursuit of prey species. Stomach contents confirm that squid are the main prey of long-finned pilot whales in Australian waters, although some fish are also taken (DotEE, 2019f). No key localities have been identified in Australia (Bannister et al., 1996) however they are considered reasonably abundant (DotEE, 2019f).

There is some (inconclusive) evidence that suggests the species moves along the edge of the continental shelf in southern Australian waters (Bannister et al., 1996) in response to prey abundance at bathymetric upper slopes and canyons (DoE, 2016g). Records from Tasmania indicate mating occurs in spring and summer with 85% of calves born between September and March although births do occur throughout the year.

No calving areas are known in Australian waters (DotEE, 2019f).

The long-finned pilot whale has been identified in surveys over the Bass Strait and eastern Great Australian Bight; however, there are no BIAs in the EMBA. During works undertaken by Origin Energy, long-finned pilot whales have been seen sporadically, such as, a sighting of approximately 30 whales occurred during the 2014 Enterprise MSS. It is likely that they would be uncommon visitors in to the EMBA.

Sperm whale

The sperm whale (*Physeter macrocephalus*) has a worldwide distribution and has been recorded in all Australian states. Sperm whales tend to inhabit offshore areas with a water depth of 600 m or greater and are uncommon in waters less than 300 m deep (DotEE, 2019f). Key locations for the species include the area between Cape Leeuwin to Esperance (WA); southwest of Kangaroo Island (SA), deep waters of the Tasmanian west and south coasts, areas off southern NSW (e.g., Wollongong) and Stradbroke Island (Qld) (DotEE, 2019f). Concentrations of sperm whales are generally found where seabeds rise steeply from a great depth (i.e., submarine canyons at the edge of the continental shelf) associated with concentrations of food such as cephalopods (DotEE, 2019f).

Females and young males are restricted to warmer waters (i.e., north of 45oS) and are likely to be resident in tropical and sub-tropical waters year-round. Adult males are found in colder waters and to the edge of the Antarctic pack ice. In southern Western Australian waters sperm whales move westward during the year. For species in oceanic waters, there is a more generalised movement of sperm whales' southwards in summer and northwards in winter (DotEE, 2019f).

Sperm whales are prolonged and deep divers often diving for over 60minutes (Bannister et al., 1996) however studies have observed sperm whales do rest at, or just below, surface for extended periods (>1 hr) (Gannier et al., 2002). In addition, female and juvenile sperm whales in temperate waters have been observed to spend several hours a day at surface resting or socialising (Hastie et al., 2003).

The sperm whale has been observed in the region, however the closest recognised BIA for foraging is further east near Kangaroo Island in South Australia. Therefore, it is likely they would be uncommon visitors in the EMBA.

Southern right whale dolphin

The southern right whale dolphin (*Lissodelphis peronnii*) is a pelagic species found in southern Australian waters but generally well offshore in deep water or on the outer edges of the continental shelf between the subtropical and subantarctic convergence (DotEE, 2019h). No key localities have been identified in Australian waters however preferred water temperatures range from approximately 2-20°C (DotEE, 2019h). Of the limited southern right whale dolphin stomachs examined, myctophids and other mesopelagic fish, squid and crustaceans have been recorded, and euphausiids are also thought to be potential prey (DotEE, 2019h). It is unknown whether the southern right whale dolphin is a surface or deep-layer feeder (Bannister et al., 1996).

Calving areas are not known, however there is evidence that the calving season occurs between November to April (DotEE, 2019h).

The Southern right whale has been observed in the region; however, no BIAs have been identified in the EMBA. Therefore, it is likely they would be uncommon visitors in the EMBA.

Dusky dolphin

The dusky dolphin (*Lagenorhynchus obscures*) is rare in Australian waters and has been primarily reported across southern Australia from Western Australia to Tasmania with a handful of confirmed sightings near Kangaroo Island and off Tasmania (DotEE, 2019i). Only 13 reports of the dusky dolphin have been made in Australia since 1828, and key locations are yet to be identified (Bannister et al., 1996). The species is primarily found from approximately 55°S to 26°S, though sometimes further north associated with cold currents. They are considered to be primarily an inshore species but can also be oceanic when cold currents are present (DotEE, 2019i).

Bottlenose dolphin

Bottlenose dolphin (*Tursiops truncates*) has a worldwide distribution from tropical to temperate waters. While the species is primarily coastal, they are also found inshore, on the shelf and open oceans.

They are associated with many types of substrate and habitats, including mud, sand, seagrasses, mangroves and reefs (DotEE, 2019j). Bottlenose dolphins are known to associate with several cetacean species such as pilot whales, white-sided, spotted, rough-toothed and Risso's dolphins, and humpback and right whales (DotEE, 2019j).

There are two forms of bottlenose dolphin, a nearshore form and an offshore form. The nearshore form occurs in southern Australia including the Otway Basin area, while the offshore form is found north of Perth and Port Macquarie in NSW. Most populations are relatively discrete and reside in particular areas, such as individual resident populations in Port Phillip Bay, Westernport Bay, Spencer Gulf, Jervis Bay and Moreton Bay. There may be some migration and exchange between the populations, but it is likely that most encountered near the Victorian coasts are local residents.

The bottlenose dolphin has been observed in the region; however, no BIAs have been identified in the EMBA. Therefore, it is likely they would be uncommon visitors in the EMBA.

Common dolphin

The common dolphin (*Delphinus delphis*) is an abundant species, widely distributed from tropical to cool temperate waters, and generally further offshore than the bottlenose dolphin, although small groups may venture close to the coast and enter bays and inlets. They have been recorded in waters off all Australian states and territories. Stranding statistics indicate that common dolphins are active in Bass Strait at all times of the year, though less so in winter (DotEE, 2019k).

Common dolphins are usually found in areas where surface water temperatures are between 10°C and 20°C, and in habitats also inhabited by small epipelagic fishes such as anchovies and sardines.

In many areas around the world common dolphins show shifts in distribution and abundance, suggesting seasonal migration. The reason for this seasonal migration is unknown however in New Zealand the shift appears to be correlated with sea surface temperature and in South Africa, the species occurrence appears to be correlated with the annual sardine run (DotEE, 2019k). They are abundant in the Bonney Upwelling during the upwelling season, and very scarce outside the season.

Risso's dolphin

Risso's dolphin (*Grampus griseus*) is a widely distributed species found in deep waters of the continental slop and outer shelf from the tropics to temperate regions. The species prefer warm temperate to tropical waters with depths greater than 1,000 m, although they do sometimes extend their range into cooler latitudes in summer (Bannister et al., 1996). They are thought to feed on cephalopods, molluscs and fish. Risso's dolphin has been observed in the region, however no BIAs have been identified in the EMBA. Therefore, it is likely they would be uncommon visitors in the EMBA.

Indian Ocean bottle-nose dolphin

Indian Ocean bottlenose dolphins are found in tropical and sub-tropical coastal and shallow offshore waters of the Indian Ocean, Indo-Pacific Region and the western Pacific Ocean bottlenose dolphins are distributed continuously around the Australian mainland, but the taxonomic status of many populations is unknown. Indian Ocean bottlenose dolphins have been confirmed to occur in estuarine and coastal waters of eastern, western and northern Australia and it has also been suggested that the species occurs in southern Australia (Kemper, 2004).

In south-eastern Australia, inshore Indian Ocean bottlenose dolphins show a high degree of site fidelity to some local areas and appear to belong to relatively small communities or populations (Möller et al., 2002).

Appendix B.3.5.4 Pinnipeds

The PMST report identified three pinnipeds that potentially occur in the EMBA (Table B-9-18). There are no identified BIAs for these pinnipeds in the EMBA.

Table B-9-18: Listed pinniped species identified in the PMST search

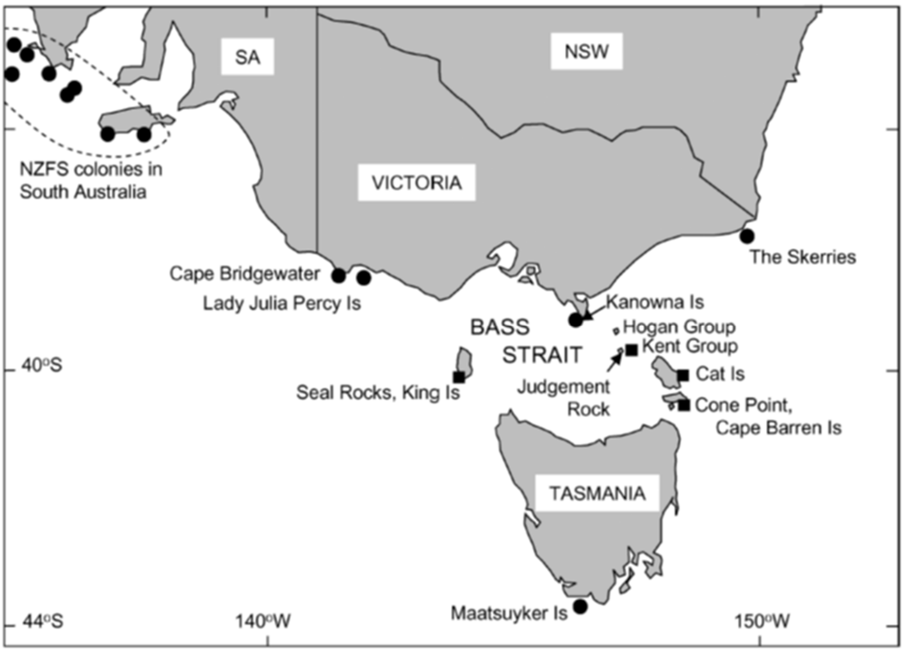
Common name	Species name	EPBC Act status			Likely presence
		Listed threatened	Listed migratory	Listed marine	
Long-nosed fur seal	*Arctocephalus forsteri*	-	-	L	SHM
Australian fur seal	*Arctocephalus pusillus*	-	-	L	BK
Australian Sea-lion	*Neophoca cinereal*	V	-	L	SHK

Common name	Species name	EPBC Act status			Likely presence
		Listed threatened	Listed migratory	Listed marine	
Listed Threatened V: Vulnerable Listed Marine L: Listed		Likely Presence SHM: Species or species habitat may occur within area. SHK: Species or species habitat known to occur within area. BK: Breeding known to occur within area			

New Zealand Fur-seal

New Zealand Fur-seals (*Arctocephalus forsteri*) are found in the coastal waters and offshore islands of South and Western Australia, Victoria, New South Wales and New Zealand. Population studies for New Zealand fur seals in Australia carried out in 1990 estimated an increasing population of about 35,000. The species breeds in southern Australia at the Pages Islands and Kangaroo Island, which produces about 75% of the total pups in Australia. Small populations are established in Victorian coastal waters including at Cape Bridgewater near Portland, Lady Julia Percy Island near Port Fairy, Kanowna Island (near Wilsons Promontory) and The Skerries in eastern Victoria.

Figure B-9-11 illustrates the current and historic distribution of New Zealand fur seal colonies (Kirkwood et al., 2009). These colonies are typically found in rocky habitat with jumbled boulders. Colonies are typically occupied year-round, with greater activity during breeding seasons. Pups are born from mid-November to January, with most pups born in December (Goldsworthy, 2008). Known sites for New Zealand Fur-seal breeding colonies within the EMBA include Lady Julia Percy Island, Seal Rocks, Kent Group Islands, Kanowa Island and Cape Bridgewater.



Filled circles = early 1800s distribution. Filled squares = current distribution

Figure B-9-11: Locations of NZ Fur-seal breeding colonies in the early 1800s and current colonies (Kirkwood et al., 2009)

Australian Fur-seal

Australian Fur-seals (*A. pusillus*) breed on islands of the Bass Strait but range throughout waters off the coasts of South Australia, Tasmania, Victoria and New South Wales. Numbers of this species are believed to be increasing as the population recovers from historic hunting (Hofmeyr et al., 2008). The species is endemic to south-eastern Australian waters.

In Victorian State waters they breed on offshore islands, including Lady Julia Percy Island, Seal Rocks in Westernport Bay, Kanowna and Rag Islands off the coast of Wilson's Promontory and The Skerries off Wingan Inlet in Gippsland (Figure B-9-12). There are important breeding sites on Lady Julia Percy Island and Seal Rocks, with 25% of the population occurring at each of these islands. Their preferred breeding habitat is a rocky island with boulder or pebble beaches and gradually sloping rocky ledges.

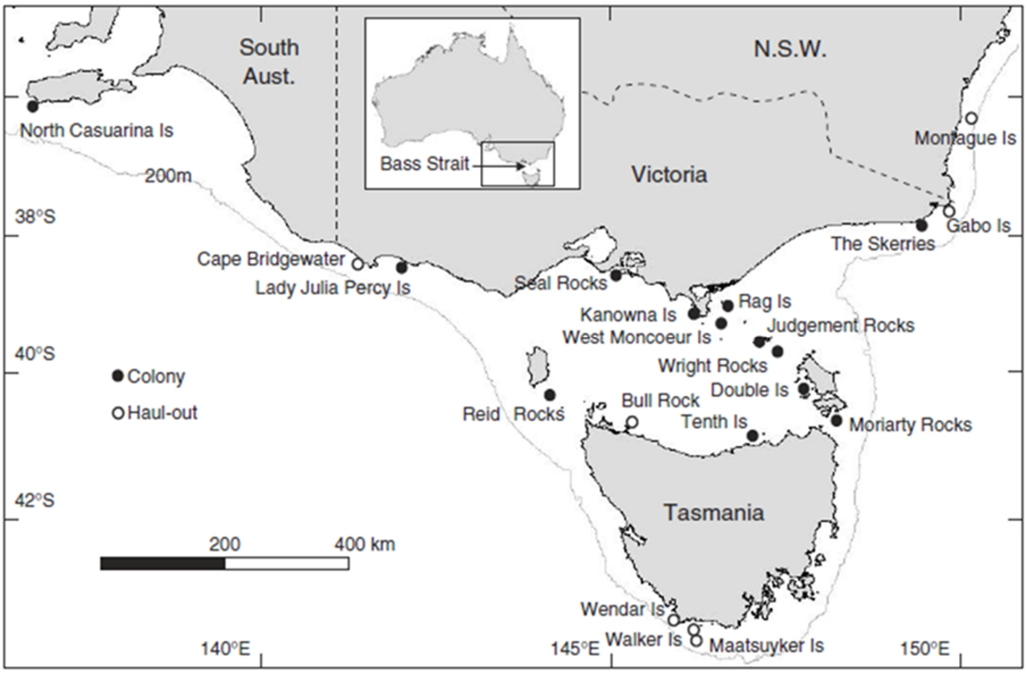
Haul out sites with occasional pup births are located at Cape Bridgewater, at Moonlight Head, on various small islands off Wilsons Promontory and Marengo Reef near Apollo Bay. Australian fur seals are present in the region all year, with breeding taking place during November and December.

Research being undertaken at Lady Julia Percy Island indicates that adult females feed extensively in the waters between Portland and Cape Otway, out to the 200 m bathymetric contour. Seal numbers on the island reach a maximum during the breeding season in late October to late December. By early December, large numbers of lactating females are leaving for short feeding trips at sea and in late December there is an exodus of adult males. Thereafter, lactating females continue to alternate between feeding trips at sea and periods ashore to suckle their pups. Even after pups begin to venture to sea, the island remains a focus, and at any time during the year groups may be seen ashore resting (Robinson et al., 2008; Hume et al., 2004; Arnould & Kirkwood, 2007).

During the summer months, Australian fur seals travel between northern Bass Strait islands and southern Tasmania waters following the Tasmanian east coast, however, 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 and Otway on the benthos at depths of between 60 - 80 m and generally within 100 - 200 km of the breeding colony for up to five days at a time.

Male Australian fur seals are bound to colonies during the breeding season from late October to late December, and outside of this they time forage further afield (up to several hundred kilometres) and are away for long periods, even up to nine days (Kirkwood et al., 2009; Hume et al., 2004).

As there are breeding and haul out sites within the EMBA it is likely that Australian Fur-seal would be present in the EMBA.



Filled circles = early 1800s distribution. Filled squares = current distribution

Figure B-9-12: Locations of Australian Fur-seal breeding colonies in the early 1800s and current colonies (Kirkwood et al., 2009)

Appendix B.3.5.5 Marine reptiles

The PMST report identified three marine turtle species that potentially occur in the EMBA (Table B-9-19). All three species of marine turtles are protected by the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017b). The PMST report identifies that feeding is known to occur in the EMBA for all species. There are no identified BIAs for these reptiles in the EMBA.

Table B-9-19: Listed turtle species identified in the PMST

Common name	Species name	EPBC Act status			Likely presence
		Listed threatened	**Listed migratory**	**Listed marine**	
Loggerhead turtle	*Caretta caretta*	E	M	L	FK
Green turtle	*Chelonia mydas*	V	M	L	FK
Leatherback turtle	*Dermochelys coriacea*	E	M	L	FK

Listed Threatened
E: Endangered
V: Vulnerable
Listed Migratory
M: Migratory
Listed Marine
L: Listed

Likely Presence
FK: Foraging, feeding or related behaviour likely to occur within area

Loggerhead turtle

The loggerhead turtle (*Caretta caretta*) is globally distributed in tropical, sub-tropical waters and temperate waters. The loggerhead is a carnivorous turtle, feeding primarily on benthic invertebrates in habitat ranging from nearshore to 55 m depth (Plotkin et al., 1993).

The main Australian breeding areas for loggerhead turtles are generally confined to southern Queensland and Western Australia (Cogger et al., 1993). Loggerhead turtles will migrate over distances in excess of 1,000 km but show a strong fidelity to their feeding and breeding areas (Limpus, 2008). Loggerhead turtles forage in all coastal states and the Northern Territory, but are uncommon in South Australia, Victoria and Tasmania (Commonwealth of Australia, 2017b). Due to waters depths it is unlikely loggerhead turtles would be present in the EMBA.

Green turtle

Green turtles (*Chelonia mydas*) nest, forage and migrate across tropical northern Australia. They usually occur between the 20°C isotherms, although individuals can stray into temperate waters as vagrant visitors. Green turtles spend their first 5-10 years drifting on ocean currents. During this pelagic (ocean-going) phase, they are often found in association with drift lines and floating rafts of Sargassum. Green turtles are predominantly found in Australian waters off the Northern Territory, Queensland and Western Australian coastlines, with limited numbers in New South Wales, Victoria and South Australia. There are no known nesting or foraging grounds for green turtles offshore Victoria; they occur only as rare vagrants in these waters (DotEE, 2019m), therefore it is expected they would only be occasional visitors in the EMBA.

Leatherback turtle

The leatherback turtle (*Dermochelys coriacea*) is a pelagic feeder found in tropical, sub-tropical and temperate waters throughout the world. Unlike other marine turtles, the leatherback turtle utilises cold water foraging areas, with the species most commonly reported foraging in coastal waters between southern Queensland and central NSW, southeast Australia (Tasmania, Victoria and eastern SA), and southern WA (Commonwealth of Australia, 2017b). This species is an occasional visitor to the Otway shelf and has been sighted on a number of occasions during aerial surveys undertaken by the Blue Whale Study Group, particularly to the southwest of Cape Otway. It is mostly a pelagic species, and away from its feeding grounds is rarely found inshore (Commonwealth of Australia, 2017b).

No major nesting has been recorded in Australia, with isolated nesting recorded in Queensland and the Northern Territory. The leatherback turtle is expected to be only an occasional visitor in the EMBA.

Appendix B.3.6 Invasive/introduced marine species

Appendix B.3.6.1 Pest species

Invasive marine species (IMS) are marine plants or animals that have been introduced into a region beyond their natural range and have the ability to survive, reproduce and establish. More than 200 non-indigenous marine species including fish, molluscs, worms and a toxic alga have been detected in Australian coastal waters.

It is widely recognised that IMS can become pests 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 & Grosholz, 2006).

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.

Key known pest species in the South-East Marine Region include (NOO, 2001):

- Northern Pacific sea star (*Asterias amurensis*);
- Fan worms (*Sabella spallanzannii* and *Euchone* sp);
- Bivalves (*Crassostrea gigas* (Pacific oyster) *Corbulagibba* and *Theorafragilis*);
- Crabs (*Carcinus maenas* (European shore crab) and *Pyromaia tuberculata*);
- Macroalgae (*Undaria pinnatifida* (Japanese giant kelp) and *Codium fragile tormentosoides*; and
- The introduced New Zealand screw shell (*Maoricolpus roseus*).

Other introduced species tend to remain confined to sheltered coastal environments rather than open waters (Hayes et al. 2005).

The Marine Pests Interactive Map (DAWR, 2019) indicates that the ports likely to be used for the survey (Warrnambool, Apollo Bay or Port Fairy) do not currently harbour any marine pests.

Appendix B.3.6.2 Viruses

A virus, the Abalone Viral Ganglioneuritis (AVG), has been detected in wild abalone populations in southwest Victoria and was confirmed as far east as White Cliffs near Johanna, and west as far as Discovery Bay Marine Park (DPI, 2012). The virus can be spread through direct contact, through the water column without contact, and in mucus that infected abalone produce before dying. The last confirmation of active disease in Victoria was from Cape Otway lighthouse in December 2009 (Victoria State Government, 2016).

Strict quarantine controls need to be observed with diving or fishing activities in south-west Victoria when the virus has been detected in the area. Given the lack of detected AVG in Victorian State waters, controls outlined in the Biosecurity Control Measures for AVG: A Code of Practice (Gavine et al., 2009) are not active.

Appendix B.4 Socio-economic environment

This section describes the socio-economic environment within the EMBA.

Appendix B.4.1 Coastal settlements

Australian's have a strong affinity to the coast, with over 80% of the population living within 50 km of the coast The coastal settlements that lie within the EMBA and are subject to potential impact are (from west to east) Discovery Bay, Cape Nelson, Portland, Port Fairy, Warrnambool, Peterborough, Childers Cove, Bay of Islands, Port Campbell, Princetown, Moonlight Head, Cape Otway, Apollo Bay, Cape Patton, Lorne, Anglesea, Torquay, Port Phillip, Mornington Peninsula, Western Port, French Island, Kilcunda, Venus Bay, Cape Liptrap, Waratah Bay, Wilsons Promontory, Corner Inlet and Eurobodalla. All settlements are within Victoria, apart from Eurobodalla in New South Wales. These settlements are administered by different councils, with some of the larger councils including the Glenelg Shire Council (Portland), Moyne Shire Council (Port Fairy, Peterborough), Warrnambool City Council, Shire of Corangamite (Port Campbell, Princetown) and the Shire of Colac Otway (Apollo Bay).

The largest settlement within the EMBA is Mornington Peninsula, with a population just under 300,000 (Table B-9-10). The Warrnambool, Peterborough, Childers Cove, Bay of Islands, Port Campbell, Princetown, Moonlight Head, Cape Otway, Apollo Bay, Cape Patton, Lorne and Anglesea settlements are along the Great Ocean Road, a National Heritage listed stretch along the Victorian coastline, with Warrnambool marking the western end. Warrnambool is another large settlement within the EMBA, with a population just under 30,000 (Table B-9-20) and is a former port for the state of Victoria. The Port of Warrnambool has a breakwater and yacht club and provides shelter for commercial fishing boats. Portland and Port Fairy are the next largest centres with populations of 9,712 and 3,340, respectively (Table B-9-20). Portland is Victoria's western-most commercial port and is a deep-water port with breakwaters sheltering a marina and boat ramp. Port Fairy has both harbour and fish processing facilities, but is not suitable for use by large vessels, nor is Port Campbell.

Table B-9-20: Coastal settlement population estimates and employment figures

Settlement	Population[1]	% of employment in industries relevant to potential impacts[2]	
		Agriculture, forestry & fishing	Accommodation & food services
Discovery Bay	N/A	N/A	N/A
Cape Nelson	N/A	N/A	N/A
Portland	9,712	2.8	8.8
Port Fairy	3,340	6.5	12.8
Warrnambool	29,661	2.1	9.1
Peterborough	247	6.7	13.3
Childers Cove	N/A	N/A	N/A
Bay of Islands	N/A	N/A	N/A
Port Campbell	478	28.4	16.6
Princetown	241	59.3	10.5
Moonlight Head	N/A	N/A	N/A
Cape Otway	15	N/A	N/A
Apollo Bay	1,598	3.6	27.9
Cape Patton	N/A	N/A	N/A
Lorne	1,114	0	0
Anglesea	2,545	0	4.8
Torquay	13,258	0	0
Port Phillip	100,872	0	0
Mornington Peninsula	289,142	0	0
Western Port	N/A	N/A	N/A
French Island	119	N/A	N/A
Kilcunda	396	0	0
Venus Bay	944	0	0
Cape Liptrap	N/A	N/A	N/A
Waratah Bay	56	N/A	N/A

Settlement	Population[1]	% of employment in industries relevant to potential impacts[2]	
		Agriculture, forestry & fishing	Accommodation & food services
Wilsons Promontory	13	N/A	N/A
Corner Inlet	N/A	N/A	N/A
Eurobodalla (NSW)	92	N/A	N/A

[1] Data from Australian Bureau of Statistics 2016 census, available at www.censusdata.abs.gov.au
[2] Data from Australian Bureau of Statistics 2016 census, available at www.censusdata.abs.gov.au

The coastal settlements within the EMBA all provide services to the commercial and recreational fishing industries in south-west Victoria and rely on fishing and tourism to contribute to their economies through income and employment. In Portland and Princetown, the largest employment industries are the agriculture, forestry and fishing industries, accounting for 59 and 28%, respectively (Table B-9-20). In all but the two largest centres, accommodation and food services (which are heavily reliant on tourism) is either the first or second largest employment industry (Table B-9-20).

Appendix B.4.2 Shipping

The south-east marine region is one of the busiest shipping regions in Australia and Bass Strait is one of Australia's busiest shipping routes (Figure B-9-13). Commercial vessels use the route when transiting between ports on the east, south and west coasts of Australia, and there are regular passenger and cargo services between mainland Australia and Tasmania.

Agricultural products and woodchips are transported from the Port of Portland to receiving ports in the Gulf of St Vincent, South Australia, and through Bass Strait to Melbourne and Sydney (NOO, 2004). The Port of Melbourne has over 3,300 vessels calling in to the port every year and is anticipating a doubling in container trade in the next decade (Port of Melbourne, 2012). Bass Strait is also transited by commercial vessels that may not call into ports on the south coast. There are also numerous minor shipping routes in the area, such as those that service King Island. Grassy is the main shipping port on King Island and is the destination for a weekly shipping service from Melbourne and Devonport.

Appendix B.4.3 Petroleum exploration

Petroleum exploration has been undertaken within the Otway Basin since the early 1960s. Gas reserves of approximately 2 trillion cubic feet (tcf) have been discovered in the offshore Otway Basin since 1995, with production from five gas fields using 700 km of offshore and onshore pipeline. Up to 2015, the DEDJTR reports that 23 PJ of liquid hydrocarbons (primarily condensate) has been produced from its onshore and offshore basins, with 65 PJ remaining, while 85 PJ of gas has been produced (Victoria and South Australia), with 1,292 PJ remaining.

Appendix B.4.4 Petroleum production

There is no non-Beach oil and gas infrastructure within the operational area. The Cooper Energy Casino and Henry gas fields and Casino-Henry pipeline and the Minerva gas field and pipeline are within the northern portion of the EMBA (Figure B-9-14).

Appendix B.4.5 Tourism

Consultation has identified that the key areas of tourism in the region include land-based sightseeing from the Great Ocean Road and lookouts along that road, helicopter sightseeing, private and chartered vessels touring into the Twelve

Apostles Marine Park, diving and fishing. Land-based tourism in the region peaks over holiday periods and in 2011, Tourism Victoria reported a total of approximately 8 million visitors to the Great Ocean Road region.

Local vessels accessing the area generally launch from Boat Bay in the Bay of Islands or from Port Campbell. Given the available boat launching facilities in the area (Peterborough and Port Campbell), and the prevailing sea-state of the area, vessel-based tourism is limited.

Appendix B.4.6 Recreational diving

Recreational diving occurs along the Otway coastline. Popular diving sites near Peterborough include a number of shipwrecks such as the Newfield, which lies in 6 m of water and the Schomberg in 8 m of water. Peterborough provides a number of good shore dives at Wild Dog Cove, Massacre Bay, Crofts Bay and the Bay of Islands. In addition, there is the wreck of the Falls of Halladale (4-11 m of water) which can be accessed from shore or via boat.

Consultation with local vessel charterers and providers of SCUBA tank fills has confirmed that diving activity is generally concentrated around The Arches Marine Sanctuary and the wreck sites of the Loch Ard and sometimes at the Newfield and Schomberg shipwrecks. Diving activity peaks during the rock lobster season with the bulk of recreational boats accessing the area launching from Boat Bay at the Bay of Islands or Port Campbell.

Appendix B.4.7 Recreational fishing

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.

The recreational fisheries that occur within the EMBA are:

- rock lobster
- finfish (multiple species are targeted, including sharks)
- abalone
- scallops
- squid
- pipi.

Of these, active recreational fishing for rock lobster, abalone, finfish and sharks is likely to occur within the EMBA. Recreational scallop and squid fishing primarily occurs within Port Phillip Bay and Western Port and as such fishing for these species is unlikely within the EMBA. Pipi harvesting occurs in Venus Bay, in the eastern portion of the EMBA, but due to high levels of toxins in pipis at that location the public is currently advised that they are unsafe for human consumption.

Information relating to the target species, fishing locations, landed catch, value and other relevant aspects of each fishery is included in Table B-9-21.

Table B-9-21: Recreational fisheries within the EMBA

Fishery	Target species	Description	Fishing activity
Rock lobster	Southern rock lobster	Recreational catch is taken by hand from coastal inshore reefs in waters less than about 20 m deep. A daily bag limit of 2 lobster applies.	Yes
Finfish	Snapper King George whiting Salmon Flathead Bream Tuna Sharks	Recreational fishing occurs along the Victorian coastline from beaches, jetties and vessels (privately owned and chartered). Artificial reefs have also been established in Port Phillip Bay and offshore from Torquay, to enhance recreational fishing opportunities.	Yes
Abalone	Blacklip abalone Greenlip abalone	A permanent closure is in place for greenlip abalone in Port Phillip Bay, and for both green- and blacklip abalone from the intertidal to 2 m water depth in all of Victoria. The central zone (which overlaps with the EMBA) is open to recreational abalone take only on nominated days between November and April.	Yes
Scallops	Commercial scallops Doughboy scallops	Scallops are collected by hand by recreational fishers while diving. Most recreational catch occurs within Port Phillip Bay.	Unlikely
Squid	Gould's squid	Recreational squid fishing predominantly occurs in Port Phillip Bay and Western Port, but also in other sheltered waters such as at Portland. Fishing is generally from jetties such as at Queenscliff (Port Phillip Bay) and Flinders (Mornington Peninsula, Western Port) or from boats.	Unlikely

Fishery	Target species	Description	Fishing activity
Pipi	Pipi	Pipi are harvested from the intertidal zone. Currently the only recreational harvest occurs in Venus Bay, although the Victorian Fisheries Authority has advised that high levels of toxins are present in pipis and advises that they are unsafe for human consumption.	Unlikely (due to toxins)

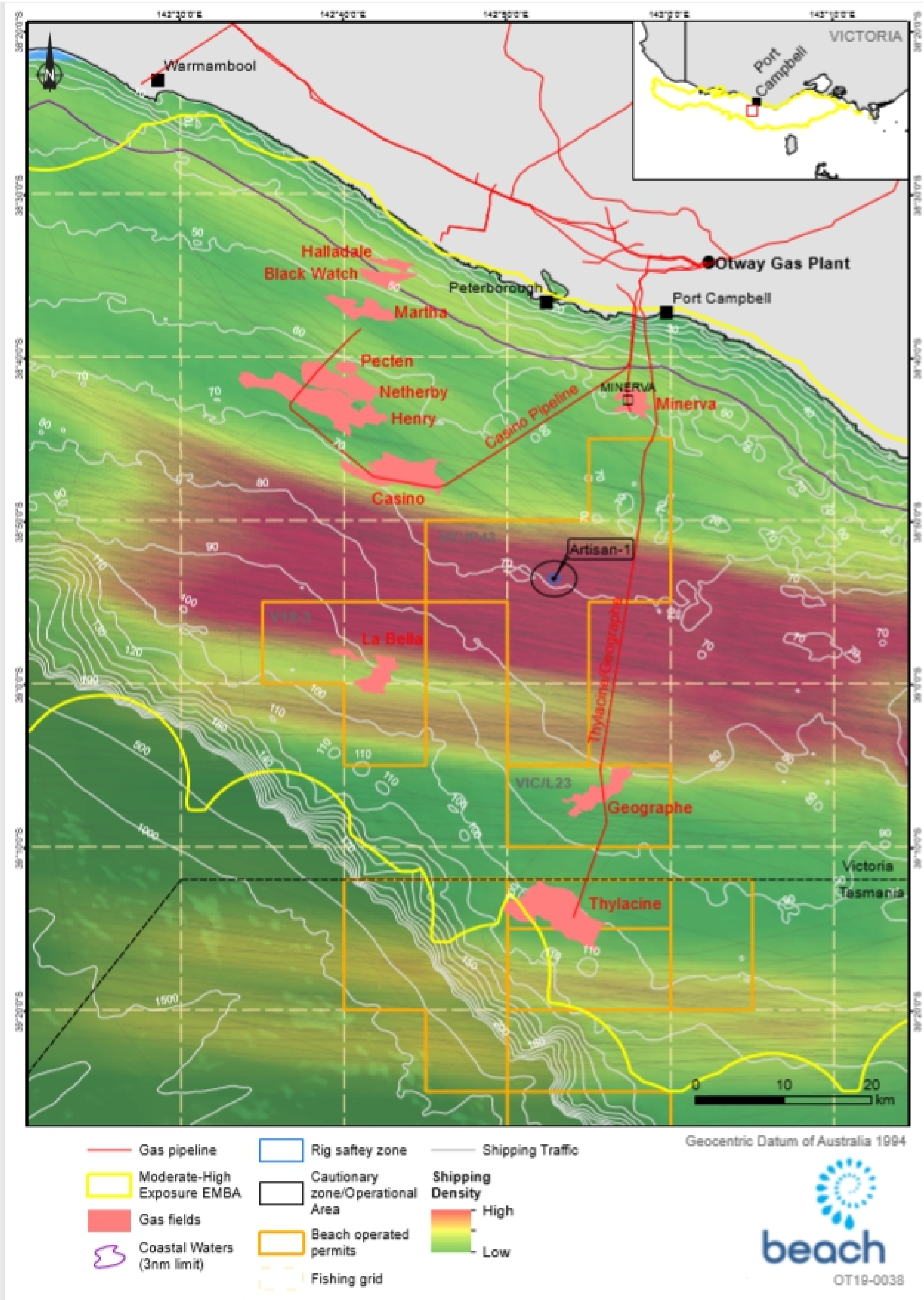


Figure B-9-13: Map of the shipping density at the Artisan-1 well location

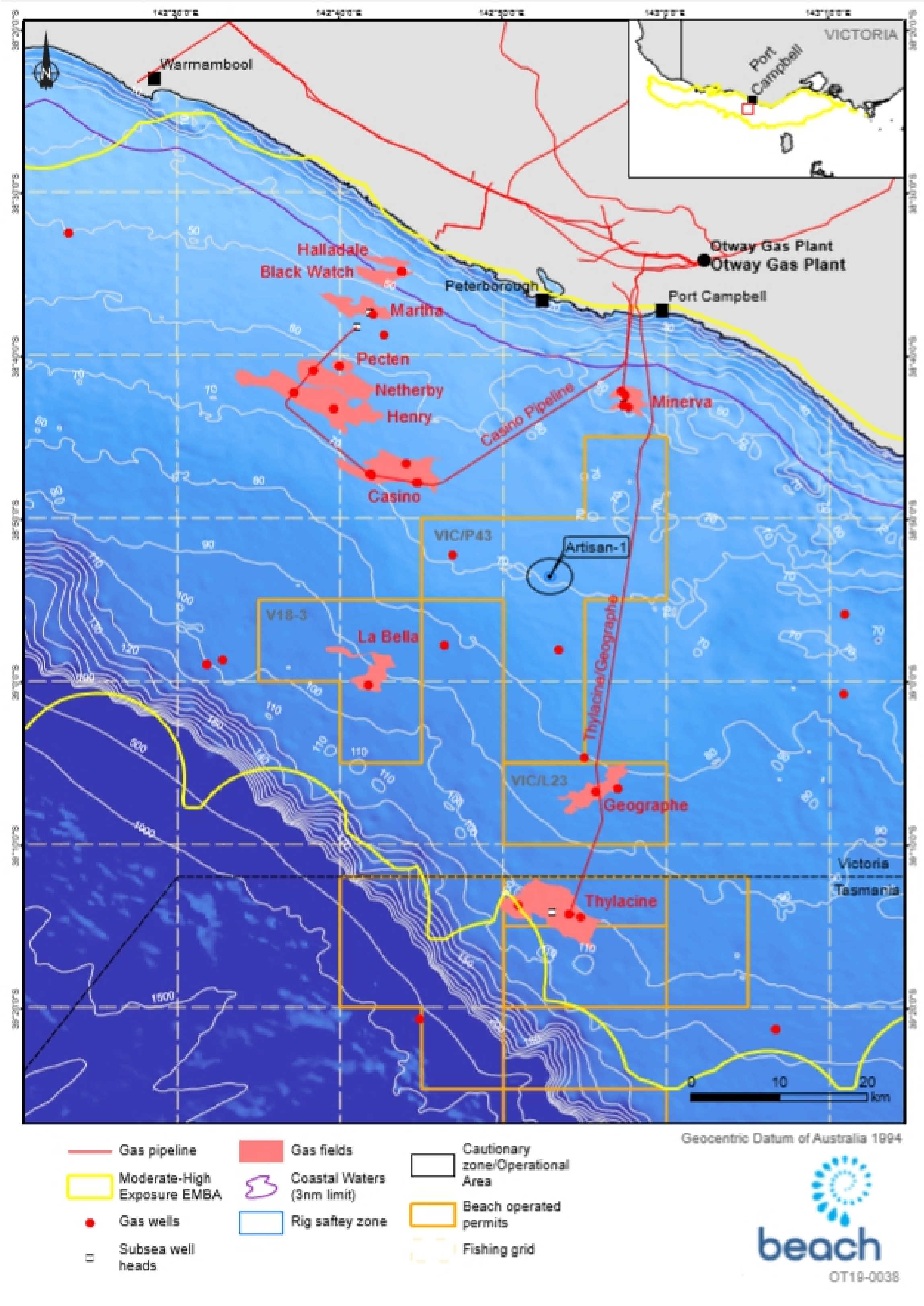


Figure B-9-14: Offshore oil and gas infrastructure in the EMBA

Appendix B.4.8 Commonwealth managed fisheries

A review of the AFMA website identified that the following Commonwealth managed fisheries overlap the EMBA:

- Bass Strait Central Zone Scallop Fishery (Bass Strait CZSF)
- Eastern Tuna and Billfish Fishery (ETBF)
- Skipjack Tuna Fishery
- Small Pelagic Fishery (SPF)
- Southern Bluefin Tuna Fishery (SBTF)
- Southern and Eastern Scalefish and Shark Fishery (SESSF)
- Southern Squid Jig Fishery.

Of these fisheries, the Bass Strait CZSF, ETBF, SBTF, SESSF and Southern Squid Jig Fishery have catch effort within the EMBA based on ABARES reports 2013 – 2017 (Patterson et al. 2018, 2017, 2016, 2015 and Georgeson et al. 2014) (Table B-9-22). The Skipjack Fishery is not currently active and management arrangements for the fishery are under review.

Information relating to the target species, fishing locations, landed catch, value and other relevant aspects of each fishery is included in Table B-9-22.

Table B-9-22: Commonwealth managed fisheries within the EMBA

Fishery	Target species	Description	Fishing Effort EMBA
Bass Strait Central Zone Scallop Fishery	Scallops	Fishery operates in the Bass Strait between the Victorian and Tasmanian and starts at 20 Nm from their respective coastlines. Fishing effort is concentrated around King and Flinders Islands. Currently 12 active boats using towed dredges. Fishing season is 1 April to 31 December. Actual catch in 2017 was 2964 tonnes. The major landing ports in Victoria are Apollo Bay and Queenscliff. Total fishery value in 2016 was A$6 million. Fishing mortality: not subject to overfishing. Biomass: Not over fished. There has been fishing effort in the EMBA based on ABARES data 2013 – 2017.	Yes
Eastern Tuna and Billfish Fishery	Albacore tuna Bigeye tuna Yellowfin tuna Broadbill swordfish Striped marlin	A longline and minor line fishery that operates in water depths > 200 m from Cape York to Victoria. Fishery effort is typically concentrated along the NSW coast and southern Queensland coast. No Victorian ports are used. In 2017 there was some fishing effort in Victoria at low levels. The number of active vessels has decreased within the fishery from around 150 in 2002 to 46 in 2017. Actual catch in the 2017 season was 4615 tonnes. Total fishery value in 2016-17 was A$35.7 million. Fishing mortality: not subject to overfishing. Biomass: Not over fished. There has been fishing effort within the EMBA in 2017 based on ABARES data 2013 – 2017.	Yes

Fishery	Target species	Description	Fishing Effort EMBA
Skipjack Tuna Fishery (Eastern)	Skipjack tuna	The Skipjack Tuna Fishery is not currently active and the management arrangements for this fishery are under review. There has been no catch effort in this fishery since the 2008 -2009 season.	No
Small Pelagic Fishery (Western sub-area)	Jack mackerel Blue mackerel Redbait Australian sardine	The Small Pelagic Fishery extends from the southern Queensland to southern Western Australia. Fishers use midwater trawls and purse seine nets. Geelong is a major landing port. Total retained catch of the four target species was 5713 tonnes in the 2017-18 season. Fishery effort generally concentrated in the near-shore Great Australian Bight to the west and south of Port Lincoln. Fishing mortality: not subject to overfishing. Biomass: Not over fished. There has been no fishing effort in the EMBA based on ABARES data 2013 – 2017.	No
Southern and Eastern Scalefish and Shark Fishery (SESSF) (Commonwealth Trawl Sector and Scalefish Hook Sector)	Blue-eye trevalla Blue grenadier Blue warehou Deepwater sharks Eastern school whiting Flathead Gemfish Gulper shark Jackass morwong John dory Mirror dory Ocean jacket Ocean perch Orange roughy Smooth oreodory Pink ling Red fish Ribaldo Royal red prawn Silver trevally Silver warehou	The Southern and Eastern Scalefish and Shark Fishery stretches south from Fraser Island in southern Queensland, around Tasmania, to Cape Leeuwin in southern Western Australia. The EMBA is within the Commonwealth Trawl Sector and Scalefish Hook Sector. A multi-sector, multi-species fishery that uses a range of gear year-round. Fishing is generally concentrated along the 200 m bathymetric contour. Total retained catch of the target species was 8631 tonnes in the 2017-18 season. In 2016-17, the fishery value was A$46.4 million. Fishing mortality: not subject to overfishing. Biomass: Not over fished. There has been fishing effort in the EMBA based on ABARES data 2013 – 2017.	Yes

Fishery	Target species	Description	Fishing Effort EMBA
Southern Bluefin Tuna Fishery	Southern bluefin tuna	The Southern Bluefin Tuna Fishery covers the entire sea area around Australia, out to 200 Nm from the coast. Southern bluefin tuna are also commonly caught off the New South Wales coastline. In this area, fishers catch these fish using the longline fishing method. A pelagic longline and purse seine fishery that was worth $38.6 million in 2016-17 (actual catch was 5334 tonnes). The fishery operates year-round. Fishery effort is generally concentrated in the Great Australian Bight and off the southern NSW coast. Fishing mortality: not subject to overfishing. Biomass: Over fished. There has been fishing effort within the EMBA in 2017 based on ABARES data 2013 – 2017.	Yes
Southern Squid Jig Fishery	Gould's squid (arrow squid)	A single species fishery that operates year-round. Portland and Queenscliff are the major Victorian landing ports. Fishing effort is generally concentrated along the 200 m bathymetric contour with highest fishing intensity south of Portland and Warrnambool. In 2016-17, the actual catch of 828 tonnes was worth A$2.24 million. In 2016-17 there were eight active vessels in the fishery. Fishing mortality: not subject to overfishing. Biomass: Not over fished. There has been fishing effort in the EMBA based on ABARES data 2013 – 2017.	Yes

Data/information sources: Australian Fisheries Management Authority (www.afma.gov.au), ABARES Fishery Status Reports 2014 to 2018.

Appendix B.4.9 Victorian managed fisheries

There are six Victorian state-managed fisheries that overlap the EMBA:

- Rock Lobster Fishery;
- Giant Crab Fishery;
- Abalone Fishery;
- Scallop (Ocean) Fishery;
- Wrasse (Ocean) Fishery; and
- Snapper Fishery.

A description of these fisheries is detailed in (Table B-9-23).

Monthly catch data by fishery grid area for each species with catch (t) and number of fishers was obtained from VFA for the period of 2014 – 2018. Data was requested from VFA for the following grids within the EMBA:

- J10; J11; J12
- K10; K11; K12

- L10; L11; L12

From the data obtained from the VFA it was identified that only the Rock Lobster and Giant Crab fisheries have catch effort within the grids. This aligns with data obtained from Victorian Fisheries Authority (www.vfa.vic.gov.au) and detailed in Table B-9-23.

Table B-9-23: State (Victorian) managed fisheries within the EMBA

Fishery	**Target species**	**Description**	**Fishing Effort EMBA**
Rock Lobster Fishery (western zone)	Southern rock lobster	Victoria's second most valuable fishery with a production value of A$24 million in 2014-15. Since 2009/10, annual quotas have been set at between 230 and 260 tonnes and have been fully caught each year. In the western zone, most catch is landed through Portland, Port Fairy, Warrnambool, Port Campbell and Apollo Bay. Closed seasons operate for male (15 Sept to 15 Nov) and female (1 June to 15 Nov) lobsters. Southern rock lobsters are found to depths of 150 metres, with most of the catch coming from inshore waters less than 100 metres deep. Fishing data from VFA for 2014 – 2018 idetnfied that there is fishing effort within the EMBA. Based on information from Seafood Industry Victoria approximately 40 t of southern rock lobster has been caught within the operational area of the last 10 years. This equates to between 1.5 – 1.7% of the total catch over the 10 year period.	Yes
Giant Crab Fishery	Giant crab	A small fishery operating in western Victoria and closely linked with the Rock Lobster Fishery. Most vessels are used primarily for rock lobster fishing with giant crab taken as by-product. Fishing effort is concentrated on continental shelf edge (~200 m deep). Giant crabs inhabit the continental slope at approximately 200 metres depth and are most abundant along the narrow band of the shelf edge. Closed seasons operate for male (15 Sept to 15 Nov) and female (1 June to 15 Nov) giant crabs. Total landed catch in 2015-16 was 10 tonnes. Fishing data from VFA for 2014 – 2018 idetnfied that there is fishing effort within the EMBA. Based on information from Seafood Industry Victoria approximately 18 t of giant crab has been caught within the operational area of the last 10 years. The total catch over the last 10 years has been 157.8 t so 18 t equates to This equates to 11% of the total catch being caught in the operational area.	Yes

Fishery	Target species	Description	Fishing Effort EMBA
Abalone Fishery (western zone)	Blacklip abalone Greenlip abalone	A highly valuable fishery (A$20 million in 2014-15) that operates along most of the Victorian shoreline, generally to 30 m depth. Abalone are harvested by divers. Total allowable commercial catch limits of blacklip abalone for the western zone are considerably less than the central and eastern zone (for 2017-18 season, 63.2 tonnes compared with 274.0 and 352.5 tonnes, respectively). There are 14 licences in the western zone. The water depths where abalone are fished are close to shore wtihin the EMBA.	Yes
Scallop (Ocean) Fishery	Scallops	Extends the length of the Victorian coastline from high tide mark to 20 Nm offshore. Fishers use a scallop dredge. Temporary closures occur when stocks are low to allow scallop beds to recover. Total allowable commercial catch for 2015-16 was set at 135 tonnes. Scallops are mostly fished from Lakes Entrance and Welshpool. Fishing data from VFA for 2014 – 2018 identified scallop fishing effort in the EMBA.	Yes
Wrasse (Ocean) Fishery	Bluethroat wrasse Purple wrasse Small catches of rosy wrasse, senator wrasse and southern Maori wrasse	Extends the length of the Victorian coastline from high tide mark to 20 Nm offshore. Fishers mostly use hook and line. Limited entry fishery with 22 current licences. Total annual catches in 2014-15 and 2015-16 were ~30 tonnes. Fishing data from VFA for 2014 – 2018 identified wrasse fishing effort in the EMBA.	Yes
Snapper Fishery (western stock) (Ocean fishery trawl (inshore) licence)	Snapper	Snapper are caught using lines, nets and haul seine. Over 90% of the catch is from Port Phillip Bay, and around 5% from coastal waters. In 2014-15, 147 tonnes were landed at a value of A$1.38 million. Fishing data from VFA for 2014 – 2018 identified snapper fishing effort in the EMBA.	Yes

Data/information sources: Victorian Fisheries Authority (www.vfa.vic.gov.au), DoEE (2015), State Govt of Victoria (2015a, b)

Table B-9-24: Giant Crab Fishery Fisher per Grid per Month from 2014 to 2018

Month	J10	La Bella K10	La Bella and umbilical route K11	Geographe and umbilical route K12	L10	Thylacine L11	Thylacine and umbilical route L12
Jan 2014		1					
Feb 2014		1					
Dec 2014		1				1	
Jan 2015		1					
Feb 2015			1				
Nov 2015						1	
Dec 2015	1	1				1	
Jan 2016						1	

Month	J10	La Bella K10	La Bella and umbilical route K11	Geographe and umbilical route K12	L10	Thylacine L11	Thylacine and umbilical route L12
Mar 2016						1	
Apr 2016						1	
May 2016		1					
Mar 2017		1				1	
Apr 2017		1				1	
May 2017		1			1	1	
Jun 2017		1			1		
Aug 2017						1	1
Jan 2018						1	
May 2018						1	1
Jun 2018							1
Aug 2018				1			
Dec 2018		1					1

Note: Data only shows those months where there was fishing effort

Table B- 9-25: Rock Lobster Fishery Fisher per Grid per Month from 2014 to 2018

Month	J10	La Bella and flowline route J11	Artisan and flowline and umbilical route J12	La Bella K10	La Bella and umbilical route K11	Geographe and umbilical route K12	L10	Thylacine L11	Thylacine and umbilical route L12
Jan 2014	1	1		1					
Feb 2014	1	1		2	1				
Mar 2014			1						
Jul 2014			1						
Aug 2014					1	1			
Sep 2014	1	1							
Dec 2014	1				1				
Jan 2015			1	1	1				
Feb 2015	1				1	1			
Apr 2015	1				1				1
May 2015	1								
Dec 2015	1			1					
Jan 2016								1	

Month	J10	La Bella and flowline route J11	Artisan and flowline and umbilical route J12	La Bella K10	La Bella and umbilical route K11	Geographe and umbilical route K12	L10	Thylacine L11	Thylacine and umbilical route L12
Feb 2016	1			1					
Mar 2016			1	1		1			
Apr 2016			1		1	1		1	
May 2016	1								
Feb 2017						1			
Mar 2017						1			
Apr 2017	1								
May 2017			1						
Jun 2017			1				1		
Aug 2017						1			1
Dec 2017	1								
Feb 2018	1		1						
Aug 2018	1		1			2			
Sep 2018			1		1	1			
Dec 2018	1			1					

Note: Data only shows those months where there was fishing effort

Appendix B.4.10 Tasmanian managed fisheries

There are eight Tasmanian state managed commercial fisheries that occur within the EMBA:

- Abalone Fishery
- Commercial Dive Fishery
- Giant Crab Fishery
- Rock Lobster Fishery
- Scalefish Fishery
- Scallop Fishery
- Seaweed Fishery
- Shellfish Fishery.

A description of these fisheries is in Table B-9-26.

The jurisdiction of all eight Tasmanian state managed fisheries intersects with the EMBA. Historic catch assessments indicate that Commercial Dive, Scallop and Shellfish Fisheries activities are unlikely to occur in the EMBA, with fishing effort located in other areas of these fisheries. The Rock Lobster and Abalone Fisheries, which are by far the most productive and economically important Tasmanian fisheries accounting for 95% of the total value, are both expected to be active within the EMBA. Giant Crab, Scalefish, Scallop and Seaweed Fisheries are also likely to be active within the EMBA to varying degrees.

The jurisdictional area of the Seaweed Fishery extends to the limit of Tasmanian State waters coastal waters (3 nm). The jurisdictional area for the Scallop Fishery extends from the high water mark to 20 nm from Tasmanian State waters into the Bass Strait and out to the limits of the AFZ (200 nm) off the rest of the State, as defined in the 1986 Offshore Constitutional Settlement (OCS) arrangements for scallop stock. The Abalone, Rock Lobster, Giant Crab, Commercial Dive, Scalefish and Shellfish Fisheries apply throughout Tasmanian State waters as defined in the 1996 OCS arrangements for invertebrates and finfish stock.

Table B-9-26: State (Tasmanian) managed fisheries within the EMBA

Fishery	Target species	Description	Fishing Effort EMBA
Abalone Fishery (Northern and Bass Strait Zones)	Black lip (*Haliotis rubra*) and greenlip abalone (*H. laevigata*)	Largest wild abalone fishery in the world (providing ~25% of global production) and a major contributor to the local economy. Abalone are hand-captured by divers in depths between 5-30 m. Blacklip abalone are collected around on rocky substrate around the Tasmanian shoreline and are the main focus of the fishery. Greenlip abalone are distributed along the north coast and around the Bass Strait islands and usually account for around 5% of the total wild harvest. Total landings were 1561 t for 2017, comprising 1421 t of blacklip and 140 t of greenlip abalone. Production value was approximately $70 million. The EMBA intersects the Northern Zone (waters around King Island) and Bass Strait Zone (waters in the Northern Bass Strait Region) of the Abalone Fishery.	Yes
Commercial Dive Fishery (Northern Zone)	White sea urchin (*Heliocidaris urethrograms*), black sea urchin (*Centrostephanus rodgersii*) and periwinkles (*Lunella undulate*)	Dive capture fishery that targets several different species; the main species collected being sea urchins and periwinkles. In 2010-2011 (the most recent period for which information was available) approximately 100 t of sea urchins and 15 t of periwinkles were harvested and the fishery had a total commercial value of around $250,000. Sea urchins and periwinkles accounting for 63% and 37% of the total respectively. Jurisdiction encompasses all Tasmanian State waters (excluding protected and research areas), although licence holders largely operate out of small vessels (<10 m) and effort is concentrated on the south and east costs of Tasmania around ports. The EMBA intersects the Northern Zone of the Commercial Dive Fishery at King Island and in the northern Bass Strait. The Northern Zone of the fishery is defined as the area of Tasmanian State waters on the east coast bounded by the line of latitude 42°20'40"S in the south and extending north to the line of latitude 41°00'26"S (from the southern point of Cape Sonnerat to Red Rocks).	Yes

Fishery	Target species	Description	Fishing Effort EMBA
Giant Crab Fishery	Giant crab (*Pseudocarcinus gigas*)	The giant crab fishery is a comparatively small fishery with the annual harvest set at 46.6 tonnes but with a high landed value of around $2 million. The fishery has been commercially targeted since the early 1990s moving from open access to limited entry. The area of the fishery includes waters surrounding the state of Tasmania generally south of 39°12′ out to 200 nm. Within the area of the fishery, most effort takes place on the edge of the continental slope in water depths between 140 m and 270 m. CPUE has declined continually since the inception of the fishery in the early 1990s indicating that it has been overfished. The TAC has been reduced to 20.7 t for 2017/18 and 2019/2020 to address the issue. The EMBA potentially overlaps the area where giant crabs are fished for on the continental slope.	Yes
Rock Lobster Fishery	Southern rock lobster (*Jasus edwardsii*)	Southern rock lobster are the other major wild-caught Tasmanian fishery. For 2019-20 the Total Allowable Catch has remained at 1220.7 t which includes the Total Allowable Recreational Catch (TARC) of 170 tonnes and the Total Allowable Commercial Catch (TACC) of 1050.7 tonnes or 100kg per unit for the 2019-20 season. Rock lobster made up a volume of 1,047 t or 25% percent of total fisheries production in 2015/16. Production value was $89 million or 51% of total fisheries value in 2014/15 (up 7% from 2013/14). Southern rock lobsters are found to depths of 150 m with most of the catch coming from inshore waters less than 100 m deep throughout state waters. There are 209 vessels active in the fishery. The EMBA potentially overlaps the Rock Lobster Fishery.	Yes
Scalefish Fishery (northwest coast)	Numerous species, but the majority of effort is on # species	Complex multi-species fishery harvesting a range of scalefish, shark and cephalopod species. Fourteen different fishing methods are used. The total catch was around 270 t in 2014/15, a decline of 20 t compared to the previous season. The highest landings of finfish include wrasse (81 t), southern calamari (76 t), flathead (36 t), southern garfish (34 t), banded morwong (30 t) and Australian salmon (23 t). The EMBA potentially overlaps the Scalefish Fishery.	Yes
Scallop Fishery	Commercial scallop (*Pecten fumatus*)	Fishery area extends 20 nm from the the high water mark of Tasmanian State waters into Bass Strait and out to 200 nm offshore from the remainder of the Tasmanian coastline. Eight vessels are active in the fishery. Fishers use a scallop dredge. Scallop beds are generally found along the east coast and Bass Strait in depths between 10-20 m but may occur in water deeper than 40 m in the Bass Strait. Scallop habitat is protected through a ban on dredging in waters less than 20 m and a network of dredge-prohibited areas around the state. There is high variability in abundance, growth, mortality, meat yield and condition of scallop stock in the fishery and recruitment is sporadic and intermittent. Managed using an adaptable strategy where surveys are undertaken to estimate abundance and decision rules are used to open an area (or areas) to fishing. When open the scallop fishery contributes significantly to total fisheries production. In 2015 the scallop fishing season ran from July to October and the catch was 781 t. At present the Tasmanian Commercial Scallop fishery remains closed. The EMBA does not overlap the area of effort for the Scallop Fishery.	No

Fishery	Target species	Description	Fishing Effort EMBA
Seaweed Fishery	Bull kelp (*Durvillea Pototorum*), Japanese kelp (*Undaria pinnatifida*)	Components of this fishery include collection of cast bull kelp and harvesting of Japanese kelp, an introduced species. The majority of cast bull kelp is collected from King Island. The right to harvest and process kelp on King Island was granted exclusively to Kelp Industries Pty Ltd in the mid-1970s. About 80 to 100 individuals collect cast bull kelp and transport it to the Kelp Industries plant in Currie. An average annual harvest above 3000 t (dried weight) has been produced in recent years, accounting for about 5% of the world production of alginates (i.e. the end product of dried bull kelp). The cast bull kelp harvesting on King Island generates about $2 million annually. Comparatively minor cast bull kelp collection also occurs at two centres of operation on Tasmania's West Coast: around Bluff Hill Point and at Granville Harbour. Japanese kelp is harvested by divers only along Tasmania's east coast where it is already well established. The EMBA potentially overlaps the Seaweed Fishery.	Yes
Shellfish Fishery	Katelysia cockles (*Katelysia scalarina*), Venerupis clam (*Venerupis largillierti*), native oyster (*Ostrea angasi*), Pacific oyster (*Crassostrea gigas*)	Comprises specific shellfish species hand captured by divers in defined locations on the east coast of Tasmania, namely Angasi oysters in Georges Bay, Venerupis clams in Georges Bay and Katelysia cockles in Ansons Bay. The taking of Pacific oysters, an invasive species, is also managed as part of the fishery but no zones apply. Pacific oysters can be collected throughout all State waters (which includes areas within the EMBA), as the aim of harvesting these animals is to deplete the wild population. The estimated total value of the shellfish fishery based on landings from 2001-2005 was $345,538. The EMBA does not overlap the Shellfish Fishery.	No

Data/information sources: Department of Primary Industries, Water and Environment (DPIPWE, 2015). Australian fisheries and aquaculture statistics 2014-15 (Patterson et al, 2016), Department of the Environment and Energy (DotEE, 2017c), Fish Research and Development Corporation (FRDC, 2017)

Appendix B.5 Cultural environment

Appendix B.5.1 Maritime archaeological heritage

Shipwrecks over 75 years old are protected within Commonwealth waters under the *Historic Shipwrecks Act 1976* (Cth), in Victorian State waters under the *Victorian Heritage Act 1995* (Vic) and in Tasmanian waters under the *Historic Cultural Heritage Act 1995*. Some historic shipwrecks lie within protected zones of up to 800 m radius, typically when the shipwreck is considered fragile or at particular risk of interference. In Tasmania, the Historic Heritage Section of the Parks and Wildlife Service is the government authority responsible for the management of the State's historic shipwrecks and other maritime heritage sites.

Within the EMBA is a 130 km stretch of coastline known as the 'Shipwreck Coast' because of the large number of shipwrecks present, with most wrecked during the late nineteenth century. The strong waves, rocky reefs and cliffs of the region contributed to the loss of these ships. More than 180 shipwrecks are believed to lie along the Shipwreck Coast (DELWP, 2016b) and well-known wrecks include Loch Ard (1878), Thistle (1837), Children (1839), John Scott (1858) and Schomberg (1855).

The wrecks represent significant archaeological, educational and recreational (i.e. diving) opportunities for locals, students and tourists (Flagstaff Hill, 2015).

None of the shipwrecks on the western section of the Victorian coast are covered by shipwreck protection zones declared under Section 103 of the *Victorian Heritage Act 1995* (DoE, 2016q, 2016r; DELWP, 2016b). On the central Victorian coast, a protection zone is in place around the shipwreck of the steamship SS Alert, which lies off Cape Schank, southeast of the entrance to Port Phillip Bay and within the EMBA. Six shipwreck protection zones occur within Port Phillip Bay (DoE, 2016q, 2016r; DTPLI, 2015) but outside the EMBA.

There are over 200 historic wrecks in the EMBA. Only one of these wrecks, the *SS Alert*, has a protection zone that is within the EMBA.

There is no identified aircraft wreckage within the EMBA.

Appendix B.5.2 Aboriginal heritage

Aboriginal groups inhabited the southwest Victorian coast as is evident from the terrestrial sites of Aboriginal archaeological significance throughout the area. During recent ice age periods (the last ending approximately 12,000-14,000 years ago), sea levels were significantly lower, and the coastline was a significant distance seaward of its present location, enabling occupation and travel across land that is now submerged.

Coastal Aboriginal heritage sites include mostly shell middens, some stone artefacts, a few staircases cut into the coastal cliffs, and at least one burial site. The various shell middens within the Port Campbell National Park and Bay of Islands Costal Park are close to coastal access points that are, in some cases, now visitor access points (Parks Victoria, 2006b).

Aboriginal people have inhabited Tasmania for at least 35,000 years. At the end of the last ice age the sea level rose, and Tasmania became isolated from the mainland of Australia. They survived in the changing landscape partly due to their ability to harvest aquatic resources, such as seals and shell fish.

Following conflict between the European colonists and the Tasmanian Aboriginal peoples, leading to the relocation of people to missions on Bruny Island, Flinders Island and other sites, and finally to Oyster Cove, their numbers diminished drastically. The Aboriginal Heritage Register (AHR), lists over 13,000 sites; however, there is no searchable database to identify any sites in the EMBA. It must be assumed that sites will be scattered along the coast of King Island within the EMBA.

Appendix B.5.3 Native title

A search of the National Native Title Tribunal (NNTT) database identifies two claims have been accepted for registration over the adjacent coastal shoreline (and terrestrial component of the EMBA). One claim is by the Eastern Maar people (VC2012/001), registered in 2013, and extends seaward 100 m from the mean low-water mark of the coastline (NNTT, 2016). There is currently no determination registered over the area of the claim (still active) in the National Native Title Register. There is also a registered claim (2014/001) over Wilson’s Promontory by the Gunaikurnai People. There are no registered claims in Tasmania.

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Appendix D RPS APASA Artisan-1 Spill Model Report

Report

13 JUNE 2019

Beach Energy Artisan-1 Exploration Well

Oil Spill Modelling

Document status

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Terms and Abbreviations

°	Degrees
‘	Minutes
“	Seconds
Actionable oil	Oil which is thick enough for effective use of mitigation strategies, such as mechanical clean up (e.g. skimmers), booms, dispersed, or burned
AMP	Australian marine parks
AMSA	Australian Maritime Safety Authority
ANZECC	Australian and New Zealand Environment and Conservation Council
API	American Petroleum Institute gravity (A measure of how heavy or light a petroleum liquid in comparison to water)
ASTM	American Society for Testing and Materials
Bonn Agreement Oil Appearance Code	An agreement for cooperation in dealing with pollution of the North Sea by oil and other harmful substances, 1983, includes: Governments of the Kingdom of Belgium, the Kingdom of Denmark, the French Republic, the Federal Republic of Germany, the Republic of Ireland, the Kingdom of the Netherlands, the Kingdom of Norway, the Kingdom of Sweden, the United Kingdom of Great Britain and Northern Ireland and the European Union
°C	Degree Celsius (unit of temperature)
cP	Centipoise (unit of viscosity)
CFSR	Climate Forecast System Reanalysis
cm	Centimetre (unit of length)
Decay	The process where oil components are changed either chemically or biologically (biodegradation) to another compound. It includes breakdown to simpler organic carbon compounds by bacteria and other organisms, photo-oxidation by solar energy, and other chemical reactions
Dissolved hydrocarbons	Dissolved hydrocarbons within the water column with alternating double and single bonds between carbon atoms forming rings, containing at least one six-membered benzene ring
g/m^2	Grams per square meter (unit of surface or area density)
EIA	Environmental impact assessment
Entrained oil	Droplets or globules of oil that are physically mixed (but not dissolved) into the water column. Physical entrainment can occur either during pressurised release from a subsurface location, or through the action of breaking waves (>12 knots)
EP	Environmental plan
EEZ	Exclusive Economic Zone
Evaporation	The process whereby components of the oil mixture are transferred from the sea-surface to the atmosphere
GODAE	Global Ocean Data Assimilation Experiment
HYCOM	Hybrid Coordinate Ocean Model is a data-assimilative, three-dimensional ocean model
HYDROMAP	Advanced ocean/coastal tidal model used to predict tidal water levels, current speed and current direction
IOA	Index of Agreement gives a non-dimensional measure of model accuracy or performance
IBRA	Interim Biogeographic Regionalisation for Australia

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IMCRA	Integrated Marine and Coastal Regionalisation of Australia
Isopycnal layers	Water column layers with corresponding water densities
ITOPF	The International Tanker Owners Pollution Federation
KEF	Key Ecological Feature
km	Kilometre (unit of length)
km^2	Square Kilometres (unit of area)
KEF	Key ecological feature
Knot	unit of wind speed (1 knot = 0.514 m/s)
LGA	Local Government Area
LOWC	Loss of Well Control
m	Metres (unit of length)
m^2	Metres squared (unit of area)
m^3	Metres cubed (unit of volume)
m/s	Metres per Second (unit of speed)
MAE	Mean Absolute Error is the average of the absolute values of the difference between model predicted and observed data (e.g. surface elevations)
MB	Marine boundary
MNP	Marine National Park
RSB	Reefs, Shoals and Banks
MS	Marine Sanctuary
NASA	National Aeronautics and Space Administration
NCEP	National Centres for Environmental Prediction
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
nm	nautical mile (unit of distance; 1 nm = 1.852 km)
NP	National Parks
Ocean current	Large scale and continuous movement of seawater generated by forces such as breaking waves, wind, the Coriolis effect, and temperature and salinity gradients. It is the main flow of ocean waters
OECD	Organisation for Economic Co-operation and Development
ppb	Parts per billion (concentration)
ppb.hrs	ppb multiplied for hours (concentration x time)
PSU	Practical salinity units
Ramsar site	A wetland site designated of international importance under the Ramsar Convention
Ramsar Convention	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
Sea surface exposure	Floating oil on the sea surface equal to or above reporting threshold (e.g. 0.5 g/m^2)
Shoreline contact	Stranded oil on the shoreline equal to or above reporting threshold (e.g. 10 g/m^2)

SIMAP	Spill Impact Mapping Analysis Program
US EPA	United States Environmental Protection Agency
Visible oil	Floating oil on the sea surface equal to or above reporting threshold (e.g. 0.5 g/m^2)

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EXECUTIVE SUMMARY

Background

Beach Energy is intending to undertake further development of the Otway offshore natural gas reserves. The proposed development will include the drilling of offshore exploration wells situated in the Otway Basin, starting with the Artisan-1 gas well. In order to support the development of environmental approvals for the drilling program, a comprehensive oil spill modelling study was commissioned which considered the following two hypothetical spill scenarios:

- 300 m^3 surface release of marine diesel over 6 hours in the event of a containment loss from a vessel at the Artisan-1 well location; and
- 222,224 bbl subsea release of condensate over 86 days to represent an unrestricted open-hole loss of well control (LOWC) event from the Artisan-1.

SIMAP's (Spill Impact Mapping Analysis Program) stochastic model was used to quantify the probability of exposure from a spill to the sea (surface and in-water), and the probability of shoreline contact from hypothetical spill scenarios. The SIMAP system and the methods and analysis presented herein, use modelling algorithms which have been peer reviewed and published in international journals. Further, RPS warrants that this work meets and exceeds the ASTM Standard F2067-13 "*Standard Practice for Development and Use of Oil Spill Models*".

Methodology

The modelling study was carried out in several stages. Firstly, a five-year current dataset (2008–2012) that includes the combined influence of three-dimensional ocean and tidal currents was developed. Secondly, the currents, spatial winds and then detailed hydrocarbon properties were used as inputs in the oil spill model to simulate the drift, spread, weathering, entrainment and fate of the spilled hydrocarbons.

As spills can occur during any set of wind and current conditions, a total of 100 spill trajectories per hypothetical spill scenario per season (e.g. summer and winter) were initiated at random times within a 5-year period (2008–2012) to enable a robust statistical analysis.

Each simulation was configurated with the same spill information (i.e. spill volume, duration and oil type) except for the start time and date which in turns, ensures that the predicted transport and weathering of an oil slick is subject to a wide range of current and wind conditions.

Oil Properties

The marine diesel oil (MDO) used for Scenario 1, is a light-persistent fuel oil used in the maritime industry. It has a density of 829.1 kg/m^3 (API of 37.6), a low pour point (-14ºC) and low viscosity (4cP). According to the International Tankers Owners Pollution Federation (ITOPF, 2014) and AMSA (2015a) guidelines, this oil is categorised as a group II oil (light-persistent).

Thylacine condensate was used for the loss of well control scenario (Scenario 2). The condensate has an API of 44.3, density of 804.6 kg/m^3 at 15ºC) with low viscosity (0.875 cP), classifying it as a Group I oil according to the International Tankers Owners Pollution Federation (ITOPF, 2014) and USEPA/USCG classifications. The condensate comprises a significant portion of volatiles and semi to low volatiles (99% total) with very little residual components (<1%).

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Key Findings

Scenario: 300 m^3 surface release of marine diesel oil

Sea surface exposure

- No shoreline contact above the minimum threshold (>10 g/m^2) was predicted for any of the seasons modelled.
- During summer conditions, low (0.5 g/m^2) and moderate (10 g/m^2) exposure to surface hydrocarbons were predicted to travel a maximum distance of 68 km and 12 km from the release location, respectively. During winter, low and moderate exposure of surface hydrocarbons extended to a maximum distance of 93 km and 10 km from the release location, respectively.
- The modelling results demonstrated a 1% probability of oil exposure on the sea surface for the Central Victoria Integrated Marine and Coastal Regionalisation of Australia (IMCRA) receptor, during the summer season.
- During winter conditions, there was a 1% probability of oil exposure on the sea surface for several receptors including the Central Victoria and Central Bass Strait IMCRA, Apollo Australian Marine Park (AMP) and within Victorian State Waters.
- None of the receptors were exposed at or above the moderate or high (>25 g/m^2) thresholds with the exception of the Otway IMCRA. This receptor registered low, moderate and high exposure to sea surface hydrocarbons due to the release location being situated within the boundaries of this receptor.

Dissolved hydrocarbon exposure

- There was no dissolved hydrocarbon exposure (over the 48-hour window) in the 0-10 m depth layer to receptors at or above the low threshold (6 ppb), with the exception of the Otway IMCRA which registered 8 ppb and 9 ppb during summer and winter conditions, respectively. None of the receptors recorded exposure (over 48 hours) at or above the moderate (50 ppb) or high (400 ppb) thresholds.
- At the depths of 0-10 m, the dissolved hydrocarbon exposure over 1 hour was predicted for the Otway IMCRA, with the maximum concentration of 76 ppb during summer and 59 ppb during winter. No moderate or high dissolved hydrocarbons exposure (over 1 hour) was predicted for any receptors, except for the Otway IMCRA.

Entrained hydrocarbon exposure

- At the depths of 0-10 m, the maximum entrained hydrocarbon exposure (over a 48-hour window) during summer and winter conditions was 2,182 ppb and 792 ppb, respectively. None of the receptors were exposed at or above the moderate (10-100 ppb) or high (>1,000 ppb) thresholds, excluding the Otway IMCRA.
- Within the 0-10 m depth layer, the maximum entrained hydrocarbon exposure (over 1 hour) for the Otway IMCRA was 5,933 ppb and 5,046 ppb, during summer and winter conditions, respectively. For receptors other than the Otway IMCRA (83% summer and 93% winter), the probability of exposure to entrained hydrocarbons at or above the moderate threshold (100-1,000 ppb) ranged from 1% (Cape Patton sub-Local Government Area (sub-LGA)) to 8% (within Victorian State Waters) during summer conditions and 1% (Twelve Apostles Marine National Park (MNP)) to 16% (Apollo AMP) during winter conditions. No other receptors were exposed at or above the high threshold (>1,000 ppb), except for the Otway IMCRA.

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Scenario: 222,224 bbl subsea release of condensate over 86 days

Sea surface exposure

- During summer conditions, low (0.5 -10 g/m^2) and moderate (10 - 25 g/m^2) exposure to surface hydrocarbons were predicted to travel a maximum distance of 52 km and 4 km from the release location, respectively. Under winter conditions, low and moderate exposure from surface hydrocarbons extended to a maximum distance of 53 km and 3 km from the release location, respectively. Note, no high exposure was predicted on the sea surface for any of the seasons assessed.
- During summer conditions, the probability of hydrocarbon exposure on the sea surface at or above the low threshold was predicted to range from 6% (Otway Ranges Interim Biogeographic Regionalisation for Australia (IBRA) sub-region) to 16% (Colac Otway and Cape Otway West sub-LGAs and within Victorian State Waters). The exception is the Otway IMCRA (100% during both seasons). The winter modelling results demonstrated a larger number of receptors exposed to surface hydrocarbons at or above the low threshold. The probability ranged from 3% (Twelve Apostles MNP and Otway Ranges IBRA) to 40% (Otway Plain IBRA; Cape Otway West sub-LGA and Colac Otway LGA). No other receptors except the Otway IMCRA were exposed to moderate or high levels for any seasons assessed.

Shoreline contact

- The probability of contact to any shoreline was 16% and 57% for the summer and winter season, respectively. While the minimum time for visible surface hydrocarbons to reach a shoreline was 3 days for 5 days, respectively.
- The maximum volume of hydrocarbons predicted to come ashore was 15 m^3 and 33 m^3, during summer and winter conditions, respectively, while the maximum length of shoreline contacted above the low threshold (10 – 100 g/m^2) was 7.0 km and 11.0 km, respectively. Note, no shoreline loading was predicted for the high threshold (above 1,000 g/m^2).
- Cape Otway West LGA was the receptor predicted with the greatest probability of contact above the low and moderate thresholds during summer (16% and 15%, respectively) and winter (40% for both thresholds) conditions. The modelling results during winter conditions demonstrated additional shoreline contact to Moyne, Corangamite, Moonlight head and Childers Cove.

In-water exposure

- At the depth of 0-10 m, the maximum concentration of dissolved hydrocarbons over the 48-hour window was 30 ppb in summer and 34 ppb in winter, and hence no moderate or high exposure was predicted during either season. For summer conditions, the probability of low exposure to dissolved hydrocarbons over 48 hours ranged from 1% (Bonney Coast Upwelling KEF, Moyne LGA, Bay of Islands and Childers Cove sub-LGAs) to 17% (Otway Plain IBRA, Colac Otway LGA, Cape Otway West sub-LGA and within Victoria State Waters)The Otway IMCRA recorded a probability of 50% during summer. During winter conditions, the probability of low exposure to dissolved hydrocarbons over 48 hours ranged from 1% (Bonney Coast Upwelling KEF, Bay of Islands and Lorne sub-LGA) to 16% (within Victoria State Waters). The Otway IMCRA registered a probability of 42% for winter. None of the receptors were exposed to moderate (50 – 400 ppb) or high (>400 ppb) dissolved hydrocarbons (over a 48-hour basis) during the summer or winter season.
- At the depths of 0-10 m, the maximum dissolved hydrocarbon concentrations predicted over the 1-hour period was 309 ppb during summer and 289 ppb for winter, which occurred within the Otway IMCRA and the Victoria State Waters. During summer conditions, the probability of moderate exposure to

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dissolved hydrocarbons ranged from 1% (Glenelg Plain and Bridgewater IBRA's; Glenelg, Moyne and Surf Coast LGAs; Lorne, Bay of Islands, Childers Cove and Cape Nelson sub-LGAs) to 43% (Otway Plain IBRA, Colac Otway LGA, Cape Otway West sub-LGA and within Victoria State Waters). The probability for Otway IMCRA was 58%. Under winter conditions, the probability of moderate exposure (over 1 hour) to dissolved hydrocarbons ranged from 1% (Gippsland Plain IBRA; Flinders IMCRA; Point Addis and Wilsons Promontory MNP; Mornington Peninsula LGA; Lorne, Mornington Peninsula and Childers Cove sub-LGAs) to 57% for the Victorian State Waters. The probability of exposure to the Otway IMCRA was 68%. None of the receptors were exposed high concentrations during the summer or winter season.

- The maximum entrained hydrocarbon concentrations time-averaged over 48 hours for the summer and winter season was 559 ppb and 569 ppb, respectively. No moderate or high exposure was predicted for any of the receptors predicted for any of the seasons. During summer conditions, the probability of low exposure to entrained hydrocarbons over 48 hours ranged from 1% (Bonney Coast Upwelling KEF; Moyne LGA; Bay of Islands and Childers Cove sub-LGAs) to 17% (Otway Plain IBRA; Colac Otway LGA; Cape Otway West sub-LGA and within Victorian State Waters), with the exception of IMCRA – Otway (50%). During winter conditions, the probability of low exposure to entrained hydrocarbons over 48 hours ranged from 1% (Bonney Coast Upwelling KEF; Bay of Islands and Lorne sub-LGAs) to 16% (Victoria State Waters), with the exception of Otway IMCRA (42%).
- Within the 0-10 m depth layer, the maximum concentration of entrained hydrocarbons over 1 hour was 948 ppb during summer and 932 ppb during winter, occurring within the Otway IMCRA. During summer conditions, the probability of moderate entrained hydrocarbon exposure ranged from 7% (Cape Patton sub-LGA) to 73% (Victorian State Waters). The probability of exposure to the Otway IMCRA receptor was 100% during both seasons. For other receptors during winter conditions, the probability of moderate entrained hydrocarbon exposure ranged from 8% (along the shoreline of Childers Cove sub-LGA; Moyne and Warrnambool LGA) to 73% (within Victorian State Waters).

1 INTRODUCTION

Beach Energy[1] is seeking approval to undertake further development of the Otway offshore natural gas reserves. The proposed development will include the drilling of offshore exploration wells situated in the Otway Basin starting with the Artisan-1 gas exploration well. In order to obtain environmental approvals for the drilling program, Beach Energy commissioned RPS to undertake a comprehensive oil spill modelling based on the following two hypothetical spill scenarios:

- 300 m^3 surface release of marine diesel over 6 hours in the event of a containment loss from a vessel at the Artisan-1 well location; and
- 222,224 bbl subsea release of condensate over 86 days to represent an unrestricted open-hole loss of well control (LOWC) event from the Artisan-1 well location.

Figure 1 and Table 1 present the location and coordinates of Artisan-1 which was used as the release location for the two scenarios.

The potential risk of exposure to the surrounding waters and contact to shorelines was assessed for summer (October to March) and winter (April to September) conditions. This approach assists with identifying the environmental values and sensitivities that would be at risk of exposure on a seasonal basis.

The purpose of the modelling is to further improve understanding of a conservative ‘outer envelope’ of the potential area that may be affected in the unlikely event of hydrocarbon release. The modelling does not take into consideration any of the spill prevention, mitigation and response capabilities that would be implemented in response to the spill. Therefore, the modelling results represent the maximum extent that the released hydrocarbon may influence.

The spill modelling was performed using an advanced three-dimensional trajectory and fates model; Spill Impact Mapping Analysis Program (SIMAP). The SIMAP model calculates the transport, spreading, entrainment and evaporation of spilled hydrocarbons over time, based on the prevailing wind and current conditions and the physical and chemical properties.

The hydrocarbon spill model, the method and analysis applied herein uses modelling algorithms which have been peer reviewed and published in international journals. Further, RPS warrants that this work meets and exceeds the American Society for Testing and Materials (ASTM) Standard F2067-13 “*Standard Practice for Development and Use of Oil Spill Models*”.

Table 1 Location of the Artisan-1 well location used for the oil spill modelling study.

Well location	Latitude	Longitude	Water Depth (m)
Artisan-1	38° 53” 29.4’ S	142° 52” 55.7’ E	60

[1] It should be noted that Beach Energy is the 100% owner of Lattice Energy. Lattice Energy are the permit titleholder.

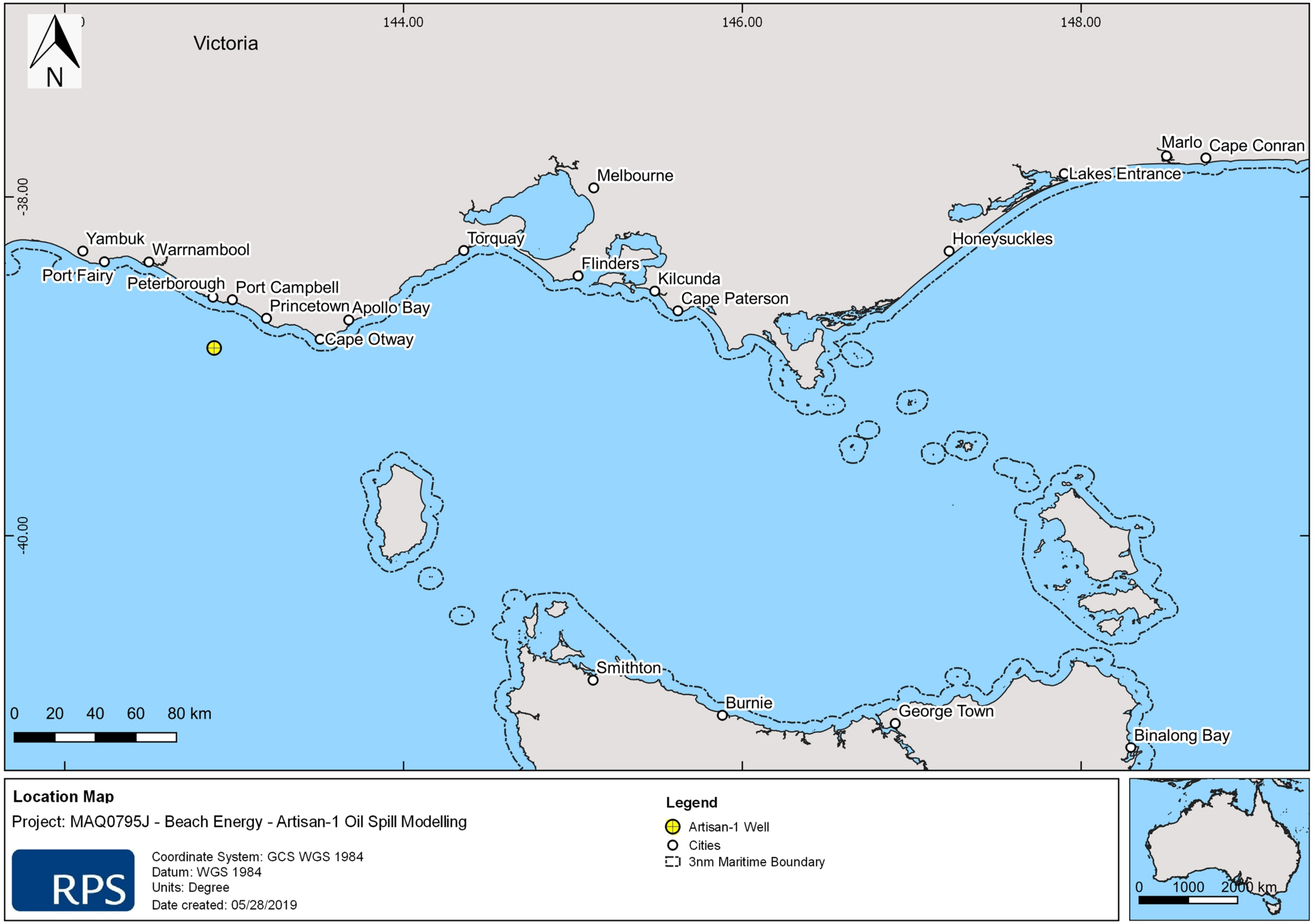

Figure 1 **Locality map of the Artisan-1 exploration well.**

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2 SCOPE OF WORK

The scope of work included the following components:

1. Generate tidal current patterns of the region using the ocean/coastal model, HYDROMAP;
2. Use HYCOM (Hybrid Coordinate Ocean Model) ocean currents combined with HYDROMAP tidal currents over a 5-year period (2008 to 2012) to account for large scale flows offshore and tidal flows nearshore;
3. Use 5 years of high-resolution wind, aggregated current data and oil characteristics as input into the 3-dimensional oil spill model SIMAP to represent the movement, spreading, entrainment, weathering of the oil over time; and
4. Use SIMAP's stochastic model (also known as a probability model) to calculate exposure to surrounding waters (sea surface and water column) and shorelines; and
5. Undertake a high-level deterministic analysis of the "worst case" LOWC scenario.

3 REGIONAL CURRENTS

Bass Strait is a body of water separating Tasmania from the southern Australian mainland, specifically the state of Victoria. The strait is a relatively shallow area of the continental shelf, connecting the southeast Indian Ocean with the Tasman Sea. Currents within the straight are primarily driven by tides, winds, incident continental shelf waves and density driven flows; high winds and strong tidal currents are frequent within the area (Jones, 1980).

The Otway Basin is part of the western field of the Bass Strait and lies along a north-west to south-east axis. It is approximately 500 km long and extends from Cape Jaffa in South Australia to north-west Tasmania and forms part of the Australian Southern Rift System.

The varied geography and bathymetry of the region, in addition to the forcing of the south-eastern Indian Ocean and local meteorology lead to complex shelf and slope circulation patterns (Middleton & Bye, 2007). Figure 2 displays seasonal surface current trends within the Bass Strait. During winter there is a strong eastward water flow due to the strengthening of the South Australian Current (fed by the Leeuwin Current in the Northwest Shelf), which bifurcates with one extension moving though the Bass Strait, and another forming the Zeehan Current off western Tasmania (Sandery & Kampf 2007). During summer, water flow reverses off Tasmania, King Island and the Otway Basin travelling eastward in offshore waters.

To accurately describe the variability in currents between the inshore and offshore region, a hybrid regional dataset was developed by combining deep ocean predictions obtained from HYCOM (Hybrid Coordinate Ocean Model) with 2-dimensional tidal currents developed by RPS. The following sections provide a summary of the hybrid regional data set.

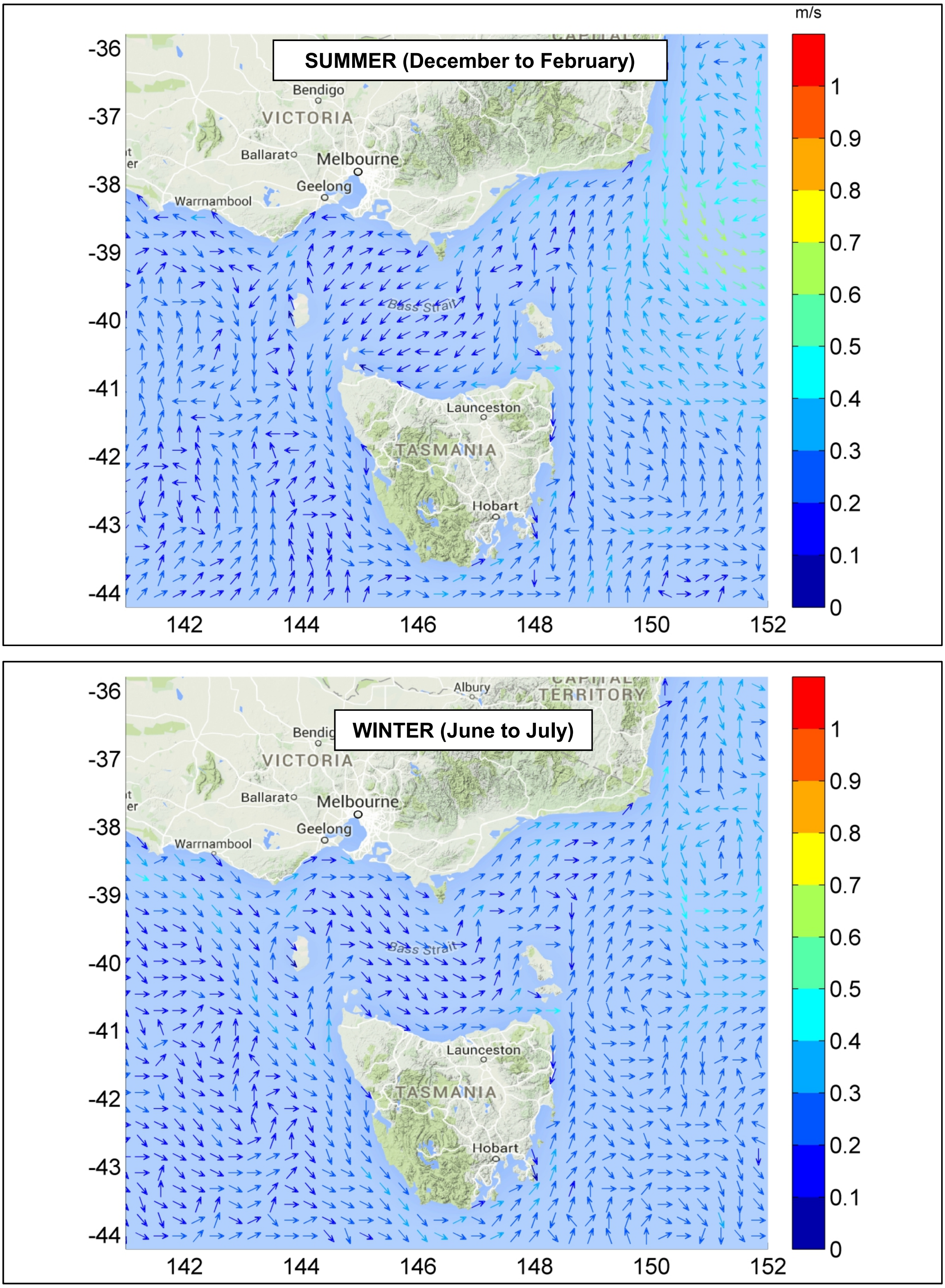

Figure 2 **HYCOM averaged seasonal surface drift currents during summer and winter.**

3.1 Tidal Currents

Tidal current data was generated using RPS's advanced ocean/coastal model, HYDROMAP. The HYDROMAP model has been thoroughly tested and verified through field measurements throughout the world over the past 32 years (Isaji & Spaulding, 1984; Isaji, et al., 2001; Zigic, et al., 2003). HYDROMAP tidal current data has been used as input to forecast (in the future) and hindcast (in the past) pollutant spills in Australian waters and forms part of the Australian National Oil Spill Emergency Response System operated by AMSA (Australian Maritime Safety Authority).

HYDROMAP employs a sophisticated sub-gridding strategy, which supports up to six levels of spatial resolution, halving the grid cell size as each level of resolution is employed. The sub-gridding allows for higher resolution of currents within areas of greater bathymetric and coastline complexity, and/or of particular interest to a study.

The numerical solution methodology follows that of Davies (1977a and 1977b) with further developments for model efficiency by Owen (1980) and Gordon (1982). A more detailed presentation of the model can be found in Isaji and Spaulding (1984) and Isaji et al. (2001).

3.1.1 Grid Setup

The tidal model domain has been sub-gridded to a resolution of 500 m for shallow and coastal regions, starting from an offshore (or deep water) resolution of 8 km. The finer grids were allocated in a step-wise fashion to more accurately resolve flows along the coastline, around islands and over regions with more complex bathymetry. Figure 3 shows the tidal model grid covering the study domain.

A combination of datasets were used and merged to describe the shape of the seabed within the grid domain (Figure 4). These included spot depths and contours which were digitised from nautical charts released by the hydrographic offices as well as Geoscience Australia database and depths extracted from the Shuttle Radar Topography Mission (SRTM30_PLUS) Plus dataset (see Becker et al., 2009).

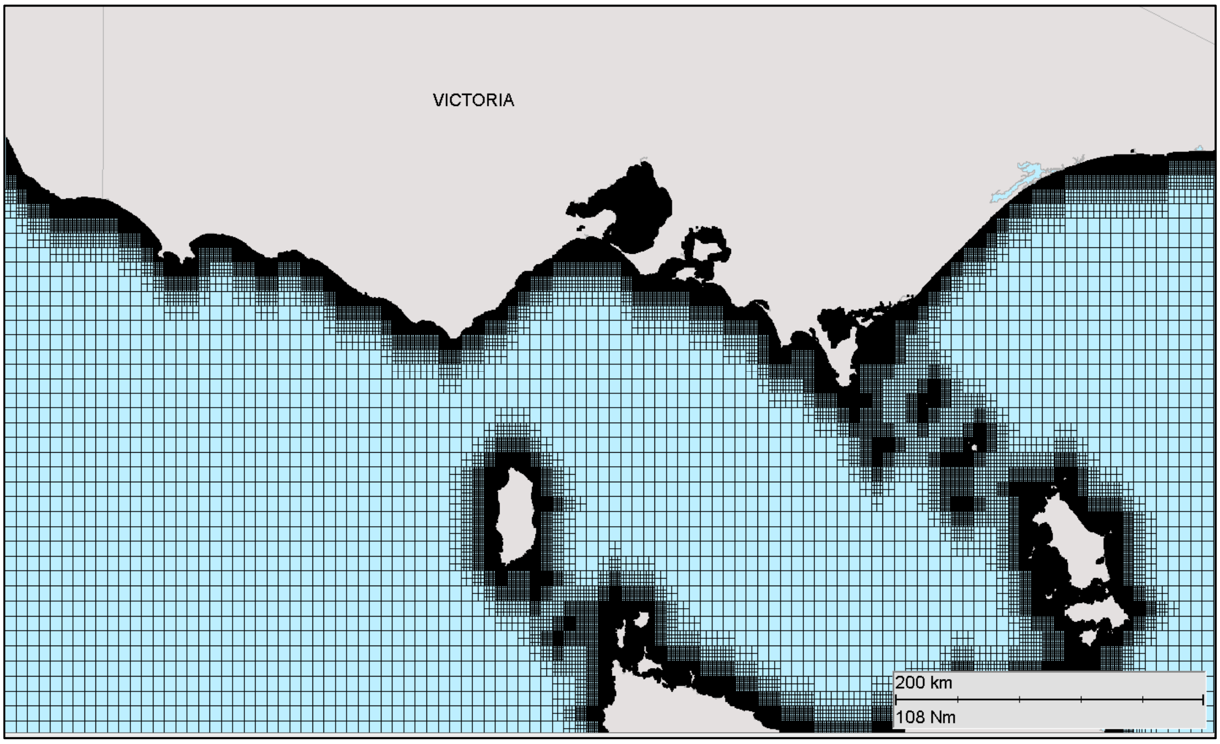

Figure 3 Sample of the model grid used to generate the tidal currents for the study region. Higher resolution areas are shown by the denser mesh.

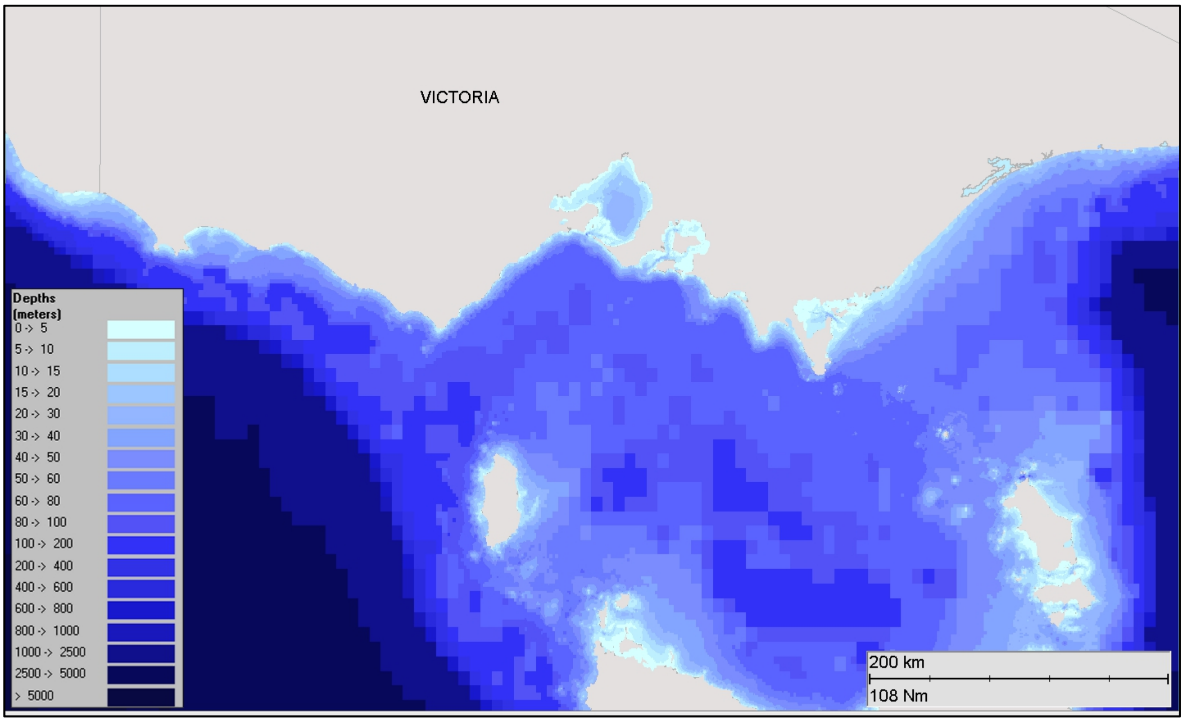

Figure 4 Bathymetry defined throughout the tidal model domain.

3.1.2 Tidal Conditions

The ocean boundary data for the regional model was obtained from satellite measured altimetry data (TOPEX/Poseidon 7.2) which provided estimates of the eight dominant tidal constituents at a horizontal scale of approximately 0.25 degrees. The eight major tidal constituents used were K_2, S_2, M_2, N_2, K_1, P_1, O_1 and Q_1. Using the tidal data, surface heights were firstly calculated along the open boundaries, at each time step in the model.

The TOPEX/Poseidon satellite data has a global resolution of 0.25 degrees and is produced and quality controlled by NASA (National Aeronautics and Space Administration). The satellites equipped with two highly accurate altimeters and capable of taking sea level measurements with an accuracy of ± 5 cm measured oceanic surface elevations (and the resultant tides) for over 13 years (1992–2005). In total, these satellites carried out 62,000 orbits of the planet.

The TOPEX/Poseidon tidal data has been widely used amongst the oceanographic community, being included in more than 2,100 research publications (e.g. Andersen, 1995; Ludicone et al., 1998; Matsumoto et al., 2000; Kostianoy et al., 2003; Yaremchuk and Tangdong, 2004; Qiu and Chen 2010). As such the TOPEX/Poseidon tidal data is considered suitably accurate for this study.

3.1.3 Surface Elevation Validation

To ensure that tidal predictions were accurate, predicted surface elevations were compared to data observed at five locations (see Figure 5).

To provide a statistical measure of the model performance, the Index of Agreement (IOA - Willmott (1981)) and the Mean Absolute Error (MAE - Willmott (1982) and Willmott and Matsuura (2005)) were used.

The MAE (Eq.1) is simply the average of the absolute values of the difference between the model-predicted (P) and observed (O) variables. It is a more natural measure of the average error (Willmott and Matsuura, 2005) and more readily understood. The MAE is determined by:

$$MAE = N^{-1} \sum_{i=1}^{N} |P_i - O_i| \qquad \text{Eq.1}$$

Where: N = Number of observations

P_i = Model predicted surface elevation

O_i = Observed surface elevation

The Index of Agreement (IOA; Eq. 2) in contrast, gives a non-dimensional measure of model accuracy or performance. A perfect agreement between the model predicted and observed surface elevations exists if the index gives an agreement value of 1, and complete disagreement between model and observed surface elevations will produce an index measure of 0 (Wilmott, 1981). Willmott et al (1985) also suggests that values larger than 0.5 may represent good model performance. The IOA is determined by:

$$IOA = 1 - \frac{\sum |X_{model} - X_{obs}|^2}{\sum (|X_{model} - \overline{X_{obs}}| + |X_{obs} - \overline{X_{obs}}|)^2} \qquad \text{Eq.2}$$

Where: X_{model} = Model predicted surface elevation

X_{obs} = Observed surface elevation

Clearly, a greater IOA and lower MAE represent a better model performance.

Figure 6 and Figure 7 illustrate a comparison of the predicted and observed surface elevations for each location for January 2014. As shown on the graph, the model accurately reproduced the phase and amplitudes throughout the spring and neap tidal cycles. Table 2 shows the statistical comparison between the observed and predicted surface elevations. For all of the stations, the IOA is well within the limits highlighting a good model performance. Hence, the tidal model predictions are considered accurate for this study.

Table 2 Statistical comparison between the observed and predicted surface elevations.

Tide Station	IOA	MAE (m)
Gabo Island	0.98	0.08
Port MacDonnell	0.98	0.05
Port Welshpool	0.92	0.30
Portland	0.97	0.07
Gabo Island	0.96	0.22

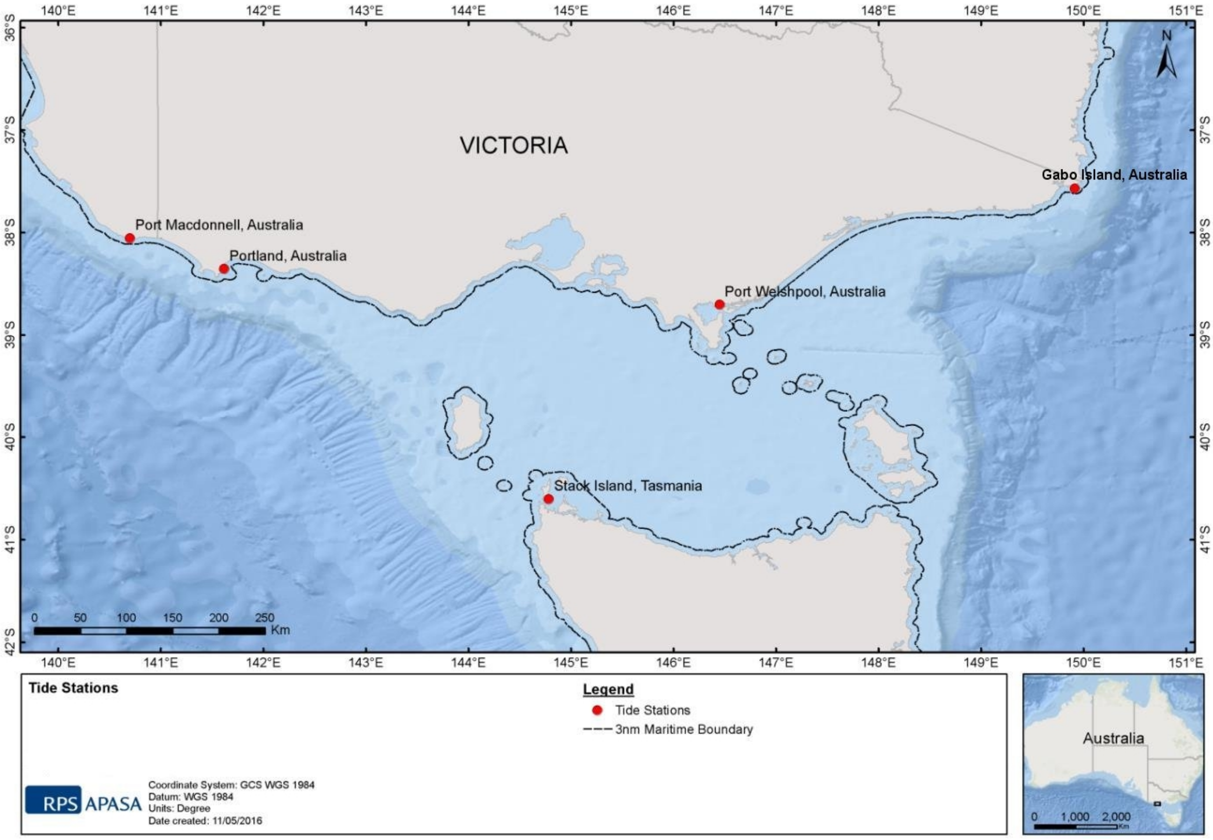

Figure 5 Tide stations used to calibrate surface elevation within the model.

Figure 8 is a snapshot of the predicted tidal current vectors.

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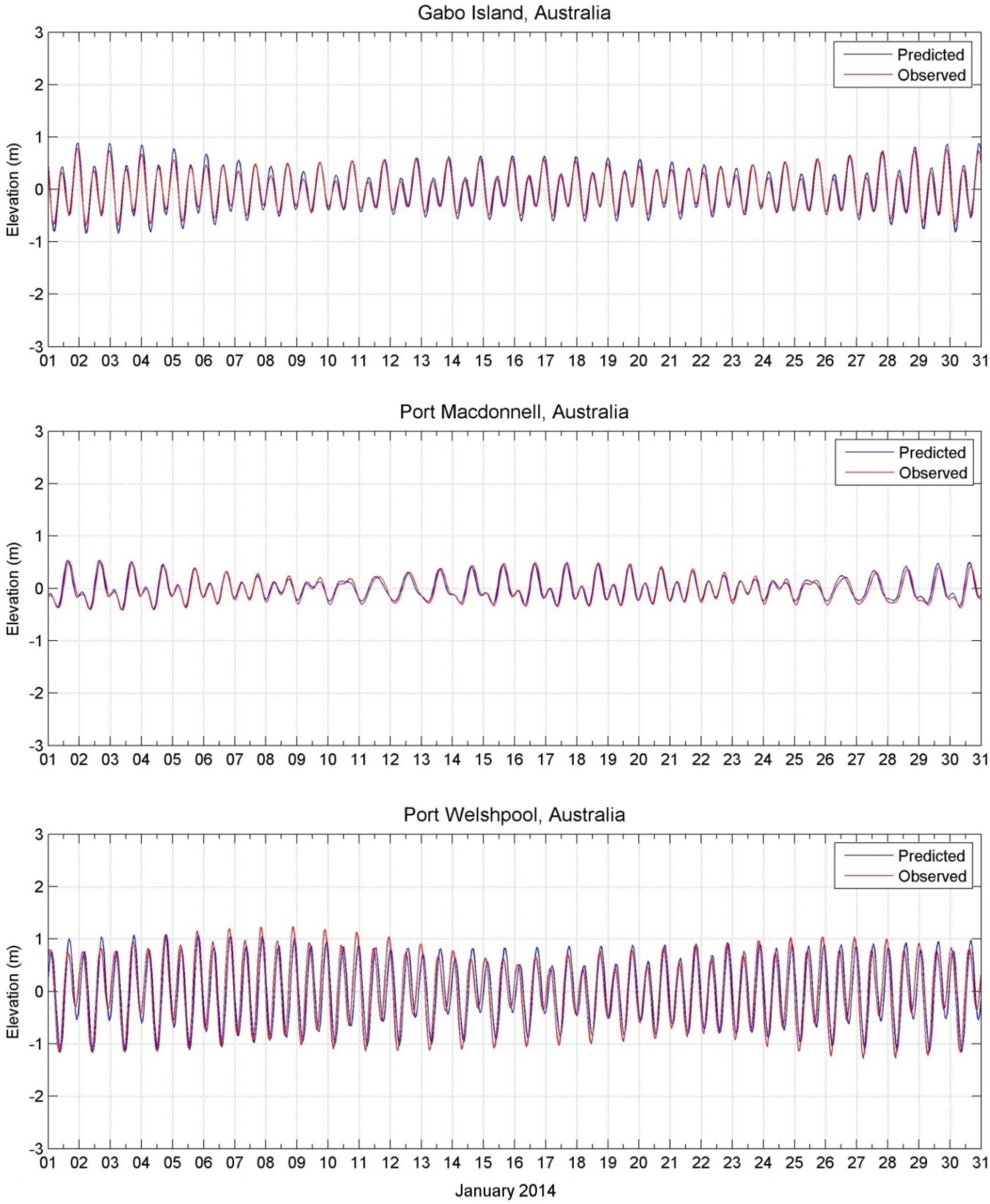

Figure 6 Comparison between HYDROMAP predicted (blue line) and observed (red line) surface elevation at tidal stations Gabo Island (upper image), Port MacDonnell (middle image) and Port Welshpool (lower image).

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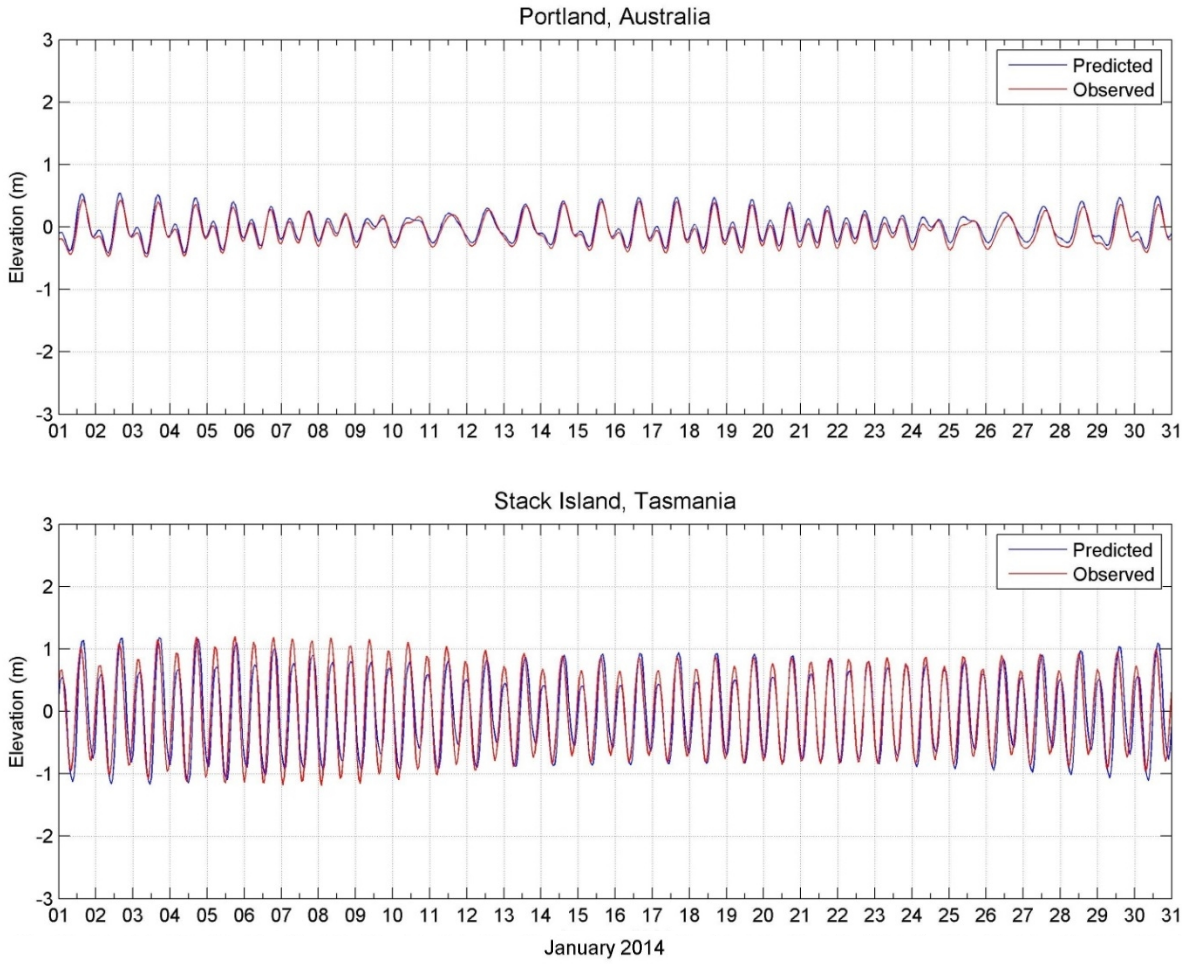

Figure 7 Comparison between HYDROMAP predicted (blue line) and observed (red line) surface elevation at tidal stations Portland (upper image) and Stack Island (lower image).

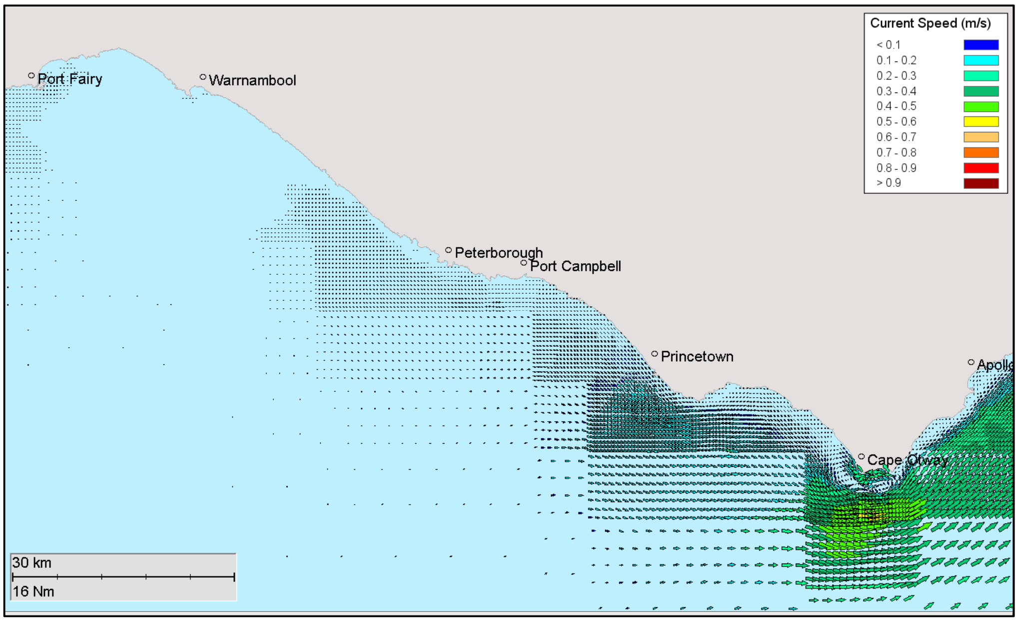

Figure 8 Snapshot of the predicted tidal current vectors. Note the density of the tidal vectors vary with the grid resolution, particularly along the coastline and around the islands and sholas.

3.2 Ocean Currents

Data describing the flow of ocean currents was obtained from HYCOM (Hybrid Coordinate Ocean Model, (Chassignet et al., 2007), which is operated by the HYCOM Consortium, sponsored by the Global Ocean Data Assimilation Experiment (GODAE). HYCOM is a data-assimilative, three-dimensional ocean model that is run as a hindcast (for a past period), assimilating time-varying observations of sea surface height, sea surface temperature and in-situ temperature and salinity measurements (Chassignet et al., 2009). The HYCOM predictions for drift currents are produced at a horizontal spatial resolution of approximately 8.25 km (1/12th of a degree) over the region, at a frequency of once per day. HYCOM uses isopycnal layers in the open, stratified ocean, but uses the layered continuity equation to make a dynamically smooth transition to a terrain following coordinate in shallow coastal regions, and to z-level coordinates in the mixed layer and/or unstratified seas.

For this study, the HYCOM reanalysis hindcast currents were obtained for the years 2008 to 2012 (inclusive). Five years of data has been found to be suitably sufficient to account for the inter-annual variations and conditions with Bass Strait.

3.3 Surface Currents at the release site

Table 3 displays the predicted average and maximum surface current speed near the release location. Figure 9 and Figure 10 illustrate the monthly and seasonal current rose distributions (2008-2012 inclusive) derived from combining HYCOM ocean current data and HYDROMAP tidal data, respectively.

Note the convention for defining current direction throughout this report is the direction the current flows towards. Each branch of the current rose distribution represents the currents flowing to that direction, with north to the top of the diagram. The branches are divided into segments of different colour, which represent the current speed ranges for each direction. Speed intervals of 0.1 m/s are predominantly used in these current roses. The length of each coloured segment within a branch is proportional to the frequency of currents flowing within the corresponding speed and direction.

The combined current data (ocean plus tides) indicated that during April to December the currents predominately flowed east and west during January to March. Monthly average surface current speed was similar throughout the year (0.16 to 0.25 m/s), while the maximum surface current speed ranged between 0.60 m/s (November and January) and 1.22 m/s (July).

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Table 3 Predicted monthly average and maximum surface current speeds adjacent to the release location. Data derived by combining the HYCOM ocean data and HYDROMAP high resolution tidal data from 2008-2012 (inclusive).

Month	Average current speed (m/s)	Maximum current speed (m/s)	General direction (towards)
January	0.17	0.60	WNW and ENE
February	0.18	0.69	WNW
March	0.16	0.85	WNW and ENE
April	0.16	1.20	E
May	0.16	0.78	E
June	0.22	0.99	E
July	0.22	1.22	E
August	0.25	1.01	ESE
September	0.22	0.90	E
October	0.18	0.68	E
November	0.17	0.60	E
December	0.19	0.68	E
Minimum	**0.16**	**0.60**	
Maximum	**0.25**	**1.22**	

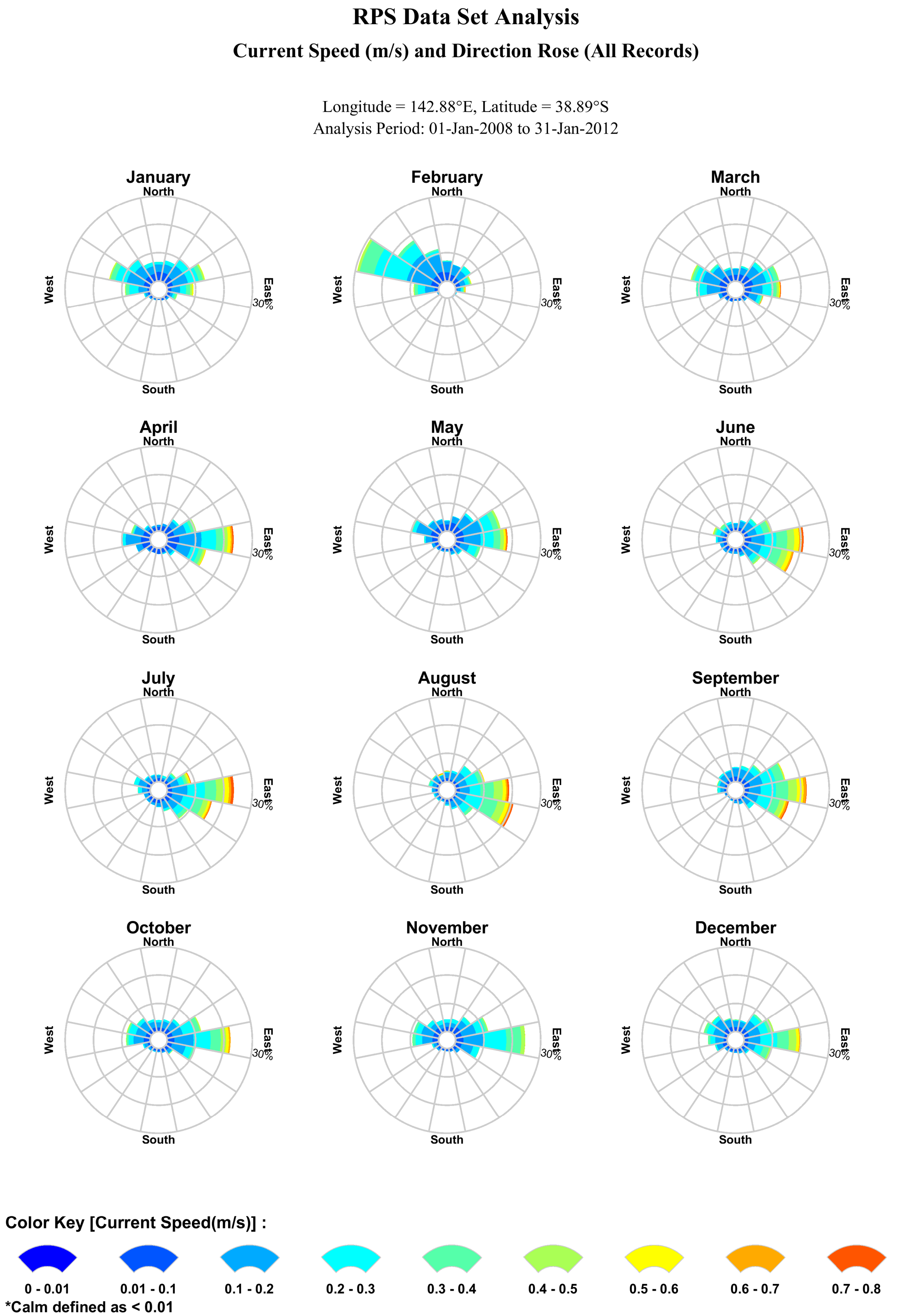

Figure 9 Monthly surface current rose plots near the release location (derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2008 – 2012 inclusive).

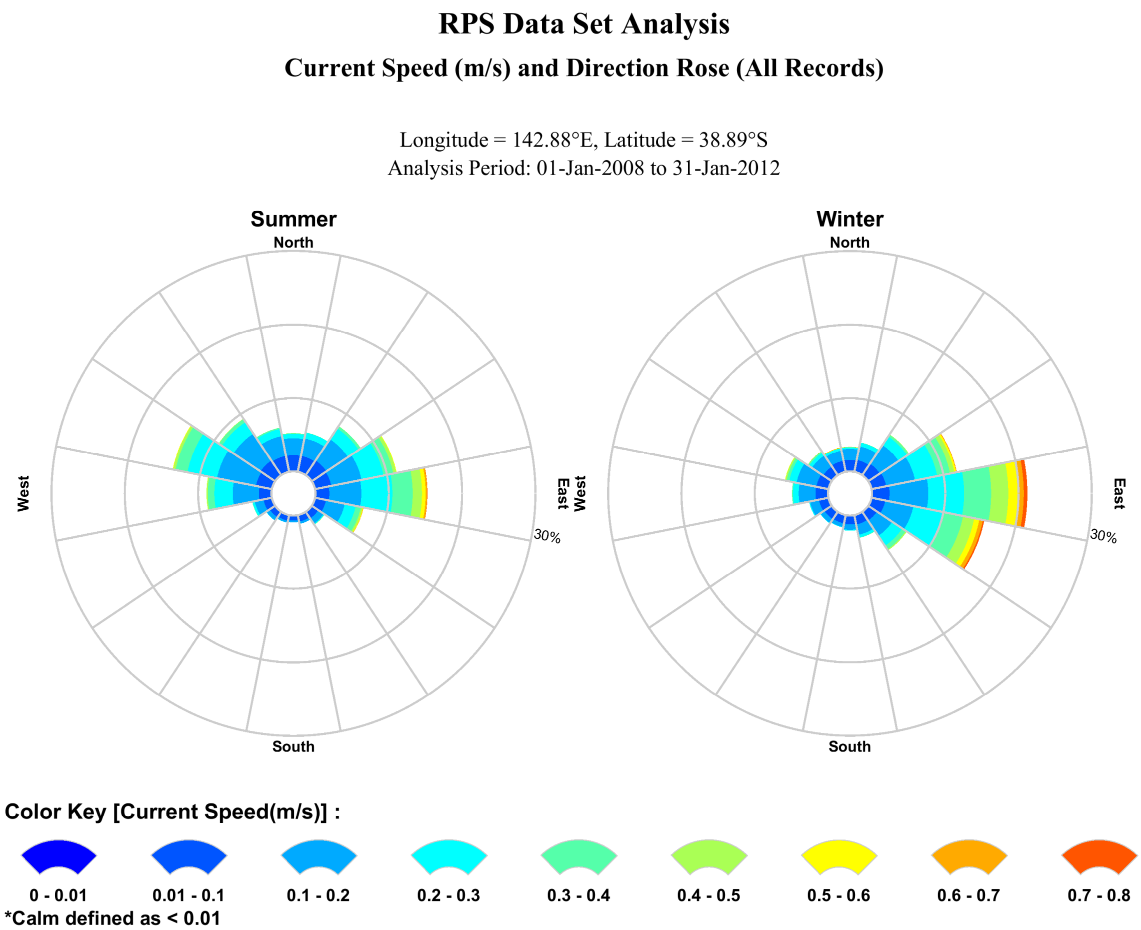

Figure 10 **Seasonal surface current rose plots near the release location (derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2008 – 2012 inclusive).**

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4 WIND DATA

High resolution wind data was sourced from the National Centre for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR; see Saha et al., 2010) from 2008 to 2012 (inclusive).The CFSR wind model includes observations from many data sources; surface observations, upper-atmosphere air balloon observations, aircraft observations and satellite observations and is capable of accurately representing the interaction between the earth's oceans, land and atmosphere. The gridded wind data output is available at ¼ of a degree resolution (~33 km) and 1-hourly time intervals. Figure 11 shows the spatial resolution of the wind field used as input into the oil spill model. Table 4 shows the monthly average and maximum winds derived from the CFSR node located adjacent to the release site. Figure 12 and Figure 13 show the monthly and seasonal wind rose distributions, respectively.

Note the convention for defining wind direction throughout this report is the direction the wind blows from. Each branch of the wind rose distribution represents wind coming from that direction, with north to the top of the diagram. The branches are divided into segments of different colour, which represent wind speed ranges from that direction. Speed ranges of 3 knot intervals, excluding the calm and near calm conditions are used in these wind roses. The length of each coloured segment within a branch is proportional to the frequency of winds blowing within the corresponding range of speeds from that direction.

The wind data analysis indicated that winds in the region are generally moderate to strong throughout the year, with a monthly average oscillating between ~13 knots (March) to ~18 knots (August). A maximum wind speed of 49 knots was recorded during September, while the lowest maximum speed of 34 knots occurred in December.

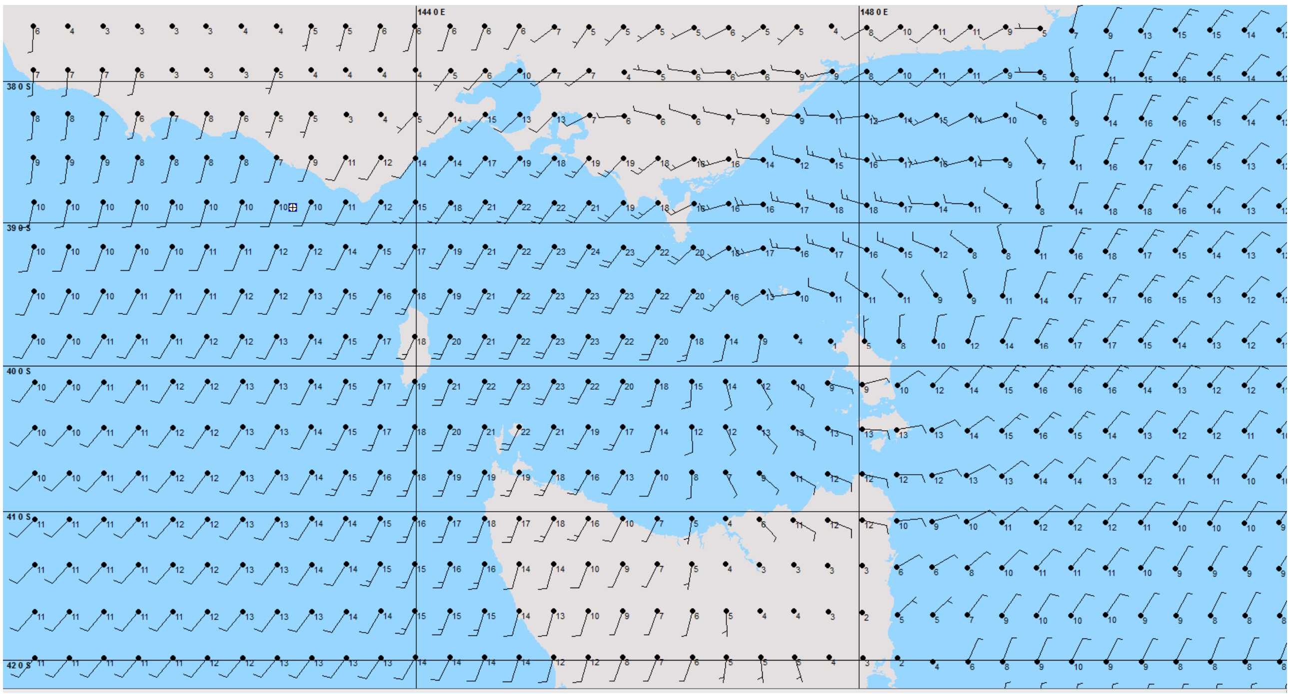

Figure 11 Image showing the CFSR modelled wind nodes.

Table 4 Predicted monthly average and maximum winds for the wind node adjacent to the release location. Data derived from CFSR hindcast model from 2008-2012 (inclusive).

Month	Average wind (knots)	Maximum wind (knots)	General direction (from)
January	13	37	Variable SW to SE
February	14	37	SE
March	13	38	Variable
April	14	44	W
May	13	36	W
June	16	46	SW to NW
July	18	44	SW to NW
August	18	46	SW to NW
September	17	49	SW
October	14	35	SW to S
November	14	38	W to SE
December	14	34	W to E
Minimum	**13**	**34**	
Maximum	**18**	**49**	

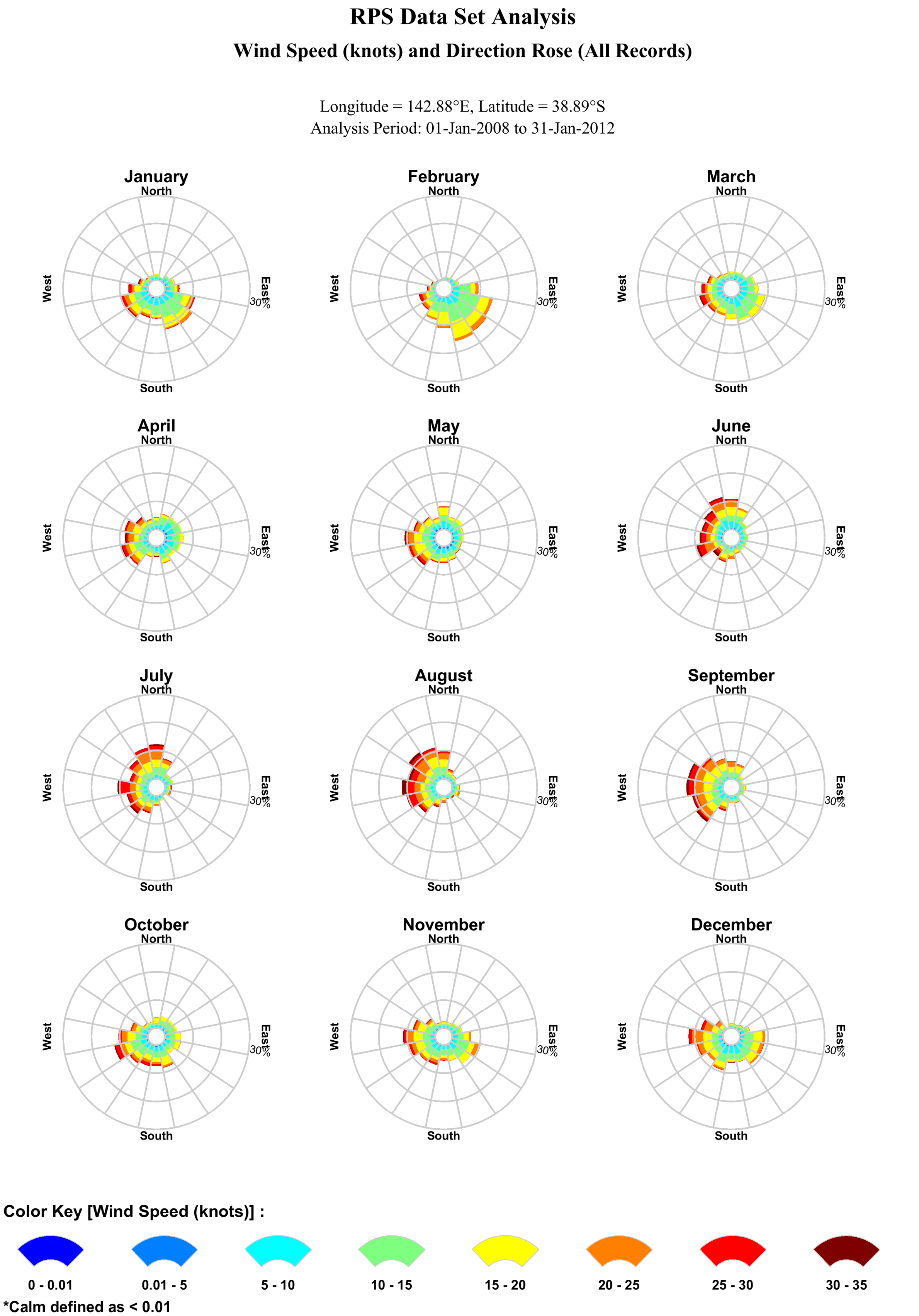

Figure 12 Monthly wind rose distributions derived from the CFSR hindcast model from 2008–2012 (inclusive), for the nearest wind node to the release location.

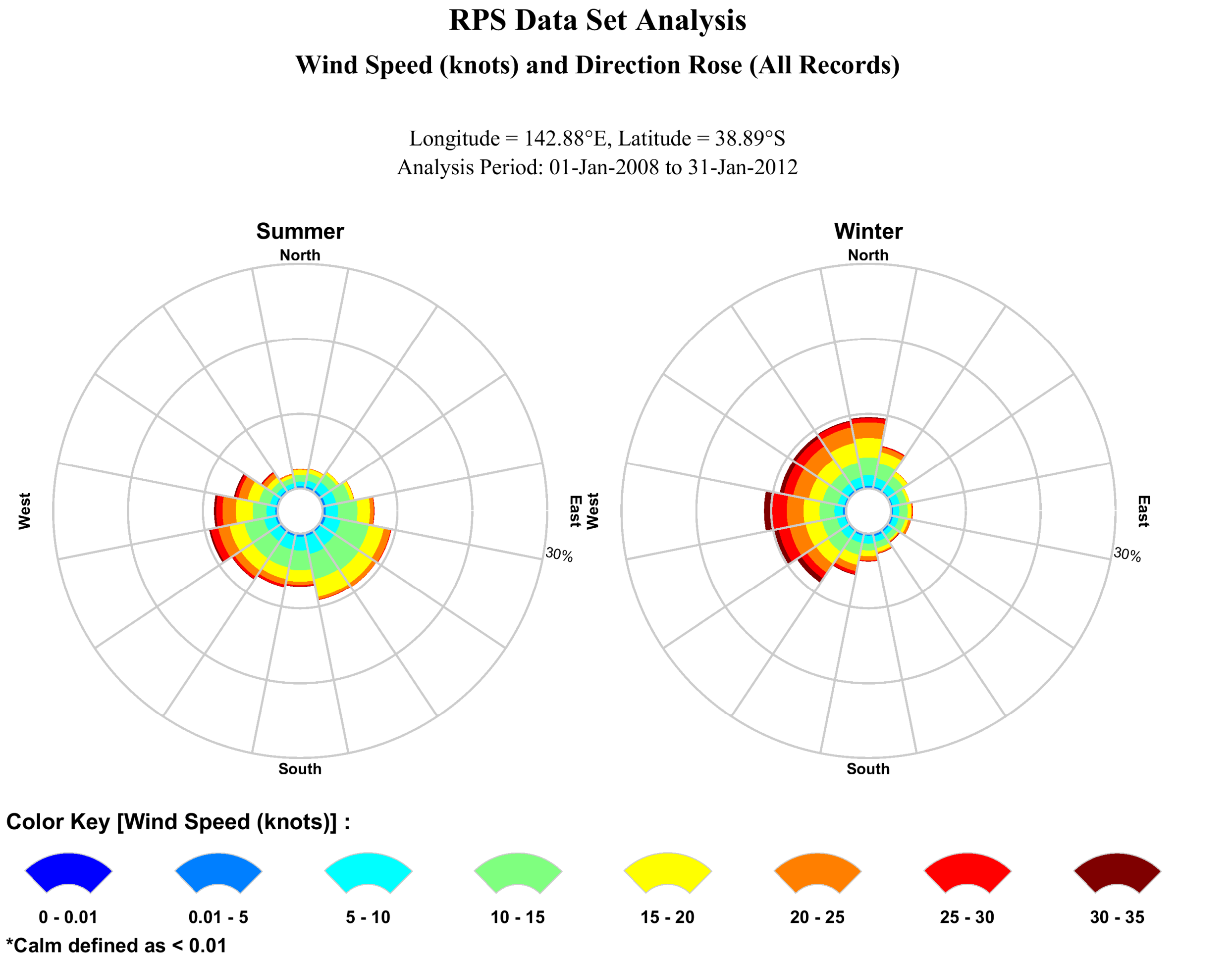

Figure 13 Seasonal wind rose distributions derived from the CFSR hindcast model from 2008–2012 (inclusive), for the nearest wind node to the release location.

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5 WATER TEMPERATURE AND SALINITY

The monthly depth-varying water temperature and salinity profiles at 5 m intervals through the water column adjacent to the release location (refer to Figure 14) was obtained from the World Ocean Atlas 2013 (WOA13) produced by the National Oceanographic Data Centre (National Oceanic and Atmospheric Administration) (see Levitus et al., 2013). The data is to inform the weathering, movement and evaporative loss of hydrocarbon spills in the surface and subsurface layers.

Table 5 summarises the monthly average sea surface temperatures and salinity (0-5 m depth layer). The sea surface temperatures were shown to range from 13.3°C (September) and 18.0°C (January). Salinity remained consistent throughout the year ranging from 35.1 to 35.6 psu.

Table 5 Monthly average sea surface temperature and salinity in the 0–5 m depth layer near the Artisan-1 well location.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°C)	18.0	17.2	17.9	16.4	16.3	16.0	14.9	13.6	13.3	14.6	14.4	16.1
Salinity (psu)	35.4	35.1	35.4	35.4	35.4	35.4	35.6	35.3	35.3	35.4	35.4	35.4

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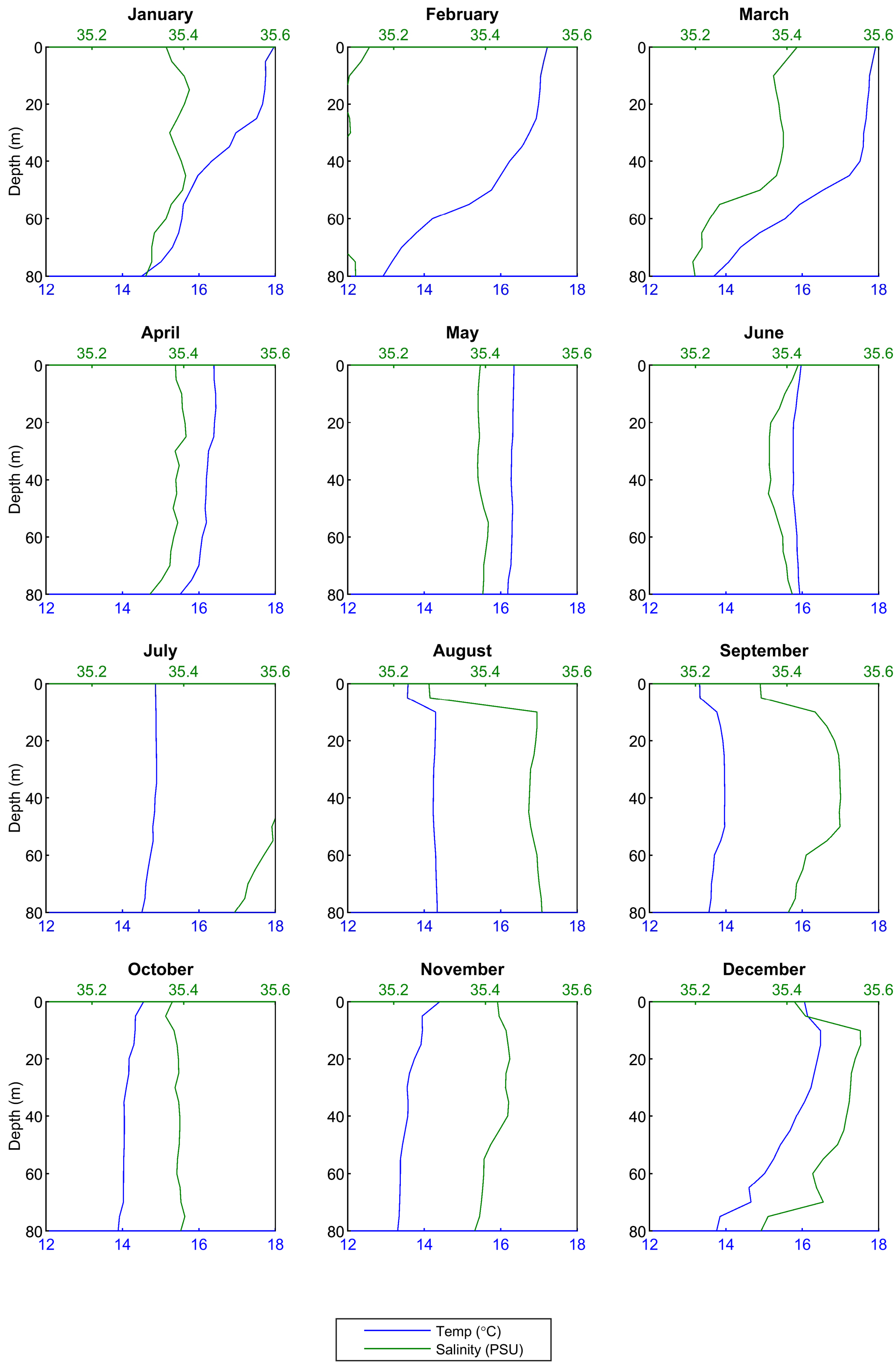

Figure 14 Monthly water temperature and salinity profiles near the release location.

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6 NEAR-FIELD MODEL – OILMAP-DEEP

Near-field modelling was carried out for the loss of well control scenario to better understand the plume dynamics due to the amalgamation of condensate and gas at the seabed using the advanced OILMAP-DEEP blowout model. OILMAP-DEEP was developed by RPS and designed to provide the near-field behaviour of multi-phase gas-condensate plumes during subsurface blowout releases.

The model simulates the plume rise dynamics in two phases, the initial jet phase and the buoyant plume phase. The initial jet phase governs the plume dynamics directly above the subsea release location and is predominantly driven by the exit velocity. During this phase, the condensate droplet size and distribution are calculated. Next, the rise dynamics are dominated by the buoyant nature of the plume until the termination of the plume phase (known as the trapping depth). At this point, the results from OILMAP-DEEP (including plume trapping depth, plume diameter and droplet size distribution) are integrated into the far-field model SIMAP to simulate the rise and dispersion of the condensate droplets.

More details on the OILMAP-DEEP model, can be found in Spaulding et al. (2015). The model has been validated against observations from Deepwater Horizon as well as small and large-scale laboratory studies on subsurface oil releases (Brandvik et al 2013, 2014; Belore 2014; Spaulding et al. 2015; Li et al. 2017). Figure 15 illustrates the various stages of an example blowout plume.

Table 6 presents the input parameters and key results of the subsea modelling. Note that a depleting release rate illustrated in Figure 16 was used for the LOWC scenario, starting from 3,758 bbl/day on day 1 and decreasing to 1,718 bbl/day on day 86. The near-field modelling showed that in the event of a blowout from a well, the gas/liquid will propel the condensate upward from the seabed and the plume would rupture the sea surface. Due to the velocity of the plume, the model predicted droplet sizes would be relatively small, ranging from 100 to 400 μm.

Table 6 Input characteristics and key results from the subsea modelling.

Input Variable	Value
Scenario	86-day loss of well control
Water depth (m)	60
Tubing diameter (inch)	8.5”
Condensate Rate (stb/day)	3,758 bbl (day 1) depleting to 1,718 bbl (day 86)
Water Rate (stb/day)	189 bbl (day 1) depleting to 137 bbl (day 86)
Gas Rate (scf/day)	290,000,000 scf (day 1) depleting to 132,000,000 scf (day 86)
Gas to Condensate ratio (scf/bbl)	81,727 (average)
Gas to Total Liquids ratio (scf/bbl)	76,868 (average)
Reservoir temperature (°C)	93
Release Pressure (psia)	2,583 (day 1) depleting to 256 (day 86)
Key Results	
Plume execution depth (m)	Plume ruptures the sea surface
Droplet Sizes	100 – 400 μm

RPS

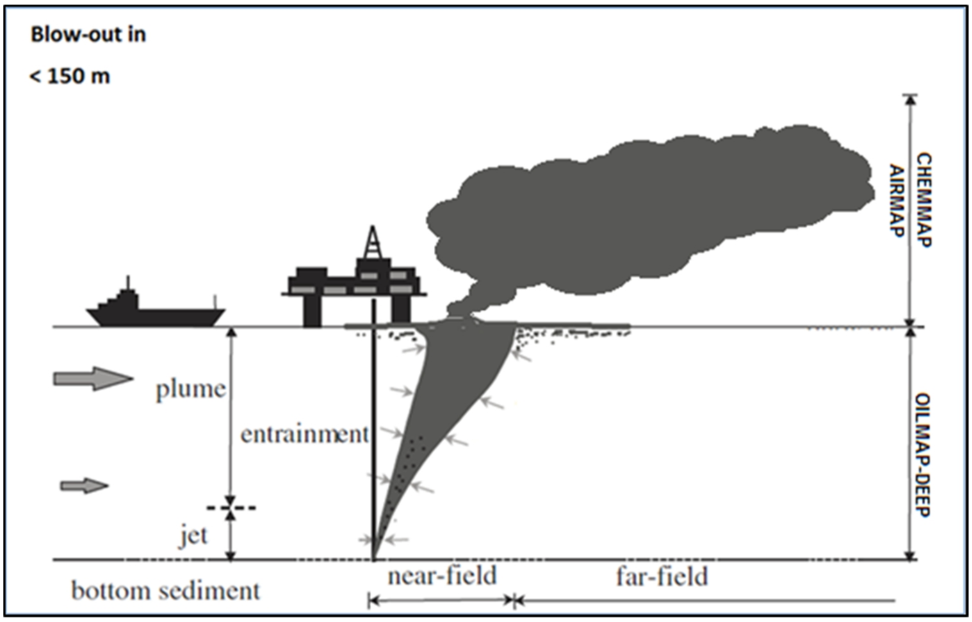

Figure 15 Example of a blowout plume illustrating the various stages of the plume in the water column (Source: Applied Science Associates, 2011).

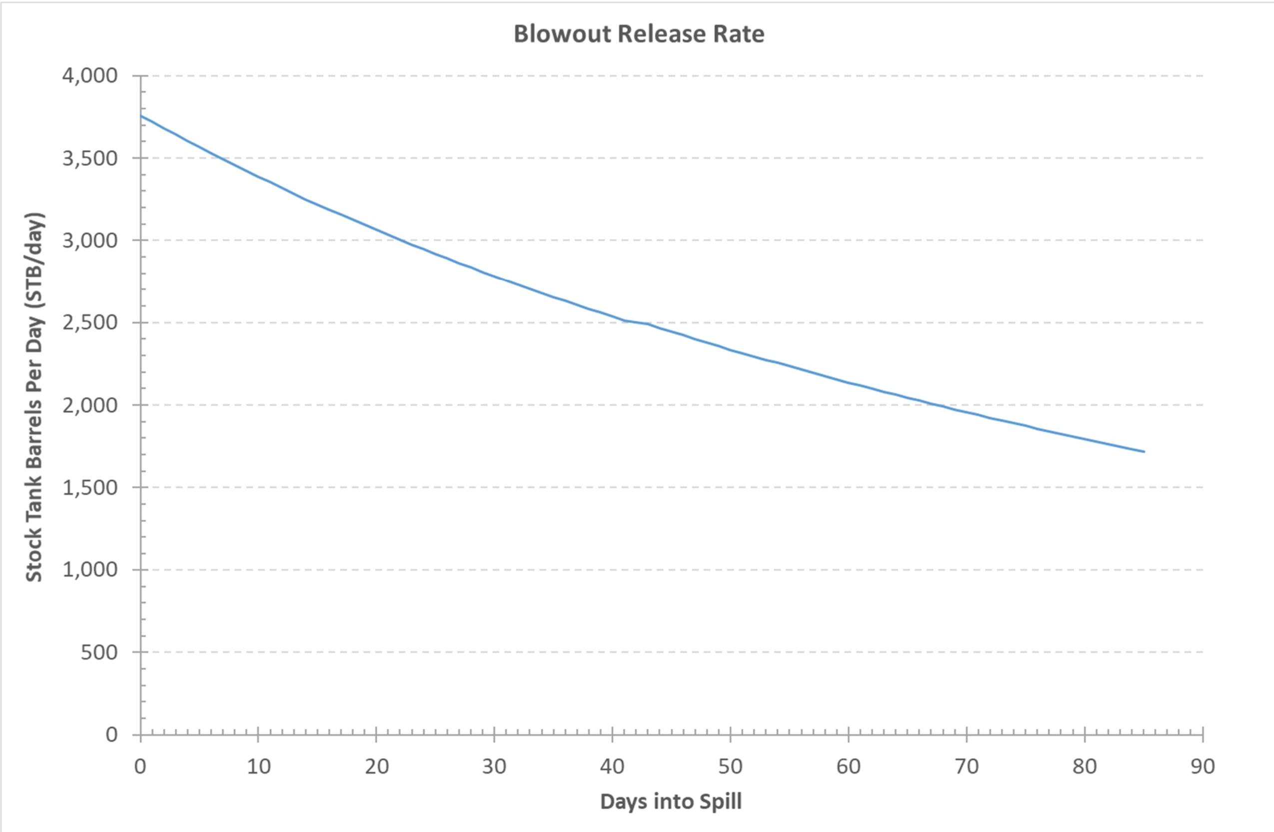

Figure 16 Depleting release rate used for the LOWC scenario

7 OIL SPILL MODEL – SIMAP

Modelling of the fate of oil was performed using SIMAP. SIMAP is designed to simulate the fate and effects of spilled hydrocarbons for both the surface and subsurface releases (Spaulding et al. 1994; French et al. 1999; French-McCay, 2003; French-McCay, 2004; French-McCay et al. 2004).

SIMAP has been used to predict the weathering and fate of oil spills during and after major incidents including: Montara (Australia) well blowout August 2009 in the Timor Sea (Asia-Pacific ASA, 2010); Macondo (USA) well blowout April 2010 in the Gulf of Mexico; Bohai Bay (China) oil spill August 2011; and the pipeline oil spill July 2013 in the Gulf of Thailand

The SIMAP model calculates the transport, spreading, entrainment, evaporation and decay of surface hydrocarbon slicks as well as the entrained and dissolved oil components in the water column, either from surface slicks or from oil discharged subsea. The movement and weathering of the spilled oil is calculated for specific oil types. Input specifications for oil mixtures include the density, viscosity, pour point, distillation curve (volume lost versus temperature) and the aromatic/aliphatic component ratios within given boiling point ranges. The SIMAP model uses an interpolation scheme based on an area-weighting scheme of the four nearest points of the wind and currents from the oil particle location.

SIMAP is a 3D model that allows for various response actions to be modelled including oil removal from skimming, burning, or collection booms, and surface and subsurface dispersant application.

The SIMAP oil spill model includes advanced weathering algorithms, specifically focussed on unique oils that tend to form emulsions and/or tar balls. The weathering algorithms are based on 5 years of extensive research conducted in response to the Deepwater Horizon oil spill in the Gulf of Mexico (French et al., 2015).

Biodegradation is included in the oil spill model. In the model, SIMAP, degradation is calculated for the surface slick, deposited oil on the shore, the entrained oil and dissolved constituents in the water column, and oil in the sediments. For surface oil, water column oil, and sedimented oil a first order degradation rate is specified. Biodegradation rates are relatively high for hydrocarbons in dissolved state or in dispersed small droplets.

7.1 Stochastic Modelling

Stochastic oil spill modelling is created by overlaying a great number (often 100 hundred) simulated hypothetical oil spills (e.g. Figure 17). Stochastic modelling involves running numerous individual oil spill simulations using a range of prevailing wind and current conditions that are historically representative of the season of where the spill event may occur.

For the stochastic modelling presented herein, 100 spills for each of season were simulated and each using the same spill information (release location, spill volume, duration and oil type) but with varied start dates and times corresponding to the period represented by the available wind and current data. During each simulation, the model records whether any grid cells are exposed to any oil concentrations, the concentrations involved and the elapsed time before exposure. The results of all 100 oil spill simulations were analysed to determine the following statistics for every grid cell:

- Exposure load (concentrations and volumes);
- Minimum time before exposure;
- Probability of contact above defined concentrations;
- Volume of oil that may strand on shorelines from any single simulation;
- Concentration that might occur on sections of individual shorelines; and
- Exposure (concentration x duration of exposure) to entrained and dissolved hydrocarbons in the water column.

Exposure (concentration x duration of exposure) to entrained and dissolved hydrocarbons in the water column

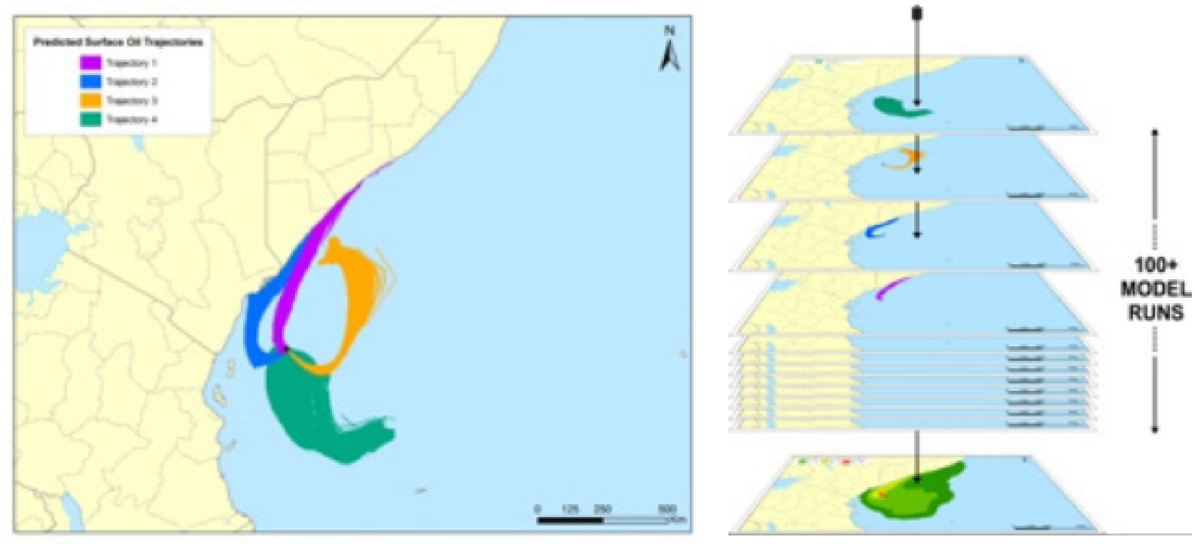

Figure 17 Predicted movement of four single oil spill simulations predicted by SIMAP for the same scenario (left image). All model runs are overlain (shown as the stacked runs on the right) and the number of times that trajectories contact a given location at a concentration is used to calculate the probability.

7.2 Sea surface, Shoreline and In-Water Exposure Thresholds

The thresholds for the sea surface, shoreline and water column (entrained and dissolved hydrocarbons) is presented in Table 7 and their relationship to exposure, are presented in Sections 7.2.1 to 7.2.3. Supporting justifications of the adopted thresholds applied during the study and additional context relating to the area of influence are also provided. It is important to note that the thresholds are in line with the thresholds recommended in the NOPSEMA oil spill modelling bulletin April 2019 (https://www.nopsema.gov.au/assets/Bulletins/A652993.pdf), In some instances, slightly more conservative. For example, the low surface exposure of >0.5 g/m^2 was adopted in the study, while the NOPSEMA bulletin recommends 1 g/m^2.

Table 7 Exposure and contact threshold values used for the Artisan-1 oil spill modelling study.

Level	Sea Surface Exposure (g/m^2)	Shoreline Contact (g/m^2)	Dissolved Hydrocarbon Concentration (ppb)[#]	Entrained Hydrocarbon Concentrations (ppb)[#]
Low	0.5	10	6	10
Moderate	10	100	50	100
High	25	1,000	400	1,000

[#]These thresholds were assessed for a) 1 hour exposure and b) 48-hour exposure windows. Both sets of results are provided in the result section(s).

RPS

7.2.1 Sea Surface Exposure Thresholds

The minimum sea surface reporting level for each spill simulation was 0.5 g/m^2, which equates to an average thickness of approximately 0.5 µm. Oil of this thickness is described as a rainbow to metallic sheen in appearance according to the Bonn Agreement Oil Appearance Code (Bonn Agreement, 2009, Table 8). This thickness is considered the minimum level for observing oil in the marine environment by the Australian Maritime Safety Authority (AMSA, 2015). Furthermore, this threshold is considered below levels which would cause environmental harm and it is more indicative of the areas perceived to be affected due to its visibility on the sea surface and potential to trigger temporary closures of areas (i.e. fishing grounds) as a precautionary measure.

Ecological impact has been estimated to occur at 10 g/m^2 (a film thickness of approximately 10 µm or 0.01 mm) according to French et al. (1996) and French-McCay (2009) as this level of fresh oiling has been observed to mortally impact some birds through adhesion of oil to their feathers, exposing them to secondary effects such as hypothermia. The appearance at this average thickness has been described as a metallic sheen (Bonn Agreement, 2009). Concentrations above 10 g/m^2 is also considered the lower actionable threshold, where oil may be thick enough for containment and recovery as well as dispersant treatment (AMSA, 2015).

Scholten et al. (1996) and Koops et al. (2004) indicated that at oil concentrations on the sea surface of 25 g/m^2 (or greater), would be harmful for all birds that have landed in an oil film due to potential contamination of their feathers, with secondary effects such as loss of temperature regulation and ingestion of oil through preening. The appearance of oil at this thickness is also described as metallic sheen (Bonn Agreement, 2009).

The sea surface reporting thresholds applied in this study were 0.5–10 g/m^2 (low), 10–25 g/m^2 (moderate) and above 25 g/m^2 (high) (Table 7).

Note that the higher threshold applied in this study falls below the thickness that would begin to present as patches of true oil colour (Table 8).

Figure 18 shows examples of the differences between oil colour and corresponding thickness on the sea surface. Hydrocarbons in the marine environment may appear differently due the ambient environmental conditions (wind and wave action).

Table 8 Bonn Agreement Oil Appearance Code

Code	Description Appearance	Layer Thickness Interval (g/m^2 or µm)	Litres per km^2
1	Sheen (silvery/grey)	0.04 – 0.30	40 – 300
2	Rainbow	0.30 – 5.0	300 – 5,000
3	Metallic	5.0 – 50	5,000 – 50,000
4	Discontinuous True Oil Colour	50 – 200	50,000 – 200,000
5	Continuous True Oil Colour	200 –>	200,000 –>

RPS

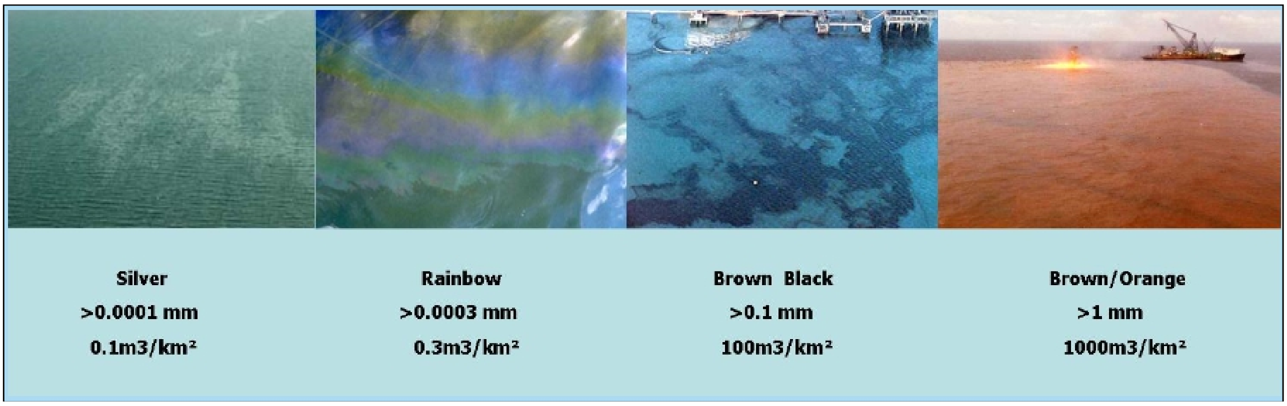

Figure 18 Photograph showing the difference between oil appearance on the sea surface (source: OilSpillSolutions.org, 2015).

The generic oil colour categories used in this report are meant as a guide only. For more accurate description of oil appearance on the sea surface a detailed analysis of an oil should be undertaken.

The specific oil type will determine appearance (i.e. colour) and behaviour on the sea surface. Lighter oils such as marine diesel and condensate, have true oil colours that are pale or transparent. As such, these oil types may not increase beyond a rainbow or metallic sheen, despite their thickness increasing beyond 25 g/m^2 (~25 um). Moreover, the physical properties and appearance of oil types will change due to weathering on the sea surface. For example, oils with high paraffinic wax content will form waxy sheets that break up into flakes or nodules after the more volatile components have evaporated. Take up of water by the oil (emulsification) will also significantly change the appearance and thickness of floating oil. Stable water-in-oil emulsions will have a higher combined mass and thickness and will present as thick, semi-solid, aerated layers that tend to be coloured strongly red/brown, orange or yellow, rather than the true oil colour.

It should be noted that in the case of solidified or emulsified oils, mass per area estimates cannot be directly referenced to the Bonn Agreement visibility scale that refers only to oil present as films or slicks of oil alone.

7.2.2 Shoreline Exposure Thresholds

The reporting threshold of 10 g/m^2 was applied as the visible limit for oil on shore. This threshold may trigger socio-economic impact, such as triggering temporary closures of beaches to recreation or fishing, or closure of commercial fisheries and might trigger attempts for shore clean-up on beaches or man-made features/amenities (breakwaters, jetties, marinas, etc.). In previous risk assessment studies, French-McCay et al (2005a; 2005b) used a threshold of 10 g/m^2, equating to approximately two teaspoons of oil per square meter of shoreline, as a low impact threshold when assessing the potential for shoreline exposure.

French et al. (1996) and French-McCay (2009) define a shoreline oil threshold of 100 g/m^2, or above, as having potentially harm shorebirds and wildlife (furbearing aquatic mammals and marine reptiles on or along the shore) based on studies for sub-lethal and lethal impacts. This threshold has been used in previous environmental risk assessment studies (see French-McCay, 2003; French-McCay et al., 2004, French-McCay et al., 2011, 2012; NOAA, 2013). Additionally, a shoreline concentration of 100 g/m^2, or above, is the minimum limit that the oil can be effectively cleaned according the AMSA (2015) guidelines. This threshold equates to approximately ½ a cup of oil per square meter of shoreline exposure. The appearance is described as a thin oil coat.

The higher threshold of 1,000 g/m^2, and above, was adopted to inform locations that might receive oil accumulation levels that could have a higher potential for ecological effect. Observations by Lin and Mendelssohn (1996), demonstrated that loadings of more than 1,000 g/m^2 of oil during the growing season would be required to impact marsh plants significantly. Similar thresholds have been found in studies assessing oil impacts on mangroves (Grant et al., 1993; Suprayogi & Murray, 1999). This concentration equates to approximately 1 litre or 4 ¼ cups of fresh oil per square meter of shoreline exposure. The appearance is described as an oil cover.

The shoreline reporting thresholds applied in this study were 10–100 g/m^2 (low), 100–1,000 g/m^2 (moderate) and above 1,000 g/m^2 (high) (Table 7).

7.2.3 Dissolved and Entrained Hydrocarbon Thresholds

Oil is a mixture of thousands of hydrocarbons of varying physical, chemical, and toxicological characteristics, and therefore, demonstrate varying fates and impacts on organisms. As such, for in-water exposure, the SIMAP model provides separate outputs for dissolved and entrained hydrocarbons from oil droplets. The consequences of exposure to dissolved and entrained components will differ because they have different modes and magnitudes of effect.

Entrained hydrocarbon concentrations were calculated based on oil droplets that are suspended in the water column, though not dissolved. The composition of this oil would vary with the state of weathering (oil age) and may contain soluble hydrocarbons when the oil is fresh. Calculations for dissolved hydrocarbons specifically calculates oil components which are dissolved in water, which are known to be the primary source of toxicity exerted by oil.

7.2.3.1 Dissolved hydrocarbons

Laboratory studies have shown that dissolved hydrocarbons exert most of the toxic effects of oil on aquatic biota (Carls et al., 2008; Nordtug et al., 2011; Redman, 2015). The mode of action is a narcotic effect, which is positively related to the concentration of soluble hydrocarbons in the body tissues of organisms (French-McCay, 2002). Dissolved hydrocarbons are taken up by organisms directly from the water column by absorption through external surfaces and gills, as well as through the digestive tract. Thus, soluble hydrocarbons are termed “bioavailable”.

Hydrocarbon compounds vary in water-solubility and the toxicity exerted by individual compounds is inversely related to solubility, however bioavailability will be modified by the volatility of individual compounds (Nirmalakhandan &Speece, 1988; Blum & Speece, 1990; McCarty, 1986; McCarty et al., 1992a, 1992b; Mackay et al., 1992; McCarty & Mackay, 1993; Verhaar et al., 1992, 1999; Swartz et al., 1995; French-McCay, 2002; McGrath et al., 2009). Of the soluble compounds, the greatest contributor to toxicity for water-column and benthic organisms are the lower-molecular-weight aromatic compounds, which are both volatile and soluble in water. Although they are not the most water-soluble hydrocarbons within most oil types, the polynuclear aromatic hydrocarbons (PAHs) containing 2-3 aromatic ring structures typically exert the largest narcotic effects because they are semi-soluble and not highly volatile, so they persist in the environment long enough for significant accumulation to occur (Anderson et al., 1974, 1987; Neff & Anderson, 1981; Malins & Hodgins, 1981; McAuliffe, 1987; NRC, 2003). The monoaromatic hydrocarbons (MAHs), including the BTEX compounds (benzene, toluene, ethylbenzene, and xylenes), and the soluble alkanes (straight chain hydrocarbons) also contribute to toxicity, but these compounds are highly volatile, so that their contribution will be low when oil is exposed to evaporation and higher when oil is discharged at depth where volatilisation does not occur (French-McCay, 2002).

French-McCay (2002) reviewed available toxicity data, where marine biota was exposed to dissolved hydrocarbons prepared from oil mixtures, finding that 95% of species and life stages exhibited 50% population mortality (LC_{50}) between 6 and 400 ppb total PAH concentration after 96 hrs exposure, with an average of 50 ppb. Hence, concentrations lower than 6 ppb total PAH value should be protective of 97.5% of species and life stages even with exposure periods of days (at least 96 hours). Early life-history stages of fish appear to be more sensitive than older fish stages and invertebrates.

Exceedances of time averaged exposure (based on 96 hours) at 6, 50 or 400 ppb was applied to indicate increasing potential for sub-lethal to lethal toxic effects (or low to high).

Furthermore, in accordance with the NOPSEMA oil spill modelling bulletin, the same thresholds were assessed over a 1 hour time step (see Table 7).

7.2.3.2 Entrained hydrocarbons

Entrained hydrocarbons consist of oil droplets that are suspended in the water column and insoluble. As such, insoluble compounds in oil cannot be absorbed from the water column by aquatic organisms, hence are not bioavailable through absorption of compounds from the water. Exposure to these compounds would require routes of uptake other than absorption of soluble compounds. The route of exposure of organisms to whole oil alone include direct contact with tissues of organisms and uptake of oil by direct consumption, with potential for biomagnification through the food chain (NRC, 2005).

The 10 ppb threshold represents the very lowest concentration and corresponds generally with the lowest trigger levels for chronic exposure for entrained hydrocarbons in the ANZECC (2000) water quality guidelines. Due to the requirement for relatively long exposure times (> 24 hours) for these concentrations to be significant, they are likely to be more meaningful for juvenile fish, larvae and planktonic organisms that might be entrained (or otherwise moving) within the entrained plumes, or when entrained hydrocarbons adhere to organisms or trapped against a shoreline for periods of several days or more.

This exposure zone is not considered to be of significant biological impact and is therefore outside the adverse exposure zone. This exposure zone represents the area contacted by the spill. This area does not define the area of influence as it is considered that the environment will not be affected by the entrained hydrocarbon at this level.

Thresholds of 10 ppb, 100 ppb and 500 ppb were applied as time averaged exposure (over 96 hours, see Table 7), to cover the range of thresholds outlined in the ANZECC/ARMCANZ (2000) water quality guidelines and the incremental change for greater potential effect.

A complicating factor that should be considered when assessing the consequence of dissolved and entrained oil distributions is that there will be some areas where both physically entrained oil droplets and dissolved hydrocarbons co-exist. Higher concentrations of each will tend to occur close to the source where sea conditions can force mixing of relatively unweathered oil into the water column, resulting in more rapid dissolution of soluble compounds.

Furthermore, in accordance with the NOPSEMA oil spill modelling bulletin, the same thresholds were assessed over a 1 hour time step (see Table 7).

7.3 Oil Properties

7.3.1 Marine Diesel Oil

Marine Diesel Oil (MDO) is a light-persistent fuel oil used in the maritime industry. It has a density of 829.1 kg/m^3 (API of 37.6) and a low pour point (-14^{o}C). The low viscosity (4 cP) indicates that this oil will spread quickly when released and will form a thin to low thickness film on the sea surface, increasing the rate of evaporation. According to the International Tankers Owners Pollution Federation (ITOPF, 2014) and AMSA (2015a) guidelines, this oil is categorised as a group II oil (light-persistent).

Table 9 details the physical properties of MDO, while Table 10 presents the boiling point ranges of the MDO used in this study.

Figure 19 illustrates the weathering graph for a 300 m^3 release of MDO over 6 hours during three wind speeds. The 5, 10 and 15 knot wind speeds were selected given that breaking waves and in turn entrainment takes place between 10 – 12 knots. The results illustrate that the prevailing wind speeds can and do influence the weathering and fate of the MDO. Under lower wind-speeds (5 knots), the MDO will remain on the surface longer, spread quicker, and in turn greater evaporation. Conversely, sustained stronger winds (>15 knots) will generate breaking waves at the surface, causing a higher amount of MDO to be entrained into the water column and reducing the amount available to evaporate.

7.3.2 Thylacine Condensate

Thylacine condensate was used for the loss of well control scenario (Scenario 2). The condensate has an API of 44.3, density of 804.6 kg/m^3 at 15ºC) with low viscosity (0.875 cP) (refer to Table 9), classifying it as a Group I oil according to the (ITOPF, 2014) and USEPA/USCG classifications. The condensate comprises a significant portion of volatiles and semi to low volatiles (99% total) with very little residual components (<1%) (refer to Table 10). This means that the majority of the condensate will evaporate readily when on the water surface, with a minimal amount of persistent components to remain on the water surface over time.

Figure 1 displays the weathering graph for a 24-hour release (3,758 bbl) of Thylacine condensate during three static wind speeds. The weathering graph shows rapid evaporation occurs during the first 24 hours (while the condensate is still being released) during all three wind speeds. Thylacine condensate is predicted to readily entrain into the water column under the higher wind speeds (10 and 15 knots). Due to the high volatility of the condensate, little is predicted to remain on the water surface after the spill ceases.

Table 9 Physical properties of MDO and Thylacine condensate

Characteristic	MDO	Thylacine Condensate
Density (kg/m^3) at 15°C	829.1	804.6
API	37.6	44.3
Dynamic viscosity (cP) at 20°C	4	0.875
Pour Point (°C)	-14	-50
Wax content (%)	1	NA
Hydrocarbon property category	Group II	Group I
Hydrocarbon property classification	Light - Persistent	Non-persistent oil

Table 10 Boiling point ranges of MDO and Thylacine condensate

Characteristic	Not Persistent			Persistent
	Volatile	Semi-volatile	Low volatility	Residual
Boiling point (ºC)	< 180	180 - 265	265 - 380	>380
MDO	6.0	34.6	54.4	5.0
Thylacine condensate	64.0	19.0	16.0	1

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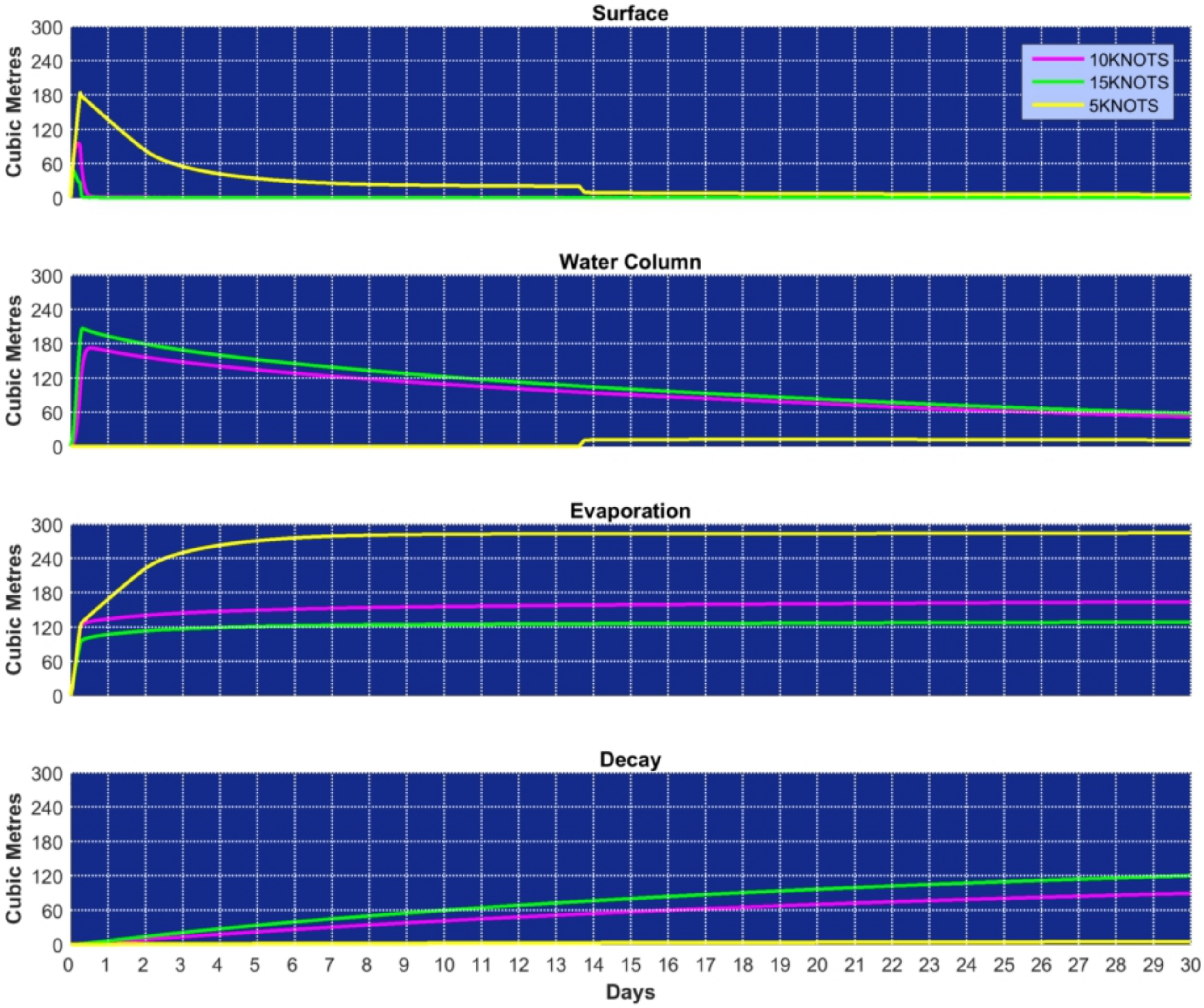

Figure 19 Weathering of a 300 m^3 surface release of MDO over 6 hours (tracked for 30 days) under three static winds conditions (5, 10 and 15 knots).

RPS

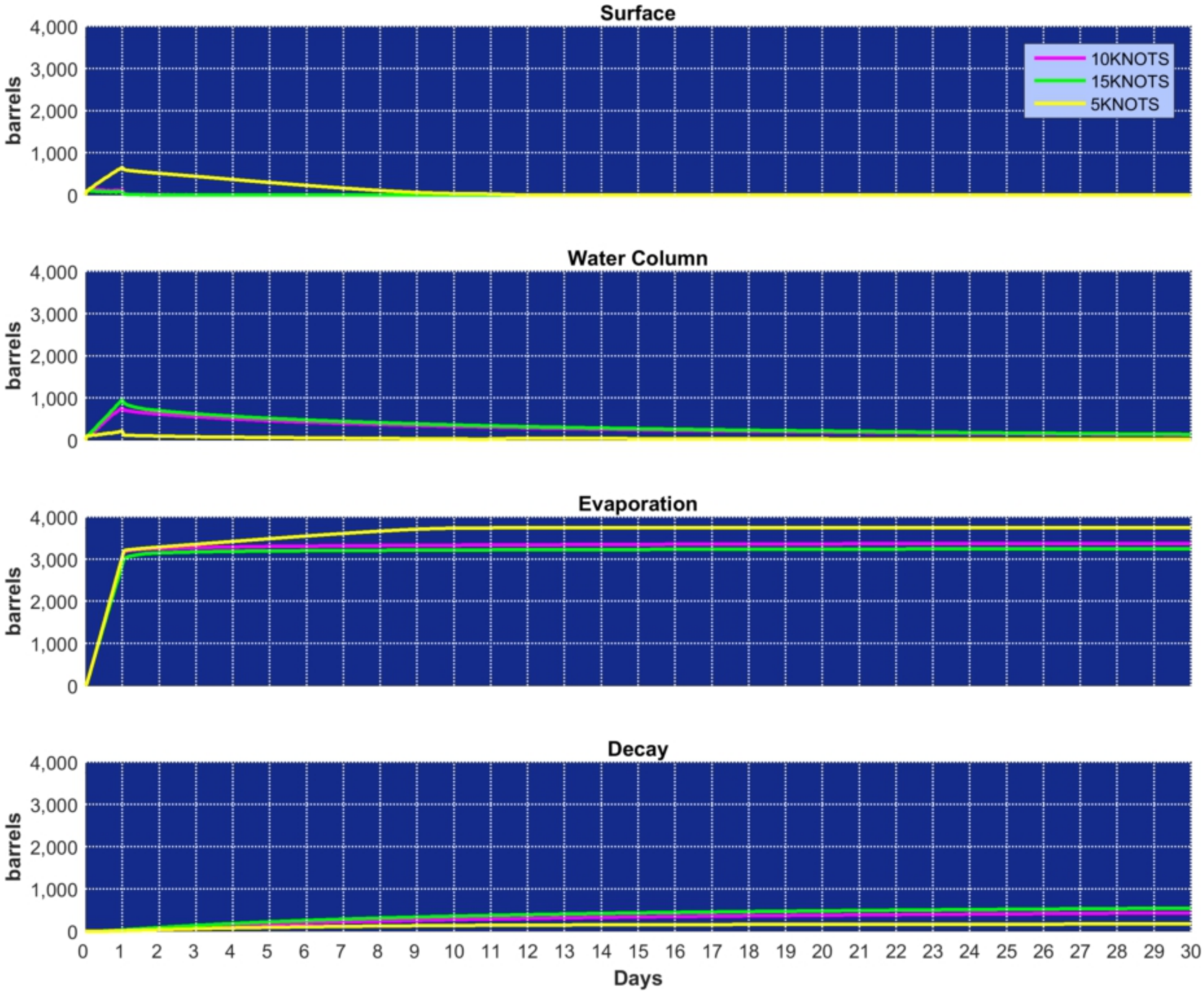

Figure 1 Weathering of 3,758 bbl subsea release of Thylacine condensate over 24 hours (tracked for 30 days) under three static wind speeds (5,10 and 15 knots).

RPS

7.4 Model Settings

This oil spill modelling study quantified the seasonal risk and potential exposure to the surrounding waters and shorelines for two plausible, yet hypothetical scenarios:

- 300 m^3 surface release of marine diesel over 6 hours in the event of a containment loss from a vessel at the Artisan-1 well location; and
- 222,224 bbl subsea release of condensate over 86 days to represent an unrestricted open-hole loss of well control (LOWC) event from the Artisan-1 well location

Table 11 provides a summary of the oil spill model settings.

Table 11 Summary of the oil spill model settings

Parameter	Oil Spill Scenario	
Scenario description	Subsea Loss of Well Control	Loss of Containment from a Vessel
Model period	Summer (October to March) Winter (April to September)	
Number of randomly selected spill start times and locations per season	100 (200 total)	100 (200 total)
Oil type	Thylacine condensate	MDO
Spill volume	222,224 bbl	300 m^3
Release type	Subsea (60m)	Surface
Release duration	86 days	6 hr
Simulation length (days)	114	30
Surface oil concentration thresholds	0.5 g/m^2, 10 g/m^2, >25 g/m^2	
Shoreline load threshold	10 g/m^2, 100 g/m^2, >1,000 g/m^2	
Dissolved hydrocarbon exposure to assess the potential exposure (ppb). *These thresholds were assessed for 1 hour and 48-hour exposure windows.*	6 ppb, potential low exposure 50 ppb, potential moderate exposure 400 ppb, potential high exposure	
Entrained hydrocarbon exposure to assess the potential exposure (ppb). *These thresholds were assessed for 1 hour and 48-hour exposure windows.*	10 ppb, potential low exposure 100 ppb, potential moderate exposure 1,000 ppb, potential high exposure	

RPS

8 PRESENTATION AND INTERPRETATION OF MODEL RESULTS

The results from the modelling study are presented in a number of statistical tables, which aim to provide a comprehensive understanding of the predicted sea-surface and in-water (subsurface) exposure and shoreline contact (if predicted).

8.1 Seasonal Analysis

The seasonal analysis is presented in the form of statistical tables based on the following principles:

- The ***greatest distance travelled by a spill trajectory*** **–** is determined by a) recording the maximum and b) second greatest distance travelled (or 99th percentile) by a single trajectory, within a scenario, from the release location to the identified exposure thresholds.
- The ***probability of shoreline contact*** – is determined by recording the number of spill trajectories to contact the shoreline, at a specific threshold, divided by the total number of spill trajectories within that scenario.
- The ***minimum time before oil exposure*** – is determined by recording the minimum time for a grid cell to record exposure, at a specific threshold.
- The ***average volume of oil ashore for a single spill*** – is determined by calculating the average volume of the all the single spill trajectories which were predicted to make shoreline contact within a scenario.
- The ***maximum volume of oil ashore from a single spill trajectory*** – is determined by identifying the single spill trajectory within a scenario/season, that recorded the maximum volume of oil to come ashore and presenting that value.
- The ***average length of shoreline contacted by oil*** – is determined by calculating the average of the length of shoreline (measured as grid cells) contacted by oil above a specified threshold.
- The ***maximum length of shoreline contacted by oil*** – is determined by recording the maximum length of shoreline (measured as grid cells) contacted by oil above a specified threshold.
- The ***probability of oil exposure to a receptor*** **–** is determined by recording the number of spill trajectories to reach a specified sea surface or subsea threshold within a receptor polygon, divided by the total number of spill trajectories within that scenario.
- The ***minimum time before oil exposure to a receptor*****–** is determined by ranking the elapsed time before sea surface exposure, at a specified threshold, to grid cells within a receptor polygon and recording the minimum value.
- The ***probability of oil contact to a receptor*** **–** is determined by recording the number of spill trajectories to reach a specified shoreline contact threshold within a receptor polygon, divided by the total number of spill trajectories within that scenario.
- The ***minimum time before shoreline contact to a receptor*** **–** is determined by ranking the elapsed time before shoreline contact, at a specified threshold, to grid cells within a receptor polygon and recording the minimum value.
- The ***average potential oil loading within a receptor*** – is determined taking the average of the maximum loading to any grid cell within a polygon, for all simulations within a scenario/season, that recorded shoreline.
- The ***maximum potential oil loading within a receptor*** – is determined by identifying the maximum loading to any grid cell within a receptor polygon, for a scenario.

RPS

- The ***average volume of oil ashore within a receptor*** – is determined by calculating the average volume of oil to come ashore within a receptor polygon, from all the single spill trajectories which were predicted to make shoreline contact within a scenario.
- The ***maximum volume of oil ashore within a receptor*** – is determined by recording the maximum volume of oil to come ashore within a receptor polygon, from all the single spill trajectories which were predicted to make shoreline contact within a scenario.
- The ***average length of shoreline contacted within a receptor*** – is determined by calculating the average of the length of shoreline (measured as grid cells) contacted by oil within a receptor polygon, at a specified threshold, from all the single spill trajectories which were predicted to make shoreline contact within a scenario.
- The ***maximum length of shoreline contacted by oil*** – is determined by recording the maximum length of shoreline (measured as grid cells) contacted by oil within a receptor polygon, at a specified threshold, from all the single spill trajectories which were predicted to make shoreline contact within a scenario.

8.2 Receptors Assessed

A range of environmental receptors and biological receptors and shorelines were assessed for sea surface exposure, shoreline contact and water column exposure as part of the study (see Table 12). The receptors are presented graphically in Figure 20 to Figure 34.

Note, the release location is situated within the Otway Integrated Marine and Coastal Regionalisation of Australia (IMCRA) receptor and hence this receptor will register all maximum values predicted by the modelling.

Table 12 Summary of receptors used to assess surface, shoreline and in-water exposure to hydrocarbons

Receptor Category	Acronym	Hydrocarbon Exposure Assessment		
		Water Column	Sea Surface	Shoreline
Marine National Park	MNP	✓	✓	✗
Australian Marine Park	AMP	✓	✓	✗
National Park	NP	✓	✓	✗
Integrated Marine and Coastal Regionalisation of Australia	IMCRA	✓	✓	✗
Interim Biogeographic Regionalisation of Australia	IBRA	✓	✓	✓
Key Ecological Feature	KEF	✓	✓	✗
Reefs, Shoals and Banks	RSB	✓	✓	✗
Ramsar	Ramsar	✓	✓	✓
State Waters	State Waters	✓	✓	✗
Local Government Areas	LGA	✓	✓	✓

Receptor Category	Acronym	Hydrocarbon Exposure Assessment		
		Water Column	Sea Surface	Shoreline
Sub-Local Government Areas	Sub-LGA	✓	✓	✓

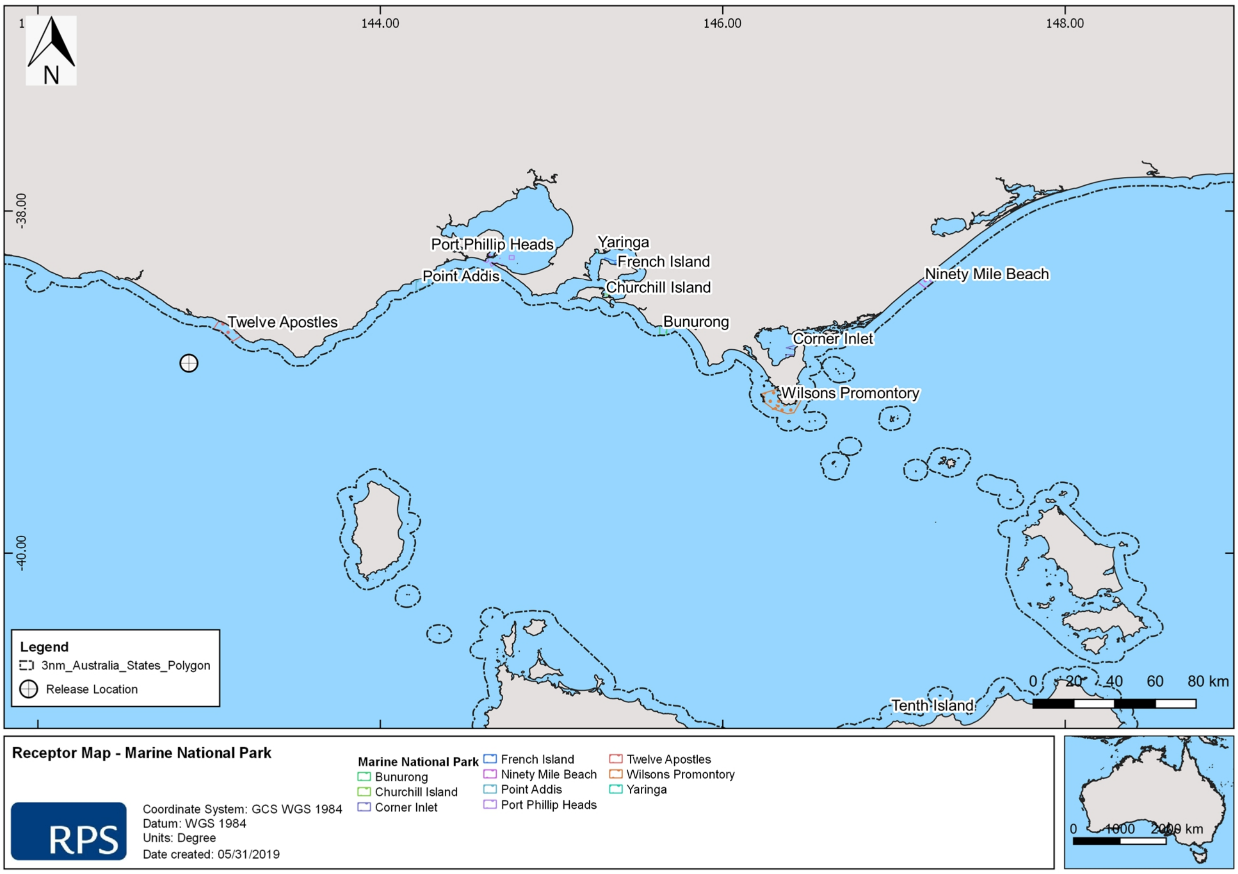

Figure 20 Receptor map for Marine National Parks.

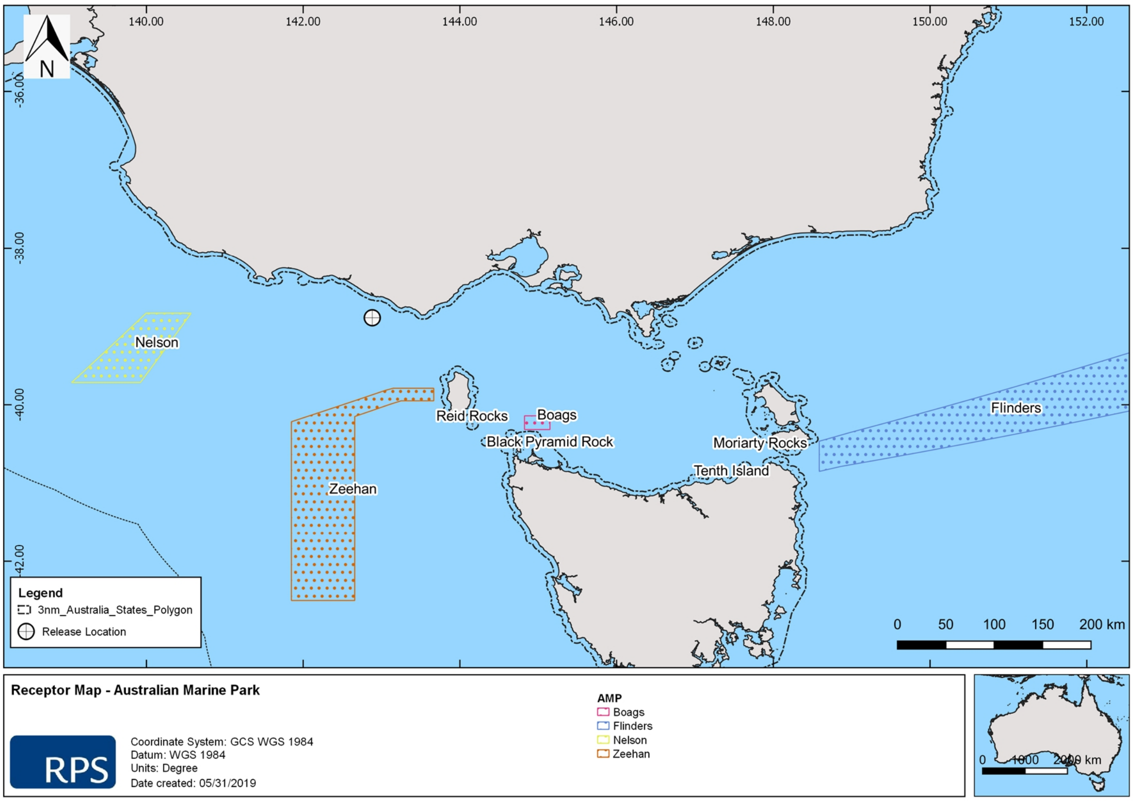

Figure 21 Receptor map for Australian Marine Parks.

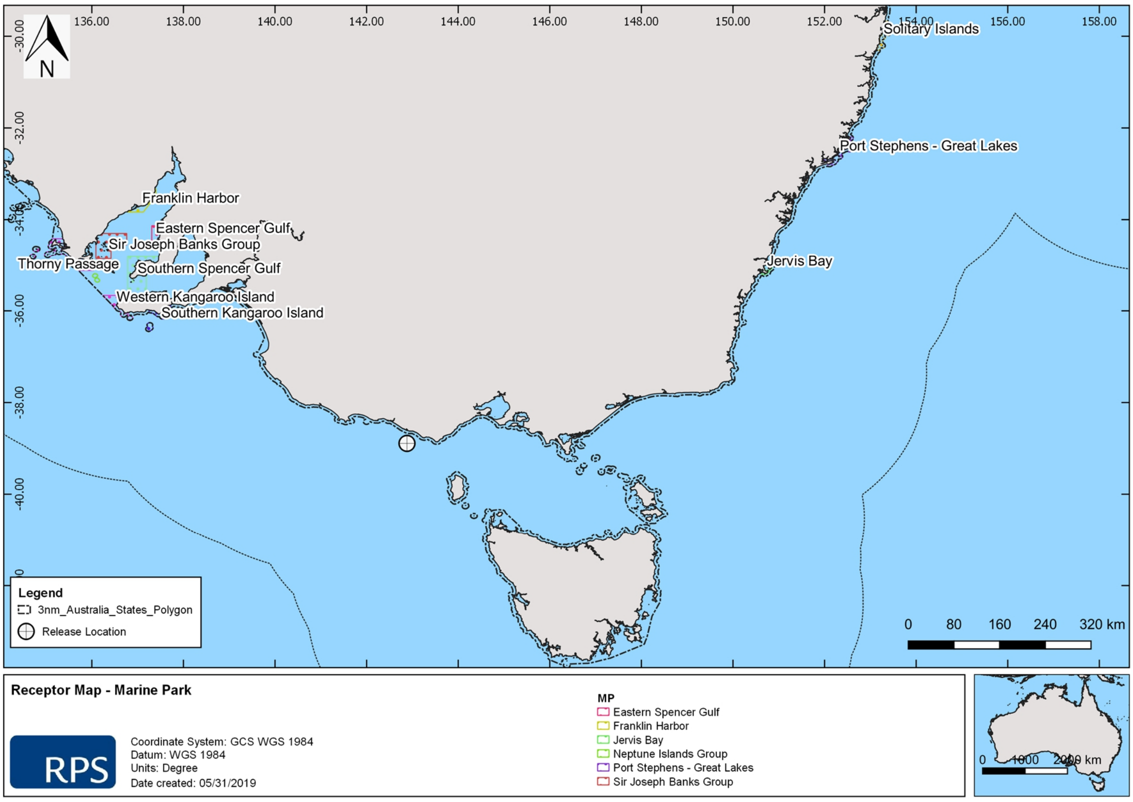

Figure 22 Receptor map for Marine Parks.

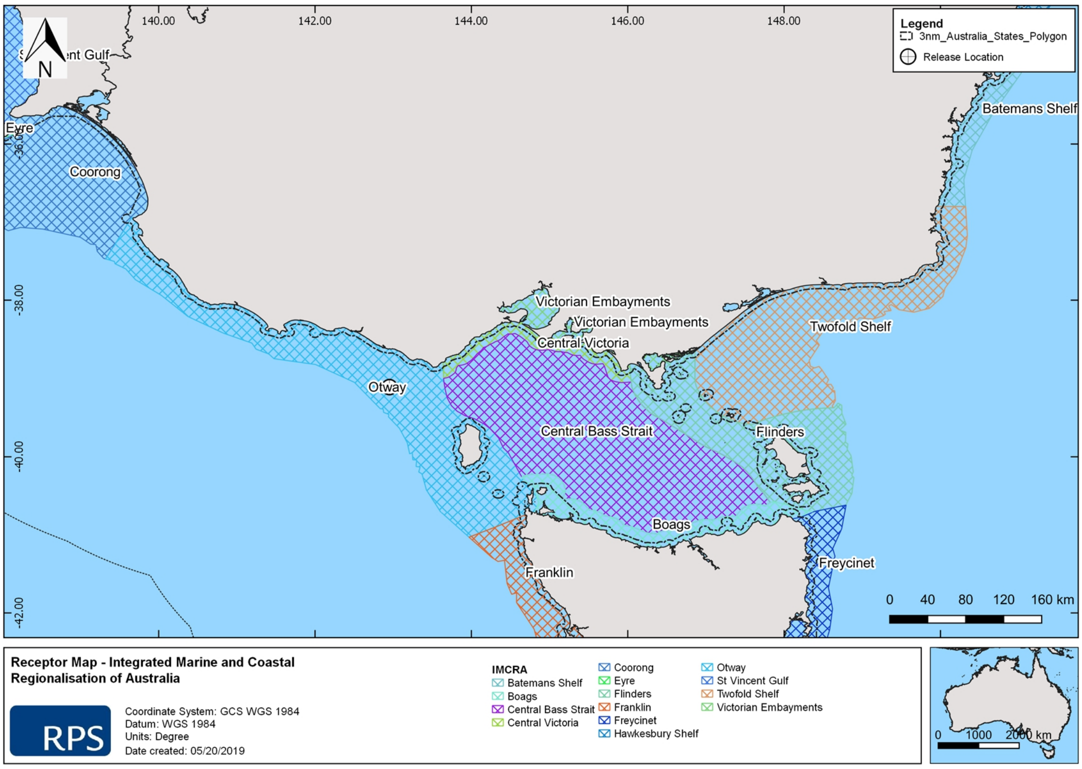

Figure 23 Receptor map illustrating the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) receptors.

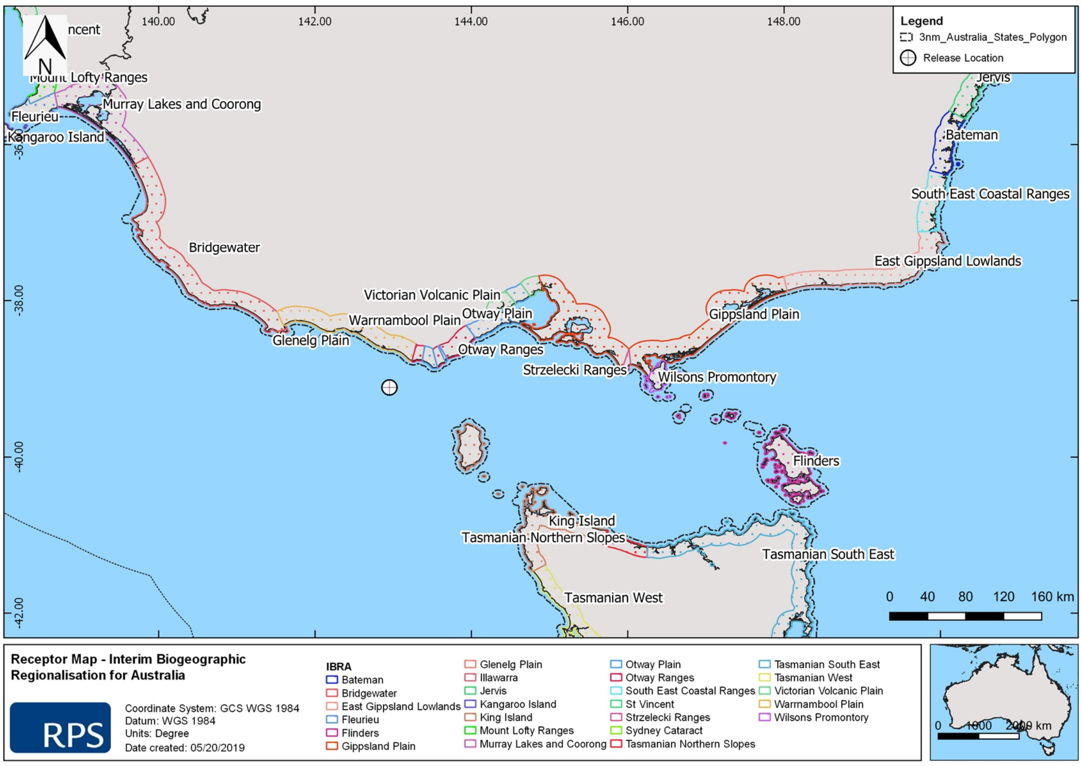

Figure 24 Map illustrating the Interim Biogeographic Regionalisation of Australia (IBRA) receptors.

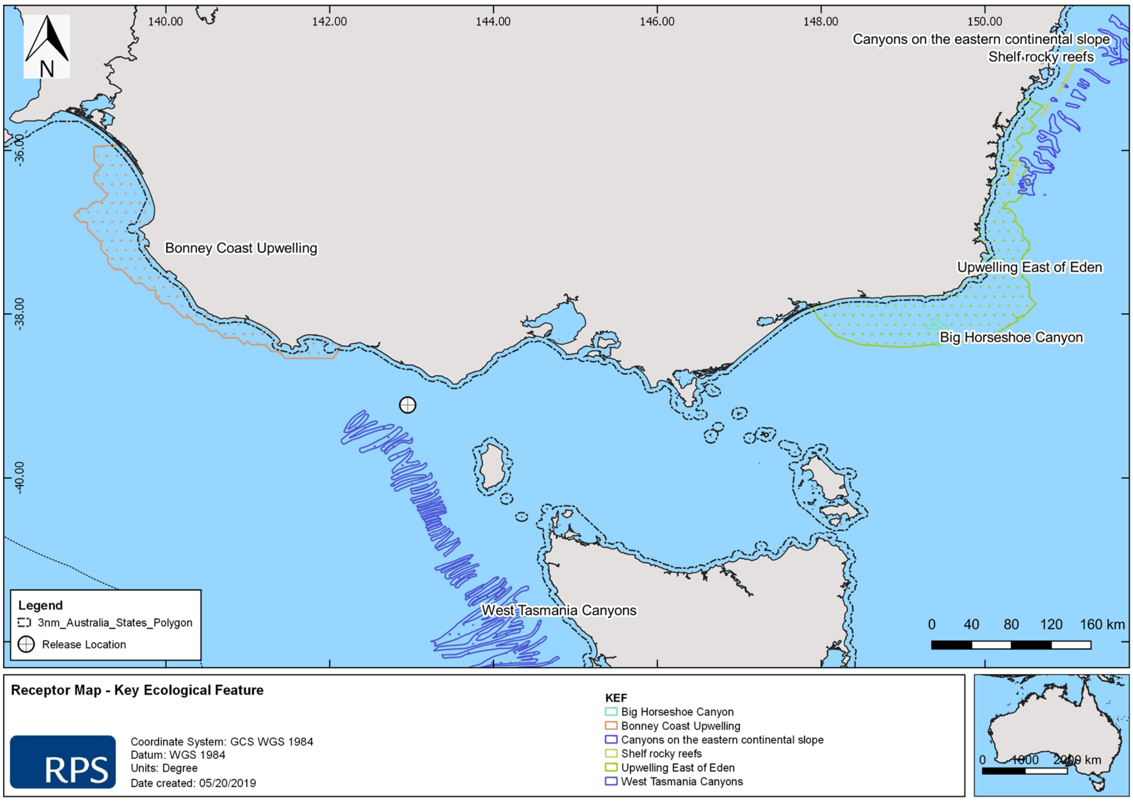

Figure 25 Receptor map of Key Ecological Features (KEF)

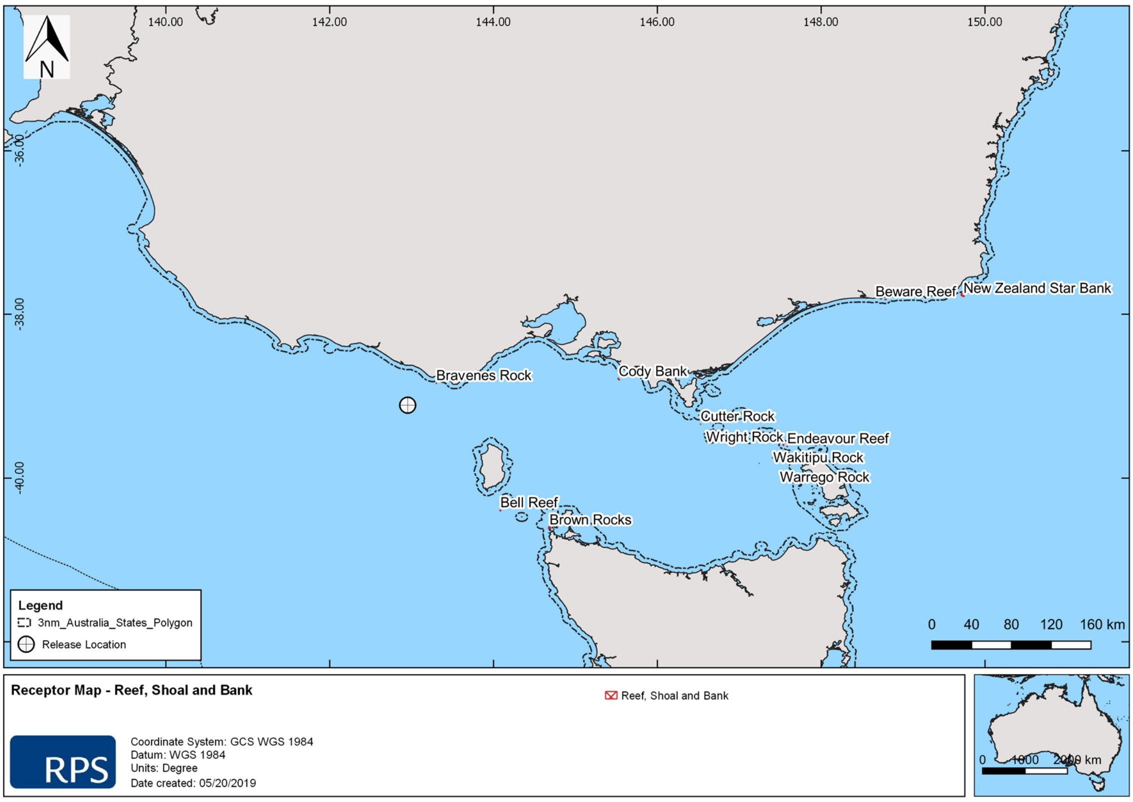

Figure 26 Receptor map of Reefs, Shoals and Banks (RSB)

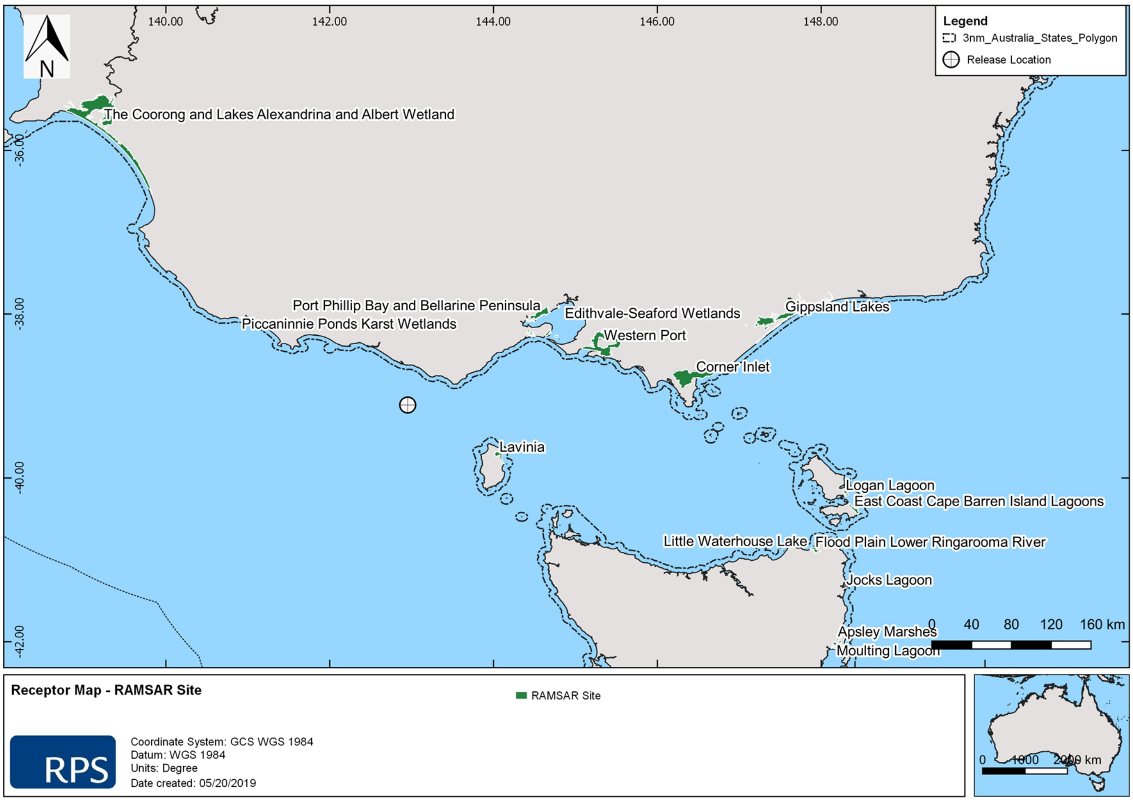

Figure 27 Receptor map of RAMSAR sites

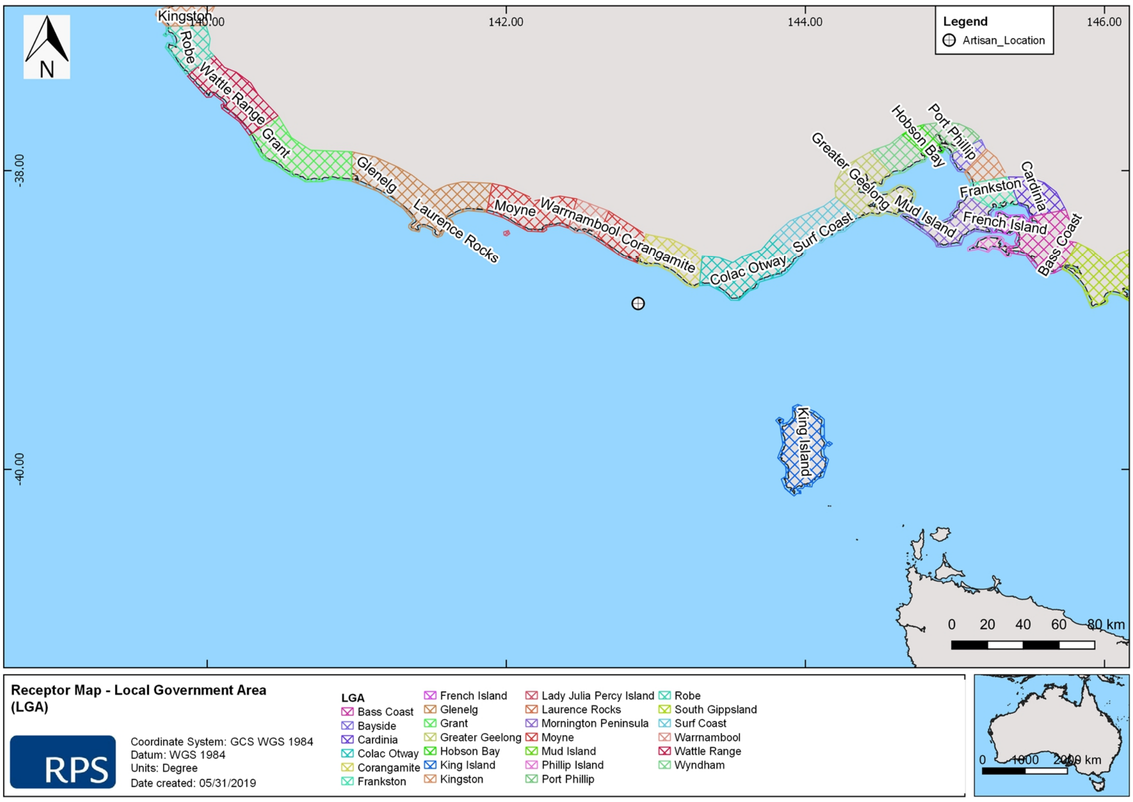

Figure 28 Receptor map of Local Government Areas (LGA) (1/3)

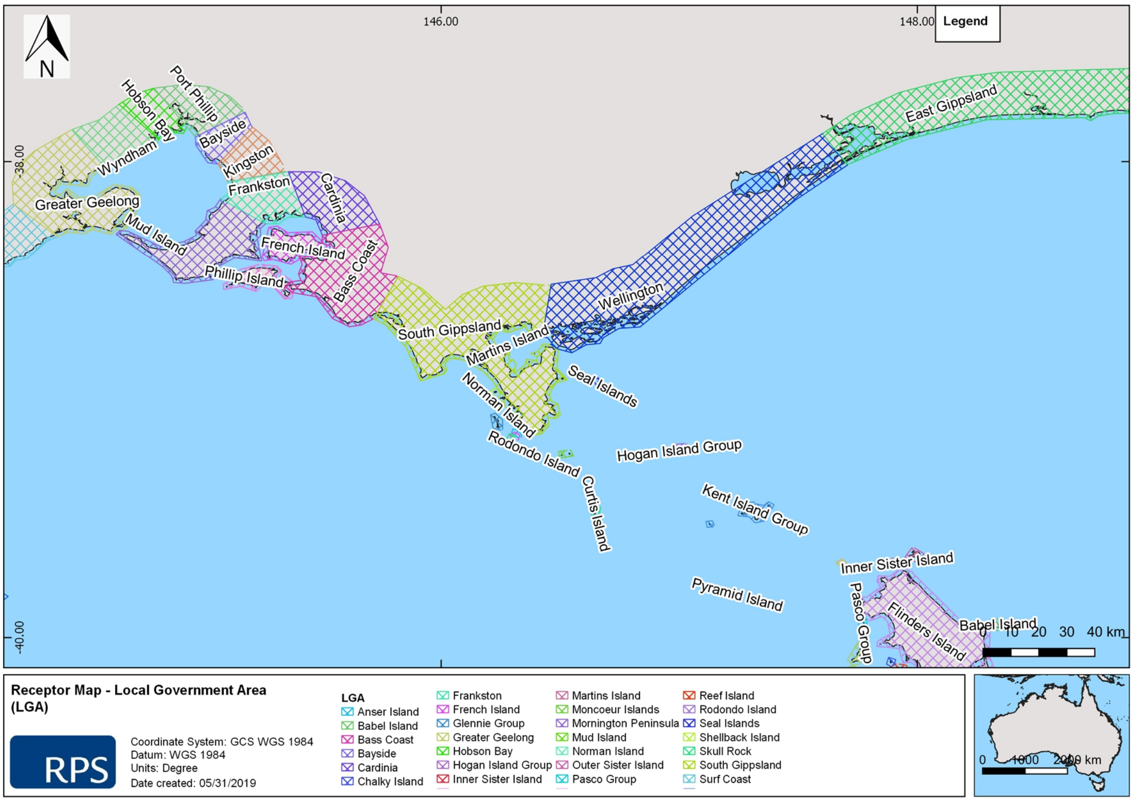

Figure 29 Receptor map of Local Government Areas (LGA) (2/3)

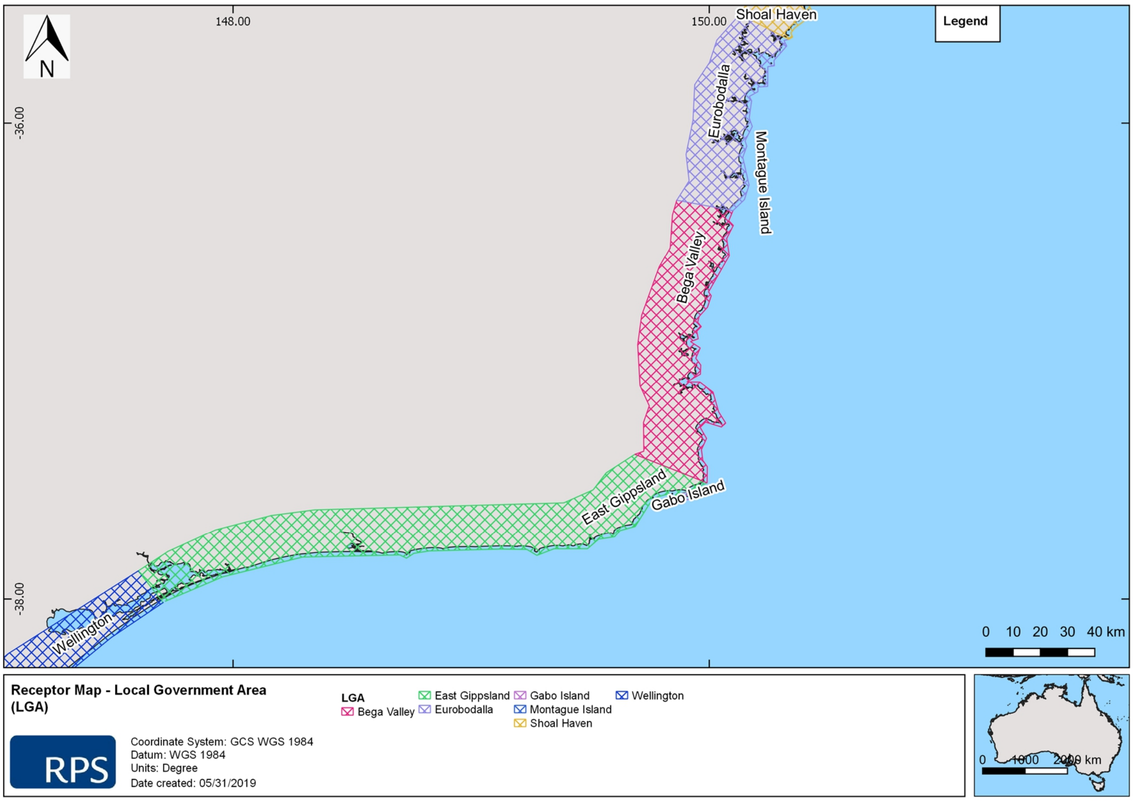

Figure 30 Receptor map of Local Government Areas (LGA) (3/3)

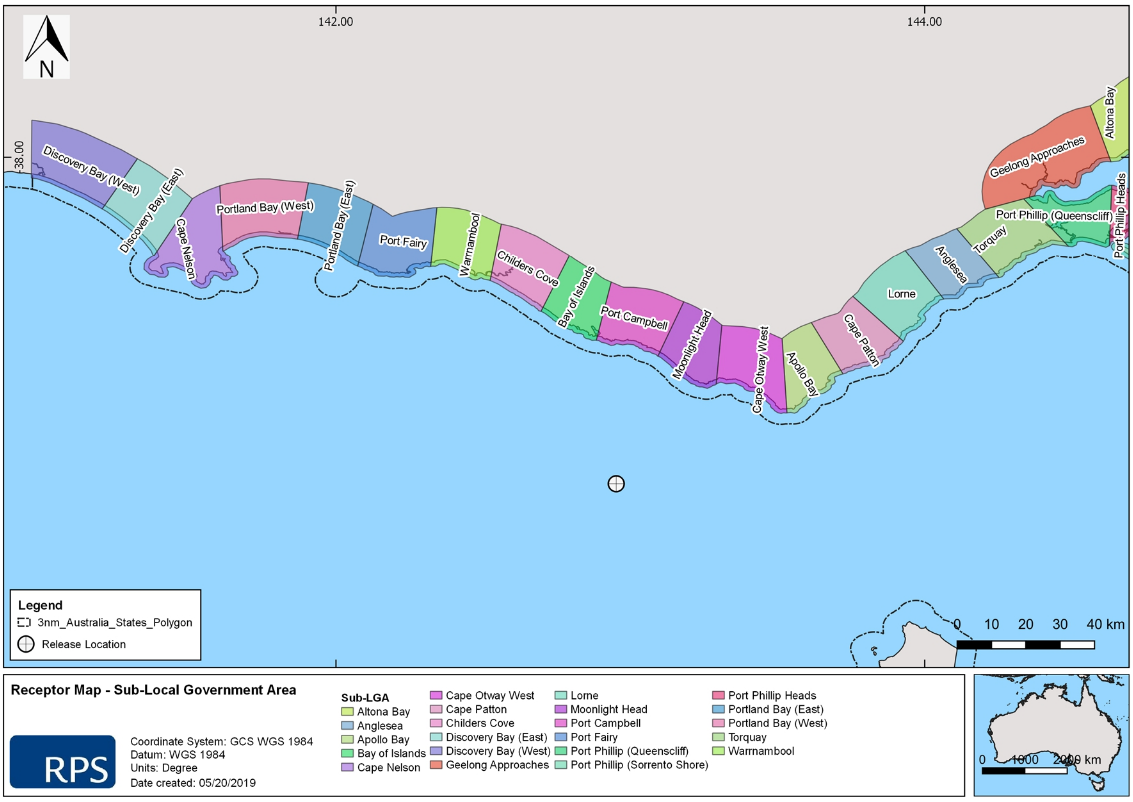

Figure 31 Receptor map of Sub-Local Government Areas (Sub-LGA) (1/3)

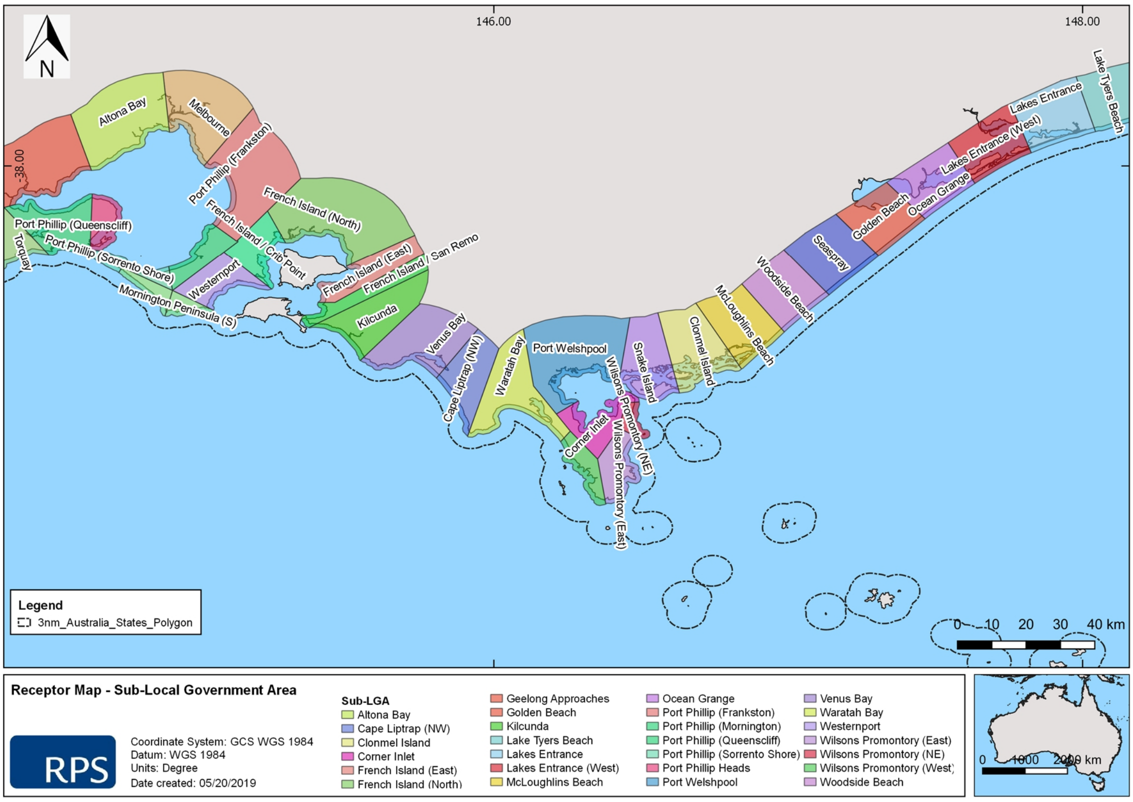

Figure 32 Receptor map of Sub-Local Government Areas (Sub-LGA) (2/3)

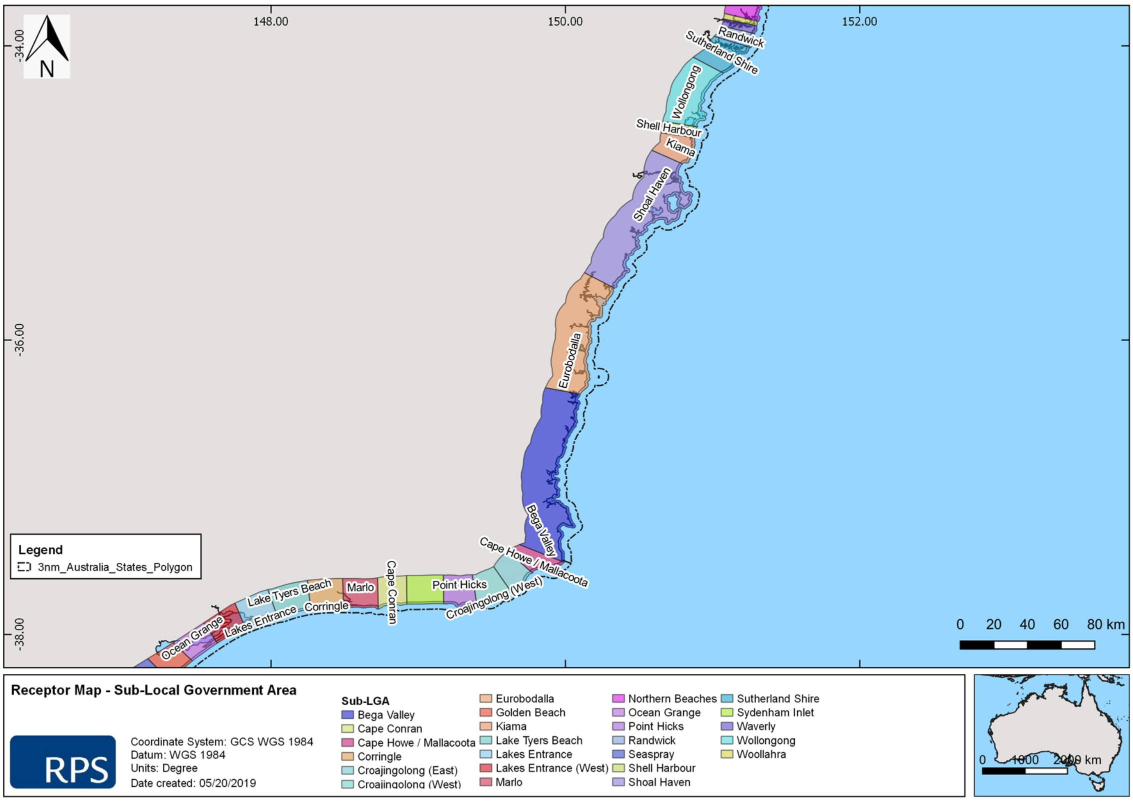

Figure 33 Receptor map of Sub-Local Government Areas (Sub-LGA) (3/3)

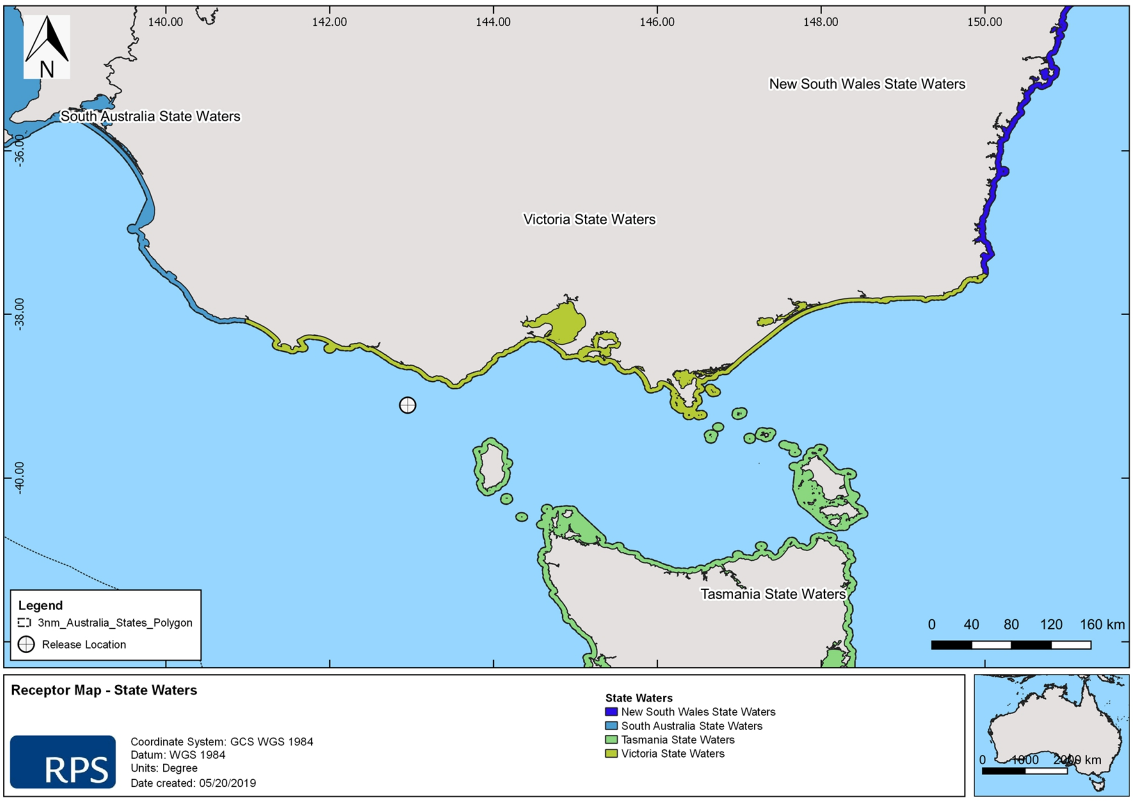

Figure 34 Receptor map of state waters.

RPS

9 RESULTS: 300 M^3 SURFACE RELEASE OF MARINE DIESEL OIL

The scenario examined a 300 m^3 release of MDO over 6 hours (tracked for 30 days) to represent a containment loss from a vessel at the Artisan-1 well location. A total of 100 spill trajectories were simulated for each of the seasons assessed, summer and winter.

Section 9.1 presents stochastic results in tabulated format.

Note, no shoreline contact was predicted for any of the seasons modelled above the minimum threshold.

9.1 Stochastic Analysis

9.1.1 Sea Surface Exposure

Table 13 presents a summary of the maximum distances and directions travelled by oil on the sea surface at the low (0.5-10 g/m^2), moderate (10-25 g/m^2) and high (>25 g/m^2) exposure thresholds for the two seasons. During summer conditions, low and moderate exposure was predicted up to 68 km and 12 km from the release location, respectively. Under winter conditions, low and moderate exposure was predicted up to 93 km and 10 km from the release location, respectively.

Table 14 presents the potential sea surface exposure to individual receptors predicted during summer and winter conditions. The modelling results demonstrated a 1% probability of oil exposure on the sea surface for the Central Victoria IMCRA receptor during the summer conditions. Stochastic results obtained during winter conditions exhibited a 1% probability of oil exposure on the sea surface for several receptors including the Central Victoria and Central Bass Strait IMCRA receptors, Apollo AMP and within Victorian State Waters.

None of the receptors were exposed at or above the moderate or high thresholds, with the exception of Otway IMCRA. Th Otway IMCRA receptor recorded low, moderate and high exposure due to the release location being situated within the boundaries of this receptor.

Table 13 Maximum distance and direction travelled on the sea surface by a single spill trajectory from the release location to the specified oil exposure thresholds.

Season	Distance and direction	Zones of potential sea surface exposure		
		Low	Moderate	High
Summer	Max. distance from release location (km)	68	12	6
	Max distance from release location (km) (99th percentile)	35	11	6
	Direction	E	NNE	E
Winter	Max. distance from release location (km)	93	10	6
	Max distance from release location (km) (99th percentile)	56	10	6
	Direction	E	WNW	ENE

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Table 14 Summary of the potential sea surface exposure to individual receptors

Season	Receptor		Probability of oil exposure on the sea surface (%) for each threshold: Low	Moderate	High	Minimum time before oil exposure on the sea surface (hours) for each threshold: Low	Moderate	High
Summer	IMCRA	Otway	100	98	48	1	1	1
		Central Victoria	1	-	-	89	-	-
Winter	IMCRA	Otway	100	98	41	1	1	1
		Central Victoria	1	-	-	133	-	-
		Central Bass Strait	1	-	-	71	-	-
	AMP	Apollo	1	-	-	35	-	-
	State Waters	Victoria State Waters	1	-	-	133	-	-

9.1.2 Water Column Exposure

9.1.2.1 Dissolved Hydrocarbons

Table 15 and Table 16 summarise the probability and maximum dissolved hydrocarbon exposure (for 1 hour and 48-hour exposure windows) to individual receptors in the 0–10 m depth layer, during summer and winter conditions.

The averaged dissolved hydrocarbon concentrations over 48 hours was highest within the Otway IMCRA receptor which registered 8 ppb and 9 ppb during summer and winter conditions, respectively. A 1% probability of exposure. No other receptors were exposed at or above the specified thresholds.

Based on the 1 hour exposure window, the Otway IMCRA receptor recorded the greatest dissolved hydrocarbon concentration of 76 ppb during summer and 59 ppb during winter. The Otway IMCRA receptor recorded a probability of 2% and 3% during the summer and winter conditions, respectively, based on the moderate threshold. There was no predicted exposure to other receptors at the moderate or high thresholds.

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Table 15 Predicted probability and maximum dissolved hydrocarbon exposure (for 1 hour and 48-hour exposure windows) to individual receptors in the 0–10 m depth layer, during summer conditions.

SUMMER Receptor		Maximum dissolved hydrocarbon exposure (ppb) for 48 hour window	Probability of time-averaged dissolved hydrocarbon exposure for 48 hour window			Maximum dissolved hydrocarbon exposure (ppb) for 1 hour window	Probability of instantaneous dissolved hydrocarbon exposure for 1 hour window		
			Low	Moderate	High		Low	Moderate	High
LGA	Colac Otway	1	-	-	-	6	1	-	-
SUB-LGA	Apollo Bay	1	-	-	-	6	1	-	-
IMCRA	Otway	8	1	-	-	76	47	2	-
	Central Victoria	1	-	-	-	21	2	-	-
	Central Bass Strait	1	-	-	-	20	1	-	-
IBRA	Otway Ranges	1	-	-	-	6	1	-	-
	Otway Plain	1	-	-	-	5	-	-	-
AMP	Apollo	1	-	-	-	22	3	-	-
State Waters	Victoria State Waters	1	-	-	-	17	2	-	-

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Table 16 Predicted probability and maximum dissolved hydrocarbon exposure (for 1 hour and 48-hour exposure windows) to individual receptors in the 0–10 m depth layer, during winter conditions.

WINTER Receptor		Maximum dissolved hydrocarbon exposure (ppb) for 48 hour window	Probability of time-averaged dissolved hydrocarbon exposure*			Maximum dissolved hydrocarbon exposure (ppb) for 1 hour window	Probability of instantaneous dissolved hydrocarbon exposure for 1 hour window		
			Low	Moderate	High		Low	Moderat e	High
LGA	Colac Otway	1	-	-	-	8	1	-	-
SUB-LGA	Cape Otway West	1	-	-	-	8	1	-	-
IMCRA	Otway	9	2	-	-	59	70	3	-
	Central Victoria	2	-	-	-	19	3	-	-
	Central Bass Strait	1	-	-	-	17	2	-	-
IBRA	Otway Ranges	1	-	-	-	5	-	-	-
	Otway Plain	1	-	-	-	8	1	-	-
AMP	Apollo	2	-	-	-	24	5	-	-
State Waters	Victoria State Waters	1	-	-	-	13	2	-	-

9.1.2.2 Entrained Hydrocarbons

Table 17 and Table 18 summarise the probability and maximum entrained hydrocarbon exposure for 1 hour and 48-hour exposure windows) to individual receptors in the 0–10 m depth layer, during summer and winter conditions.

The maximum entrained hydrocarbon concentrations over 48 hour exposure window during summer and winter conditions was 2,182 ppb and 792 ppb, respectively. None of the receptors with the exception of the Otway IMCRA receptor were exposed at or above the moderate (100-1,000 ppb) or high (>1,000 ppb) thresholds during summer or winter conditions.

Based on the 1 hour exposure window, the maximum entrained hydrocarbon concentrations predicted for the Otway IMCRA receptor during summer and winter conditions was 5,933 ppb and 5,046 ppb, respectively. The probability of exposure at or above the moderate (100-1,000 ppb) threshold to receptors other than IMCRA Otway (83% summer and 93% winter) ranged from 1% (Cape Patton sub-LGA) to 8% (Victorian State Waters) during summer conditions and 1% (Twelve Apostles MNP) to 16% (Apollo AMP) during winter conditions. None of the receptors was exposed at or above the high threshold (1,000 ppb), with the exception of IMCRA – Otway.

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Table 17 Predicted probability and maximum entrained hydrocarbon exposure (for 1 hour and 48-hour exposure windows) to individual receptors in the 0–10 m depth layer during summer conditions.

SUMMER Receptor		Maximum time-entrained hydrocarbon exposure (ppb) for 48 hour window	Probability of entrained hydrocarbon exposure for 48 hour window			Maximum entrained hydrocarbon exposure (ppb) for 1 hour window	Probability of entrained hydrocarbon exposure for 1 hour window		
			Low	Moderate	High		Low	Moderate	High
AMP	Apollo	166	-	-	-	406	25	7	-
IBRA	Glenelg Plain	58	-	-	-	33	9	-	-
	Bridgewater	58	-	-	-	31	5	-	-
	Warrnambool Plain	317	-	-	-	228	25	4	-
	Otway Ranges	254	-	-	-	218	25	2	-
	Otway Plain	284	-	-	-	208	28	3	-
	Gippsland Plain	39	-	-	-	21	1	-	-
	Wilsons Promontory	21	-	-	-	12	1	-	-
IMCRA	Otway	2,182	1	-	-	5,933	97	83	39
	Victorian Embayments	14	-	-	-	11	1	-	-
	Central Victoria	178	-	-	-	399	22	5	-
	Central Bass Strait	172	-	-	-	334	13	2	-
	Flinders	22	-	-	-	13	1	-	-
KEF	Bonney Coast Upwelling	125	-	-	-	98	22	-	-
MNP	Discovery Bay	48	-	-	-	25	3	-	-
	Twelve Apostles	372	-	-	-	278	26	6	-
NP	Lower South East	24	-	-	-	22	2	-	-
	Bunurong Marine Park	24	-	-	-	14	1	-	-
	Wilsons Promontory Marine Park	21	-	-	-	12	1	-	-
LGA	Phillip Island	20	-	-	-	19	1	-	-
	Norman Island	21	-	-	-	12	1	-	-

	Shellback Island	20	-	-	-	11	1	-	-
	Glenelg	58	-	-	-	33	9	-	-
	Warrnambool	46	-	-	-	24	8	-	-
	Moyne	172	-	-	-	96	17	-	-
	Corangamite	317	-	-	-	218	26	4	-
	Colac Otway	284	-	-	-	208	28	3	-
	Surf Coast	69	-	-	-	48	5	-	-
	Mornington Peninsula	19	-	-	-	11	1	-	-
	Bass Coast	40	-	-	-	21	1	-	-
	South Gippsland	22	-	-	-	12	1	-	-
	Grant	26	-	-	-	20	1	-	-
	Lady Julia Percy Island	73	-	-	-	43	5	-	-
	Laurence Rocks	41	-	-	-	26	7	-	-
State Waters	South Australia State Waters	31	-	-	-	26	2	-	-
	Victoria State Waters	372	-	-	-	388	30	8	-
SUB-LGA	Wilsons Promontory (West)	22	-	-	-	12	1	-	-
	Venus Bay	21	-	-	-	13	1	-	-
	Kilcunda	40	-	-	-	21	1	-	-
	French Island / San Remo	14	-	-	-	10	1	-	-
	Mornington Peninsula (SW)	18	-	-	-	10	1	-	-
	Port Phillip (Sorrento Shore)	18	-	-	-	11	1	-	-
	Anglesea	21	-	-	-	13	3	-	-
	Lorne	78	-	-	-	49	5	-	-
	Cape Patton	156	-	-	-	132	14	1	-
	Apollo Bay	168	-	-	-	208	21	3	-
	Cape Otway West	284	-	-	-	197	28	2	-
	Moonlight Head	317	-	-	-	218	26	4	-
	Port Campbell	220	-	-	-	157	18	2	-

Bay of Islands	172	-	-	-	96	17	-	-
Childers Cove	62	-	-	-	43	10	-	-
Warrnambool	27	-	-	-	23	7	-	-
Port Fairy	56	-	-	-	36	2	-	-
Portland Bay (East)	31	-	-	-	21	2	-	-
Portland Bay (West)	38	-	-	-	21	1	-	-
Cape Nelson	58	-	-	-	31	9	-	-
Discovery Bay (East)	46	-	-	-	24	2	-	-
Discovery Bay (West)	24	-	-	-	16	2	-	-

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Table 18 Predicted probability and maximum entrained hydrocarbon exposure (for 1 hour and 48-hour exposure windows) to individual receptors in the 0–10 m depth layer during winter conditions.

WINTER Receptor		Maximum time-entrained hydrocarbon exposure (ppb) for 48 hour window	Probability of entrained hydrocarbon exposure for 48 hour window			Maximum entrained hydrocarbon exposure (ppb) for 1 hour window	Probability of entrained hydrocarbon exposure for 1 hour window		
			Low	Moderate	High		Low	Moderate	High
AMP	Apollo	99	-	-	-	501	54	16	-
	Beagle	6	-	-	-	11	2	-	-
IBRA	Flinders	5	-	-	-	10	1	-	-
	Warrnambool Plain	54	-	-	-	98	17	-	-
	Otway Ranges	169	-	-	-	196	21	4	-
	Otway Plain	298	-	-	-	448	27	6	-
	Gippsland Plain	20	-	-	-	23	8	-	-
	Strzelecki Ranges	12	-	-	-	13	1	-	-
	Wilsons Promontory	19	-	-	-	21	3	-	-
IMCRA	Twofold Shelf	5	-	-	-	10	1	-	-
	Otway	792	2	-	-	5,046	99	93	58
	Victorian Embayments	18	-	-	-	20	3	-	-
	Central Victoria	137	-	-	-	446	54	14	-
	Central Bass Strait	69	-	-	-	386	51	13	-
	Flinders	19	-	-	-	22	4	-	-
KEF	West Tasmania Canyons	12	-	-	-	14	1	-	-
	Bonney Coast Upwelling	13	-	-	-	15	1	-	-
MNP	Bunurong	10	-	-	-	12	1	-	-
	Point Addis	16	-	-	-	17	2	-	-
	Port Phillip Heads	15	-	-	-	19	4	-	-

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	Twelve Apostles	129	-	-	-	283	15	1	-
	Wilsons Promontory	14	-	-	-	16	3	-	-
NP	Wilsons Promontory Marine Park	17	-	-	-	20	2	-	-
RAMSAR	Port Phillip Bay and Bellarine Peninsula	7	-	-	-	10	1	-	-
LGA	Phillip Island	19	-	-	-	22	3	-	-
	Hogan Island Group	5	-	-	-	10	1	-	-
	Glennie Group	14	-	-	-	15	3	-	-
	Norman Island	19	-	-	-	20	3	-	-
	Shellback Island	17	-	-	-	21	2	-	-
	Anser Island	11	-	-	-	12	2	-	-
	Kanowna Island	10	-	-	-	12	2	-	-
	Skull Rock	10	-	-	-	12	2	-	-
	Warrnambool	8	-	-	-	10	1	-	-
	Moyne	49	-	-	-	71	6	-	-
	Corangamite	44	-	-	-	98	18	-	-
	Colac Otway	298	-	-	-	448	27	6	-
	Surf Coast	21	-	-	-	23	3	-	-
	Greater Geelong	20	-	-	-	22	3	-	-
	Mornington Peninsula	20	-	-	-	23	8	-	-
	South Gippsland	18	-	-	-	21	2	-	-
	Lady Julia Percy Island	8	-	-	-	11	1	-	-
State Waters	Tasmania State Waters	6	-	-	-	11	2	-	-
	Victoria State Waters	298	-	-	-	548	40	9	-
SUB-LGA	Wilsons Promontory (West)	18	-	-	-	21	2	-	-
	Waratah Bay	12	-	-	-	13	1	-	-
	Cape Liptrap (NW)	13	-	-	-	15	1	-	-

Westernport	11	-	-	-	14	2	-	-
Mornington Peninsula (S)	14	-	-	-	16	8	-	-
Mornington Peninsula (SW)	20	-	-	-	23	8	-	-
Port Phillip (Sorrento Shore)	20	-	-	-	22	4	-	-
Port Phillip Heads	10	-	-	-	13	3	-	-
Port Phillip (Queenscliff)	11	-	-	-	15	3	-	-
Torquay	20	-	-	-	22	2	-	-
Anglesea	12	-	-	-	14	2	-	-
Lorne	16	-	-	-	18	3	-	-
Cape Patton	68	-	-	-	95	7	-	-
Apollo Bay	70	-	-	-	84	27	-	-
Cape Otway West	298	-	-	-	448	27	6	-
Moonlight Head	44	-	-	-	98	18	-	-
Port Campbell	43	-	-	-	65	7	-	-
Bay of Islands	49	-	-	-	71	6	-	-
Childers Cove	31	-	-	-	41	1	-	-

*Concentration recorded over a 48-hour window.
^Instantaneous concentration recorded over one hour.

10 RESULTS: 222,224 BBL SUBSEA RELEASE OF CONDENSATE

The scenario examined a 222,224 bbl subsea release of Thylacine condensate over 86 days (tracked for 114 days) to represent an unrestricted open-hole loss of well control from Artisan-1 well location. A total of 100 spill trajectories were simulated for each of the seasons assessed, summer and winter.

Section 10.1 presents stochastic results for sea surface, shoreline and in-water exposure in tabulated format.

10.1 Stochastic Analysis

10.1.1 Sea Surface Exposure and Shoreline Contact

Table 19 presents a summary of the maximum distance and direction travelled by condensate on the sea surface at the low (0.5-10 g/m^2), moderate (10-25 g/m^2) and high (>25 g/m^2) exposure thresholds for each of the two seasons considered, summer and winter. During summer conditions, low and moderate exposure of surface hydrocarbons were predicted up to 52 km and 4 km from the release location, respectively, while during winter, low and moderate exposure surface hydrocarbons extended to a maximum distance of 53 km and 3 km from the release location, respectively. Note, no high exposure from surface hydrocarbons was predicted for any of the seasons assessed.

Table 20 presents the potential sea surface exposure to individual receptors predicted during summer and winter conditions. The probability of hydrocarbon exposure on the sea surface at or above the low threshold was predicted to range from 6% (Otway Ranges IBRA) to 16% (Colac Otway LGA, Cape Otway West sub-LGA and Victorian State Waters) during summer conditions, with the exception of Otway IMCRA receptor (100%). The winter stochastic modelling results demonstrated a larger number of receptors potentially exposed to surface hydrocarbons at or above low levels with a probability of exposure predicted to range from 3% (Twelve Apostles MNP and Otway Ranges IBRA) to 40% (Otway Plain IBRA, Cape Otway West sub-LGA and Colac Otway LGA), with the exception of Otway IMCRA (100%) and within Victorian State Waters (57%). None of the receptors other than the Otway IMCRA were exposed at or above the moderate or high thresholds for any seasons assessed.

Table 21 presents a summary of potential hydrocarbon contact to any shorelines for summer and winter conditions while Table 22 summarises potential shoreline contact to individual receptors, for each season.

The probability of contact to any shoreline was 16% and 57% for the summer and winter season, respectively, while the minimum time for visible surface hydrocarbon to reach a shoreline was 3 days for 5 days, respectively. The maximum volume of hydrocarbons predicted to come ashore was 15 m^3 and 33 m^3, during summer and winter conditions, respectively, while the maximum length of shoreline contacted above the low threshold (>10 g/m^2) was 7.0 km and 11.0 km, respectively. Note, no shoreline loading above 1,000 g/m^2 was predicted.

The Otway IMCRA shoreline was the only receptor to record of contact above 100 g/m^2 with a probability of 3% during summer and 2% during winter conditions. The modelling results during winter conditions demonstrated additional shoreline contact to Moyne, Corangamite, Moonlight head and Childers Cove.

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Table 19 Maximum distance and direction travelled on the sea surface by a single spill trajectory from the release location to the specified oil exposure thresholds.

Season	Distance and direction	Zones of potential sea surface exposure		
		Low	Moderate	High
Summer	Max. distance from release site (km)	52	4	NA
	Max distance from release site (km) (99th percentile)	34	4	NA
	Direction	E	E	NA
Winter	Max. distance from release site (km)	53	3	NA
	Max distance from release site (km) (99th percentile)	49	3	NA
	Direction	NNW	W	NA

Table 20 Summary of the potential sea surface exposure to individual receptors

			Probability of oil exposure on the sea surface (%)			Minimum time before oil exposure on the sea surface (hours)		
Season	Receptor		Low	Moderate	High	Low	Moderate	High
Summer	LGA	Colac Otway	16	-	-	80	-	-
	SUB-LGA	Cape Otway West	16	-	-	80	-	-
	IMCRA	Otway	100	100	-	1	3	-
	IBRA	Otway Ranges	6	-	-	1,343	-	-
		Otway Plain	12	-	-	80	-	-
	State Waters	Victoria State Waters	16	-	-	80	-	-
Winter	LGA	Moyne	8	-	-	649	-	-
		Corangamite	14	-	-	311	-	-
		Colac Otway	40	-	-	188	-	-
	SUB-LGA	Cape Otway West	40	-	-	188	-	-
		Moonlight Head	14	-	-	311	-	-
		Childers Cove	8	-	-	649	-	-
	IMCRA	Otway	100	100	-	1	2	-
	IBRA	Warrnambool Plain	22	-	-	311	-	-
		Otway Ranges	3	-	-	413	-	-
		Otway Plain	40	-	-	188	-	-
	MNP	Twelve Apostles	3	-	-	821	-	-
	State Waters	Victoria State Waters	57	-	-	188	-	-

RPS

Table 21 Summary of potential oil contact to any shoreline for each season assessed

Shoreline statistics	Summer	Winter
Probability of contact to any shoreline (%)	16	57
Minimum time for visible oil to reach a shoreline (days)	3	5
Maximum volume of hydrocarbons ashore (m^3)	15	33
Average volume of hydrocarbons ashore (m^3)	1	5
Maximum length of the shoreline >10 g/m^2 (km)	7.0	11.0
Average shoreline length (km) >10 g/m^2 (km)	4.7	5.6
Maximum length of the shoreline >100 g/m^2 (km)	4.0	8.0
Average shoreline length (km) >100 g/m^2 (km)	2.4	3.5
Maximum length of the shoreline >1,000 g/m^2 (km)	-	-
Average shoreline length (km) > 1,000 g/m^2 (km)	-	-

RPS

Table 22 Summary of the potential shoreline contact to individual receptors for each season assessed

		Probability of shoreline loading (%)			Minimum time before shoreline accumulation (hours)			Load on shoreline (g/m²)		Volume on shoreline (m³)		Mean length of shoreline contacted (km)			Maximum length of shoreline contacted (km)		
Season	**Receptor**	**>10 g/m²**	**>100 g/m²**	**>1,000 g/m²**	**>10 g/m²**	**>100 g/m²**	**>1,000 g/m²**	**Mean**	**Peak**	**Mean**	**Peak**	**>10 g/m²**	**>100 g/m²**	**>1,000 g/m²**	**>10 g/m²**	**>100 g/m²**	**>1,000 g/m²**
Summer	Colac Otway	16	15	-	77	277	-	136	520	1	15	5	2	-	7	4	-
Summer	Cape Otway West	16	15	-	77	277	-	136	520	1	15	5	2	-	7	4	-
Winter	Moyne	8	8	-	26	27	-	88	130	<1	5	4	2	-	5	2	-
Winter	Corangamite	14	10	-	635	654	-	241	984	2	23	4	3	-	5	3	-
Winter	Colac Otway	40	40	-	125	247	-	194	670	5	33	6	4	-	11	8	-
Winter	Cape Otway West	40	40	-	109	174	-	194	670	5	33	6	4	-	11	8	-
Winter	Moonlight Head	14	10	-	109	174	-	241	984	2	23	4	3	-	5	3	-
Winter	Childers Cove	8	8	-	125	247	-	88	130	<1	5	4	2	-	5	2	-

RPS

10.1.2 Water Column Exposure

10.1.2.1 Dissolved Hydrocarbons

Table 23 and Table 24 summarise the probability and maximum dissolved hydrocarbon exposure (for 1 hour and 48-hour exposure windows) to individual receptors in the 0–10 m depth layer, during summer and winter conditions.

For the 48 hour time-averaged exposure window, dissolved hydrocarbons remained below 30 ppb in summer and 34 ppb in winter conditions, and hence no moderate or high exposure was predicted under the seasonal conditions modelled. During summer conditions, the probability of low exposure ranged from 1% (Bonney Coast Upwelling KEF, Moyne LGA, Bay of Islands and Childers Cove sub-LGAs) to 17% (Otway Plain IBRA, Colac Otway LGA, Cape Otway West sub-LGA and within Victoria State Waters)The Otway IMCRA recorded a probability of 50% during summer. During winter conditions, the probability of low exposure to dissolved hydrocarbons over 48 hours ranged from 1% (Bonney Coast Upwelling KEF, Bay of Islands and Lorne sub-LGA) to 16% (within Victoria State Waters). The Otway IMCRA registered a probability of 42% for winter. None of the receptors were exposed to moderate (50 – 400 ppb) or high (>400 ppb) dissolved hydrocarbons (over a 48 hour basis) during the summer or winter season.

The analysis for the dissolved hydrocarbons over a 1 hour window showed that the maximum exposure was 309 ppb during summer and 289 ppb during winter, which was predicted within the Otway IMCRA and Victorian State Waters. During summer conditions, the probability of moderate exposure to dissolved hydrocarbons ranged from 1% (Glenelg Plain and Bridgewater IBRA's; Glenelg, Moyne and Surf Coast LGAs; Lorne, Bay of Islands, Childers Cove and Cape Nelson sub-LGAs) to 43% (Otway Plain IBRA, Colac Otway LGA, Cape Otway West sub-LGA and within Victoria State Waters). The probability for Otway IMCRA was 58%. Under winter conditions, the probability of moderate exposure (over 1 hour) to dissolved hydrocarbons ranged from 1% (Gippsland Plain IBRA; Flinders IMCRA; Point Addis and Wilsons Promontory MNP; Mornington Peninsula LGA; Lorne, Mornington Peninsula and Childers Cove sub-LGAs) to 57% for the Victorian State Waters. The probability of exposure to the Otway IMCRA was 68%. None of the receptors were exposed high concentrations during the summer or winter season.

RPS

Table 23 Predicted probability and maximum dissolved hydrocarbon exposure (for 1 hour and 48-hour exposure windows) to individual receptors in the 0–10 m depth layer, during summer conditions.

SUMMER Receptor		Maximum dissolved hydrocarbon exposure (ppb) for 48 hour window	Probability of time-averaged dissolved hydrocarbon exposure for 48 hour window			Maximum dissolved hydrocarbon exposure (ppb) for 1 hour window	Probability of instantaneous dissolved hydrocarbon exposure for 1 hour window		
			Low	Moderate	High		Low	Moderate	High
AMP	Apollo	20	11	-	-	225	98	30	-
	Beagle	1	-	-	-	9	1	-	-
	Nelson	1	-	-	-	18	3	-	-
	Zeehan	1	-	-	-	19	4	-	-
IBRA	Glenelg Plain	6	-	-	-	53	25	1	-
	Bridgewater	4	-	-	-	54	20	1	-
	Warrnambool Plain	24	5	-	-	217	99	14	-
	Otway Ranges	13	7	-	-	161	100	27	-
	Otway Plain	23	17	-	-	235	98	43	-
	Gippsland Plain	3	-	-	-	28	11	-	-
	Wilsons Promontory	1	-	-	-	12	3	-	-
IMCRA	Coorong	0	-	-	-	12	1	-	-
	Otway	30	50	-	-	309	100	58	-
	Victorian Embayment	3	-	-	-	31	6	-	-
	Central Victoria	18	9	-	-	253	95	28	-
	Central Bass Strait	17	6	-	-	254	88	20	-
	Flinders	2	-	-	-	26	5	-	-
KEF	West Tasmania Canyons	2	-	-	-	34	8	-	-
	Bonney Coast Upwelling	10	1	-	-	97	60	2	-
MNP	Churchill Island	1	-	-	-	7	2	-	-
	Discovery Bay	3	-	-	-	41	15	-	-
	Point Addis	2	-	-	-	34	14	-	-
	Port Phillip Heads	2	-	-	-	21	7	-	-
	Twelve Apostles	27	6	-	-	217	98	20	-
	Wilsons Promontory	2	-	-	-	12	2	-	-

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MP	Lower South East	1	-	-	-	16	3	-	-
	Bunurong Marine Park	1	-	-	-	10	3	-	-
NP	Wilsons Promontory Marine Park	1	-	-	-	6	1	-	-
	Port Phillip Bay and Bellarine Peninsula	1	-	-	-	31	4	-	-
RAMSAR	Western Port	1	-	-	-	12	2	-	-
SHORE	Phillip Island	2	-	-	-	24	11	-	-
	Mud Island	1	-	-	-	12	2	-	-
	Moncoeur Islands	1	-	-	-	9	1	-	-
	Rodondo Island	1	-	-	-	11	2	-	-
	Glennie Group	1	-	-	-	12	3	-	-
	Norman Island	1	-	-	-	10	1	-	-
	Anser Island	1	-	-	-	6	1	-	-
	Kanowna Island	1	-	-	-	10	1	-	-
	Skull Rock	1	-	-	-	7	1	-	-
	Glenelg	6	-	-	-	54	25	1	-
	Warrnambool	5	-	-	-	46	25	-	-
	Moyne	7	1	-	-	66	74	1	-
	Corangamite	24	5	-	-	217	100	17	-
	Colac Otway	23	17	-	-	235	100	43	-
	Surf Coast	5	-	-	-	57	24	1	-
	Greater Geelong	2	-	-	-	31	8	-	-
	Mornington Peninsula	3	-	-	-	28	11	-	-
	Bass Coast	1	-	-	-	21	5	-	-
	South Gippsland	1	-	-	-	7	1	-	-
	Grant	1	-	-	-	19	3	-	-
	Lady Julia Percy Island	2	-	-	-	28	22	-	-
	Laurence Rocks	5	-	-	-	18	20	-	-
State Waters	South Australia State Waters	1	-	-	-	26	6	-	-
	Victoria State Waters	30	17	-	-	309	100	43	-
SUB-LGA	Wilsons Promontory (West)	1	-	-	-	6	1	-	-
	Cape Liptrap (NW)	1	-	-	-	7	1	-	-
	Venus Bay	1	-	-	-	10	3	-	-

Kilcunda	1	-	-	-	21	5	-	-
French Island / San Remo	1	-	-	-	14	4	-	-
French Island / Crib Point	1	-	-	-	6	1	-	-
Westernport	1	-	-	-	13	6	-	-
Mornington Peninsula (S)	1	-	-	-	14	7	-	-
Mornington Peninsula (SW)	2	-	-	-	24	11	-	-
Port Phillip (Sorrento Shore)	3	-	-	-	23	8	-	-
Port Phillip Heads	1	-	-	-	31	6	-	-
Port Phillip (Queenscliff)	2	-	-	-	23	7	-	-
Torquay	3	-	-	-	23	8	-	-
Anglesea	3	-	-	-	32	12	-	-
Lorne	5	-	-	-	57	24	1	-
Cape Patton	11	2	-	-	161	85	8	-
Apollo Bay	13	4	-	-	154	95	15	-
Cape Otway West	23	17	-	-	235	100	43	-
Moonlight Head	24	5	-	-	217	100	17	-
Port Campbell	12	3	-	-	103	77	6	-
Bay of Islands	7	1	-	-	66	74	1	-
Childers Cove	7	1	-	-	55	55	1	-
Warrnambool	3	-	-	-	36	16	-	-
Port Fairy	2	-	-	-	23	11	-	-
Portland Bay (East)	1	-	-	-	10	2	-	-
Cape Nelson	6	-	-	-	54	25	1	-
Discovery Bay (East)	1	-	-	-	11	2	-	-
Discovery Bay (West)	1	-	-	-	8	1	-	-

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Table 24 Predicted probability and maximum dissolved hydrocarbon exposure (for 1 hour and 48-hour exposure windows) to individual receptors in the 0–10 m depth layer, during winter conditions .

WINTER Receptor		Maximum dissolved hydrocarbon exposure (ppb) for 48 hour window	Probability of time-averaged dissolved hydrocarbon exposure for 48 hour window			Maximum dissolved hydrocarbon exposure (ppb) for 1 hour window	Probability of instantaneous dissolved hydrocarbon exposure for 1 hour window		
			Low	Moderate	High		Low	Moderate	High
AMP	Apollo	13	7	-	-	237	100	39	-
	Beagle	2	-	-	-	37	13	-	-
	Zeehan	1	-	-	-	16	3	-	-
IBRA	King Island	1	-	-	-	9	1	-	-
	Flinders	1	-	-	-	9	2	-	-
	Glenelg Plain	4	-	-	-	19	2	-	-
	Bridgewater	2	-	-	-	8	1	-	-
	Warrnambool Plain	14	4	-	-	237	100	21	-
	Otway Ranges	14	6	-	-	248	100	35	-
	Otway Plain	30	10	-	-	203	100	51	-
	Gippsland Plain	6	-	-	-	51	16	1	-
	Strzelecki Ranges	4	-	-	-	31	18	-	-
	Wilsons Promontory	4	-	-	-	34	21	-	-
IMCRA	Twofold Shelf	2	-	-	-	28	6	-	-
	Otway	34	42	-	-	289	100	68	-
	Victorian Embayments	4	-	-	-	36	9	-	-
	Central Victoria	25	7	-	-	235	100	33	-
	Central Bass Strait	17	4	-	-	282	100	26	-
	Flinders	5	-	-	-	66	27	1	-
KEF	West Tasmania Canyons	4	-	-	-	36	8	-	-
	Bonney Coast Upwelling	6	1	-	-	86	19	2	-
	Upwelling East of Eden	1	-	-	-	9	1	-	-
MNP	Bunurong	2	-	-	-	34	10	-	-
	Churchill Island	1	-	-	-	8	1	-	-
	Point Addis	5	-	-	-	51	41	1	-

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	Port Phillip Heads	1	-	-	-	15	8	-	-
	Twelve Apostles	16	6	-	-	155	100	18	-
	Wilsons Promontory	5	-	-	-	66	23	1	-
NP	Bunurong Marine Park	1	-	-	-	24	8	-	-
	Wilsons Promontory Marine Park	4	-	-	-	33	9	-	-
RAMSAR	Port Phillip Bay and Bellarine Peninsula	1	-	-	-	14	2	-	-
	Western Port	3	-	-	-	22	2	-	-
SHORE	King Island	1	-	-	-	9	1	-	-
	Seal Islands	2	-	-	-	15	2	-	-
	Phillip Island	3	-	-	-	26	13	-	-
	French Island	1	-	-	-	10	1	-	-
	Moncoeur Islands	1	-	-	-	26	8	-	-
	Hogan Island Group	1	-	-	-	9	2	-	-
	Rodondo Island	1	-	-	-	24	13	-	-
	Glennie Group	4	-	-	-	34	21	-	-
	Norman Island	3	-	-	-	33	16	-	-
	Shellback Island	2	-	-	-	24	9	-	-
	Anser Island	2	-	-	-	27	18	-	-
	Kanowna Island	3	-	-	-	18	18	-	-
	Skull Rock	3	-	-	-	16	18	-	-
	Glenelg	4	-	-	-	19	2	-	-
	Warrnambool	5	-	-	-	34	13	-	-
	Moyne	14	4	-	-	87	60	5	-
	Corangamite	14	5	-	-	237	100	21	-
	Colac Otway	30	10	-	-	212	100	51	-
	Surf Coast	4	-	-	-	46	50	-	-
	Greater Geelong	2	-	-	-	26	15	-	-
	Mornington Peninsula	6	-	-	-	52	13	1	-
	Bass Coast	2	-	-	-	24	9	-	-
	South Gippsland	4	-	-	-	43	18	-	-
	Lady Julia Percy Island	2	-	-	-	20	7	-	-

	Laurence Rocks	1	-	-	-	19	2	-	-
State Waters	Tasmania State Waters	1	-	-	-	15	3	-	-
	Victoria State Waters	34	16	-	-	289	100	57	-
SUB-LGA	Wilsons Promontory (East)	2	-	-	-	31	11	-	-
	Wilsons Promontory (West)	4	-	-	-	33	14	-	-
	Waratah Bay	4	-	-	-	31	18	-	-
	Cape Liptrap (NW)	4	-	-	-	43	16	-	-
	Venus Bay	2	-	-	-	24	9	-	-
	Kilcunda	1	-	-	-	18	7	-	-
	French Island / San Remo	1	-	-	-	8	2	-	-
	French Island / Crib Point	1	-	-	-	8	1	-	-
	Westernport	6	-	-	-	31	6	-	-
	Mornington Peninsula (S)	6	-	-	-	51	12	1	-
	Mornington Peninsula (SW)	4	-	-	-	33	11	-	-
	Port Phillip (Sorrento Shore)	2	-	-	-	26	10	-	-
	Port Phillip Heads	1	-	-	-	14	4	-	-
	Port Phillip (Queenscliff)	2	-	-	-	25	15	-	-
	Torquay	3	-	-	-	44	16	-	-
	Anglesea	4	-	-	-	40	31	-	-
	Lorne	7	1	-	-	57	50	1	-
	Cape Patton	13	3	-	-	124	92	8	-
	Apollo Bay	14	4	-	-	212	100	21	-
	Cape Otway West	30	10	-	-	203	100	51	-
	Moonlight Head	14	4	-	-	237	100	21	-
	Port Campbell	9	3	-	-	112	67	5	-
	Bay of Islands	14	1	-	-	90	60	5	-
	Childers Cove	14	4	-	-	78	24	1	-
	Warrnambool	1	-	-	-	9	3	-	-
	Port Fairy	5	-	-	-	29	3	-	-
	Portland Bay (East)	1	-	-	-	15	1	-	-
	Cape Nelson	4	-	-	-	19	2	-	-

*Concentration recorded over a 48-hour window.
^Instantaneous concentration recorded over one hour.

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10.1.2.2 Entrained Hydrocarbons

Table 25 and Table 26 summarise the probability and maximum entrained hydrocarbon exposure (for 1 hour and 48-hour exposure windows) to individual receptors in the 0–10 m depth layer at, or above the exposure thresholds during summer and winter.

The maximum entrained hydrocarbon exposure over 48 hour window predicted for the summer and winter season was 559 ppb and 569 ppb, respectively, and hence no moderate or high exposure was predicted. During summer conditions, the probability of low exposure to entrained hydrocarbons over 48 hours ranged from 1% (Bonney Coast Upwelling KEF; Moyne LGA; Bay of Islands and Childers Cove sub-LGAs) to 17% (Otway Plain IBRA; Colac Otway LGA; Cape Otway West sub-LGA and within Victorian State Waters), with the exception of IMCRA – Otway (50%). During winter conditions, the probability of low exposure to entrained hydrocarbons over 48 hours ranged from 1% (Bonney Coast Upwelling KEF; Bay of Islands and Lorne sub-LGAs) to 16% (Victoria State Waters), with the exception of Otway IMCRA (42%).

For the 1 hour exposure window, the entrained hydrocarbon concentrations had peaked at 948 ppb during summer and 932 ppb during winter with the maximum values predicted within the Otway IMCRA During summer conditions, the probability of moderate entrained hydrocarbon exposure ranged from 7% (Cape Patton sub-LGA) to 73% (Victorian State Waters). The probability of exposure to the Otway IMCRA receptor was 100% during both seasons. For other receptors during winter conditions, the probability of moderate entrained hydrocarbon exposure ranged from 8% (along the shoreline of Childers Cove sub-LGA; Moyne and Warrnambool LGA) to 73% (within Victorian State Waters).

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Table 25 Predicted probability and maximum entrained hydrocarbon exposure (for 1 hour and 48-hour exposure windows) to individual receptors in the 0–10 m depth layer during summer conditions.

Receptor		Maximum time-entrained hydrocarbon exposure (ppb) for 48 hour window	Probability of entrained hydrocarbon exposure for 48 hour window			Maximum entrained hydrocarbon exposure (ppb) for 1 hour window	Probability of entrained hydrocarbon exposure for 1 hour window		
			Low	Moderate	High		Low	Moderate	High
AMP	Apollo	81	11	-	-	255	98	50	-
	Beagle	12	-	-	-	15	14	-	-
	Murray	7	-	-	-	10	1	-	-
	Zeehan	7	-	-	-	14	8	-	-
IBRA	Glenelg Plain	36	-	-	-	41	45	-	-
	Bridgewater	32	-	-	-	37	36	-	-
	Warrnambool Plain	255	5	-	-	293	100	38	-
	Otway Ranges	184	7	-	-	215	100	29	-
	Otway Plain	294	17	-	-	333	100	71	-
	Gippsland Plain	41	-	-	-	47	62	-	-
	Strzelecki Ranges	18	-	-	-	20	14	-	-
	Wilsons Promontory	24	-	-	-	28	21	-	-
IMCRA	Coorong	9	-	-	-	13	12	-	-
	Otway	559	50	-	-	948	100	100	-
	Victorian Embayment	37	-	-	-	42	52	-	-
	Central Victoria	117	9	-	-	255	96	50	-
	Central Bass Strait	94	6	-	-	220	95	38	-
	Flinders	24	-	-	-	28	29	-	-
KEF	West Tasmania Canyons	16	-	-	-	25	16	-	-
	Bonney Coast Upwelling	36	1	-	-	53	74	-	-
MNP	Bunurong	12	-	-	-	14	19	-	-
	Churchill Island	11	-	-	-	13	12	-	-
	Discovery Bay	14	-	-	-	17	20	-	-
	Point Addis	35	-	-	-	41	49	-	-
	Port Phillip Heads	31	-	-	-	35	49	-	-

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	Twelve Apostles	256	6	-	-	302	100	60	-
	Wilsons Promontory	23	-	-	-	26	22	-	-
MP	Lower South East	10	-	-	-	13	16	-	-
NP	Bunurong Marine Park	17	-	-	-	20	36	-	-
	Corner Inlet Marine and Coastal	10	-	-	-	11	2	-	-
	Wilsons Promontory Marine Park	23	-	-	-	27	8	-	-
RAMSAR	Corner Inlet	10	-	-	-	11	2	-	-
	Port Phillip Bay and Bellarine	19	-	-	-	25	39	-	-
	Western Port	21	-	-	-	24	19	-	-
SHORE	Phillip Island	30	-	-	-	35	46	-	-
	Mud Island	23	-	-	-	28	29	-	-
	Moncoeur Islands	12	-	-	-	14	14	-	-
	Rodondo Island	13	-	-	-	17	16	-	-
	Glennie Group	22	-	-	-	25	20	-	-
	Norman Island	24	-	-	-	28	15	-	-
	Shellback Island	23	-	-	-	27	6	-	-
	Kanowna Island	14	-	-	-	16	21	-	-
	Skull Rock	15	-	-	-	17	21	-	-
	Glenelg	36	-	-	-	41	45	-	-
	Warrnambool	34	-	-	-	38	63	-	-
	Moyne	82	1	-	-	90	95	-	-
	Corangamite	255	5	-	-	293	100	30	-
	Colac Otway	294	17	-	-	333	100	71	-
	Surf Coast	47	-	-	-	59	48	-	-
	Greater Geelong	46	-	-	-	52	44	-	-
	Mornington Peninsula	41	-	-	-	47	62	-	-
	Bass Coast	20	-	-	-	23	41	-	-
	South Gippsland	24	-	-	-	27	28	-	-
	Grant	10	-	-	-	14	16	-	-
	Lady Julia Percy Island	33	-	-	-	40	58	-	-
	Laurence Rocks	33	-	-	-	37	46	-	-
State Waters	South Australia State Waters	13	-	-	-	22	17	-	-
	Victoria State Waters	296	17	-	-	336	100	73	-

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SUB-LGA	Corner Inlet	10	-	-	-	12	3	-	-
	Wilsons Promontory (East)	11	-	-	-	14	17	-	-
	Wilsons Promontory (West)	24	-	-	-	27	20	-	-
	Waratah Bay	18	-	-	-	22	14	-	-
	Cape Liptrap (NW)	20	-	-	-	24	28	-	-
	Venus Bay	17	-	-	-	20	36	-	-
	Kilcunda	20	-	-	-	23	41	-	-
	French Island / San Remo	16	-	-	-	19	24	-	-
	French Island / Crib Point	9	-	-	-	12	9	-	-
	Westernport	25	-	-	-	29	42	-	-
	Mornington Peninsula (S)	33	-	-	-	39	60	-	-
	Mornington Peninsula (SW)	41	-	-	-	47	62	-	-
	Port Phillip (Sorrento Shore)	41	-	-	-	45	53	-	-
	Port Phillip (Mornington)	11	-	-	-	12	18	-	-
	Port Phillip Heads	25	-	-	-	32	41	-	-
	Port Phillip (Queenscliff)	31	-	-	-	36	44	-	-
	Torquay	46	-	-	-	52	39	-	-
	Anglesea	30	-	-	-	34	38	-	-
	Lorne	48	-	-	-	59	48	-	-
	Cape Patton	78	2	-	-	121	95	7	-
	Apollo Bay	80	4	-	-	139	95	17	-
	Cape Otway West	294	17	-	-	333	100	71	-
	Moonlight Head	255	5	-	-	293	100	30	-
	Port Campbell	155	3	-	-	196	100	27	-
	Bay of Islands	82	1	-	-	90	95	-	-
	Childers Cove	63	1	-	-	72	68	-	-
	Warrnambool	28	-	-	-	34	56	-	-
	Port Fairy	26	-	-	-	31	46	-	-
	Portland Bay (East)	15	-	-	-	18	12	-	-
	Portland Bay (West)	22	-	-	-	25	19	-	-
	Cape Nelson	36	-	-	-	41	45	-	-
	Discovery Bay (East)	11	-	-	-	14	8	-	-

*Concentration recorded over a 48-hour window.
^Instantaneous concentration recorded over one hour.

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Table 26 Predicted probability and maximum entrained hydrocarbon exposure (for 1 hour and 48-hour exposure windows) to individual receptors in the 0–10 m depth layer during winter conditions.

Receptor		Maximum time-entrained hydrocarbon exposure (ppb) for 48 hour window	Probability of entrained hydrocarbon exposure for 48 hour window			Maximum entrained hydrocarbon exposure (ppb) for 1 hour window	Probability of entrained hydrocarbon exposure for 1 hour window		
			Low	Moderate	High		Low	Moderate	High
AMP	Apollo	85	7	-	-	225	100	48	-
	Beagle	18	-	-	-	24	40	-	-
IBRA	King Island	10	-	-	-	14	10	-	-
	Flinders	14	-	-	-	23	19	-	-
	Warrnambool Plain	178	4	-	-	214	100	39	-
	Otway Ranges	168	6	-	-	202	100	47	-
	Otway Plain	303	10	-	-	333	100	58	-
	Gippsland Plain	55	-	-	-	67	83	-	-
	Strzelecki Ranges	22	-	-	-	25	54	-	-
	Wilsons Promontory	69	-	-	-	79	74	-	-
	Bateman	6	-	-	-	6	-	-	-
IMCRA	Batemans Shelf	9	-	-	-	12	8	-	-
	Twofold Shelf	14	-	-	-	23	21	-	-
	Otway	569	42	-	-	932	100	100	-
	Victorian Embayments	28	-	-	-	32	57	-	-
	Central Victoria	112	7	-	-	225	100	48	-
	Central Bass Strait	105	4	-	-	227	100	23	-
	Flinders	72	-	-	-	84	75	-	-
KEF	West Tasmania Canyons	17	-	-	-	21	17	-	-
	Bonney Coast Upwelling	32	1	-	-	42	32	-	-
	Upwelling East of Eden	14	-	-	-	17	21	-	-
MNP	Bunurong	11	-	-	-	15	29	-	-
	Cape Howe	9	-	-	-	9	-	-	-
	Churchill Island	14	-	-	-	16	16	-	-
	Point Addis	34	-	-	-	38	72	-	-
	Port Phillip Heads	25	-	-	-	30	59	-	-
	Twelve Apostles	169	6	-	-	230	100	43	-

	Wilsons Promontory	71	-	-	-	84	74	-	-
AMP	Apollo	85	7	-	-	225	100	48	-
MP	Batemans	7	-	-	-	9	-	-	-
NP	Bunurong Marine Park	16	-	-	-	19	47	-	-
	Corner Inlet Marine and Coastal Park	10	-	-	-	12	10	-	-
	Shallow Inlet Marine and Coastal Park	10	-	-	-	12	9	-	-
	Wilsons Promontory Marine Park	60	-	-	-	67	72	-	-
RAMSAR	Corner Inlet	10	-	-	-	12	10	-	-
	Port Phillip Bay and Bellarine Peninsula	18	-	-	-	23	27	-	-
	Western Port	16	-	-	-	21	30	-	-
RSB	New Zealand Star Bank	7	-	-	-	9	-	-	-
SHORE	King Island	10	-	-	-	14	10	-	-
	Seal Islands	7	-	-	-	11	2	-	-
	Phillip Island	28	-	-	-	33	79	-	-
	French Island	11	-	-	-	18	11	-	-
	Mud Island	15	-	-	-	19	25	-	-
	Curtis Island	8	-	-	-	11	5	-	-
	Moncoeur Islands	18	-	-	-	24	38	-	-
	Hogan Island Group	14	-	-	-	23	19	-	-
	Rodondo Island	19	-	-	-	25	59	-	-
	Glennie Group	68	-	-	-	78	74	-	-
	Norman Island	71	-	-	-	84	74	-	-
	Shellback Island	36	-	-	-	44	69	-	-
	Montague Island	6	-	-	-	9	-	-	-
	Anser Island	41	-	-	-	49	69	-	-
	Kanowna Island	36	-	-	-	42	69	-	-
	Skull Rock	37	-	-	-	42	70	-	-
	Warrnambool	80	-	-	-	137	30	8	-
	Moyne	143	4	-	-	207	72	8	-
	Corangamite	178	5	-	-	214	100	36	-
	Colac Otway	303	10	-	-	333	100	58	-
	Surf Coast	45	-	-	-	50	69	-	-
	Greater Geelong	45	-	-	-	51	54	-	-

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	Mornington Peninsula	37	-	-	-	42	83	-	-
	Bass Coast	19	-	-	-	23	52	-	-
	South Gippsland	65	-	-	-	72	73	-	-
	Eurobodalla	6	-	-	-	9	-	-	-
	Lady Julia Percy Island	32	-	-	-	37	24	-	-
	Laurence Rocks	8	-	-	-	12	4	-	-
State Waters	Tasmania State Waters	14	-	-	-	23	21	-	-
	Victoria State Waters	303	16	-	-	333	100	73	-
	New South Wales State Waters	9	-	-	-	13	11	-	-
SUB-LGA	Eurobodalla	6	-	-	-	9	-	-	-
	Corner Inlet	10	-	-	-	12	10	-	-
	Wilsons Promontory (East)	22	-	-	-	27	56	-	-
	Wilsons Promontory (West)	65	-	-	-	72	73	-	-
	Waratah Bay	22	-	-	-	25	54	-	-
	Cape Liptrap (NW)	27	-	-	-	31	66	-	-
	Venus Bay	16	-	-	-	18	45	-	-
	Kilcunda	19	-	-	-	23	52	-	-
	French Island / San Remo	13	-	-	-	15	28	-	-
	French Island / Crib Point	12	-	-	-	19	11	-	-
	Westernport	23	-	-	-	28	64	-	-
	Mornington Peninsula (S)	36	-	-	-	42	83	-	-
	Mornington Peninsula (SW)	37	-	-	-	42	83	-	-
	Port Phillip (Sorrento Shore)	31	-	-	-	35	75	-	-
	Port Phillip Heads	24	-	-	-	29	46	-	-
	Port Phillip (Queenscliff)	29	-	-	-	36	50	-	-
	Torquay	45	-	-	-	51	34	-	-
	Anglesea	29	-	-	-	34	49	-	-
	Lorne	39	1	-	-	50	69	-	-
	Cape Patton	67	3	-	-	95	99	-	-
	Apollo Bay	70	4	-	-	132	100	11	-
	Cape Otway West	303	10	-	-	333	100	58	-
	Moonlight Head	178	4	-	-	214	100	36	-
	Port Campbell	127	3	-	-	182	91	11	-

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Bay of Islands	84	1	-	-	104	72	2	-
Childers Cove	143	4	-	-	207	46	8	-
Warrnambool	16	-	-	-	22	21	-	-
Port Fairy	12	-	-	-	16	14	-	-
Portland Bay (East)	9	-	-	-	11	2	-	-

*Concentration recorded over a 48-hour window.
^Instantaneous concentration recorded over one hour.

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Appendix E Offshore Victoria – Otway Basin Oil Pollution Emergency Plan

Plan

CDN/ID S4100AH717907

Oil Pollution Emergency Plan

Offshore Victoria – Otway Basin

In the event of an oil pollution emergency refer directly to Section 4 (Response Actions)

Revision	Date	Reason for issue	Reviewer/s	Consolidator	Approver
0	21/06/2019	Issued for use	PW	GLE	TF

Review due	Review frequency
21/06/2020	1 year

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

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1 Purpose

The purpose of this Oil Pollution Emergency Plan (OPEP or 'the Plan') is to:

- Describe the arrangements regarding Beach Energy's access to resources and appropriately trained response personnel in order to effectively respond to and manage an emergency oil spill response in a timely manner
- Provide a timely implementation of the pre-determined response strategies as outlined in this OPEP, based on credible worst-case hydrocarbon spill risks as presented within activity-specific Environment Plan (EPs)
- Ensure the processes and response structures are consistent with those used in applicable government and industry oil spill response plans, namely:
    - The National Plan for Maritime Environmental Emergencies ('NatPlan') (AMSA, 2019)
    - State Maritime Emergencies (non-Search and Rescue) Plan ('VicPlan') (EMV, 2016)
    - Tasmanian Marine Oil Spill Contingency Plan ('TasPlan') (DPIPWE, 2011)
    - The AMOSPlan (AMOSC, 2017)
- Ensure effective integration and use of industry and government response efforts and resources
- Meet the following regulatory requirements:
    - Commonwealth - Regulation 14(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (herein referred to as the OPGGS(E))
    - Victoria - Regulation 17 of the Offshore Petroleum and Greenhouse Gas Storage Regulations 2011 (herein referred to as the OPGGS Regulations)
    - Tasmania – Regulation 20 of the Petroleum (Submerged Lands) (Management of Environment) Regulations 2012 (herein referred to as the P(SL) (MoE) Regulations).

This OPEP supersedes the Origin Energy Integrated Gas Otway Offshore Oil Pollution Emergency Plan (TAS 9100 SAF PLN, CDN/ID 3973983)

2 The Proponent

The proponent, Lattice Energy Limited (Lattice), is wholly owned by Beach Energy Limited (Beach).

Lattice is the majority owner and the nominated operator for the offshore facilities and infrastructure presented in Figure 3.1 and located within the petroleum titles relevant to the scope of this OPEP (Table 3.1).

Given Lattice is the proponent for this project, as a member of the Beach group, it may be referred to in this application as 'Beach'. There may also be references to 'Origin' in material relevant to this document because that material was prepared before Lattice's change of name, or before Lattice was acquired by Beach.

3 Scope

This OPEP covers potential oil pollution emergencies that may result from Beach petroleum activities within State and Commonwealth waters of the Otway Basin off the west coast of Victoria. Spills within the Otway Basin may impact both Victorian and/or Tasmanian jurisdictions

The plan recognises the divisions of responsibility as defined under the terms of the "NatPlan", which have been incorporated into this plan.

3.1 Interface with Emergency Response Documents

This OPEP interfaces with the follow emergency response documents:

- Beach Crisis Management Plan (CMP)
- Beach Emergency Management Plan (EMP)
- Vessel-specific Shipboard Oil Pollution Emergency Plan (SOPEP) / Shipboard Marine Pollution Emergency Plan (SMPEP), or equivalent
- Beach Well Operations Management Plan (WOMP)
- Beach Otway Offshore Blow-out Contingency Plan (BCP) and/or Source Control Contingency Plan (SCCP)
- Beach Otway Offshore Drilling Emergency Response Plan (ERP)
- Otway Offshore Drilling Well Control Bridging Document
- Beach Well-specific Relief Well Plan
- Beach Offshore Victoria Operational and Scientific Monitoring Program (OSMP).

3.2 Beach Offshore Facilities and Activities within the Otway Basin

This OPEP covers petroleum activities in Commonwealth waters, Victorian State waters off the west coast of Victoria and Tasmanian State waters north west of the Tasmanian coastline, collectively within the Otway Basin.

Beach facilities and activities within the Otway Basin covered by this OPEP are summarised in Table 3.1. A detailed description of offshore facilities and petroleum activities is available within activity-specific Environment Plans (EPs).

The locations of facilities, infrastructure and petroleum titles covered by this OPEP are presented in Figure 3.1.

Table 3.1: Summary of Beach facilities and activities within the Otway Basin

Facility / Activity	Description	Title	Hydrocarbon type	Minimum distance from shore	Water Depth (approx.)	Flight Time (approx.)	Vessel Steaming Time (approx.)
Geographe production wells	Producing Geographe gas wells and two plugged and suspended Geographe wells (GEO-1 and GEO-3),	VIC/L23	Geographe gas condensate	45 km	80 m	20 min (Warrnambool)	16 hrs (Port Anthony)
Thylacine production wells	Producing Thylacine gas wells and the plugged and suspended Thylacine 1 exploration well	TL/2 TL/3	Thylacine gas condensate	70 km	100 m	25 min (Warrnambool)	20 hrs (Port Anthony)
Thylacine Platform-A (unmanned)	Unmanned Thylacine-A production platform, supporting the wellheads and topsides facilities required for production metering from the combined Thylacine wells	T/L2	Thylacine gas condensate	70 km	100 m	25 min (Warrnambool)	20 hrs (Port Anthony)
Thylacine / Geographe Pipeline	Offshore pipeline system consisting of a 500mm (20 inch) production pipeline and a 100mm mono ethylene glycol (MEG) piggyback service pipeline from the platform to the shore crossing at the Port Campbell Rifle Range, situated to the west of Port Campbell	VIC/PL36(V) VIC/PL36 T/PL3	Co-mingled gas condensate	0-70 km	Shallow to 100 m	Varies	Varies
Offshore Drilling	Exploration & production drilling	VIC/P43 T/30P	Thylacine gas condensate	32 km	70 m to 110 m	15 min (Warrnambool)	10 hrs (Port Anthony)
	La Bella production drilling	VIC/P73	Gas condensate	45 km	90 m	20 min (Warrnambool)	16 hrs (Port Anthony)
	Geographe production drilling	VIC/L23	Geographe gas condensate	45 km	80 m	20 min (Warrnambool)	16 hrs (Port Anthony)
	Thylacine production drilling	T/L2 T/L3	Thylacine Gas condensate	70 km	100 m	25 min (Warrnambool)	20 hrs (Port Anthony)
Vessel-based activities	Site surveys & project support	All petroleum titles in Figure 1	Marine Diesel	0-70 km	Shallow to 100 m		

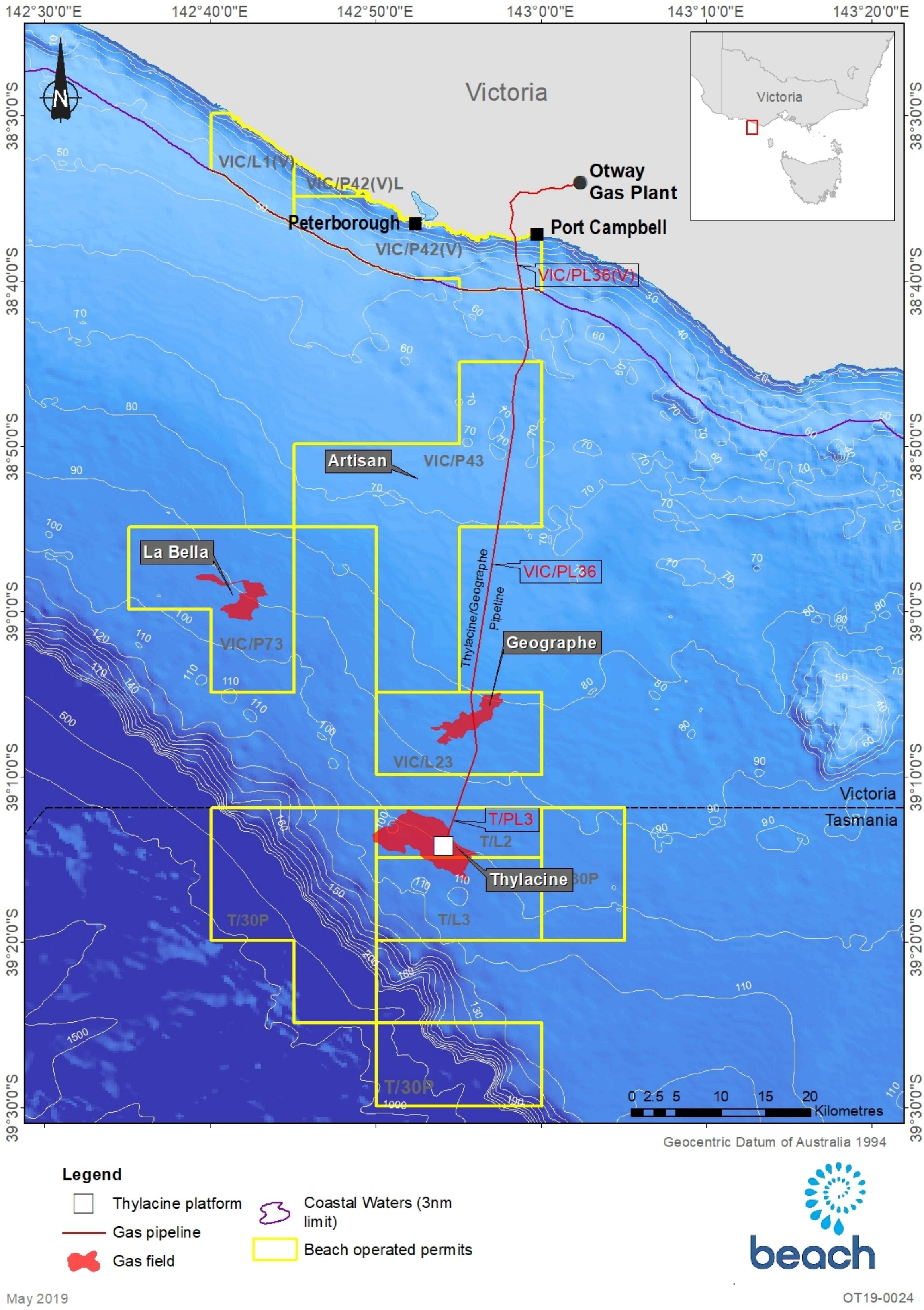


Figure 3.1: Locations of facilities, infrastructure and petroleum titles

3.3 Hydrocarbon Types

There are two types of hydrocarbon covered in this OPEP that are associated with the Otway offshore activities;

- Marine Diesel
- Gas Condensate (Geographe and Thylacine).

3.3.1 Marine Diesel

Marine diesel (DMA blend) is a light petroleum distillate. At the environmental conditions experienced in Otway Basin, marine diesel is predicted to undergo rapid evaporative loss and slicks are expected to break up rapidly. Characteristics of the DMA blend diesel are detailed in Table 3.2 and Table 3.3.

Table 3.2: Marine diesel physical characteristics

Parameter	MDA Blend
Density (kg/m^3)	829 at 15°C
API	37.6
Dynamic viscosity (cP)	4.0 at 25°C
Pour point (°C)	-14
Oil category	Group II
Oil persistence classification	Light-persistent oil

Table 3.3: Marine diesel boiling point ranges

Parameter	Volatiles (%)	Semi-volatiles (%)	Low-volatiles (%)	Residual (%)
Boiling point (°C)	<180	180-265	265-380	>380
DMA Blend Diesel	6.0	34.6	54.4	5
	⇦	Non-Persistent	⇨	⇦ Persistent ⇨

3.3.2 Gas Condensate

The target reservoirs within the Otway Basin are gas condensate. As a result, no heavy oil will be present during extraction or drilling activities. The fields of the Otway Basin have slightly different condensate characteristics and potential flow rates (pressures). Characteristics of the two types of condensate are detailed in Table 3.4 and Table 3.5.

Condensate characteristics indicate that spills of these fluids are likely to spread rapidly, and residual hydrocarbons potentially distributed over a large area. Any slicks will break up readily as a result of weathering processes.

Table 3.4: Condensate physical characteristics

Parameter	Geographe Condensate	Thylacine Condensate
Density (kg/m^3)	751 at 15°C	805 at 15°C
API	56.9	44.3
Dynamic viscosity (cP)	0,500 at 25°C	0.875 at 20°C
Pour point (°C)	-50	-50
Oil category	Group I	Group I
Oil persistence classification	Non-persistent oil	Non-persistent oil

Table 3.5: Condensate boiling point ranges

Parameter	Volatiles (%)	Semi-volatiles (%)	Low-volatiles (%)	Residual (%)
Boiling point (°C)	<180	180-265	265-380	>380
Geographe Condensate	78.4	13.4	7.2	1
Thylacine Condensate	64.0	19.0	16.0	1
	⇦	Non-Persistent	⇨	⇦ Persistent ⇨

3.4 Potential Worst-Case Spill Scenarios

The potential worst-case hydrocarbon spill scenarios relating to the Otway offshore activities are:

- for drilling an open-hole and unrestricted well release from the Artisan-1 location representing the overall worst-case loss of well control (LOWC) within the Otway Basin given its proximity to shore, noting other wells within the area may have similar flow rates and reservoir properties but are in deeper water and located further from shore
- an uncontrolled well release from the Geographe production well location
- an uncontrolled well release from the Thylacine production well location
- a pipeline rupture
- a release of marine diesel from a vessel involved in the Otway offshore activities, either near-shore or in deep water.

These hypothetical worst-case discharges (WCD) have been subject to modelling via an OILMAP stochastic module used to quantify the probability of sea surface exposure, contact to shorelines, largest shoreline loading, time to shoreline loading, in-water dissolved aromatic and entrained hydrocarbon concentrations. This involved simulating multiple spill trajectories with randomly varying metocean conditions to represent varying annual conditions.

An analysis of the modelling results for visual and actionable surface and shoreline exposure, minimum time to shoreline contact and maximum shoreline loading is presented in Table 3.6. Further detail relating to spill modelling results and potential environmental impacts can be found within activity-specific Environment Plans (EPs).

3.5 Spill Modelling Analysis

Table 3.6: Analysis of spill modelling

Spill Scenario	Drilling 8-1/2" open hole	Producing Wells		Pipeline Rupture	Vessel Spill	
Location	Artisan-1	Geographe	Thylacine	3nm from shore – State / Commonwealth boundary	Artisan-1	3nm from shore – State / Commonwealth boundary
Product	Thylacine condensate	Geographe Condensate	Thylacine Condensate	Co-mingled Condensate	DMA Blend Diesel	
Release Volume	2,584 bbl/day	750 bbl/day	1,010 bbl/day	1,175 bbl	300m^3	300m^3
Duration	86 days	86 days	86 days	14.4 min	6 hours	6 hours
Sea Surface 0.5g/m^2 (Barely Visible)	Up to 52 km and 53 km from the release site under summer and winter conditions, respectively Dissipates in <2 days	Up to 6 km and 7 km from the release site under summer and winter conditions, respectively	Up to 15 km and 17 km from the release site under summer and winter conditions, respectively	Up to 14.1 km and 19.6 km from the release site under summer and winter conditions, respectively Dissipates in <2 days	Up to 68 km and 93 km from the release site under summer and winter conditions, respectively Dissipates in <2 days	Up to 31.5 km and 45.8 km from the release site under summer and winter conditions, respectively Dissipates in <2 days
Sea Surface >10g/m^2 (Actionable)	Up to 4 km and 3 km from the release site under summer and winter conditions, respectively Dissipates in <1 day	Nil	Nil	Up to 4.9 km and 5.2 km from the release site under summer and winter conditions, respectively Dissipates in <1 day	Up to 12 km and 10 km from the release site under summer and winter conditions, respectively Dissipates in <2days	Up to 26.1 km and 33.9 km from the release site under summer and winter conditions, respectively Dissipates in <2days
Shoreline >100g/m^2 (Actionable)	Up to 4 km summer & 8 km winter	Nil	Nil	Up to 3 km summer & 4 km winter	Nil	Up to 10 km summer & 9.5 km winter
Shoreline >1000g/m^2 (High loading)	Nil	Nil	Nil	Nil	Nil	Up to 4km summer & 4.5 km winter
Shoreline Minimum Time to Contact	3 days summer & 5 days winter	N/A	N/A	7 hours summer & winter	N/A	5 hours summer & winter
Shoreline Maximum Loading m^3	15 m^3 summer and 33 m^3 winter	Nil	Nil	5.0 m^3 summer and 6.5 m^3 winter	Nil	142 m^3 summer and 110 m^3 winter

3.6 Actionable Response Areas

Figure 3.2. Figure 3.3, Figure 3.4 and Figure 3.5 represent the areas where a spill response could be undertaken to; protect, deflect, or mount a shoreline clean-up operation.

To identify areas where a response may be actionable the following oil exposures were used from NP–GUI–025: National Plan response, assessment and termination of cleaning for oil contaminated foreshores (AMSA 2015):

- A sea surface oil exposure of 10 g/m^2 as this represents the practical limit for surface response options; below this thickness, oil containment, recovery and chemical treatment (dispersant) become ineffective
- A shoreline contact exposure of 100 g/m^2 as this represents the minimum thickness that does not inhibit the potential for recovery and is best remediated by natural coastal processes alone.

N.B. There are no identified actionable response areas within Tasmanian State waters or lands

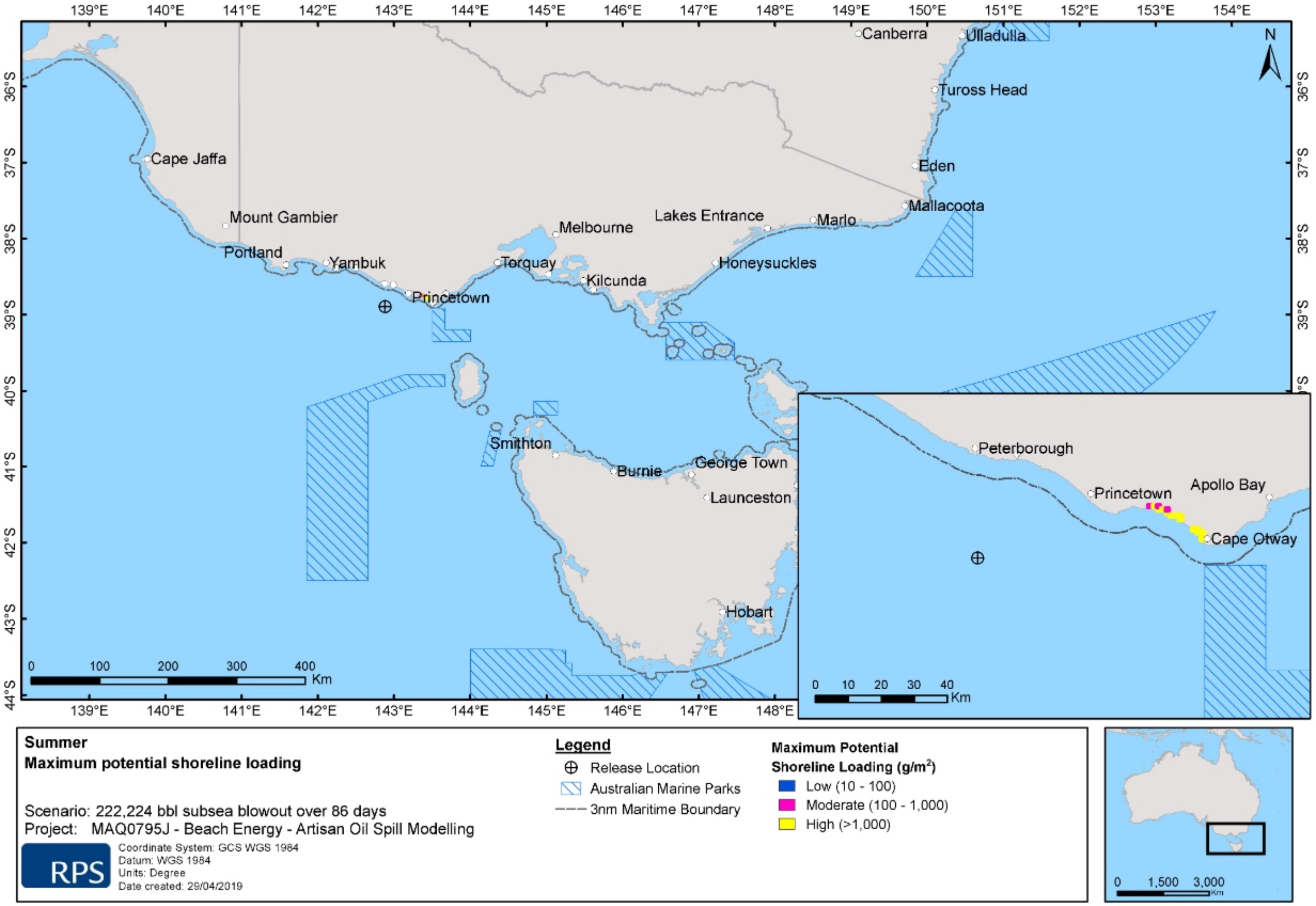


Figure 3.2: Condensate spill (LOWC) actionable response areas – Summer (RPS APASA, 2019)

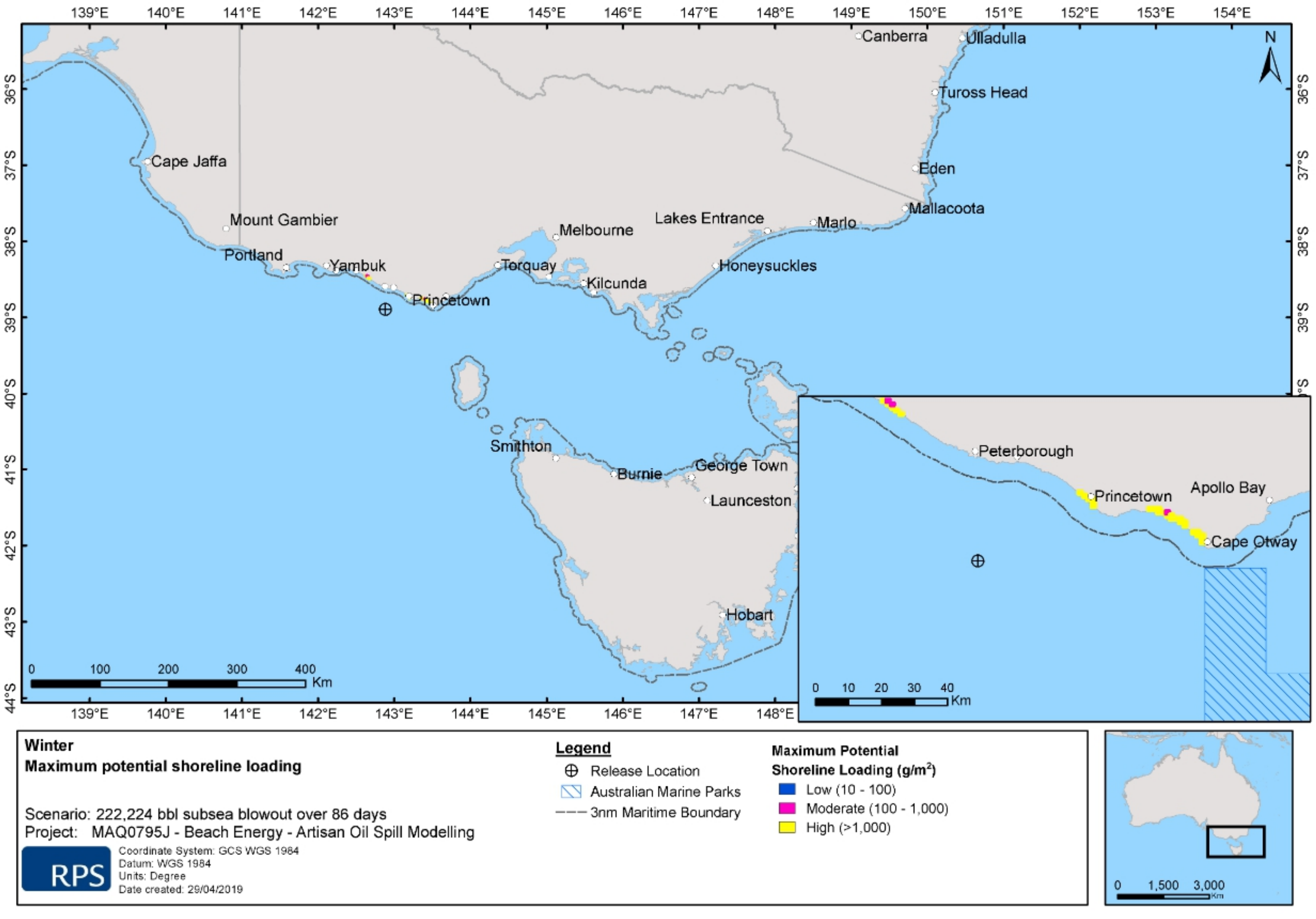


Figure 3.3: Condensate spill (LOWC) actionable response areas – Winter (RPS APASA, 2019)

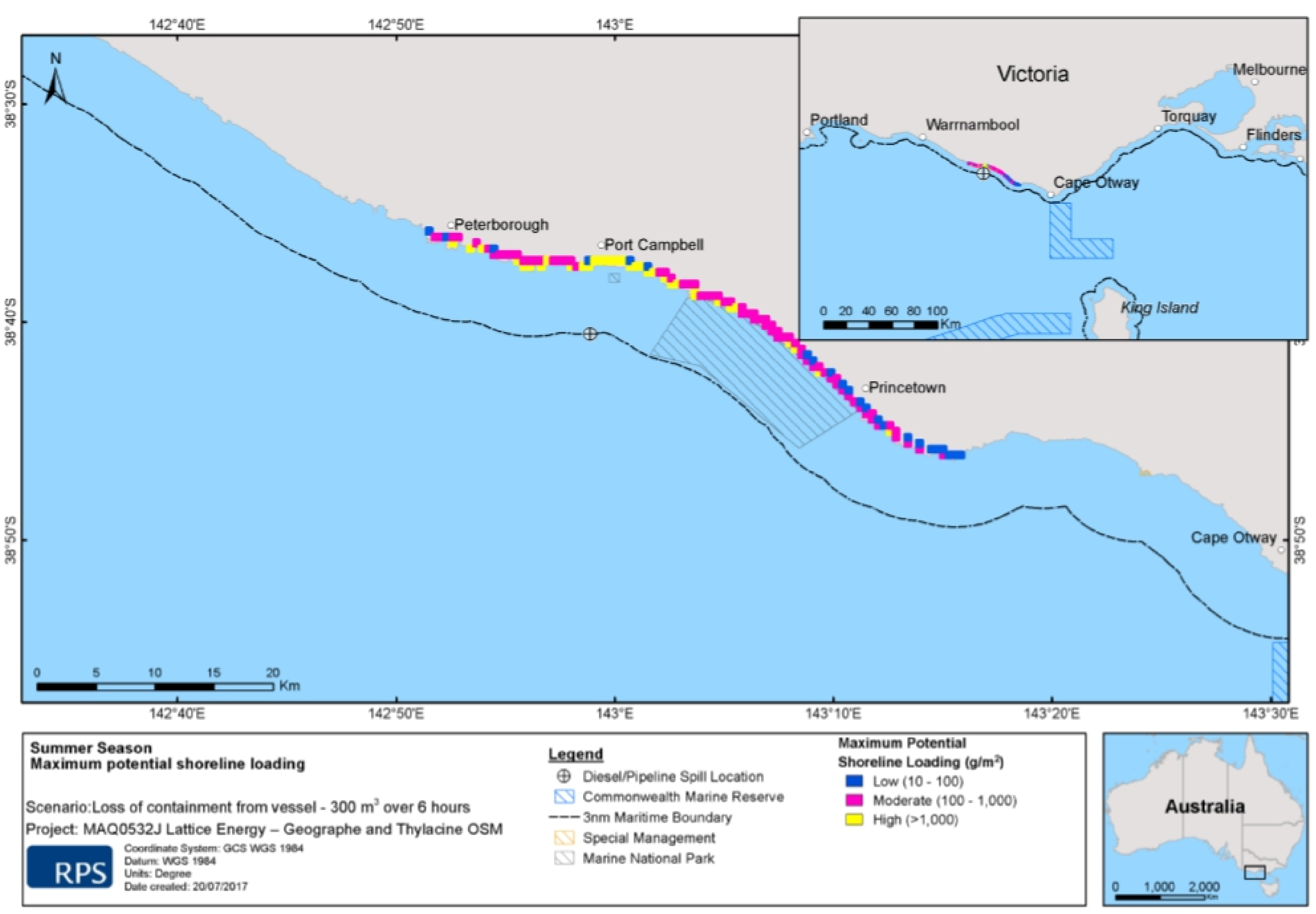


Figure 3.4: Marine diesel spill actionable response areas – Summer (RPS APASA, 2017)

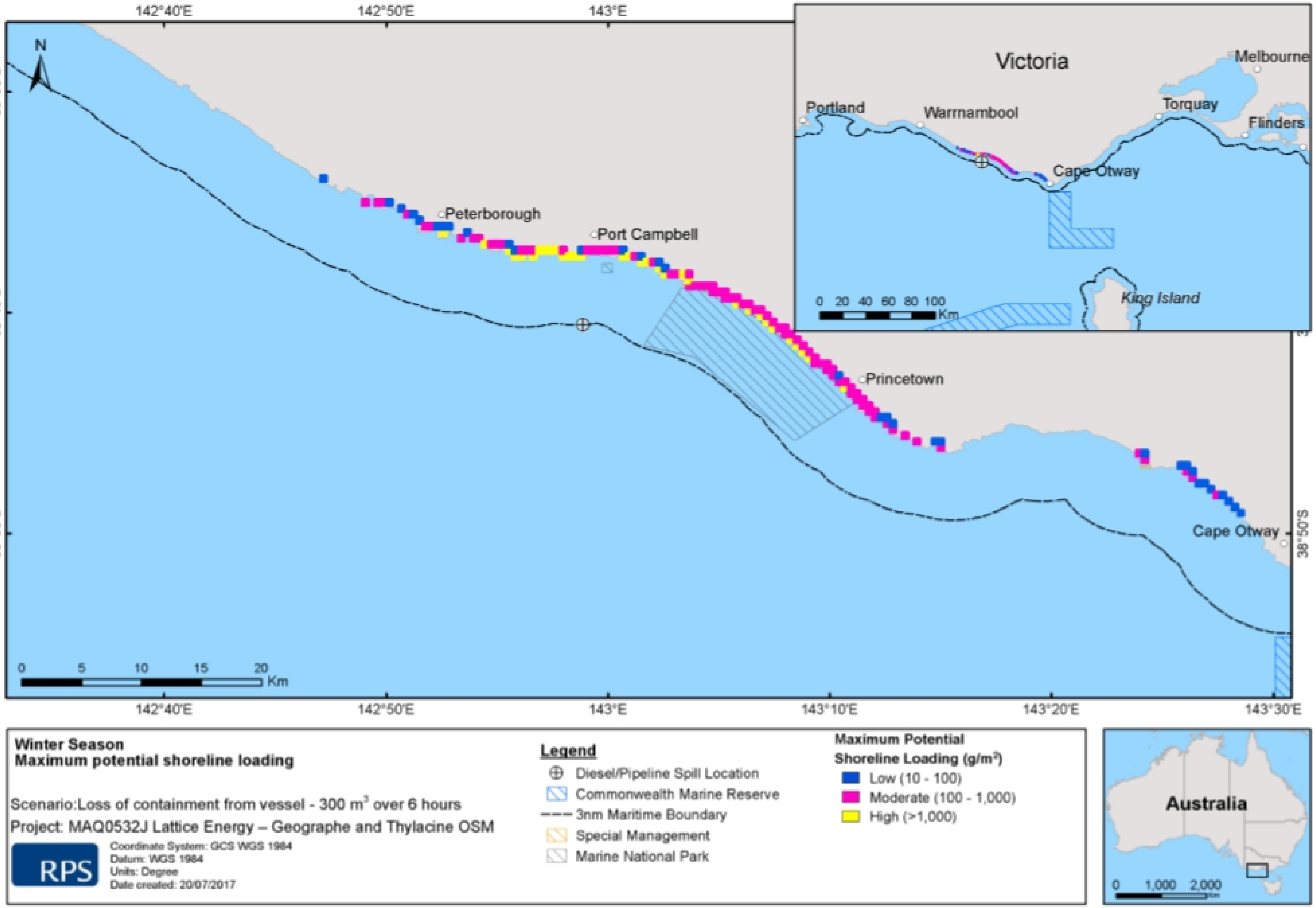


Figure 3.5: Marine diesel spill actionable response areas – Winter (RPS APASA, 2017)

4 Response Actions

4.1 Response Levels and Control Agencies

4.1.1 Level of Spill

In line with the National Plan and for the purpose of response planning, marine oil spills are divided into three categories. Depending on the spill size, the level structure allows for escalation of the response according to the risk of impacts, appropriate response actions and resources required for the response.

The level response concept adopted by Beach and the NatPlan is:

Level 1 Spills able to be resolved through the application of local or initial resources only.

Level 2 Spills more complex in size, duration, resource management and risk and may require deployment of jurisdiction resources beyond the initial response.

Level 3 Spills requiring support of national, and potentially international, resources to respond.

4.1.2 Statutory and Control Agencies

This plan recognises that under existing Commonwealth and State Intergovernmental Agreements, Authorities have been nominated with statutory and control responsibility for spills within harbours, State waters and Commonwealth waters around Australia.

While Beach remains accountable for spills relating to its petroleum operations, the nominated Control Agency will vary depending on source, size and location of the spill as defined in Table 4.1.

It should also be noted that state agencies such as the Victorian Department of Jobs, Precincts and Regions (DJPR) or the Tasmanian Department of Primary Industries, Parks, Water and Environment (DPIPWE), may assume Incident Control in state waters under the following circumstances:

- the incident is greater than a Level 1 spill in state waters and requires immediate escalation
- the incident occurred in Commonwealth waters, but has impacted on State waters
- the Control Agency has requested State assistance
- the State believes that Beach is not implementing an appropriate response to the incident.

4.1.2.1 Victorian State Arrangements

In the event that an incident in Commonwealth waters has impacted on Victorian State waters, DJPR will only assume Incident Control over the impacted area in State waters while Beach (or other Control Agency) will remain responsible for managing the spill outside Victorian coastal waters in consultation with the State.

Whilst DJPR is the Control Agency for marine pollution in Victorian State waters, Beach shall conduct initial necessary response actions in State waters, in accordance with this OPEP and continue to manage those operations until formal incident control can be established by DJPR.

Upon establishment of incident control by DJPR, Beach shall continue to provide planning and resources in accordance with this OPEP. This includes response assets and contracts specified in this OPEP, such as those pertaining to equipment, waste management, transport and personnel (operational and EMT staff) as well as arrangements with third-party response service providers. For response in State waters, DJPR will use the accepted OPEP as a starting point for a response. DJPR reserves the right to deviate from this OPEP in circumstances where there is a justifiable cause, in consultation with Beach. In this instance, Beach shall consult with NOPSEMA and DJPR Earth Resources Regulation (ERR) on any possible compliance ramifications.

If an incident affecting wildlife occurs in Commonwealth waters close to Victorian State waters, AMSA will request support from Department of Environment, Land, Water and Planning (DELWP) to assess and lead a wildlife response if required. DELWP may also place a DELWP Liaison officer in an Oil Spill Incident Management Team (IMT).

Where DJPR is leading an oil spill response within Victorian State waters, a joint IMT will be established. The joint IMT is to ensure a coordinated response between lead agencies.

DELWP will lead the wildlife response within the IMT under guidance from its own response plans and arrangements.

Additional detail on the management of a cross-jurisdiction marine pollution incident that originates in Commonwealth waters and results in DJPR exercising its control agency obligations in State waters is provided in Section 5.6.

4.1.2.2 Tasmanian State Arrangements

Under the *Pollution of Water by Oil and Other Noxious Substances Act 1987*, the Tasmanian Environmental Protection Authority (EPA) Division (DPIPWE) is responsible for preparedness for and responding to oil and chemical spills in Tasmania. Activities that the EPA Division undertakes to ensure Tasmania is prepared in the event of an oil spill include:

- Developing and managing oil spill response capabilities in Tasmania
- Providing resources and support during marine oil spill response operations in Tasmania
- Developing and delivering appropriate training programs for marine oil spill response around the State
- Assisting ports and industry in developing marine oil spill contingency plans in line with Tasmanian Marine Oil Spill Contingency Plan (TasPlan)
- Providing 24 hour on call support for marine oil spills
- Developing national networks to ensure Tasmania is up to date in oil spill response techniques
- Maintaining the Oil Spill Response Atlas (OSRA)
- Raising community awareness about the impact of marine oil spills.

In the event that an incident in Commonwealth waters has impacted on Tasmanian State waters, DPIPWE will only assume Incident Control over the impacted area in State waters while Beach (or other Control Agency) will remain responsible for managing the spill outside Tasmanian coastal waters in consultation with the State.

When under direction of DPIPWE, a Beach Emergency Management Liaison Officer (EMLO) trained in AIIMS and conversant with DPIPWE’s processes and expectations shall be allocated to DPIPWE.

The Tasmanian Oiled Wildlife Response Plan (WildPlan) is administered by the Resource Management and Conservation Division of the DPIPWE and outlines priorities and procedures for the rescue and rehabilitation of oiled wildlife.

Table 4.1: Statutory and Control Agencies

Spill Source	Level of Spill	Impact to State Waters (<3nm)	Impact to Commonwealth Waters (>3nm)	Statutory Agency	Control Agency
Condensate release from platform, sub-sea wells / installation or pipeline	1	✓		Vic DJPR Tas DPIPWE	Beach
			✓	NOPSEMA	Beach
	2	✓		Vic DJPR Tas DPIPWE	Vic DJPR Tas DPIPWE
			✓	NOPSEMA	Beach
	3	✓		Vic DJPR Tas DPIPWE	Vic DJPR Tas DPIPWE
			✓	NOPSEMA	Beach
Diesel release from vessel	1	✓		Vic DJPR Tas DPIPWE	Vessel Owner / Operator
			✓	AMSA	Vessel Owner / Operator
			✓ (within 500m platform exclusion zone)	NOPSEMA	Vessel Owner / Operator
	2 and 3	✓		Vic DJPR Tas DPIPWE	Vic DJPR Tas DPIPWE
			✓	AMSA	AMSA

4.2 Immediate Actions and Notification Requirements (Contacts correct as of 19 June 2019)

4.2.1 Vessel Spill / Collision (L1 / L2 / L3)

Table 4.2: Immediate Actions – Vessel Spill / Collisions

Item	Action	Responsibility	Timing
1.	**Initial Emergency Actions**		
1.1	Implement the relevant emergency response procedures to protect human life and the environment in accordance with the vessel SOPEP / SMPEP	Vessel Master	ASAP
1.2	Identify any potential fire risks and attempt to isolate the supply of oil to the spillage	Vessel Master	ASAP
1.3	Identify the extent of spillage and the weather/sea conditions in the area	Vessel Master	ASAP
1.4	Notify Otway Production Manager / MODU OIM / Drill Site Manager	Vessel Master	ASAP
1.5	Notify Operations Manager / Drilling Manager	Otway PM / MODU OIM / Drill Site Manager	ASAP
2.	**Level 1 Notifications**		
2.1	Any vessel collision with a facility or MODU within Commonwealth waters (>3nm) and / or any hydrocarbon spill >80L AMSA: Ph: 1800 641 792 Email: mdo@amsa.gov.au NOPSEMA: Ph: 08 6461 7090 Email: submissions@nopsema.gov.au	Vessel Master / Operations Manager / Drilling Manager	ASAP but not later than 2 hours after collision / spill
2.2	Within or potential for moderate to significant environmental damage to Victorian State waters (<3nm) – refer to activity-specific EP for clarification DJPR EMB: Ph: 0409 858 715 (24/7) and Email: semdincidentroom@ecodev.vic.gov.au	Vessel Master / Operations Manager / Drilling Manager	ASAP
2.3	Within or potential for release to cause, or may cause, environmental harm or environmental nuisance in Tasmanian State waters (<3nm) – refer to activity-specific EP for clarification DPIPWE: Ph: +61 (0)3 6165 4599 or 1800 005 171 (within Tasmania only) Radio: TasPorts Vessel Traffic Services VHF radio channel 16/14/12 Call sign “relevant port name VTS" Email: incidentresponse@epa.tas.gov.au	Vessel Master / Operations Manager / Drilling Manager	ASAP
2.4	Within port boundary or potential impact to Port boundary – notify relevant Port Authority	Vessel Master	ASAP
2.5	Notify and escalate to the EMT if available response resources are inadequate	Operations Manager / Drilling Manager	ASAP
3.	**Level 2 / 3 Notifications**		
3.1	Notify and escalate to the EMT	Operations Manager / Drilling Manager	ASAP
3.2	Any vessel collision with a facility or MODU within Commonwealth waters and / or any Level 2 / 3 vessel spill AMSA: Ph: 1800 641 792 Email: mdo@amsa.gov.au NOPSEMA: Ph: 08 6461 7090	Emergency Management Liaison Officer (EMLO)	ASAP but not later than 2 hours after becoming

Item	Action	Responsibility	Timing
	Email: submissions@nopsema.gov.au		aware of spill
3.3	Within Commonwealth waters (>3nm) – written report to NOPSEMA: Email: submissions@nopsema.gov.au and NOPTA: Email: info@nopta.gov.au	Emergency Management Liaison Officer (EMLO)	Within 3 days of spill
3.4	Spill with potential to impact Australian Marine Park(s) Director of National Parks: Ph: 02 6274 2220	Emergency Management Liaison Officer (EMLO)	ASAP
3.5	Within or potential for moderate to significant environmental damage to Victorian State waters (<3nm) – refer to activity-specific EP for clarification or the impact of wildlife (including cetaceans) DJPR EMB: Ph: 0409 858 715 (24/7) and Email: semdincidentroom@ecodev.vic.gov.au and DELWP: Ph: 1300 134 444 Email: sscviv.scmdr.delwp@scc.vic.gov.au	Emergency Management Liaison Officer (EMLO)	ASAP
3.6	Within or potential for release to cause, or may cause, environmental harm or environmental nuisance in Tasmanian State waters (<3nm) – refer to activity-specific EP for clarification DPIPWE: Ph: +61 (0)3 6165 4599 or 1800 005 171 (within Tasmania only) Radio: TasPorts Vessel Traffic Services VHF radio channel 16/14/12 Call sign "relevant port name VTS" Email: incidentresponse@epa.tas.gov.au	Emergency Management Liaison Officer (EMLO)	ASAP (first instance of oil on/in water)
3.7	Within port boundary or potential impact to Port boundary – notify relevant Port Authority	Vessel Master	ASAP
3.8	Complete Level 2/3 Incident Report (Appendix C. 4)	Emergency Management Liaison Officer (EMLO)	ASAP
3.9	Confirm takeover of incident control by AMSA (>3nm) or State agency as the Control Agency (<3nm)	EMT Operations Lead	ASAP
4.	**Level 2 / 3 Monitoring, Evaluation & Surveillance**		
4.1	Request assistance from AMOSC via execution of Service Contract/Service Note as directed by Control Agency	EMT Lead	ASAP
4.2	Mobilise surveillance by aircraft via service provider as directed by Control Agency	EMT Logistics Lead	ASAP
4.3	Deploy oil spill tracking buoy	EMT Logistics Lead	ASAP
4.4	Initiate oil spill trajectory modelling via service provider as directed by Control Agency	Health, Safety & Environment	ASAP
5.	**Level 2 / 3 Oil Spill Response**		
5.1	Provide support and information to the Control Agency as directed	EMT Lead	As directed
5.2	Determine and implement offshore and onshore response options for oil spill tracking, dispersion, containment, collection, treatment, oiled wildlife response & shoreline clean-up in consultation with and as directed by Control Agency	EMT Operations Lead / Health, Safety & Environment	As directed
5.3	Monitor shoreline and intertidal zones to identify areas affected by the oil spill and to determine the nature of the impact as directed by Control Agency	Health, Safety & Environment	As directed
5.4	Complete role-specific ongoing actions as outlined in Appendix B of ERP	All EMT	ASAP

Item	Action	Responsibility	Timing
6.	**Ongoing Monitoring**		
6.1	Implement Beach Offshore Victoria OSMP	Health, Safety & Environment	As required

4.2.2 Loss of Integrity – Platform or Pipeline (L2 / L3)

Table 4.3: Immediate Actions – Loss of Integrity from Platform or Pipeline

Item	Action	Responsibility	Timing
1.	**Initial Emergency Actions**		
1.1	Implement the relevant emergency response procedures to protect human life and the environment and in particular, those procedures focused at reducing the risk of fire or explosion	Thylacine PIC	ASAP
1.2	Identify any potential fire risks and attempt to isolate the supply of oil to the spillage	Thylacine PIC	ASAP
1.3	Identify the extent of spillage and the weather/sea conditions in the area	Thylacine PIC	ASAP
1.4	Notify Otway Production Manager	Thylacine PIC	ASAP
1.5	Notify Operations Manager	Otway PM	ASAP
2.	**Level 1 Notifications**		
2.1	Within Commonwealth waters (>3nm) and / or any hydrocarbon spill >80L NOPSEMA: Ph: 08 6461 7090 Email: submissions@nopsema.gov.au	Operations Manager	ASAP but not later than 2 hours after spill
2.2	Within or potential for moderate to significant environmental damage to Victorian State waters (<3nm) – refer to activity-specific EP for clarification DJPR EMB: Ph: 0409 858 715 (24/7) and Email: semdincidentroom@ecodev.vic.gov.au	Operations Manager	ASAP
2.3	A release or potential release from pipeline within 3nm DJPR ERR: Ph: 0419 597 010 (ERR Duty Officer) and Email: Compliance.Southwest@ecodev.vic.gov.au	Operations Manager	ASAP
2.4	Complete Level 1 Incident Report (Appendix C. 3)	Operations Manager	ASAP
2.5	Notify and escalate to the EMT if available response resources are inadequate	Operations Manager	ASAP
3.	**Level 2 / 3 Notifications**		
3.1	Notify and escalate to the EMT	Operations Manager	
3.2	Within Commonwealth waters (>3nm) NOPSEMA: Ph: 08 6461 7090 Email: submissions@nopsema.gov.au	Emergency Management Liaison Officer (EMLO)	ASAP but not later than 2 hours after becoming aware of spill
3.3	Within Commonwealth waters (>3nm) – written report to NOPSEMA: Email: submissions@nopsema.gov.au and NOPTA: Email: info@nopta.gov.au	Emergency Management Liaison Officer (EMLO)	Within 3 days of spill

Item	Action	Responsibility	Timing
3.4	Spill with potential to impact Australian Marine Park(s) Director of National Parks: Ph: 02 6274 2220	Emergency Management Liaison Officer (EMLO)	ASAP
3.5	Within or potential for moderate to significant environmental damage to Victorian State waters (<3nm) – refer to activity-specific EP for clarification or the impact of wildlife (including cetaceans) DJPR EMB: Ph: 0409 858 715 (24/7) and Email: semdincidentroom@ecodev.vic.gov.au DELWP: Ph: 1300 134 444 Email: sscviv.scmdr.delwp@scc.vic.gov.au	Emergency Management Liaison Officer (EMLO)	ASAP
3.6	Within or potential for release to cause, or may cause, environmental harm or environmental nuisance in Tasmanian State waters (<3nm) – refer to activity-specific EP for clarification DPIPWE: Ph: +61 (0)3 6165 4599 or 1800 005 171 (within Tasmania only) Radio: TasPorts Vessel Traffic Services VHF radio channel 16/14/12 Call sign "relevant port name VTS" Email: incidentresponse@epa.tas.gov.au	Emergency Management Liaison Officer (EMLO)	ASAP (first instance of oil on/in water)
3.7	Confirm takeover of incident by State agency (DJPR) as the Control Agency (<3nm)	EMT Operations Lead	ASAP
3.8	Notify AMSA and request 500m exclusion zone from location of the spill AMSA: Ph: 1800 641 792 Email: mdo@amsa.gov.au	EMT Operations Lead	ASAP
3.9	Complete Level 2/3 Incident Report (Appendix C. 4)	Emergency Management Liaison Officer (EMLO)	ASAP
3.10	Notify and escalate to CMT if Level 3 response required	EMT Lead	ASAP
4.	**Level 2 / 3 Monitoring, Evaluation & Surveillance**		
4.1	Request assistance from AMOSC via execution of Service Contract/Service Note or as requested by Control Agency	EMT Lead	ASAP
4.2	Mobilise surveillance by aircraft via service provider or as requested by Control Agency	EMT Logistics Lead	ASAP
4.3	Deploy oil spill tracking buoy	EMT Logistics Lead	ASAP
4.4	Initiate oil spill trajectory modelling via service provider or as requested by Control Agency	EMT Planning Lead	ASAP
5.	**Level 2 / 3 Oil Spill Response**		
5.1	Assess the feasibility and safety risks to implement source control. Develop source control strategy and implement when safe to do so.	EMT Lead	ASAP
5.2	For loss of integrity from subsea wells, inform Beach Emergency Management Team – see Table 4.4 below for immediate actions.	EMT Lead	ASAP
5.3	Determine and implement offshore and onshore response options for oil spill tracking, collection, treatment and clean-up as directed by Control Agency.	EMT Operations Lead / Health, Safety & Environment	As directed
5.4	Determine the likelihood for an oil slick to reach a shoreline and take necessary action as directed by Control Agency	Health, Safety & Environment	ASAP & As directed
5.5	Monitor shoreline and intertidal zones to identify areas affected by the oil spill and to determine the nature of the impact as directed by Control Agency	Health, Safety & Environment	ASAP & As directed

Item	Action	Responsibility	Timing
5.6	Complete role-specific ongoing actions as outlined in Appendix B of ERP	All EMT	ASAP
6.	**Ongoing Monitoring**		
6.1	Implement Beach Offshore Victoria OSMP	Health, Safety & Environment	As required

4.2.3 Loss of Well Control (L2 / L3)

Table 4.4: Immediate Actions – Loss of Well Control

Item	Action	Responsibility	Timing
1.	**Initial Emergency Actions**		
1.1	Implement Otway Offshore Well Control Bridging document	MODU OIM	ASAP
1.2	Notify and escalate to Beach Drilling Superintendent / Otway Offshore Drilling Manager	Beach Senior Wellsite Representative	ASAP
1.3	Initiate Wells Emergency Team (WET)	Wells Superintendent or Manager	ASAP
1.4	Notify EMT Leader	WET Leader	ASAP
1.5	In alignment with NOPSEMA accepted WOMP, implement: • Otway Offshore Blow-out contingency Plan (BCP); • Otway Offshore Drilling Emergency Response Plan (ERP); • Otway Offshore Drilling Well Control Bridging Document; • Well-specific Relief Well Plan	EMT Leader and WET	ASAP
1.6	Notify Otway Production Manager	EMT Lead	ASAP
1.7	Notify Operations Manager	EMT Lead	ASAP
2.	**Level 2 / 3 Notifications**		
2.1	For all LOWC incidents NOPSEMA: Ph: 08 6461 7090 Email: submissions@nopsema.gov.au	Emergency Management Liaison Officer (EMLO)	ASAP but not later than 2 hours after becoming aware of spill
2.2	Within Commonwealth waters (>3nm) – written report to NOPSEMA: Email: submissions@nopsema.gov.au and NOPTA: Email: info@nopta.gov.au	Emergency Management Liaison Officer (EMLO)	Within 3 days of spill
2.3	For all LOWC incidents with potential to impact Australian Marine Park(s) Director of National Parks: Ph: 02 6274 2220	Emergency Management Liaison Officer (EMLO)	ASAP
2.4	For all LOWC incidents with potential for moderate to significant environmental damage to Victorian State waters (<3nm) or the impact of wildlife (including cetaceans) DJPR EMB: Ph: 0409 858 715 (24/7) and Email: semdincidentroom@ecodev.vic.gov.au DELWP: Ph: 1300 134 444 Email: sscviv.scmdr.delwp@scc.vic.gov.au	Emergency Management Liaison Officer (EMLO)	ASAP

Item	Action	Responsibility	Timing
2.5	For all LOWC incidents with potential to cause, or may cause, environmental harm or environmental nuisance in Tasmanian State waters (<3nm) – refer to activity-specific EP for clarification DPIPWE: Ph: +61 (0)3 6165 4599 or 1800 005 171 (within Tasmania only) Radio: TasPorts Vessel Traffic Services VHF radio channel 16/14/12 Call sign "relevant port name VTS" Email: incidentresponse@epa.tas.gov.au	Emergency Management Liaison Officer (EMLO)	ASAP (first instance of oil on/in water)
2.6	Confirm takeover of incident by State agency as the Control Agency (<3nm)	EMT Lead	ASAP
2.7	Notify AMSA and request 2 km exclusion zone from the well location AMSA: Ph: 1800 641 792 Email: mdo@amsa.gov.au	Emergency Management Liaison Officer (EMLO)	ASAP
2.8	Complete Level 2/3 Incident Report (Appendix C. 4)	Emergency Management Liaison Officer (EMLO)	ASAP
2.9	Notify and escalate to CMT should well flow remain uncontrolled	EMT Lead	ASAP
3.	**Level 2 / 3 Monitoring, Evaluation & Surveillance**		
3.1	Request assistance from AMOSC via execution of Service Contract/Service Note	EMT Lead	ASAP
3.2	Mobilise surveillance by aircraft via service provider	EMT Logistics Lead	ASAP
3.3	Deploy oil spill tracking buoy	EMT Logistics Lead	ASAP
3.4	Initiate oil spill trajectory modelling via service provider	Health, Safety & Environment	ASAP
4.	**Level 2 / 3 Oil Spill Response**		
4.1	Request assistance from well control service provider	WET Lead	ASAP
4.2	Engage vessel broker and commission response vessels	EMT Logistics Lead	Within 2 weeks
4.3	Request assistance from AMOSC via execution of Service Contract/Service Note	EMT Lead	If required
4.4	Request assistance from AMOSC and deploy subsea first response toolkit	WET Operations	Within 2 weeks
4.5	Deploy MODU and commence drilling relief well	WET Operations	Within 8 weeks
4.6	Determine and implement offshore and onshore response options for oil spill tracking, dispersion, containment, collection, treatment and clean-up or as directed by Control Agency	Health, Safety & Environment	ASAP & As directed
4.7	Determine the likelihood for an oil slick to reach a shoreline and take necessary action as directed by Control Agency	Health, Safety & Environment	ASAP & As directed
4.8	Monitor shoreline and intertidal zones to identify areas affected by the oil spill and to determine the nature of the impact	Health, Safety & Environment	ASAP & As directed
4.9	Complete ongoing actions as outlined in Appendix B of ERP	All EMT	ASAP
5.	**Ongoing Monitoring**		
5.1	Implement Beach Offshore Victoria OSMP	Health, Safety & Environment	ASAP

5 Crisis and Emergency Management (CEM) Framework

The Beach emergency management structure consists of a three-tiered approach. With teams that have specific roles regarding response to and management of emergency and crisis events. This visual overview clearly depicts this framework and associated protocols for the effective management and coordination of all levels of emergency and crisis events impacting on the Beach organisation. The framework is depicted in Figure 5.1.

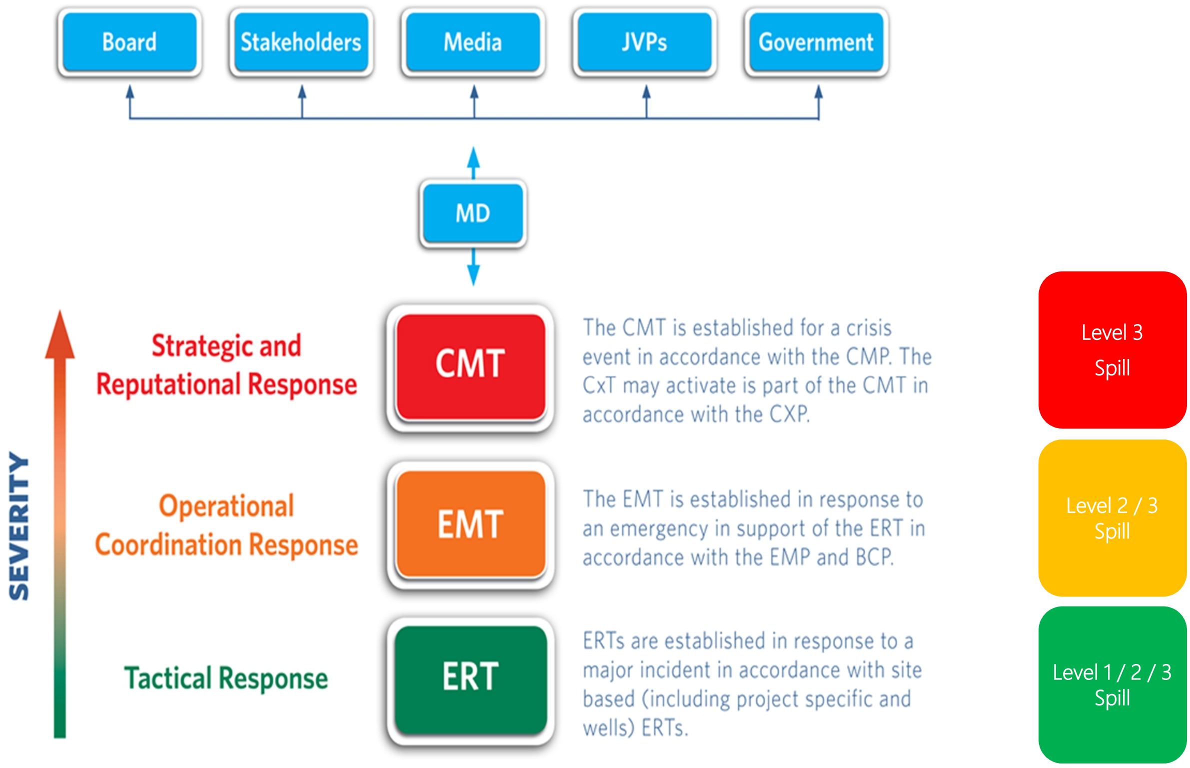


Figure 5.1: Beach Energy Crisis and Emergency Management Framework

In summary:

- Site-based ERTs carry out emergency response activities at the site of the emergency
- Adelaide and Melbourne based EMTs – provide operational management support to the site-based ERT, facilitate planning and liaise with external parties
- The Adelaide-based WET interface with the MODU and implement Beach source control procedures in the event of a LOWC
- The Adelaide-based CMT undertakes crisis management operations and direct strategic actions at the corporate level, addresses implications of the crisis on the employees, is concerned with the company's reputation, relationships with external parties and joint venture partners
- The CMT is activated for a crisis event or as directed by the MD or the CMT Leader.

The extent of the response structure will be dictated by the size of the incident and the required response.

5.1 Managing Director (MD)

The Beach Managing Director (MD) will be the critical interface between the CMT and senior external stakeholders, including, but not limited to the Beach Energy Board of Directors, the media and government.

The CMT Leader will keep the MD apprised of the incident and will discuss decisions of the CMT with the MD and render advice as required. However, the MD may assume the role of CMT Leader.

5.2 Crisis Management Team (CMT)

Leadership of the CMT (Figure 5.2) is empowered by the Beach MD to assume responsibility for providing strategic support to emergency or crisis events impacting Beach operations or commercial viability.

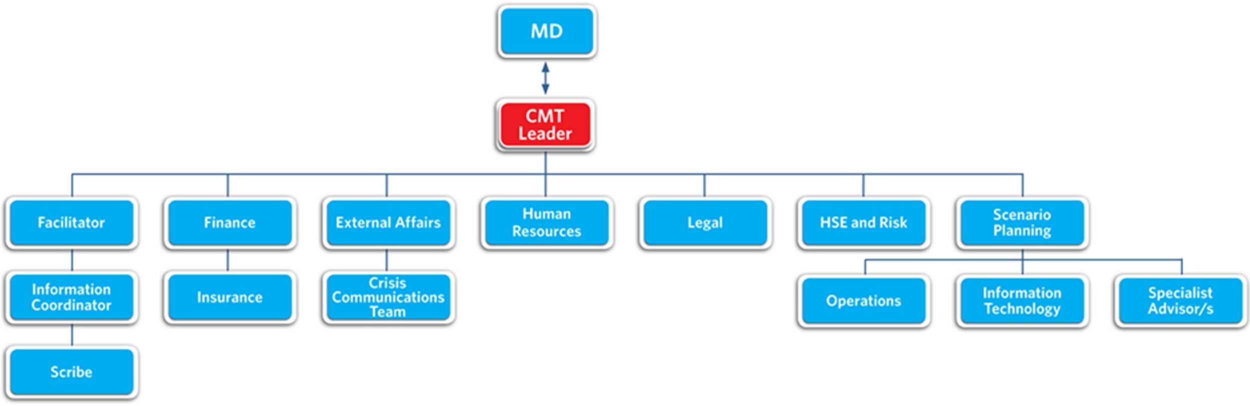


Figure 5.2: Composition of the Crisis Management Team

5.3 Emergency Management Team (EMT)

The EMT (Figure 5.3) is led by the EMT Leader and assumes responsibility for providing and coordinating operational emergency management activities in support of site/facility response activities during any emergency or crisis event. An Emergency Management Liaison Officer (EMLO) is embedded within the Oil Spill Response function of the EMT and acts as the key interface between the Beach EMT and State Control Agency Incident Management Teams (IMT).

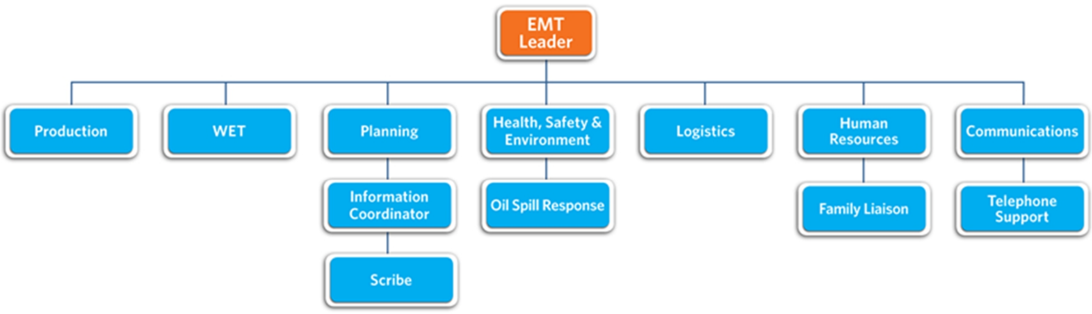


Figure 5.3: Composition of the Emergency Management Team

5.4 Emergency Response Team (ERT)

Each site has a site, project or area-specific ERP and an ERT that is typically a Beach team led by the ERT Leader. The site may also have Incident Controller/s reporting to them.

This role assumes responsibility for coordinating a site's tactical response to an emergency at a Beach site and for communicating with the Beach EMT and Emergency Services as required.

The ERT has responsibility for controlling the immediate response to a site emergency and providing direction, advice and support to the Incident Controller/s as required.

5.5 Wells Emergency Team (WET)

In the event of an emergency at Wells/Drilling site, the ERP of the Drilling Contractor is activated along-side that of the Beach Well Control Bridging document. All Beach personnel on site will have a role in an emergency and the senior Beach representative will be responsible for communicating with the on-call Well Emergency Team (WET) Leader.

In the event of an offshore well control incident, The WET will form and be the conduit of information to the EMT Leader. The WET's primary function is to bring the well under control.

The WET team consists of the WET Leader, WET Operations, WET Planning, WET Information Coordinator, HSE Advisor, WET Logistics and a Scribe. This team is the first line of communication from the Beach senior site representative (on site) to escalate the major incident or emergency event. The WET Leader will commence providing the site with additional resources and technical expertise. Additional resources may be called in, such as additional Technical/specialist engineers as required, and these personnel will constitute the WET. The WET Leader must inform the EMT Leader that the WET will be activating and will receive and assess the initial reports from the affected site. The WET will monitor rosters and resources of the site during a declared event and has oversight of company resources to the response and at the scene in coordination with the EMT and associated response strategy.

The WET will provide the EMT with updates from the affected Beach assets. The EMT will be able to support the response through the provision of additional resources (HR, HSE, Comms etc.) as well as being the conduit of information to the CMT. Together, the WET and the EMT work to resolve all issues including supply management and may involve system modelling, ongoing intelligence, risk exposures, engineering and technical issues, supply status and forecasting, alternate response strategies and overall assessment of the impacts that the event and any planned response may have on the system and supply situation.

5.6 Joint Strategic Coordination Committee (Victoria)

The following section has been adapted from DJPR guidance.

Transboundary arrangements from state to state is covered by the National Plan. Where Victorian State waters are impacted by cross-jurisdictional marine pollution incidents, DJPR will only assume the role of control agency for response activities occurring in Victorian State waters, in accordance with the State Maritime Emergencies (non-search and rescue) Plan. In this instance, Beach and DJPR shall work collaboratively, sharing response resources and providing qualified personnel to the DJPR IMT. To facilitate effective coordination between the two control agencies and their respective IMT, a Joint Strategic Coordination Committee (JSCC) shall be established. The control and coordination arrangements for cross-jurisdictional maritime emergencies is outlined in Figure 9.

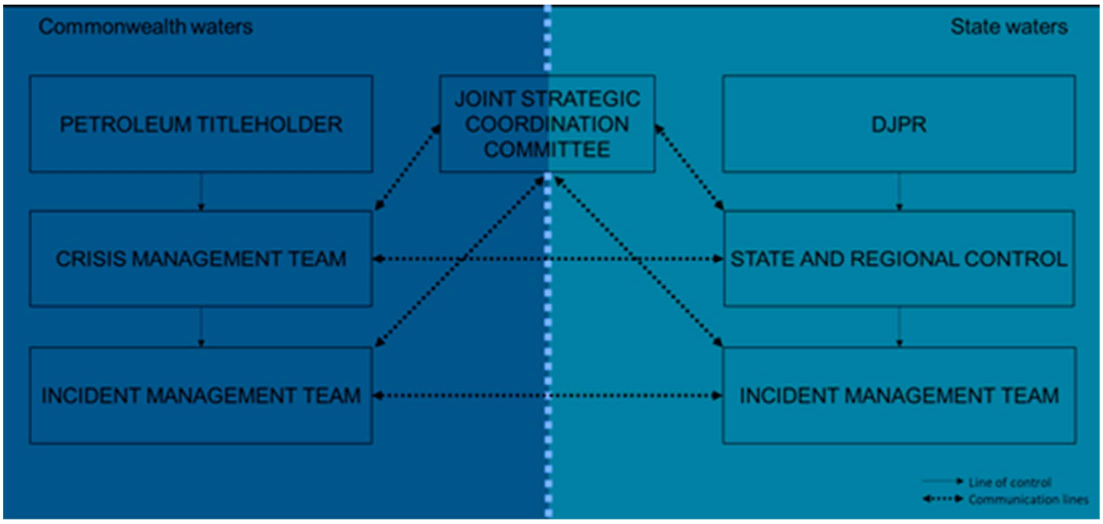


Figure 5.4: Joint Strategic Coordination Committee (Victoria) structure (DJPR, 2019).

The role of the JSCC is to ensure appropriate coordination between the respective IMTs established by multiple control agencies. The key functions of the JSCC include:

- Ensuring key objectives set by multiple IMTs in relation to the marine pollution incident are consistent and focused on achieving an effective coordinated response
- Resolving competing priorities between multiple IMTs
- Resolving competing requests for resources between the multiple IMTs, including those managed by Australian Maritime Safety Authority (AMSA), such as national stockpile equipment, dispersant aircraft and the National Response Team
- Resolution of significant strategic issues as they arise during the incident response
- Ensuring that there is a shared understanding of the incident situation and its meaning amongst all key stakeholders
- Ensuring there is agreement on how information is communicated to the public, particularly those issues that have actual or perceived public health implications
- Ensuring adequate coordination and consistency is achieved in relation to access and interpretation of intelligence, information and spill modelling to promote a common operating picture.

The JSCC will be administered by DJPR and the inaugural JSCC meeting will be convened by the State Controller Maritime Emergencies (SCME) once both Beach and DJPR formally assume the role of control agency in respective jurisdictions.

The JSCC will be jointly chaired by the SCME and the Beach CMT/EMT Leader, who will determine whom will sit in the committee for a coordinated response. As the relevant jurisdictional authority in Commonwealth waters, NOPSEMA may opt to participate in the JSCC as they see fit.

In a cross-jurisdictional marine pollution incident, DJPR and Beach shall each deploy an EMLO to corresponding IMTs for effective communication between DJPR and Beach. The role of the DJPR EMLO includes, but is not limited to:

- Represent DJPR and provide the primary contact for Beach, inter-agency and/or inter-State coordination
- Facilitate effective communications between DJPR's SCME and Incident Controller and the Beach CMT / EMT Leader
- Provide enhanced situational awareness to DJPR of the incident and the potential impact on State waters
- Facilitate the delivery of technical advice from DJPR to the Beach EMT Leader as required.

5.7 Roster

A roster is maintained for CMT Leaders and for full EMTs (inclusive of the WET). The roster is promulgated each Friday morning for the next twelve weeks and is kept on the Beach Energy Intranet 'Umbrella' in the 'Emergency Management' site. See link: Weekly EMT and CMT on-call roster [1]

All CMT, EMT and WET members (both primary and secondary) will make themselves available to the extent possible, acknowledging that alternates will be called if the primary is not contactable. Primary members will advise their alternate when they will not be available to respond.

CMT leaders, in the absence of either the primary or the secondary being available, must contact suitable persons within the organisation with the required subject matter expertise.

[1] https://hse.beachenergy.com.au/Weekly%20EMT%20oncall%20roster/Forms/AllItems.aspx

6 Responsibilities/Accountabilities

For Level 1 spills, the site ERT has responsibility for oil spill response and implementation of this OPEP.

For Level 2/3 spills, the Beach EMT Leader has responsibility for oil spill response and implementation of this OPEP in parallel with the Emergency Management Plan (EMP) (INT 1000 SAF PLN, CDN/ID 18025990).

Individual role and responsibility checklists for the EMT can be found in Appendix B of the EMP.

In the event of loss of containment/spill, the EMT Health, Safety & Environment (HSE) Leader becomes the 2nd In Command (2IC). (Appendix B. 2 of EMP)

Role-specific responsibilities for an offshore oil pollution emergency are detailed in the immediate actions and notifications (Section 3) of this OPEP.

For Level 3 spills, the CMT has responsibility for implementation of the Crisis Management Plan (CMP)

For Level Individual role and responsibility checklists for the CMT can be found in Appendix B of the CMP.

7 Net Environmental Benefit Analysis (NEBA)

The NEBA process is used to compare the likely positive and negative outcomes of various oil spill response options with respect to environmental sensitivities at risk from the spill or response activities. NEBA recognises that certain clean-up options may cause a net negative environmental impact in comparison to the impact of leaving the spill to disperse and weather naturally or alternative response options. The key objective is to identify the response options that will result in minimal impacts and maximum recovery of the environment, considering the specific sensitivities of the resources that have been prioritised for protection. The NEBA will be undertaken by the Control Agency.

A NEBA may be either 'strategic' (pre-spill event) or 'operational' (post-spill event).

The following steps allow for an effective NEBA to be conducted:

Step 1

a. Identify potential spill impact area based on incident specifics, trajectory modelling and observations. Within the predicted impact area, identify the key characteristics of the habitats. This can be based on field observation, aerial photos and local knowledge.

Step 2

a. Identify resources (human, ecological, economic etc) at risk at each of the different habitats within the impact area.

Step 3

a. Assess the potential impact from the spill on each of the resources at risk based on severity of impact and predicted recovery time. This is assuming no response to the spill.

b. A precautionary approach should be adopted, assuming that the entire site will be covered by oil and that this will persist at the site for at least 24 hours. However, in certain situations the behaviour of the spill may be more accurately predicted, and this information can be used when assessing potential impacts. The second assumption that must be agreed is whether the percentage of a species or resource impacted relates to the local (site), regional or even global (in the case of endangered species) population. This does not necessarily need to be consistently applied to all resources at the site. For example, it may be considered that if a resource is very abundant regionally then it is not significant enough at a particular site to warrant a high level of concern even though it may be seriously impacted at that site.

Step 4

a. Review the site-specific advantages and disadvantages of the different response options available, using natural recovery as a baseline. The predicted effect, likely impact and recovery time of the various response options on each of the resources must be assessed.

b. In the case of a hydrocarbon spill from Beach activities or operations within the Otway Basin impacting Victorian State waters and/or lands, it is expected that the Control Agency (DJPR) would undertake an operational NEBA, with support from Beach as requested, in determining the most appropriate response actions in accordance with the NatPlan or the VicPlan as applicable. Under the NatPlan, Environmental Science Coordinators contribute advice on likely environmental outcomes of each response option to the spill planning team based on a NEBA approach.

c. As part of the response planning process, Beach has conducted strategic NEBA (Table 10.2). As part of the due diligence process, Beach may also conduct an operational NEBA and would engage with the Control Agency regarding the results of that assessment and recommendations for response activities. Additionally, information from the NEBA may be used to help inform requirements for environmental monitoring relating to anticipated impacts from the spill and any response activities. Beach's operational NEBA assessment would be conducted by an environmental professional with experience in oil spill planning and response.

8 Response Areas and Onshore Priority Planning Areas

8.1 Response areas

To identify the response planning areas the following oil exposures were used adopted based on AMSA guidance:

- Offshore: A sea surface oil exposure of >25 g/m^2 as this represents the practical limit for surface response options; below this thickness, oil containment, recovery and chemical treatment (dispersant) become ineffective
- Onshore: A shoreline contact exposure of >100 g/m^2 as this represents the minimum thickness that does not inhibit the potential for recovery and is best remediated by natural coastal processes alone.

It is noted that within NOPSEMA Bulletin #1 Oil spill modelling (A652993) (NOPSEMA 2019) refers to >50 g/m^2 as a level to inform response planning, and therefore the use of >25 g/m^2 from stochastic modelling results is considered conservative.

For the spill scenarios as identified in Section 3.4, the response areas have been defined based on the outcomes of stochastic modelling (Figure 8.1).

Note there is no offshore response areas associated with the LOWC scenarios for the drilling or producing wells (i.e. there was no surface exposure above the >25 g/m^2 threshold predicted). Similarly, there is no onshore response area associated with the producing LOWC scenarios.

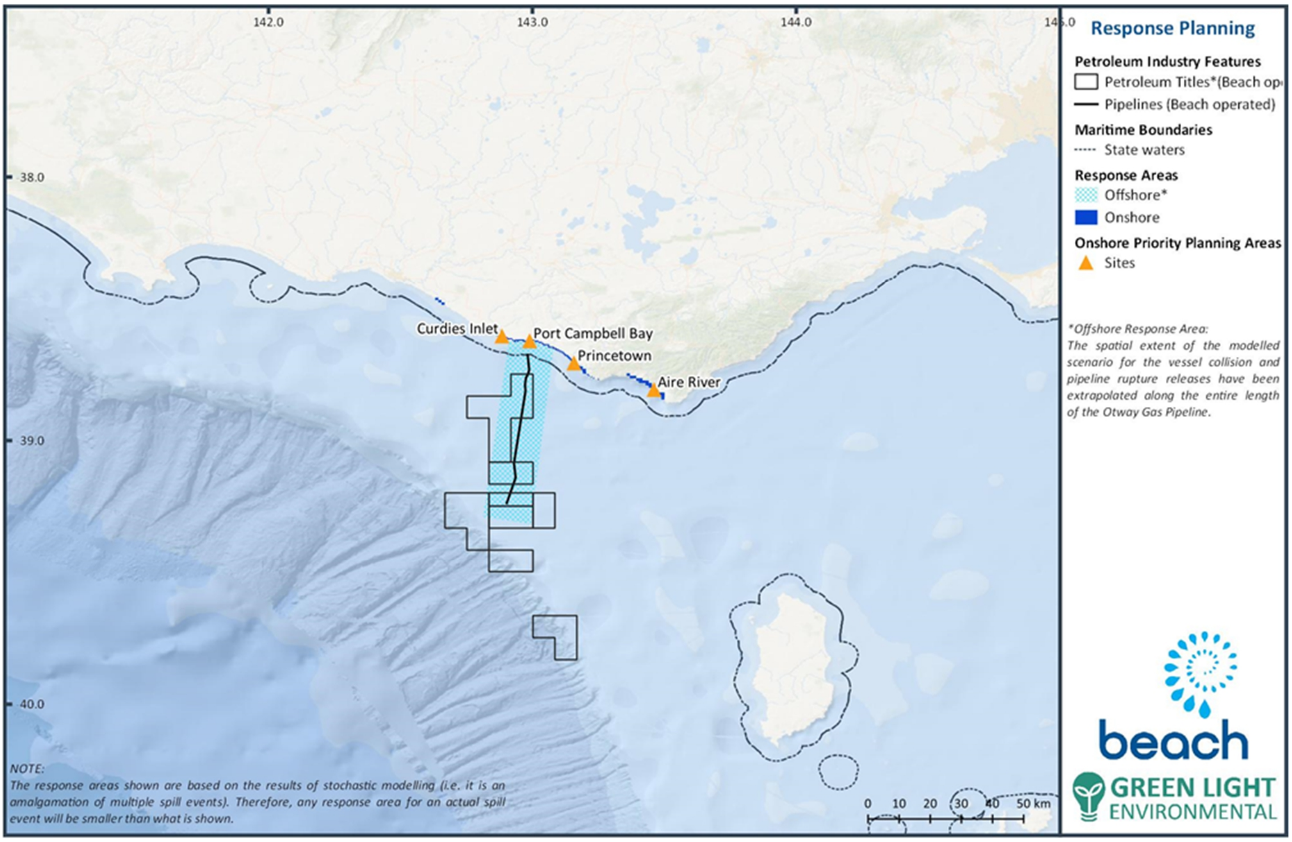


Figure 8.1: Response areas and onshore priority planning areas

8.2 Onshore priority planning areas

Within the onshore response areas, priority planning areas have been identified where the following two criteria are met:

- Predicted time to exposure is less than 7-days
- Sensitive environmental receptors are present in the intertidal/coastal zone:
  - National or internally important wetlands
  - Sheltered tidal flats
  - Mangrove or saltmarsh habitat
  - Known breeding/calving/nesting aggregation areas for protected fauna
  - Known breeding/haul-out areas for pinnipeds
  - Threatened ecological communities.

Note, the requirement for time to exposure is based upon the time required to plan and implement a response in this area, i.e. it is estimated to take approximately 5 days to develop and ground-truth a tactical response plan (TRP) and 24-48 hours to mobilise equipment and personnel to location.

The priority planning areas identified for spill scenarios that are relevant to the Otway Basin assets and activities are detailed in Table 8.1. A series of TRPs have been developed for these priority protection areas to assist in implementing a rapid response.

Table 8.1: Priority response planning areas

Priority response planning area	Sensitive environmental receptors
Aire River	• Wetland of national importance • Saltmarsh habitat
Princetown	• Wetland of national importance • Saltmarsh habitat • Nearshore TEC (Giant Kelp)
Port Campbell Bay	• Nearshore TEC (Giant Kelp)
Curdies Inlet	• Saltmarsh habitat

9 Environmental Monitoring

The Offshore Victoria Operational and Scientific Monitoring Plan (OSMP) provides a framework for Beach's environmental monitoring response to Level 2 and Level 3 offshore hydrocarbon spills from their petroleum activities undertaken in the Otway and Bass Basins.

Oil spill monitoring has been divided into two types:

- Operational monitoring which collects information about the spill and associated response activities to aid planning and decision making during the response or clean-up operations. Operational monitoring typically finishes when the spill response is terminated.

- Scientific monitoring (also known as Type II or recovery phase monitoring) which is focussed on non-response objectives and evaluating environmental impact and recovery from the spill and response activities. Scientific monitoring may continue for extended periods after a spill response is terminated.

Operational monitoring studies may be implemented in conjunction with relevant response strategies as described in this OPEP (e.g. Monitoring and Evaluation, Chemical Dispersants, Shoreline Clean-up and oiled wildlife response (OWR)).

10 Response Strategies

There are a number of response strategies which can be utilised in response to hydrocarbon spills, including:

- Source control
- Monitoring and evaluation
- Assisted natural dispersion
- Chemical dispersants
- Containment and recovery
- Protection and deflection
- Shoreline assessment and clean-up
- Oiled wildlife response.

Table 10.1 summarises the response options that are feasible and effective in response to the hydrocarbon types associated with the Otway Offshore activities.

Table 10.1: Response option feasibility and effectiveness by hydrocarbon type

Response Strategy	Hydrocarbon Type	Feasibility / Effectiveness	Implement	Justification
Source control	Gas Condensate & DMA	Feasible & effective	Yes	Always primary spill response strategy. Reduction in release volume has direct environmental benefit.
Monitor & evaluate	Gas Condensate & DMA	Feasible & effective	Yes	Both gas condensate and DMA will largely evaporate and disperse rapidly, a residual fraction of the hydrocarbon may spread to sensitive receptors. Monitoring and evaluation of the spill trajectory will provide information to inform other response strategies and monitoring requirements.
Assisted natural dispersion	Gas Condensate	Not feasible & not effective	No	Gas condensate will evaporate and disperse rapidly, therefore assisted natural dispersion will present no net environment benefit.
	DMA	Feasible but partially effective	Pending NEBA	DMA will evaporate and disperse rapidly. Depending on weather conditions, thickness of surface slick proximity to sensitive receptors this response may present a net environmental benefit.
Chemical dispersants	Gas Condensate & DMA	Feasible but not effective	Pending NEBA & only for VOC reduction	Not recommended for Group I oils such as condensate due to the very low viscosity and high volatility – generally no environmental benefit gained by the application of dispersant on Group I oils. Subsea dispersant injection (SSDI) may reduce volatile organic compounds (VOCs) at sea surface within the response area, therefore creating a safer work environment for responders.
	DMA	Feasible but not effective	No	Although “conditional” for Group II oil, the size of potential spill volume and the natural tendency of spreading into very thin films is evidence that dispersant application will be an ineffective

Response Strategy	Hydrocarbon Type	Feasibility / Effectiveness	Implement	Justification
				response. The dispersant droplets will penetrate through the thin oil layer and cause 'herding' of the oil which creates areas of clear water and should not be mistaken for successful dispersion (see ITOPF – Technical Information Paper No. 4: The Use of Chemical Dispersants to Treat Oil Spills).
Containment & recovery	Gas Condensate	Not feasible & not effective	No	High volatility of condensate creates inherent safety risks when attempting to recover mechanically. Logistically, gas condensate will evaporate faster than the collection rate of a thin surface film present. To be of value, contain and recover techniques are dependent on adequate oil thickness (generally in excess of 10 g/m^2)
	DMA	Not feasible & not effective	No	Low viscosity property allows for efficient containment by boom and recovery by oleophilic skimmers (i.e. komara disc skimmer) with ~90% hydrocarbon to water recovery rate. To be of value, contain and recover techniques are dependent on adequate oil thickness (generally in excess of 10 g/m^2), The normal sea state of the Otway basin does not provide significant opportunities to utilise this equipment.
Protection & deflection	Gas Condensate	Potentially feasible & partially effective	Pending NEBA	High volatility of condensate creates inherent safety risks when attempting to deflect mechanically. The normal sea state of the Otway Basin does not provide significant opportunities to utilise this equipment efficiently.
	DMA	Potentially feasible & partially effective	Pending NEBA	Low viscosity property allows for efficient protection and deflection with boom such as absorbent, zoom boom and beach guardian. The normal sea state of the Otway basin does not provide significant opportunities to utilise this equipment efficiently.
Shoreline assessment & clean-up	Gas Condensate	Potentially feasible & partially effective	Pending NEBA	Condensate is highly volatile and will evaporate naturally even if shoreline impact occurred. Potentially, more environmental impact would occur during clean-up operations depending on the shoreline type and sensitivities present. Shoreline assessment activities would occur if shoreline impact occurred.
	DMA	Potentially feasible & partially effective	Pending NEBA	The normal sea state of the Otway basin encourages natural processes with high energy wave action, wind and regular storm events. Potentially, more environmental impact would occur during clean-up operations depending on the shoreline type and sensitivities present. Shoreline assessment activities would occur if shoreline impact occurred.
Oiled wildlife response	Gas Condensate	Potentially feasible & partially effective	Yes	If oiling occurs in areas above the conservative environmental exposure threshold of >10g/m^2 for surface & >100g/m^2 for shoreline, oiled wildlife response may be effective. At the direction of State Control Agency, impacts to wildlife shall be monitored and oiled wildlife response implemented to affected wildlife as appropriate. Effectiveness of response option depends on affected species and habitat type.
	DMA	Potentially feasible & partially effective	Yes	

10.1 Strategic NEBA and Response Strategy Implementation

Table 10.2 summarises the response strategies that are relevant (based upon the extent of hydrocarbon exposure) and feasible or potentially feasible to implement for hypothetical spill scenarios associated with the Otway Offshore activities and a strategic pre-spill NEBA.

Table 10.2 : Response feasibility and strategic NEBA

Scenario	Hydrocarbon Type	Response	Strategic NEBA
Vessel Spill	DMA	Source Control	Yes, source control always considered to provide net environmental benefit by virtue of reducing the overall spill volume.
		Monitor & Evaluate	No direct net environmental benefit. Indirect benefit by informing response strategies.
		Assisted Natural Dispersion	Site-specific operational NEBA required prior to undertaking response option given variability in potential impact depending on location of spill in relation to marine ecology and habitats.
		Protect & Deflect	Yes, potential net environmental benefit to coastal habitats, coastal ecology and socio-economic receptors. Site-specific operational NEBA required prior to undertaking response option.
		Shoreline Clean-up	Yes, potential net environmental benefit to coastal habitats: sandy beaches & intertidal rocky platforms. Potential net benefit to shoreline birds and socio-economic receptors. Potential negative impact for coastal habitats: saltmarsh / seagrass & wetlands. Site-specific operational NEBA required prior to undertaking response option.
		Oiled Wildlife Response	Will occur (at the direction of State Control Agency) for all impacted species: cetaceans, pinnipeds, turtles & sea birds. Coastal ecology: shoreline birds, pinniped haul-out sites & penguin colonies.
Loss of Integrity Platform or Pipeline	Gas Condensate	Source Control	Yes, source control always considered to provide net environmental benefit by virtue of reducing the overall spill volume.
		Monitor & Evaluate	No direct net environmental benefit. Indirect benefit by informing response strategies.
Loss of Well Control	Gas Condensate	Source Control	Yes. Source control always considered to provide net environmental benefit by virtue of reducing the overall spill volume.
		Monitor & Evaluate	No direct net environmental benefit. Indirect benefit by informing response strategies.
		Chemical Dispersants	No direct net environmental benefit. Indirect benefit by potentially enabling a more effective source control operation and reducing safety risks for responders. Dispersant efficacy & VOC monitoring determines overall net benefit of applying dispersants.
		Protect & Deflect	Yes, potential net environmental benefit to coastal habitats, coastal ecology and socio-economic receptors. Site-specific operational NEBA required prior to undertaking response option.
		Shoreline Clean-up	Yes, potential net environmental benefit to coastal habitats: sandy beaches & intertidal rocky platforms. Potential net benefit to shoreline birds and socio-economic receptors. Potential negative impact for coastal habitats: saltmarsh / seagrass & wetlands. Site-specific operational NEBA required prior to undertaking response option.

Scenario	Hydrocarbon Type	Response	Strategic NEBA
		Oiled Wildlife Response	Will occur (at the direction of State Control Agency) for all impacted species: cetaceans, pinnipeds, turtles & sea birds. Coastal ecology: shoreline birds, pinniped haul-out sites & penguin colonies.

10.1.1 Source Control

Source control is the primary and most effective form of spill response. In the event of an offshore hydrocarbon spill, the feasibility of controlling the spill from the source should always be considered, giving due consideration to logistical constraints and safety implications.

Source control equipment and resources available to Beach in the event of a LOWC are detailed in Appendix B. 1.

10.1.1.1 Vessel

For a vessel spill at sea, the Vessel Master shall implement the Shipboard Marine Pollution Emergency Plan (SMPEP) or Shipboard Oil Pollution Emergency Plan (SOPEP) (equivalent to class).

10.1.1.2 Pipeline / Platform

System pressures are monitored via the distributed control system (DCS) onshore, and the platform and pipeline can be shut down via the DCS or emergency shut down (ESD) can be implemented from the platform.

10.1.1.3 Well Control

Restoring well control is the primary objective under a loss of well control scenario. The primary method of well control is via a dynamic well kill by intersecting the well bore below the release location via a relief well and circulating kill weight drilling fluid into the well bore, thus controlling the flow of hydrocarbons from the reservoir.

Capping stack systems have not proven to be effective in water depths less than 100m. This is due to the hazards relating to the deployment of a cap on a free flowing well. Alternative techniques like offset installation equipment (OIE) have been developed for wells at water depths of greater than 75m; however, these may still not be effective in the Otway Basin. Prior to the drilling of any well a Relief Well Plan will be developed. This will provide details of all realistic well control scenarios and will review the potential use of capping stack and OIE technology on a case by case basis. If capping stack or OIE technology is shown to be a viable option, then it will form part of the Relief Well Plan.

Relief Well

Drilling a relief well is the primary source control strategy for wells in the Otway Basin. Each well, or group of similar wells, has a Relief Well Plan detailing: the relief well strategy for each well or group of similar wells, anticipated timeframes to drill a relief well and resources available to implement the relief well strategy.

Beach anticipate the mobilisation of an alternate MODU to the Otway Basin and the successful intersection of a flowing well would take approximately 86 days. Details of the source control methods applicable to the specific wells will be detailed in Well-specific Relief Well Plans.

Chemical Dispersant Application

Whilst ineffective as a response option for dispersing gas condensate or diesel oil from the sea surface, subsea dispersant injection (SSDI) within the column of flowing hydrocarbons and/or the application of dispersants at surface may act to reduce volatile organic compounds (VOCs) within the response area, thereby enabling the implementation of well control strategies.

Potentially suitable chemical dispersants can be found on the Register of Oil Spill Control Agents (OSCA).

Monitoring dispersant efficacy to achieve the desired outcome is essential to ensure dispersant application is providing a net environmental benefit during a response.

10.1.2 Monitoring and Evaluation

Understanding the behaviour and trajectory of hydrocarbon slicks is required for L2 and L3 spill scenarios to confirm the potential for environmental harm from the spill. There are a number of methods that can be used to monitor and evaluate hydrocarbon spills including direct observation (surveillance by air, vessel or tracking buoys), manual calculations, or computer modelling. Each of these methods, including the triggers for their use, is discussed in the following sections.

10.1.2.1 Predicting spill trajectory

Manual calculations for estimation of spill trajectory will be used for an initial calculation in parallel with oil spill trajectory modelling (OSTM) to provide an accurate spill trajectory for the current weather conditions and type/volume of hydrocarbon spill.

For a L2 or L3 spill, trajectory modelling would be conducted based on real time spill and metocean data and this information would be used to refine the spill response planning and execution.

10.1.2.2 Aerial / Vessel surveillance

Estimation of hydrocarbon volume can be estimated using the Bonn Agreement Oil Appearance Code (BAOAC – Refer to Appendix D).

Aircraft provide a better platform than vessels for surveillance, and Beach would utilise this option in the event of a Level 2 or 3 spill to provide information on the location, extent, trajectory and spill volume estimate.

Fixed-wing aviation support available to Beach in the event of a L2/L3 spill is detailed in Appendix B. 3. Trained oil spill observers would be engaged from AMOSC to undertake the observations.

Aerial observations would be discontinued (with only shoreline surveillance remaining) once no areas of metallic sheen or true oil colour were observed as this would indicate that the slick thickness was less than 5 microns throughout and therefore poses little risk of environmental harm and is not amenable for any on-water or shoreline clean-up techniques.

10.1.2.3 Satellite Tracking Buoys

These units can be used to track the movement and extent of a spill. Beach will obtain these units from AMOSC if deemed required during a response and may be used in parallel with aerial surveillance to track the extent of a spill.

10.1.3 Protection and Deflection

Deflection equipment such as booms can be deployed to deflect slicks from encroaching on environmentally sensitive areas. Absorbent type booms are a suitable secondary protection measures at environmental sensitive sites. The feasibility and effectiveness of these measures is largely dependent on calm sea conditions allowing for the deployment of booms and this response option is only warranted where shoreline resources or offshore infrastructure are at risk.

Priority response areas are identified in Section 8.2.

Detailed Tactical Response Plans (TRPs) have been developed for priority protection areas.

All protection and deflection operations within State waters shall be under the direction of the State Control Agency. Beach will support protection and deflection operations as direct by State Control Agency.

10.1.4 Shoreline Clean-Up

Shoreline clean-up strategies must be developed in consideration of the shoreline character, resources at risk, and nature and degree of oiling. In general, other strategies are considered prior to shoreline clean-up due to the immediate environmental impact, heavy resource requirement, health and safety concerns (i.e. manual handling, heat stress, fatigue, etc), logistical complexities and waste management.

Shoreline clean-up of diesel or condensate is not generally feasible or beneficial in the high energy environments typical of the Victorian south coast, and any diesel would be highly weathered before it could make landfall and would be expected to have minimal environmental impacts.

The coastline of the Otway Basin is dominated by sheer sandstone cliffs with small and remote beaches which experience frequent heavy surf and swell. These locations rarely have vehicle that would allow for the deployment of clean-up equipment and teams. Any hydrocarbons on these shorelines will likely weather rapidly and be broken down by natural processes.

In the event shoreline impact, DJPR would be the State Control Agency for the response within Sate waters or lands. Beach would support the response option as directed.

10.1.5 Oiled Wildlife Response (OWR)

10.1.5.1 Victorian State waters

DELWP is the agency responsible for responding to wildlife affected by a marine pollution emergency in Victorian State waters. If an incident which affects or could potentially affect wildlife occurs in Commonwealth waters close to Victorian State waters, AMSA will request support from DELWP to assess and lead a response if required. DELWP's response to oiled wildlife is undertaken in accordance with the Wildlife Response Plan for Marine Pollution Emergencies (draft).

Beach will provide support for the response through provision of resources as requested by DELWP utilising existing contracts such as AMOSC.

AMOSC maintains oiled fauna kits.

Both DELWP and AMSA have local and regional oiled wildlife response capability that may be activated under the direction of DELWP.

Personnel may also be deployed under the direction of DELWP to undertake wildlife response activities in State jurisdiction.

DELWP responds to oiled wildlife notifications and has identified the following steps which must be taken when reporting wildlife affected by an oil spill:

1. Notify the DJPR State Duty Officer on 0409 858 715 and the DELWP State Agency Commander on 1300 13 4444 immediately.
2. Notify AMSA (02 6230 6811) if the oil spill occurs in Commonwealth waters and wildlife is affected.
3. Determine the exact location of the animal and provide accurate directions. Maintain observation until DELWP can deploy staff to the site.
4. Take response actions only as advised by DELWP or AMSA:
    - Determine the exact location of the animal for accurate directions for appropriately trained wildlife response personnel. Maintain observation and keep people, dogs and wildlife scavengers away until trained rescuers have arrived.
    - Avoid handling or treating injured wildlife as this may cause further stress and poses a safety risk to untrained handlers.

10.1.5.2 Tasmanian State Waters

The Tasmanian Oiled Wildlife Response Plan (WildPlan) is administered by the Resource Management and Conservation Division of the DPIPWE and outlines priorities and procedures for the rescue and rehabilitation of oiled wildlife.

Wildlife rescue kits are held at the Hobart and Launceston DPIPWE offices.

To activate oiled wildlife response, contact Natural and Cultural Heritage Division (OWR) on (03) 6165 4396

10.2 Waste Management

10.2.1 Disposal of Waste

Of the modelled worst-case discharge scenarios, only a near-shore diesel spill from a vessel collision of a full LOWC from Artisan-1 well location is predicted to result in actionable thresholds of shoreline hydrocarbon exposure. Likewise, these scenarios also have the potential for waste generation from oiled wildlife response.

10.2.2 Waste Management Methodology

This section provides context for the potential scale of waste that may be generated during oil pollution response operations.

During clean-up and oil recovery operations, the type and amount of waste generated will depend on the location and recovery method (see Table 10.3).

Table 10.3: Waste volume calculation

Location	Hydrocarbon : Waste volume	Comments
Offshore recovery	1 : 3	Inefficiency of recovery systems causing higher levels of water to oil ratio intake
Shoreline clean-up	1 : 10-20	Significant increase in waste volume due to collection of surrounding environment

In the event of a clean-up operation, temporary waste handling bases will be set up at designated staging areas such as Port Welshpool. Beach in conjunction with its current waste management contractor will determine the suitability of temporary storage facilities for the collected hydrocarbons and oily debris. Table 10.4 summarises packing, storing and disposal of different types of waste that Beach's EPA licensed waste contractor, can support.

The transport of waste material may be required at sea, from sea to land and on land to on land, liquid transport trucks, flatbed trucks, dump trucks and gully suckers can be utilised to transport waste material through Beach's licensed waste contractor.

Table 10.4: Waste category, storage, disposal and treatment options

Waste category	Packing & temporary onsite storage	Disposal & treatment[5]
Oiled Liquids	Oil field tanks (fast tanks) IBC Tank trucks Livestock tanks Sealed oil drums Lined skips/pits[1]	Recovery and recycling Bioremediation/land farming[3] Incineration/land filling[2]
Oiled man-made materials	Lined skips Lined earthen pits or berms[1] Industrial waste bags Plastic trash bags Sealed-top drums	Recovery and recycling Incineration/land filling[2]
Oiled naturally occurring organic materials	Lined skips Lined earthen pits or berms[1] Industrial waste bags Plastic trash bags Sealed-Top drums	Recovery and recycling Bioremediation/land farming[3] Incineration/land filling[2]
Oiled dead wildlife/birds[4]	Industrial waste bags Plastic trash bags	Incineration/land filling[2]

1. Lined pits for the storage of oiled wastes cannot be constructed within a National Park due to the sensitivity of the location. The potential impacts on subterranean fauna and aquifers must be considered at all other locations.
2. Incineration and land filling will only occur at appropriately licensed waste disposal facilities
3. Suitable areas to be identified in consultation with local and state authorities.
4. Wildlife and birds are collected by those trained in wildlife recovery. All dead wildlife and birds must be segregated. Some wildlife carcasses may need to be retained for scientific purposes. DELWP and/or DPIPWE will provide direction if this is required.
5. Sorted by most preferred to least preferred method

11 Spill Response Environmental Performance Outcomes, Standards & Measurement Criteria

Table 11.1: Spill Response Environmental Performance Outcomes, Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Responsible Person	Measurement Criteria
Source Control			
Isolation of spill source & cessation of spill to sea from vessel spill	**SOPEP/SMPEP** Beach requires all vessels contracted within the Otway Basin to have an SOPEP / SMPEP (appropriate to class).	Vessel Owner / Operator	Vessel contracts Pre-mobilisation inspection records
Beach has source control plans in place	**Source Control Plans** Beach shall have: • A NOPSEMA accepted WOMP for all wells prior to drilling and throughout the production phase; • A Source Control Contingency Plan (SCCP) consistent with International Oil and Gas Producers (IOGP) Report 594 - Subsea Well Source Control Emergency Response Planning Guide for Subsea Wells (Jan, 2019). • A relief well plan for all wells, or groups of similar wells prior to drilling and throughout the production phase.	Offshore Wells Manager	Documented NOPSEMA accepted WOMP Documented SCCP Documented Relief Well Plans
Beach maintains capability to effectively implement well control	**Well Control Resources** Beach shall maintain contractual agreements with response organisations for direct or indirect access to: • Well control specialists; • Debris clearance equipment; • Chemical dispersants and application equipment; • Response vessels; and • MODUs	Offshore Wells Manager	Well Control Bridging Document with Rig Contractor Well Control Specialist contract(s) in place AMOSC contract in place with option to access ORSL equipment Vessel / MODU Broker reports
Beach tests source control capability	**Spill Response Exercises** Beach shall undertake a desktop source control exercise at least annually.	Crisis, Emergency & Security Advisor	Exercise records including annual source control capability testing
Beach responds in a timely manner	**Response Timing** Beach shall: • Mobilise Well Control Specialists to Adelaide within 3 days of a L3 LOWC event; • Drill a successful relief well within 86 days of a L3 LOWC event occurring.	Wells Emergency Team	Mobilisation records confirm: • Well Control Specialist on site within 3 days; • Well fully controlled within 86 days
Beach controls the use of chemical dispersants	**Dispersant Application** Beach shall: • Only use chemical dispersants to reduce VOCs within the source control response area; • Only use dispersants on the Register of Oil Spill Control Agents; • Monitor dispersant efficacy for reducing VOCs to below lower explosive limits (LVLs) within the response area; • Cease dispersant application if dispersant found to be ineffective for reducing VOCs to below LVLs within the response area; when there is no health and safety risk to response personnel from VOCs; and when the well is controlled.	EMT Lead	Incident Action Plan (IAP) Monitoring records including VOC measurements Incident records including dispersant type & usage
Beach monitors the effectiveness of dispersants	**Operational Monitoring** Beach will implement the following operational monitoring in alignment with the Offshore Victoria Operational and Scientific Monitoring Plan: • Study O4: Dispersant efficacy	HSE Lead	Monitoring records

Environmental Performance Outcome	Environmental Performance Standard	Responsible Person	Measurement Criteria
Monitoring and Evaluation			
Beach maintains capability to effectively implement monitoring & evaluation	**Monitoring & Evaluation Resources** Beach Energy shall maintain contractual agreements with response organisations for direct or indirect access to: • AMOSC trained observers; • AMOSC equipment; • Fixed-wing aircraft; • Surveillance vessels; and • OSTM Consultants	Crisis, Emergency & Security Advisor	AMOSC contract in place Aviation contracts in place OSTM contract in place Vessel / MODU Broker reports
Risks managed from monitoring & evaluation	**Risk Assessment** In consultation with State Control Agency and relevant stakeholders, and prior to undertaking monitoring & evaluation operations, Beach will undertake a risk assessment (Beach's Risk Assessment Process will be used unless otherwise directed) and mitigate potential impacts to: • Marine fauna including listed migratory species; • Commercial shipping; • Aviation; and • Socio-economic receptors	EMT Lead	Documented risk assessment Consultation records
Beach implements monitoring & evaluation to inform spill response for L2/3 spills	**Implement Monitoring & Evaluation** Beach will implement monitoring and evaluation (as per s10.1.2 or as directed by the Control Agency) during a L2/L3 oil pollution emergency or as requested by State Control Agency where state waters are, or have the potential to be, impacted.	EMT Lead	Incident records
Shoreline Clean-up			
Beach maintains capability to effectively assess shorelines and implement shoreline clean-up	**Shoreline Clean-up Resources** Beach Energy shall maintain contractual agreements with response organisations for direct or indirect access to: • AMOSC Core Group response personnel; • AMOSC equipment • Waste management contractors & licenced waste facilities; and • Scientific monitoring consultants	Crisis, Emergency & Security Advisor	AMOSC contract in place Waste Management contract in place Scientific monitoring consultant contract in place
Shoreline Assessment undertaken	**Shoreline Assessment** In consultation with State Control Agency, an assessment will be undertaken of affected and potentially affected shorelines.	HSE Lead	Shoreline assessment records
Operational monitoring undertaken	**Operational Monitoring** Beach will implement, via scientific monitoring consultants, the following operational monitoring in alignment with the Offshore Victoria Operational and Scientific Monitoring Plan: • Study O2: Hydrocarbon on shorelines; and • Study O3: Oiled wildlife surveillance	HSE Lead	Monitoring records indicate monitoring undertaken in accordance with NOPSEMA accepted OSMP.
Shoreline clean-up present net environmental benefit	**NEBA** Beach will jointly undertake a NEBA with State Control Agency and only implement shoreline clean-up where a net environmental benefit is agreed with the Control Agency.	HSE Lead	Documented NEBA Communications records
Risks managed from shoreline clean-up operations	**Risk Assessment** In consultation with State Control Agency and relevant stakeholders, and prior to undertaking shoreline clean-up operations, Beach will undertake site-specific risk assessment and mitigate potential impacts to: • Shoreline habitats;	EMT Lead	Documented risk assessment

Environmental Performance Outcome	Environmental Performance Standard	Responsible Person	Measurement Criteria
	• Shoreline communities; • Oiled wildlife; • Cultural heritage sites; and • Socio-economic receptors		
Relevant access authority obtained	**Site Access** In consultation with State Control Agency, access authority from relevant stakeholders shall be obtained prior to undertaking shoreline clean-up operations.	EMT Lead	Records of access authority
Tactical Response Plans developed	**Tactical Response Plans** Tactical Response Plans shall be developed for all priority protection areas where predicted shoreline hydrocarbon loading exceeds 100 g/m^2 within 7 days.	Crisis, Emergency & Security Advisor	Documented TRPs for all priority protection areas
Scientific monitoring undertaken	**Scientific Monitoring** Beach will implement the following scientific monitoring in alignment with the Offshore Victoria Operational and Scientific Monitoring Plan: • Study S2: Shoreline sediments impact assessment; and • Study S5: Wildlife impact assessment	HSE Lead	Monitoring records indicate monitoring undertaken in accordance with NOPSEMA accepted OSMP.
Oiled Wildlife Response			
Beach maintains capability to effectively implement oiled wildlife response	**Oiled Wildlife Resources** Beach Energy shall maintain contractual agreements with response organisations for direct or indirect access to: • AMOSC Core Group response personnel; • AMOSC equipment (OWR kit) • Waste management contractors & licenced waste facilities; and • Scientific monitoring consultants	Crisis, Emergency & Security Advisor	AMOSC contract in place Waste Management contract in place Scientific monitoring consultant contract in place
Required notifications undertaken	**Notifications** Beach will notify Sate Control Agency (DJPR), DELWP and AMSA as soon as possible after a spill that has, or has the potential to, affect wildlife.	Communications Lead	Communications records
Operational monitoring undertaken	**Operational Monitoring** Beach will implement, via scientific monitoring consultants, the following operational monitoring in alignment with the Offshore Victoria Operational and Scientific Monitoring Plan: • Study O3: Oiled wildlife surveillance	HSE Lead	Monitoring records
Shoreline clean-up present net environmental benefit	**NEBA** Beach will jointly undertake a NEBA with State Control Agency (DJPR) and DELWP and only implement oiled wildlife response where a net environmental benefit is agreed with the DELWP.	HSE Lead	Documented NEBA Communications records
Risks managed from shoreline clean-up operations	**Risk Assessment** In consultation with State Control Agency, DELWP and relevant stakeholders, and prior to undertaking oiled wildlife response, Beach will undertake site-specific risk assessment and mitigate potential impacts to: • Shoreline habitats; • Shoreline communities; • Oiled wildlife; • Cultural heritage sites; and • Socio-economic receptors	EMT Lead	Documented risk assessment Consultation records
Authority to handle wildlife obtained	**Fauna Handling** In consultation with DELWP, only authorised responders shall handle and treat oiled wildlife.	HSE Lead	Consultation records Licencing records.

Environmental Performance Outcome	Environmental Performance Standard	Responsible Person	Measurement Criteria
Scientific monitoring undertaken	**Scientific Monitoring** Beach will implement the following scientific monitoring in alignment with the Offshore Victoria Operational and Scientific Monitoring Plan: • Study S5: Wildlife impact assessment	HSE Lead	Monitoring records indicate monitoring undertaken in accordance with NOPSEMA accepted OSMP.
Waste Management			
Waste management appropriate	**Waste Management Plan** Site-specific waste management plans will be developed in consultation and agreement with the EPA, DJPR EMB and the land custodian / owner.	HSE Lead	Documented Waste Management Plan Consultation records
Waste storage appropriate	**Waste Storage** Waste storage arrangements will be agreed with the Beach Waste Management Contractor in consultation and agreement with the EPA, DJPR EMB and the custodian / owner and will be: • Fully bunded; • Secured; and • Supervised	HSE Lead	Documented Waste Management Plan Consultation records
Waste disposal appropriate	**Waste Facility** Wastes will be segregated and manifested to ensure they are sent to an appropriately licenced waste facility as agreed with the EPA.	HSE Lead	Documented waste manifest Licenced waste Contractors & waste facilities. Consultation records
Waste transport appropriate	**Waste Transport** Wastes will be transported by correctly permitted vehicles to licenced waste facilities in accordance with Victorian Environment Protection Authority (EPA) requirements.	HSE Lead	Documented waste manifest Licenced waste transporters Consultation records

12 On-Going Response Preparedness and Exercises

12.1 OPEP Review

The plan shall be reviewed and updated as necessary in response to one or more of the following:

- annually
- when major changes which may affect the Oil Spill Response coordination or capabilities have occurred
- routine testing of the plan if gaps are identified within the plan
- after an actual emergency
- if Beach's spill risk profile changes significantly due to additional activities or operations.

The review of the plan shall consider external influences including:

- change in any relevant legislation
- advice from the government relating to the conservation of listed species
- updates to State or Australian Marine Park management plans
- changes in fisheries management or other socio-economic features of the environment
- new knowledge about the receiving environment in bioregional profiles or published scientific literature that may contribute to environmental baselines or data collection methods
- change in State or Commonwealth oil spill response arrangements and resources.

12.2 Testing Arrangement

In accordance with Regulation 14 (8A) & (8C) of the OPGGS(E) Regulations the response arrangements within this OPEP will be tested:

- when they are introduced
- when they are significantly amended
- not later than 12 months after the most recent test
- if a new location for the activity is added to the EP after the response arrangements have been tested, and before the next test is conducted – testing the response arrangement in relation to the new location as soon as practicable after it is added to the plan
- if a facility becomes operational after the response arrangements have been tested and before the next test is conducted – testing the response arrangements in relation to the facility when it becomes operational.

The effectiveness of response arrangements will be measured by the performance standards detailed in Table 11.1 for each exercise type. Exercises will be documented, and corrective actions/recommendations tracked to closure.

A log shall be maintained during all oil pollution response exercises including a record of the effectiveness and timeliness of the response against the objectives of the exercise.

Where objectives are not met, or potential improvements have been identified during an exercise, these learnings shall be recorded and retained for inclusion into the subsequent revision of this OPEP.

Where significant deficiencies are identified in the effectiveness or timeliness of response arrangements as identified within this OPEP, this OPEP shall be updated within one month of the exercise to address the identified issues

As required by the Environment Regulation 14(8A), the testing must relate to the nature and scale of the risk of oil pollution relevant to the activity.

Testing arrangements appropriate to the nature and scale of each activity covered by this OPEP are included in Table 12.1. In accordance with Regulation 14 (8C) (d) and (e), these arrangements are also designed to provide for:

- the various locations of Beach facilities and activities in the Otway Basin.
- response arrangements in relation to each of the facilities and activities.

Not all spill preparedness and response testing environmental performance outcomes will be tested simultaneously. The frequency of testing will relate to the potential spill level, spill risk and complexity of response.

Table 12.1: Spill Preparedness and Response Testing Environmental Performance Outcome, Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Testing Frequency	Responsible Person	Measurement Criteria
Vessel Operations (Level 1 / 2 spill)				
Response systems functioning	Emergency communications with offshore vessels when new to field	Prior to arrival in field	Beach Contract Owner	Exercise records confirm effective communications
Procedures in place and appropriate	Validation of vessel SOPEP / SMPEP	Prior to arrival in field	Beach Contract Owner	Vessel inspection / audit records confirm SOPEP / SMPEP in place
	OPEP / OSMP Effectiveness of OPEP & OSMP in guiding spill response and remediation of vessel spill tested by EMT	Annually	Crisis, Emergency & Security Advisor	Exercise records confirm OPEP / OSMP effective
	ERP Effectiveness of ERP tested in guiding EMT to fulfil roles and responsibilities tested	Annually	Crisis, Emergency & Security Advisor	Exercise records conform all EMT able to fulfil allocated roles & responsibilities
Contractual arrangements in place to obtain equipment & people	Contractual arrangements with L2 service providers validated	Annually	Crisis, Emergency & Security Advisor	All required contracts in place

Environmental Performance Outcome	Environmental Performance Standard	Testing Frequency	Responsible Person	Measurement Criteria
Equipment available in a timely manner	Equipment stock levels and deployment times from AMOSC validated (desktop)	Annually	Crisis, Emergency & Security Advisor	Written confirmation of AMOSC capability
Appropriately trained people available	Validation environmental monitoring Specialists capability continues to meet Beach requirements based upon company spill risk profile (desktop)	Upon contract renewal	Crisis, Emergency & Security Advisor	Written confirmation of Environmental Consultant capability to implement OSMP / OSMPIP
	Internal and external training requirements for EMT validated (desktop)	Annually	Crisis, Emergency & Security Advisor	Training records in place and meet capability requirements
Pipeline and Platform Operations (Level 1 / 2 spill)				
Response systems functioning	Emergency communications will be tested between ERT and EMT	Annually	Crisis, Emergency & Security Advisor	Exercise records confirm effective communications
	Emergency notifications between EMT and Regulator(s) tested (including regulatory timeframes)	Annually	Crisis, Emergency & Security Advisor	Exercise records confirm effective communications and notification timeframes met
Procedures in place and appropriate	OPEP / OSMP Effectiveness of OPEP & OSMP in guiding spill response and monitoring of pipeline rupture or release from platform by EMT	Annually	Crisis, Emergency & Security Advisor	Exercise records confirm OPEP / OSMP effective
	ERP Effectiveness of ERP tested in guiding EMT to fulfil roles and responsibilities tested	Prior to each offshore drilling campaign	Crisis, Emergency & Security Advisor	Exercise records conform all EMT able to fulfil allocated roles & responsibilities
Contractual arrangements in place to obtain equipment & people	Contractual arrangements with L2 service providers validated	Annually	Crisis, Emergency & Security Advisor	All required contracts in place
Equipment available in a timely manner	Equipment stock levels and deployment times from AMOSC validated (desktop)	Annually	Crisis, Emergency & Security Advisor	Written confirmation of AMOSC capability
Appropriately trained people available	Internal and external training requirements for EMT validated (desktop)	Annually	Crisis, Emergency & Security Advisor	Training records in place and meet capability requirements
Drilling (Level 2 / 3 LOWC)				
Response systems functioning	Emergency communications between the MODU and EMT tested	Prior to each offshore drilling campaign	Crisis, Emergency & Security Advisor	Exercise records confirm effective communications
	Emergency notifications between EMT and Regulator(s) tested (including regulatory timeframes)	Prior to each offshore drilling campaign and annually	Crisis, Emergency & Security Advisor	Exercise records confirm effective communications and notification timeframes met

Environmental Performance Outcome	Environmental Performance Standard	Testing Frequency	Responsible Person	Measurement Criteria
	Communication systems and methods between CMT / EMT Leader / EMT members tested	Prior to each offshore drilling campaign and annually	Crisis, Emergency & Security Advisor	Exercise records confirm effective communications
	OSTM arrangements tested	Prior to each offshore drilling campaign and annually	Crisis, Emergency & Security Advisor	Exercise records confirm ability to initiate OSTM
Procedures in place and appropriate	OPEP / OSMP Effectiveness of OPEP & OSMP in guiding spill response and remediation of LOWC tested by EMT	Prior to each offshore drilling campaign	Crisis, Emergency & Security Advisor	Exercise records confirm OPEP / OSMP effective
	ERP Effectiveness of ERP tested in guiding EMT to fulfil roles and responsibilities tested	Prior to each offshore drilling campaign	Crisis, Emergency & Security Advisor	Exercise records conform all EMT able to fulfil allocated roles & responsibilities
	Relief Well Plan Relief well readiness tested as per arrangement in relief well plan.	Prior to each offshore drilling campaign	Crisis, Emergency & Security Advisor	Exercise records confirm relief well plan in place & tested
Contractual arrangements in place to obtain equipment & people to respond to a L2 / L3 LOWC	Contractual arrangements with L2/L3 service providers validated	Prior to each offshore drilling campaign and annually	Crisis, Emergency & Security Advisor	All required contracts in place
Equipment available in a timely manner to respond to a L2 / L3 LOWC	L2 / L3 response equipment availability, condition and mobilisation readiness validated (desktop)	Prior to each offshore drilling campaign	Crisis, Emergency & Security Advisor	Exercise records confirm equipment available, in serviceable condition & ready for mobilisation.
	Logistics pathways for mobilisation & deployment of L2 / L3 equipment, including support vessels and suitable MODUs validated (desktop)	Prior to each offshore drilling campaign	Crisis, Emergency & Security Advisor	Exercise records confirm logistics pathways open and likely to facilitate deployment within anticipated timeframes
Appropriately trained people available to respond to a L2 / L3 LOWC	Validation Well Control Specialists capability continues to meet Beach requirements based upon company spill risk profile (desktop)	Prior to each offshore drilling campaign & upon contract renewal	Crisis, Emergency & Security Advisor	Written confirmation of Well Control Specialists capability
	Validation environmental monitoring Specialists capability continues to meet Beach requirements based upon company spill risk profile (desktop)	Prior to each offshore drilling campaign & upon contract renewal	Crisis, Emergency & Security Advisor	Written confirmation of Environmental Consultant capability to implement OSMP / OSMPIP
	Internal and external training requirements for EMT validated (desktop)	Prior to each offshore drilling campaign and annually	Crisis, Emergency & Security Advisor	Training records in place and meet capability requirements

13 Training and Competency

All personnel who have been assigned Beach EMT roles (including Alternates) are required to be conversant with their roles and associated responsibilities as defined within the EMP.

All personnel with specific roles or responsibilities within the Beach CEM Framework shall receive appropriate levels of training and ongoing development commensurate with the responsibility and associated accountabilities required of each EMT position.

A Crisis and Emergency Management Team Capability Matrix is updated by the Crisis, Emergency and Security (CES) Advisor and managed by the Senior Capability Advisor. A summary of oil spill training and competency requirements for CMT & EMT personnel is provided in Table 13.1.

Table 13.1: Training Requirements

Course Name	CMT–Specific Training	Individual OPEP / OSMP Awareness	Fundamentals of Emergency Management (EM), EMT role/responsibility training	Management (IMO L 2)	Command & Control (IMO L3)	AIIMS process
Internal / External	Internal / External	Internal	Internal	External	External	Internal
CMT Members	✓					
EMT Leader		✓	✓			✓
EMT Production		✓	✓			
EMT Wells		✓	✓			
WET		✓	✓			
EMT Planning		✓	✓			
EMT Information Coordinator		✓	✓			
EMT Scribe		✓	✓			
EMT Health, Safety & Environment		✓	✓	✓		
Oil Spill Response		✓	✓	✓	✓	
EMLO		✓	✓	✓	✓	✓
EMT Logistics		✓	✓			
EMT Human Resources		✓	✓			
EMT Communications		✓	✓			
Operations Manager			✓			
Otway Production Manager			✓			
Thylacine PIC			✓			

14 Record keeping

All consultation correspondence, written reports (including monitoring, audit and review reports) such as emergency exercise logs used to record the effectiveness and timeliness of the response against the objectives of the exercise, or any other record relating to the environmental performance of this OPEP must be retained for a minimum of 5 years following the cessation of activities within the scope of this OPEP.

All records must be stored in a way that makes retrieval of the document or record reasonably practicable.

15 List of Abbreviations

Definitions of terms used in this document:

Abbreviation	Definition
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority
BCP	Blow-out Contingency Plan
CEM	Beach Emergency’s Crisis and Emergency Management Framework
CMP	Crisis Management Plan
CMT	Crisis Management Team
CxT	Crisis Communications Team
DCS	Distributed Control System
DELWP	(Victorian) Department of Environment, Land, Water and Planning
DJPR EMB	(Victorian) Department of Jobs, Precincts and Regions – Emergency Management Branch
DJPR ERR	(Victorian) Department of Jobs, Precincts and Regions – Earth Resources Regulation
DPIPWE	(Tasmanian) Department of Primary Industries, Parks, Waters and Environment
EMBA	Environment that May be Affected
EMLO	(Beach) Emergency Management Liaison Officer
EMT	Emergency Management Team
EP	Environment Plan
EPA	Environmental Protection Authority
ERP	Emergency Response Plan
ERT	Emergency Response Team
ESD	Emergency Shut Down
HSE	Health, Safety, and Environment
IMT	Incident Management Team
IT DR	Business Continuity and IT Disaster Recovery
JSCC	Joint Strategic Coordination Committee
LOWC	Loss of Well Control
MD	Managing Director
National Plan	National Plan for Maritime Environmental Emergencies
NEBA	Net Environmental Benefit Analysis
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NRC	National Response Centre
OIE	Offset Installation Equipment
OSMP	Operational & Scientific Monitoring Plan
OSMIP	Operational & Scientific Monitoring Implementation Plan

Abbreviation	Definition
OSRL	Oil Spill Response Limited
OSTM	Oil Spill Trajectory Model
OWR	Oiled Wildlife Response
POLREP	Marine Pollution Report
SCCP	Source Control Contingency Plan
SCME	State Controller Maritime Emergencies
SITREP	Marine Pollution Situation Report
SMPEP	Shipboard Marine Pollution Emergency Plan
SOPEP	Shipboard Oil Spill Pollution Emergency Plan
SSDI	Subsea Dispersant Injection
WET	Wells Emergency Team
WOMP	Well Operations Management Plan

Appendix A Emergency Contacts Directory (Current 19th June 2019)

A. 1. External Contacts

A. 1. 1 Regulatory Contacts

Regulator	Contact	Phone	E-Mail
AMSA	Marine oil pollution	1800 641 792	mdo@amsa.gov.au https://www.amsa.gov.au/about/contact-us
DoEE	Director of National Parks	02 6274 2220	
	Switchboard	02 6274 1111	
NOPSEMA	Emergency	08 6461 7090	submissions@nopsema.gov.au
NOPTA	Titles		titles@nopta.gov.au & info@nopta.gov.au
Tas DPIPWE	Pollution Hotline	+61 (0)3 6165 4599 or 1800 005 171 (within Tasmania only) Radio: TasPorts Vessel Traffic Services VHF radio channel 16/14/12 Call sign "relevant port name VTS"	incidentresponse@epa.tas.gov.au
	Whale Hotline	0427942537	
	Natural and Cultural Heritage (OWR) Division	(03) 6165 4396	Kathryn.Lambert@dpipwe.tas.gov.au
Vic DJPR	General	13 61 86	customer.service@ecodev.vic.gov.au
	State Duty Officer	0409 858 715 (24/7)	sccvic.sdo.dedjtr@scc.vic.gov.au & semdincidentroom@ecodev.vic.gov.au
	West of Cape Otway – Portland Region	(03) 5525 0900	
	East of Cape Otway – Port Philip Region	(03) 9644 9777	
	Compliance South West Team	0419 597 010 ERR Duty Officer	Compliance.Southwest@ecodev.vic.gov.au
Vic DELWP	State Control Centre	1300 134 444	sscviv.scmdr.delwp@scc.vic.gov.au
	Customer Service Centre	136186	
Vic Port of Portland	Duty Officer	(03) 5525 0999	
Vic Gippsland Ports	Duty Officer	(03) 5150 0500	

A. 1. 2 Responder Contacts

Responder	Function	Contact	Phone	E-Mail
Adagold Aviation Pty Ltd	Fixed-wing aviation support		1800 767 747	
AMOSC	Spill Response - all		0438 379 328	
AMSA	Spill Response - vessel		1 800 641 792	
Boots and Coots (Halliburton) (Australia, New Zealand, Papua New Guinea, Timor Leste)	Well Control Specialist	Level 27, 140 St. Georges Terrace Perth WA 6000 Australia	Perth: +61 8 9455 8300 or 24/7: +1-281-931-8884 or 1-800-BLOWOUT	
Bristow	Helicopter support		(03) 5991 9591	
Cudd Well Control (Houston)	Well Control Specialist	Headquarters: Cudd Well Control 2828 Technology Forest Blvd. The Woodlands, TX 77381	T: 713.849.2769 F: 713.849.3861	cwcinfo@cudd.com

A. 1. 3 Consultant Contacts

Consultant	Service	Contact	Phone	E-Mail
BMT	OSMP implementation	Level 4 20 Parkland Rd Osborne Park Western Australia 6017	+61 8 6163 4900	environment.env@bmtglobal.com
Cardno	OSMP implementation	Level 11 515 St Paul's Terrace Fortitude Valley QLD 4006	+61 (7) 3369 9822	
GHD	OSMP implementation	Level 10 999 Hay Street Perth, Western Australia 6000	+61 8 6222 8222	
RPS	Oil Spill Trajectory Modelling		0408 477 196	response@apasa.com.au
RPS Australia West	OSMP Implementation Plan	27 – 31 Troode Street, West Perth, WA, 6005	+61 8 9211 1111	

A. 2. Internal Beach Contacts

A. 2. 1 Internal Beach Contacts

Contact / Function	Phone	E-Mail
Otway Operations Manager		
EMT Leader		
Well Emergency Team Leader		

Appendix B Spill Equipment and Resources (Current 19th June 2019)

B. 1. Source Control Equipment – Well Control

A detailed description of available source control equipment and resources including deployment timeframes is detailed within the Beach Offshore Source Control Contingency Plan (SCCP) and well-specific relief well plans. As summary of these resources is provided below.

B. 1. 1 Well Control Specialists

Access to a range of source control equipment including equipment and personnel is available through 3rd party contracts with:

- Boots and Coots (Halliburton): https://www.halliburton.com/en-US/ps/project-management/well-control-prevention/well-control-prevention-services.html
- Cudd Well Control: http://www.cuddwellcontrol.com/

Contact details for these well control specialists are provided in Appendix A.

B. 1. 2 MODU

The Otway and Bass Fields are considered remote locations and therefore likely to have an impact on the time taken for a suitable rig to be mobilised to the relief well location. This timeframe has been built into the Oil Spill Modelling. Rig broker reports are used to monitor the rig market on a monthly basis and if required, assist in sourcing and contracting a suitable MODU. The rig broker can be contracted to identify and contract a suitably specified rig (including Australian Safety Case status) within 14 days. Note, a MODU mobilised from the NW Shelf or Singapore is likely to take 35 days. These periods have been factored into the relief well schedule within the well-specific relief well plans.

MODU selection for relief well drilling will be based on the following:

- Rating of well control equipment: Rigs considered shall have equipment rated to at least 10,000psi to perform the required well kill
- Water depth: Rig being considered for relief well drilling must be rated for the water depth of 60m-100m
- Seabed conditions.

B. 1. 3 Casing and Consumables

A detailed description of casing and consumable requirements based upon relief well design is detailed within the well-specific relief well plans.

B. 1. 4 AMOSC Subsea First Response Toolkit (SFRT) and Chemical Dispersants

The SFRT was engineered and built by Oceaneering Norway and bought by a number of AMOSC Member Companies in 2013. The equipment is located in Henderson WA and is currently stored and maintained by Oceaneering Australia. AMOSC owns this suite of equipment which includes 500m³ of dispersant for Subsea Dispersant Injection (SSDI).

As an AMOSC member company, Beach has access to the SFRT upon request to membership of the SFRT.

There is a provision made by the Committee to provide up to 250m³ of dispersant into a surface spill response given certain provisions are met in the first instance by AMOSC.

B. 2. Maintenance Vessels & Vessels of Opportunity

Beach has existing contracts in place to support its maritime requirements.

The contracts for the Otway Basin currently resides with a number of service provides that have undertaken the Beach Contracts and procurement process.

Over time vessels and operating companies change in the region. Beach has a procurement process, contractor management process and contracting management system that is implemented prior to engagement of vessels.

Any vessels used on the project will carry a vessel SOPEP and Level 1 spill equipment on-board appropriate to the nature and scale of the vessel and vessel crew are fully trained and exercised in the application of the SOPEP.

Beach receives a monthly update of available vessels under an existing arrangement with a Vessel Broker.

B. 3. Fixed Wing Aviation Support

Beach may call upon fixed wing aircraft for aerial surveillance in the event of a Level 2 or Level 3 spill. The need for this service will be determined by the EMT Leader during the incident response and as per the OPEP Part 2 of this OPEP.

Beach will engage fixed wing aircraft through their preferred supplier Adagold Aviation Pty Ltd who will act as an aviation broker and engage the most appropriate aircraft available.

Beach will supply the aviation provider with the relevant flight pattern and log sheet for the surveillance and any additional trained oil spill observers via arrangements with AMOSC.

B. 4. Helicopter Support

During an incident response, Beach may call upon helicopter services to undertake aerial surveillance assistance or transport personnel in an event of a Level 2 or 3 spill, with the requirement determined by the EMT Leader at the time of the incident.

Bristow are the current contractor for the provision of helicopter services for Beach’s Otway offshore activities. At least one helicopter will be available for use by Beach during a spill response. A helicopter will be located at either Warrnambool or Tooradin.

When drilling projects are in progress there may also be other Bristow helicopters located at Warrnambool or Essendon. Beach and Bristow have a working arrangement for this service and tests the call out process as part of its emergency response test plan and schedule.

A typical total mobilisation and flight time from:

- Essendon to site is about 1hr 45min (minimum)
- Tooradin to site is about 1hr 30min hours.
- Warrnambool to site is about 50 min (20 min flight time)

Beach will supply the helicopter provider with the relevant flight pattern and log sheet for the surveillance and trained oil spill observers via arrangements with AMOSC.

B. 5. Oiled Wildlife Response

Under the National Plan, Maritime Emergencies Non-Search & Rescue (NSR) Plan and TasPlan, the response to oiled wildlife from a vessel spill where a government agency is the Control Agency is covered in terms of responsibilities and equipment.

In Victoria, DELWP is the lead agency for wildlife impacted by marine pollution. The response procedures are defined in the Wildlife Response Plan for Marine Pollution Emergencies. This plan is incorporated as part of State Maritime Emergencies (non-search and rescue) Plan where an oil spill has occurred.

The Tasmanian Oiled Wildlife Response Plan (WildPlan) is administered by the Resource Management and Conservation Division of the Department of Primary Industries, Parks, Water and Environment (DPIPWE) and outlines priorities and procedures for the rescue and rehabilitation of oiled wildlife.

Oiled wildlife kits are available through AMOSC, the national plan and state agencies. DELWP has a number of first strike kits as well as arrangements in place for triage and rehabilitation of small oiled seabirds. Wildlife rescue kits are held at the Hobart and Launceston DPIPWE offices.

AMOSC also has wildlife equipment which can be mobilised directly by Beach in the event of a spill where there is a likelihood of oiled wildlife requiring treatment. However, it is noted that the remoteness and typical sea conditions of the Otway offshore area and the logistic constraints associated with finding and collecting oiled wildlife at sea, will limit the feasibility of an offshore wildlife response effort.

Advice will be sought from AMOSC and regulatory agencies to guide any decisions regarding mounting a wildlife response will be based on the risks posed by the spill and safety and feasibility of a response.

B. 6. Government Resources

B. 6. 1 Australian Maritime Safety Authority

The Australian Maritime Safety Authority (AMSA) administers the National Plan which requires each State and Territory to produce its own contingency plans to support the national plan. If a spill occurs in Victorian or Tasmanian state waters the Maritime Emergencies (NSR) Plan or TasPlan is activated. If the spill is beyond the resources of the state agencies, then the additional resources can be sourced through agreements in the National plan for a marine pollution response.

B. 6. 2 Victorian Department of Jobs, Precincts and Regions (DJPR) Emergency Management Branch (EMB)

In the event of a diesel spill from a supply vessel near shore, the equipment within the respective port region will be utilised as per the Maritime Emergencies (NSR) Plan through Vic DJPR Emergency Management Branch (EMB).

In an event of a Level 2/3 incident, Vic DJPR, as per the Maritime Emergencies (NSR) Plan, may provide the following assistance as required:

- Provision of vessels and support to CFA/MFB for chemical spills in State Waters
- Coordinate the supply of State equipment and personnel resources in support of the Incident Management Team
- Coordinate provision of Victorian equipment and personnel for any interstate or Commonwealth response.

VIC DJPR EMB is updated with Beach's program changes as part of its consultation program and shall be provided a copy of the accepted OPEP.

B. 6. 3 Tasmanian Department of Primary Industry, Parks, Water and Environment (DPIPWE)

In the event of a spill from a vessel near shore, the equipment within the respective port will be utilised as per the TasPlan through Tas DPIPWE. This equipment may also be available to support a Level 2 or 3 spill where Beach is the Control Agency. Stockpiles of Level 1 equipment are located at Burnie, Devonport, Bell Bay and Hobart Ports and a current list of equipment is available from Tas DPIPWE.

B. 7. AMOSC Resources

AMOSC is supported by a core group of key personnel from oil industry members companies who are trained and regularly exercised in spill response. When called upon under arrangements established in AMOSPlan, Core Group Members are able to respond to an incident at short notice and provide a high level of expertise in leading teams on the ground responding to an incident. Actual timings and Core Group availability is updated monthly and can be obtained through AMOSC as required. AMOSC also holds large stockpiles of oil spill response equipment designed for both coastal and offshore use and has established contractual arrangements and processes for the mobilisation of equipment and personnel to assist with a spill anywhere in Australian waters. A list of the AMSOC available equipment can be obtained through the AMOSC or their website.

AMOSC assistance may be sought in the event of a Level 2 or 3 spill. Beach's EMT Leader shall determine when and whether AMOSC notification and assistance will be required.

Under AMOSPlan, should the spill response require equipment or personnel from another company, the request for assistance is made directly by Beach to that company. AMOSC can assist in this dialogue through the Mutual Aid Policy, and Beach will contact AMOSC to activate the relevant Principal & Agency Agreement (of the lending company) and Mutual Aid Policy if borrowing resources.

AMOSC headquarters and their major equipment base are located in Geelong, adjacent to the Port of Geelong Corio Quay Supply base.

Beach shall provide AMSOC a copy of the accepted OPEP.

B. 8. Environmental Monitoring Resources

Beach has a current Master Service Agreement in place with several recognised specialist environmental consultants capable of undertaking scientific monitoring. Beach will undertake audits / desk top reviews of the capabilities of these consultants to ensure that they are capable of meeting the requirements of this OPEP.

Annual reviews of contracts and service providers are completed by Beach to confirm they still meet the required standards and are able to provide the contracted services. If any existing contractors are deemed unsuitable, a like service provider will be appointed. Should it be required (as determined by EMT Leader and Health, Safety & Environment), the environmental consultant will undertake scientific sampling and analysis to fulfil the requirements of this monitoring program as detailed in Operational & Scientific Monitoring Plan (OSMP) / Operational and Scientific Monitoring Implementation Plan (OSMIP).

Appendix C Templates and Forms

Refer to the Australian Maritime Safety Authority website for the latest forms:

- https://www.amsa.gov.au/
- https://www.amsa.gov.au/forms-and-publications/environment/
- https://www.amsa.gov.au/forms-and-publications/environment/publications/NP-Reports/index.asp

Forms from AMSA include:

- Marine Pollution Report (POLREP)
  Marine Pollution Situation Report (SITREP)

C. 1. Marine Pollution Report (POLREP)

Online via https://amsa-forms.nogginoca.com/public/ or manual below:

Marine Pollution Report (POLREP)

NOTE: Incidents to be reported are outlined on page 3

Send completed form to: **AMSA Environment Protection**
Fax: **(02) 6230 6868** Email: **rccaus@amsa.gov.au**

Date of incident

Time of incident

C.C.

Location name / Description

Incident coordinates

Format of coordinates used (select one)	Latitude of spill	Longitude of spill
Degrees & decimal degrees	. °	. °
Degrees, minutes & decimal minutes	° ' . '	° ' . '
Degrees, minutes & seconds	° ' . "	° ' . "

Description of incident

POLLUTION SOURCE

☐ Vessel ☐ Land ☐ Other ☐ Unknown Details

Vessel Details: Type (if known): ☐ Tanker ☐ Container ☐ Bulk Cargo ☐ Fishing ☐ Defence ☐ Recreational

☐ Other vessel type (specify):

Vessel name | Flag state / callsign | Australian vessel? ☐ Yes ☐ No

POLLUTANT

☐ **Oil** → ☐ Bilge ☐ Diesel bunker ☐ HFO Bunker ☐ Crude ☐ Unknown
☐ Other Specify

☐ **Chemical** → Name | MARPOL Cat. / UN Nos

☐ **Garbage** →
☐ **Packaged** →
☐ **Sewage** →
☐ **Other** →
Details / description

EXTENT

Size of spill (length & width in metres)

Amount of pollutant, if known (litres)

ADDITIONAL INFORMATION

Has the discharged stopped? ☐ Yes ☐ No ☐ Unknown

Response action undertaken? ☐ Yes ☐ No If yes, provide details below, please include any environmental impact

Weather conditions at site

☐ Photos taken ▶	Details	Held by
☐ Video taken ▶	Details	Held by
☐ Samples taken ▶	Description	Held by
☐ Items retrieved ▶	Description	Held by

Original report source

Name	Position	Phone

Combat agency

Statutory agency

Equipment used
☐ AMSA ☐ State / NT

Possible further action
☐ Legal ☐ AMSA assistance ☐ Other

SENDER DETAILS

Name	Agency	Date
Phone	Fax	Email

PRIVACY STATEMENT

The Australian Maritime Safety Authority (AMSA) is collecting the information on this form to enable it to carry out its role as managing agency of the National Plan to Combat Pollution of the Sea by Oil and other Noxious and Hazardous Substances.

AMSA may give some or all of this information to other government bodies, non-government organisations who have responsibilities under the National Plan, and law enforcement agencies.

SUMMARY OF INCIDENTS TO BE REPORTED

All slicks, including deck washings, that can be seen trailing a vessel should be reported. The type of substance contained in the slick may not be able to be determined until further investigation has been undertaken by enforcement agencies.

REPORTABLE	NON-REPORTABLE
Oil - All slicks trailing from a vessel. All spills in the marine environment (notwithstanding the size or amount of oil or sheen). All spills where National Plan equipment is used in a response. *Note: If oil or sheen is "visible" then it is an illegal discharge MARPOL permitted oily discharges are at 15 parts of oil to one million parts of water (15ppm). Oil discharges at sea cannot be visually observed until at least 50ppm and even that may not be readily discernable depending upon the observation platform, sea state, weather conditions etc.*	• Coral spawning. • Algal bloom. • Oil spills specifically known to be from land sources (eg drains, road tanker accidents) and where there is no response using National Plan equipment or resources used. • Exploration/production associated discharges where there is no response and National Plan equipment or resources used. (these are reportable to the relevant authority eg: Mines Department or Department of Science Industry and Resources).
Chemicals – All sightings of slicks/discolourations trailing vessels. All odorous discharges from a vessel.	
Harmful Packaged Substances - All packages associated with a vessel.	
Sewage – All slicks seen trailing from a vessel.	
Garbage – All sightings of garbage being disposed from a vessel. Any type of garbage found that can be specifically tied to a specific vessel such as garbage with printing showing a vessel name (eg Quarantine bonded plastic bags with identifier tag).	• Dumping at sea that requires a permit (EPA or EA) • Dumped dredge spoil. • Floating logs.

C. 2. Marine Pollution Situation Report (SITREP)

Marine Pollution Situation Report (SITREP)

Incident name / Description

Date | Time | Sitrep No

Priority ☐ Urgent ☐ Immediate

Final Sitrep? ☐ Yes ☐ No Next Sitrep on:

Description of incident and impact

Overall weather conditions

Summary of response actions to date

Current Strategies

Summary of Resources available/ deployed

Other information

SITREP prepared by

Name	Agency	Role
Phone	Fax	Email

Attachments | No of pages attached

C. 3. Oil Spill Incident Report – Level 1 Spill

Date:		
Spill observer:		
Report time:		
Reported to:		
Location of the spill:		
Material spilled:		
Estimate of spill quantity and description of appearance of the slick:		
Particulars of damage caused as a result:		
Apparent source/cause of the spill:		
Action taken to control spill:		
Has spill been contained? (Tick✓) ❑ Yes❑ No		
Comments:		
Location	**Reported by**	**Reported to**
Time	**Date**	**Phone No**
Are additional resources required to disperse/contain spill:❑Yes❑No		

C. 4. Oil Spill Incident Report – Level 2/3 Spill

Date:			Report time:			
Spill observer:			Reported to:			
Time spill occurred:			Date spill occurred:			
Material spilled:			API gravity:			
Apparent source/cause:						
Location of spill:	Latitude:			Longitude:		
Is spill continuing?	Yes			No		
If yes, estimated rate of release:	cubic metres/day:			bbl/day:		
Volume of discharge: a) estimated	cubic metres:			bbls:		
Volume of discharge: b) known	cubic metres:			bbls:		
Size of spill: (plot on chart)						
Rate and direction of slick movement:						
Oil slick type:	Continuous:			Windows:		
Estimated average thickness:						
Estimated time to nearest threatened resource:	(hrs)					
Meteorological and Ocean Data						
Temperature:	Air:o C			Water:o C		
Wind speed:	knots			Direction:		
Precipitation:						
Forecast:						
Oceanographic Data	Tide state:	Direction:				
	Currents:	Speed:				
Direction:Sea state:	1	2	3	4	5	6+
Average wave height:	metres					
Period:	seconds					
Comments:						

C. 5. Oil Spill Trajectory Modelling Request Form (RPS APASA)

OIL SPILL TRAJECTORY MODELLING REQUEST	Email completed form to RPS APASA response staff response@apasa.com.au After sending this request, phone Duty Officer on telephone number provided.

Priority of Request: ☐ **Urgent** ☐ **Exercise** Date and Time of Request:

Incident Name	
Name of requesting person and position in response	Contact telephone number
Email address for model output (preferred method)	Fax number for receipt of model output

Surface or Subsurface spill? Surface ☐ Subsurface ☐ Depth of spill (m)	If subsurface spill, describe the spill source. ☐ Low Turbulence (eg. Low Pressure Pipeline Leak) ☐ Medium Turbulence (eg. Intermediate Pressure Pipeline Leak) ☐ High Turbulence (eg. Well Blowout under pressure, or ruptured pipeline under pressure)

Spill Start Date			Spill start time (use 24 hour clock, state time zone – GMT or Local)	Requested Simulation Length (hrs)
Day	Month	Year		

Oil Name:	Oil Type: *Bunker C, Diesel Fuel, Crude, Condensate*

Spill location (select one format)	Latitude of spill (N)	Longitude of spill (E)
Degrees, minutes & seconds	° ′ ″	° ′ ″
Degrees, minutes & decimal minutes	° . ′	° . ′
Degrees, minutes & decimal minutes	. °	. °
Easting & Northing (Zone)	S/N	E/W

Instantaneous spill ☐	Amount	(select one)	☐ Tonnes ☐ Cubic Metres ☐ Litres ☐ Barrels
Continuous spill ☐	Duration (hours)	Amount (per hour)	☐ Tonnes ☐ Cubic Metres ☐ Litres ☐ Barrels

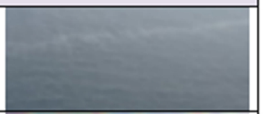
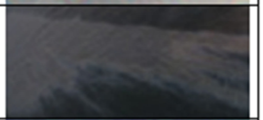
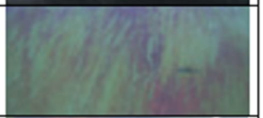
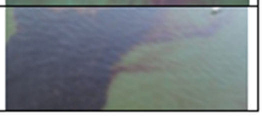
Present wind speed and directions, sea states and water temperatures (°C) at the site (if known):

NOTES (describe special details of the incident, special concerns, doubts about information etc.)

C. 6. Stand down of EMT Checklist

STAND DOWN CHECKLIST / ACTIONS	
KEY ACTIONS:	
The EMT Leader is responsible for assigning personnel to commence the collation of emergency data prior to the commencement of the investigation process. On-going resources for incident control and post incident recovery (if required) should also be considered by the EMT Leader, including current/potential business continuity aspects (per Beach Energy's Business Continuity Plan).	
Final information release and/or notification should occur to some, or all, of the following:	
• All Site ERT and support personnel	• All relevant EMT and support personnel
• Contractor Management	• Regulatory authorities
• Emergency Services	• Employees (off and on duty)
• Employees families/NOK	• Third Parties
• Suppliers and/or contractors	• Joint Venture Partners and customers
• Media	• Government support agencies
• Mutual aid	• Environmental agencies
• Trade unions	• Local community and pressure groups
Initial 'hot' debrief of all personnel to include:	
• A short report by all persons of the history of the incident and their responses; • Outstanding problems with health, safety and environment; • Recovery of production; • Technical information regarding Beach's ongoing operations; and • Emotional responses to what has happened.	
Then:	
• Close additional security arrangements • Finalise additional catering and other services • Continue counselling for those involved in the incident • Compile and file all documents relating to the response • Ensure that all log entries are signed and that all call records and Sit Rep's are signed off by the person who prepared the document • Arrange for full incident investigation and analysis • Approve/comment on incident debriefing reports and recommended actions	
Carry out an After-Action Review to ascertain effectiveness of:	
Incident callout	**Site ERT functions**
• Overall emergency response	• Interface with other EMT members
Recommend revision of Emergency Plans as required.	
Schedule time for After-Action Review and if required, full debrief on the incident.	

Appendix D Bonn Agreement Oil Appearance Code

Code	Description / Appearance	Layer Thickness Interval (Microns)	Litres per km²	Typical Appearance
1	Sheen (silver / grey)	0.04-0.30	40-300	
2	Rainbow	0.30-5.0	300-5,000	
3	Metallic	5.0-50	5,000-50,000	
4	Discontinuous True Oil Colour	50-200	50,000-200,000	
5	Continuous True Oil Colour	>200	>200,000	

Appendix E Aerial Surveillance Observer Log – Oil Spill

Survey Details							
Date		Start time	End time	Observers			
Incident				Area of survey			
Aircraft Type		Call sign		Average altitude		Remote sensing used	

Weather Conditions			
Wind speed (knots)		Wind direction	
Cloud base (feet)		Visibility (Nm)	
Time high water		Current direction	
Time low water		Current speed (Nm)	

Slick Details							
Slick grid parameters by lat/long				Slick grid parameters by air speed		Slick grid dimensions	
Length Axis		Width Axis		Length Axis	Width Axis	Length	Nm
Start Latitude		Start Latitude		Time (seconds)	Time (seconds)	Width	Nm
Start Longitude		Start Longitude				Length	km
End Latitude		End Latitude		Air Speed (Knots)	Air Speed (Knots)	Width	km
End Longitude		End Longitude				Total Grid Area	km^2

Code	Colour	%age cover observed		Total Grid Area		Area per oil code		Factor	Oil volume	
1	Silver		%		km^2		km^2	40 – 300L/km^2		L
2	Rainbow		%		km^2		km^2	300 – 5,000L/km^2		L
3	Metallic		%		km^2		km^2	5,000 – 50,000L/km^2		L
4	Discontinuous true oil colour		%		km^2		km^2	50,000 – 200,000L/km^2		L
5	Continuous true oil colour		%		km^2		km^2	>200,000L/km^2		L
Non shaded areas to be completed on flight. Shaded areas completed on return.								TOTAL		L

Appendix F Aerial Surveillance Observer Log – Marine Mammals

Date :	Survey #
Aircraft/Pilot:	Observers :
Blue Whale Study Contact:	Enquest Contact:
Survey Start Time:	Survey Finish Time:

Event#	Waypoint #	Event time [hh:mm]	Event Position [dd.mmm]	Description of sighting and marine mammal	No. of Marine Mammal(s)	Sterling Position [dd.mmm]
			. °S			. °S
			. °E			. °E
			. °S			. °S
			. °E			. °E
			. °S			. °S
			. °E			. °E
			. °S			. °S
			. °E			. °E
			. °S			. °S
			. °E			. °E

Appendix G Shoreline Assessment

General Information			
Date	Dd/mm/yy:	Survey Time	From:To:
Weather	Sun / Cloud / Fog / Rain / Windy		
Location	Description:	LAT: LONG:	
Total Length	m		

Survey Team	
Name	Organisation

Shoreline Type			
Legend: P = PrimaryS = Secondary			
	Exposed Bedrock Cliff and Seawalls		Intertidal Mud/ Sand Flats
	Exposed Bedrock Platform or Reef		Mangroves
	Sheltered Bedrock Platform or Reef		Salt marshes
	Exposed Boulder/ Cobble and Rip rap		Seagrass (Shallow/Intertidal)
	Sheltered Boulder/ Cobble and Rip rap		Shallow/Intertidal Corals
	Pebble Beaches		Natural Inlets/ Channels
	Sand Beaches		Marinas/ Artificial Waterways

Operational Features	
Debris Present: Yes /No Amount: _______ m3	
Direct Backshore Access: Yes / No	Access Restrictions:
Backshore cliff: Yes / No Height __________m	Suitable Lay down Area:Yes / No

Surface Oiling Conditions

Place an X in the appropriate box

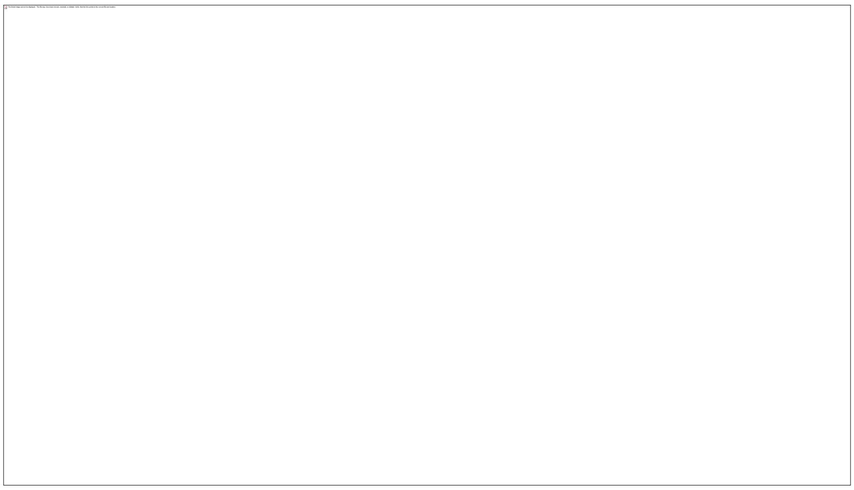
Zone #	Tidal Zone				Oil Cover			Oil Thickness					Oil Character					
	L	M	U	S	Length	Width	Cover (%)	PO	CV	CT	ST	FL	FR	MS	TB	TP	SR	AP

Legend:

Tidal Zone L = Lower Tidal M = Middle Tidal U = Upper Tidal S = Super Tidal

Surface Oiling Thickness	**Surface Oiling Character**
PO = Pooled Oil (fresh oil or mousse > 1 cm thick) CV = Cover (oil or mousse from >0.1 cm to <1 cm on any surface) CT = Coat (visible oil <0.1 cm, which can be scraped off with fingernail) ST = Stain (visible oil, which cannot be scraped off with fingernail) FL = Film (transparent or iridescent sheen or oily film)	FR = Fresh Oil (unweathered, liquid oil) MS = Mousse (emulsified oil occurring over broad areas) TB = Tar balls (discrete accumulations of oil <10 cm in diameter) TP = Tar Patties (highly weathered oil, of tarry, nearly solid consistency) SR = Surface Oil Residue (non-cohesive, oiled surface sediments) AP = Asphalt Pavements (cohesive, heavily oiled surface sediments)

Distribution Guide (% Oil Cover)



Sketch	**Date:**

Checklist: (Place an X once completed)

Oiled Area		Local Features	
Orientation (North)		Access	
Scale		Survey Area (Width/Length)	

Appendix F Offshore Victoria – Operational and Scientific Monitoring Plan

Plan

CDN/ID S4100AH717908

Offshore Victoria Operational and Scientific Monitoring Plan

Revision	Date	Reason for issue	Reviewer/s	Consolidator	Approver
0	19/06/2019	Issued for use	PW	GLE	TF

Review due	Review frequency
19/06/2020	1 year/s

THE THREE WHATS

What can go wrong?

What could cause it to go wrong?

What can I do to prevent it?

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1 Introduction

1.1 Purpose

This Offshore Victoria Operational and Scientific Monitoring Plan (OSMP) provides the framework for environmental monitoring response to Level 2 and Level 3 offshore hydrocarbon spills from petroleum activities undertaken by Beach Energy Ltd (Beach) in the Otway and Bass Basins.

The OSMP is a component of the environmental management framework, which also includes activity specific Environment Plans (EP), the Offshore Victoria – Otway Basin Oil Pollution Emergency Plan (OPEP) (CDN/ID S4100AH717907) and the BassGas Offshore OPEP (CDN/ID 3972816)

The OSMP has been developed to satisfy the requirements of Regulation 14(8AA) and 14(8D) of the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (OPGGS(E)R), Regulation 16 of the Victorian *Offshore Petroleum and Greenhouse Gas Storage Regulations 2011* (OPGGSR) and Regulation 19 of the Tasmanian *Petroleum (Submerged Lands) (Management of Environment) Regulations 2012* (P(SL)(ME)R).

The OSMP is to be read in conjunction with the relevant EP and OPEP when considering the existing environment, values and sensitivities, credible hydrocarbon spill risks and potential impacts, response activities and the decision processes that will apply in the event that a spill occurs. The relevant EP also describes any related performance standards, notification requirements and/or reporting compliance.

1.2 Scope

1.2.1 Activities

This OSMP is relevant to all Beach petroleum activities within the Otway and Bass Basins regulated under the Commonwealth OPGGS(E)R, Victorian OPGGSR and Tasmanian P(SL)(ME)R. This includes, but is not limited to the following activity types:

- Operation of a facility or pipeline
- Vessel activities
- Drilling.

1.2.2 Hydrocarbon type

Spill risks from the above activities that could result in a Level 2 or Level 3 spill event include two hydrocarbon types:

- Gas condensate
- Marine diesel.

This OSMP is relevant to all hydrocarbon types and states (i.e. fresh and weathered); and all distributions throughout the environment (e.g. surface, entrained, dissolved and shoreline).

1.2.3 Geographic extent

This OSMP is relevant and applicable to all Commonwealth and State marine and coastal areas that are potentially at risk of exposure to hydrocarbons in the event of a Level 2 or Level 3 spill resulting from Beach's petroleum activities within the Otway and Bass Basins.

The spatial extent of any particular operational or scientific monitoring study will depend on the actual and/or potential area exposed by an individual spill event. Therefore, monitoring extent would only be finalised once a spill event has occurred and be at a sufficient scale to meet monitoring objectives.

1.3 Responsibilities/Accountabilities

Beach is responsible for the implementation and adherence to the requirements of this OSMP for events where they are the Control Agency. Key roles and responsibilities are identified in Table 1.1

For hydrocarbon spill events where the Control Agency is not Beach (e.g. for spills impacting State waters, or vessel spills in Commonwealth waters), the relevant Control Agency would be responsible for the initiation and implementation of response phase (i.e. operational) monitoring requirements. It is noted that implementation may be delegated to another agency or company (including Beach) to provide services. The Control Agency (specifically the Incident Controller) is also responsible for initiating the recovery phase (i.e. scientific) monitoring, in conjunction with support agencies, local government and statutory authorities (AMSA 2019).

Table 1.1: Roles and responsibilities for OSMP implementation

Role	Timing	Responsibilities
Emergency Management Team (EMT) Leader	Emergency response	• Overall responsibility for implementation of this OSMP during an oil spill response • Equivalent to role of Incident Controller
Heath, Safety & Environment (HSE) Lead (or delegate)	Emergency response	• Interface between EMT and Environment SME • Responsible for ensuring safe operations during OSMP implementation • Provides operational monitoring data to EMT to support response planning • Initiation of operational and scientific monitoring studies • Termination of operational monitoring studies
Planning Lead (or delegate)	Emergency response	• Interface with Environment SME for OSMP implementation (as required)
Logistics Lead (or delegate)	Emergency response	• Interface with Environment SME for OSMP implementation • Support (as required) for implementing operational monitoring (e.g. site access etc.) • Support (as required) for mobilising plant and equipment (e.g. vessels, air support, vehicles etc.)
Emergency Management Liaison Officer	Emergency response	• Interface between Beach EMT and State Control Agency Incident Management Team (IMT)
Environment SME	Emergency response Ongoing	• Interface between HSE Lead and Monitoring Provider • Provide advice to HSE Lead on initiation of operational and scientific monitoring studies • Provide advice to HSE Lead on termination of operational monitoring studies • Termination of scientific monitoring studies

Role	Timing	Responsibilities
		• Day-to-day coordination of operational monitoring • Review and approval of operational monitoring plans and data reports • Day-to-day coordination of scientific monitoring • Review and approval of scientific monitoring plans and data reports • Interface with external agencies including NOPSEMA, DJPR and DPIPWE
Monitoring Provider – Study Lead	Emergency response Ongoing	• Interface with HSE Lead and Environment SME • Implementation of individual monitoring studies (as required) • Prepare monitoring plans and sampling procedures • Review and approve data reports • Ensure compliance with requirements of this OSMP
Monitoring Provider – Field Personnel	Emergency response Ongoing	• Undertake field sampling and observations • Ensure compliance with requirements of this OSMP
Monitoring Provider – Office Personnel	Emergency response Ongoing	• Prepare data reports • Ensure compliance with requirements of this OSMP

1.4 Definitions/Acronyms

Definitions of terms used in this plan:

Terms/acronym	Definition/expansion
AMSA	Australian Maritime Safety Authority
ANOVA	Analysis of variance
ANZECC	Australian and New Zealand Environment and Conservation Council
API	American Petroleum Institute
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
BACI	Before After Control Impact
Beach	Beach Energy Ltd
Control Agency	The Control Agency for an oil spill response is the government agency or company assigned by legislation, administrative arrangement or within the relevant contingency plan to control response activities to an oil spill
DJPR	(Victoria) Department of Jobs, Precincts and Regions
DPIPWE	(Tasmania) Department of Primary Industries, Parks, Water and Environment
EP	Environment Plan
EPBC Act	(Commonwealth) Environment Protection and Biodiversity Conservation Act 1999
EMT	Emergency Management Team
EUL	Environment Unit Lead
HSE	Heath, Safety and Environment
Incident Controller	The individual responsible for the management of all incident control activities across an incident (Note: for spill events where Beach is the Control Agency, this is the equivalent of the EMT Leader)

Terms/acronym	Definition/expansion
IMT	Incident Management Team
IvC	Impact versus Control
LCL	Lower control limit
LEL	Lower explosive limit
Level 2	Level 2 incidents are more complex in size, duration, resource management and risk and may require deployment of jurisdiction resources beyond the initial response (as per NatPlan)
Level 3	Level 3 incidents are generally characterised by a degree of complexity that requires the Incident Controller to delegate all incident management functions to focus on strategic leadership and response coordination and may be supported by national and international resources (as per NatPlan)
MBACI	Multiple Before After Control Impact
MNES	Matters of national environmental significance
Monitoring Provider	Service provider for environmental monitoring studies; may be one or multiple companies (as required)
NATA	National Association of Testing Authorities
NatPlan	National Plan for Maritime Environmental Emergencies
NOAA	(United States) National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
OPGGS(E)R	(Commonwealth) Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPGGSR	(Victoria) Offshore Petroleum and Greenhouse Gas Storage Regulations 2011
OSMP	Operational and Scientific Monitoring Plan
OSRL	Oil Spill Response Limited
OPEP	Oil Pollution Emergency Plan
PAH	Polycyclic aromatic hydrocarbons
PERMANOVA	Permutational multivariate analysis of variance
PSD	Particle size distribution
P(SL)(ME)R	(Tasmania) Petroleum (Submerged Lands) (Management of Environment) Regulations 2012
Ramsar	Convention on wetlands of international importance
SAP	Sampling and Analysis Plan
SD	Standard deviation
SMART	Special Monitoring of Applied Response Technologies
SME	Subject Matter Expert
SQGV	Sediment quality guideline value
Statutory Authority	The Statutory Authority has the statutory responsibility for marine pollution incidents in their area of jurisdiction
TOC	Total organic carbon
TPH	Total petroleum hydrocarbon
UCL	Upper control limit
USEPA	United States Environment Protection Authority
VOC	Volatile organic compound

2 OSMP Framework

2.1 Objectives

The objectives of this OSMP are:

- Identify and describe the operational and scientific monitoring that may be implemented in the event of a Level 2 or Level 3 hydrocarbon spill to the marine or coastal environment
- Demonstrate an appropriate degree of readiness to implement this monitoring in the event of a hydrocarbon spill to the marine or coastal environment.

2.2 Overview

This OSMP provides the framework for Beach's environmental monitoring response to Level 2 and Level 3 offshore hydrocarbon spills from their petroleum activities undertaken in the Otway and Bass Basins.

2.2.1 Types of monitoring

Oil spill monitoring has been divided into two types, operational and scientific, which are undertaken for two distinct, but closely related, purposes (NOPSEMA 2016).

Operational monitoring (also known as Type I or response phase monitoring) which collects information about the spill and associated response activities to aid planning and decision making during the response or clean-up operations. Operational monitoring may include both initial response phase monitoring (i.e. rapid qualitative and observational data gathering for situational awareness) and advanced response phase monitoring (i.e. quantitative measurement) (Hook et al. 2016). Operational monitoring typically finishes when the spill response is terminated.

Four operational monitoring studies have been identified (see Section 3):

- O1: Hydrocarbon in offshore waters
- O2: Hydrocarbon on shorelines
- O3: Oiled wildlife surveillance
- O4: Dispersant efficacy.

Operational monitoring studies complement the Monitoring and Evaluate response strategy described in the relevant OPEP. This response strategy may include spatial surveillance techniques and spill trajectory predictions. Operational monitoring (e.g. Study O4) can also be directly related to a particular response strategy (i.e. Chemical Dispersants) (see Section 2.2.2).

Scientific monitoring (also known as Type II or recovery phase monitoring) which is focussed on non-response objectives and evaluating environmental impact and recovery from the spill and response activities. Scientific monitoring may continue for extended periods after a spill response is terminated.

Six scientific monitoring studies have been identified (see Section 4):

- S1: Offshore waters impact assessment

- S2: Shoreline sediments impact assessment
- S3: Subtidal habitats impact assessment
- S4: Intertidal habitats impact assessment
- S5: Wildlife impact assessment
- S6: Commercial fisheries exposure assessment.

Operational and scientific monitoring studies may occur simultaneously (i.e. scientific monitoring can start before a response operation is completed). There may also be an information flow between studies, for example data from operational monitoring may be used to trigger the initiation of scientific studies.

Different oil types, spill locations, and volumes require different studies to form a fit–for–purpose operational and scientific monitoring program that is able to determine the extent, severity and persistence of environmental impacts from the oil spill.

2.2.2 Links to response options

The objective of individual operational monitoring studies are typically associated with one or more specific response strategies (Table 2.1).

Table 2.1: Operational monitoring and response strategies

Response strategy	Study O1 Hydrocarbon in offshore waters	Study O2 Hydrocarbon on shorelines	Study O3 Oiled wildlife surveillance	Study O4 Dispersant efficacy
Source control	✓			
Monitor and evaluate	✓	✓	✓	
Assisted natural dispersion	✓			
Chemical dispersants	✓			✓
Containment and recovery	✓			
Protection and deflection	✓	✓	✓	
Shoreline clean-up		✓	✓	
Oiled wildlife response		✓	✓	

2.2.3 Links to environmental values and sensitivities

The types of environmental values and sensitivities known to occur in the Otway and Bass Basins and the related operational and scientific monitoring studies area shown in Table 2.2.

Table 2.2: Environmental values and sensitivities and related operational and scientific monitoring studies

Environmental value and sensitivities	**Matters of national environmental significance**	**Value or sensitivity present in region**		**Operational Monitoring**				**Scientific Monitoring**					
		Otway Basin	**Bass Basin**	**Study O1** Hydrocarbon in offshore waters	**Study O2** Hydrocarbon on shorelines	**Study O3** Oiled wildlife surveillance	**Study O4** Dispersant efficacy	**Study S1** Offshore waters impact assessment	**Study S2** Shoreline sediments impact assessment	**Study S3** Subtidal habitats impact assessment	**Study S4** Intertidal habitats impact assessment	**Study S5** Wildlife impact assessment	**Study S6** Commercial fisheries exposure assessment
Protected areas													
Australian Marine Parks	✓[1]	✓	✓	✓		✓		✓		✓		✓	
State marine protected areas		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
State terrestrial protected areas		✓	✓		✓	✓			✓			✓	
Wetlands of international importance (Ramsar wetlands)	✓	✓	✓		✓	✓			✓		✓	✓	
Ecological features													
Key ecological features	[2]	✓	×	✓				✓		✓			
Threatened ecological communities	✓	✓	✓	✓						✓	✓		
Threatened and migratory species	✓	✓	✓			✓						✓	
Invertebrates		✓	✓									✓	✓
Fish		✓	✓									✓	✓
Sharks		✓	✓			✓						✓	

Environmental value and sensitivities	Matters of national environmental significance	Value or sensitivity present in region		Operational Monitoring				Scientific Monitoring					
		Otway Basin	Bass Basin	Study O1	Study O2	Study O3	Study O4	Study S1	Study S2	Study S3	Study S4	Study S5	Study S6
				Hydrocarbon in offshore waters	Hydrocarbon on shorelines	Oiled wildlife surveillance	Dispersant efficacy	Offshore waters impact assessment	Shoreline sediments impact assessment	Subtidal habitats impact assessment	Intertidal habitats impact assessment	Wildlife impact assessment	Commercial fisheries exposure assessment
Cetaceans		✓	✓			✓						✓	
Pinnipeds		✓	✓			✓						✓	
Turtles		✓	✓			✓						✓	
Birds		✓	✓			✓						✓	
Subtidal benthic habitats		✓	✓							✓			
Intertidal benthic habitats		✓	✓								✓		
Wetlands of national importance		✓	✓			✓					✓	✓	
Cultural and heritage features													
World Heritage properties	✓	×	×		✓				✓		✓		
Commonwealth Heritage places		×	✓		✓				✓		✓		
National Heritage places	✓	✓	✓		✓				✓		✓		
Indigenous Protected Areas		✓	✓		✓				✓		✓		
Areas of Aboriginal cultural heritage sensitivity		✓	✓		✓				✓		✓		
Shipwrecks		✓	✓	✓				✓		✓			

Environmental value and sensitivities	Matters of national environmental significance	Value or sensitivity present in region		Operational Monitoring				Scientific Monitoring					
		Otway Basin	Bass Basin	Study O1	Study O2	Study O3	Study O4	Study S1	Study S2	Study S3	Study S4	Study S5	Study S6
				Hydrocarbon in offshore waters	Hydrocarbon on shorelines	Oiled wildlife surveillance	Dispersant efficacy	Offshore waters impact assessment	Shoreline sediments impact assessment	Subtidal habitats impact assessment	Intertidal habitats impact assessment	Wildlife impact assessment	Commercial fisheries exposure assessment
Socioeconomic features													
Commercial fisheries		✓	✓										✓
Tourism and recreation		✓	✓		✓	✓			✓	✓	✓	✓	
Coastal settlements		✓	✓		✓	✓			✓		✓	✓	
Shipping		✓	✓	✓				✓					
Petroleum industry		✓	✓	✓				✓					

Notes:

1. Commonwealth marine areas are listed as a MNES under the EPBC Act. Marine protected areas are marine areas which are recognised to have high conservation value.
2. Key ecological features are not MNES and have no legal status in their own right; however, they may be considered as components of the Commonwealth marine area.

2.2.4 Implementation

This OSMP is supported by the Offshore Victoria – Otway Basin OPEP, the BassGas Offshore OPEP and the OSMP Implementation Guide and OSMP Resources and Capability.

The Implementation Guide is not a prescriptive set of procedures that must strictly be followed but has been prepared to provide Beach and their Monitoring Provider/s sufficient information to efficiently finalise a monitoring design of an appropriate nature and scale in the event of a hydrocarbon spill.

The Implementation Guide also includes draft Standard Operating Procedures. Where practicable, these operating procedures are aligned with existing standards and processes (see also Section 2.3).

It is expected that final sampling designs, monitoring plans and procedures would only be finalised once a spill event has occurred. This is essential to ensure the finalised monitoring plan/s are fit for purpose and tailored to the specific location, hydrocarbon type, environmental sensitivities, and the nature and scale of the individual spill.

2.3 Guidance and best practice

This OSMP incorporates regulatory guidance from the following documents:

- Guidance note – Oil pollution risk management (NOPSEMA 2018)
- Information paper – Operational and scientific monitoring programs (NOPSEMA 2016).

Where appropriate sampling design and procedures are aligned with existing standards or guidance notes. These include, but are not limited to:

- Oil Spill Monitoring Handbook (Hook et al. 2016)
- Australian and New Zealand Water Quality Guidelines for Fresh and Marine Waters Quality (ANZECC & ARMCANZ 2000)
- Parks Victoria Standard Operating Procedure for Biological Monitoring of Subtidal Reefs (Edmunds and Hart 2005)
- Parks Victoria Standard Operating Procedure for Biological Monitoring of Intertidal Reefs (Hart and Edmunds 2005)
- Industry Recommended Subsea Dispersant Monitoring Plan (American Petroleum Institute 2013)
- Dispersant Application Monitoring Field Guide Tier I Visual Observation (OSRL 2011)
- Special Monitoring of Applied Response Technologies (NOAA 2006).

2.4 Communication and Notification

Stakeholder (including regulators) consultation and external notification requirements are described in the activity-specific EPs. This includes the requirement to consult with:

- Department of Jobs, Precincts and Regions (Victoria) and/or Department of Primary Industries, Parks, Water and Environment (Tasmania), in the event that a hydrocarbon spill is likely to impact State waters.

- Department of the Environment and Energy (DoEE), in the event that a hydrocarbon spill is likely to impact matters of national environmental significance.
- Director of National Parks, in the event that a hydrocarbon spill and/or response activities are likely to impact an Australian Marine Park.

Consultation may also be undertaken with the above agencies in the event of a Level 2 or Level 3 hydrocarbon spill with respect to input and/or review of a spill-specific Sampling and Analysis Plan (SAP) for scientific monitoring studies.

2.5 Review and Revisions

This Offshore Victoria OSMP (and supporting guides and procedures) are subject to review, and revised if necessary, on an annual basis to incorporate the following:

- Significant change in the hydrocarbon spills risks associated with Beach activities and/or facilities within offshore Victorian waters
- Significant environmentally relevant changes (e.g. changes to relevant legislation, stakeholder information, MNES, State/Commonwealth management plans, or availability of new literature)
- Findings from internal or external audits or exercises
- Lessons learned following any actual spill event.

Review records will be detailed in Beach Document Information and History tables. Subsequent revisions to the OSMP (or supporting guides and procedures) will be actioned and closed-out as soon as practicable following the review.

As part an EP, Regulation 19 of the OPGGS(E)R also provides for the revision of the OSMP at least 14 days before the end of the period of five years from the most recent approval of an associated EP.

3 Operational Monitoring

The following sections outline the individual operational monitoring studies that may be implemented in the event of a Level 2 or Level 3 hydrocarbon spill to the marine or coastal environment. The tables describe the objective, initiation and termination criteria, implementation times, and provide a high-level description of monitoring, reporting, resources and competencies.

The studies are presented separately below; however, in practice they may be undertaken simultaneously.

These overviews are supported by the OSMP Implementation Plan, which has been prepared to provide Beach and their Monitoring Provider/s sufficient information to efficiently finalise a monitoring design of an appropriate nature and scale in the event of a hydrocarbon spill.

Four operational monitoring studies have been identified:

- O1: Hydrocarbon in offshore waters
- O2: Hydrocarbon on shorelines
- O3: Oiled wildlife surveillance
- O4: Dispersant efficacy.

The operational monitoring studies described in this OSMP complement the Monitor and Evaluate response strategy described in the OPEP in providing information to support decision-making around response activity.

Note: due to the rapid weathering characteristics of gas condensate and marine diesel, operational monitoring studies O1, O2 and O3 are not considered relevant for a pipeline rupture or vessel collision event where there is only a short period of hydrocarbon release. The time that would elapse between a spill occurring and monitoring personnel being on site would render the data collected unnecessary in informing response strategies. Studies O1, O2 and O3 are, therefore, only actioned (once initiation criteria are met) as a result of a loss of well control incident.

3.1 Study O1: Hydrocarbon in offshore waters

An overview of the key components of Study O1 is provided below:

Component	Description
Objective	Determine hydrocarbon concentrations in offshore marine waters
Initiation trigger	• The EMT Leader (or delegate) has confirmed that a Level 2 or Level 3 offshore hydrocarbon spill has occurred **or** • The EMT Leader (or delegate) advises that either full or partial implementation of the study is to commence
Termination trigger	• Any related scientific monitoring studies have been initiated by the HSE Lead (or delegate) **and** • The EMT Leader (or delegate) considers that continuation of monitoring under Study O1 will not result in a change to the scale or location of active response options **or** • The EMT Leader (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response **or** • The HSE Lead (or delegate) has advised that continuation of monitoring under Study O1 may increase overall environmental impact
Timing	Study O1 is to be implemented[1] within 24 hours of the initiation criteria being met

Component	Description
Sampling	The following types of sampling may be implemented under Study O1: • Collection of an oil sample from water surface for physical and chemical characterisation • In-situ water quality data (e.g. water column profiles, TPH and/or physical characteristics) • Surface water sample collection for chemical analysis (e.g. TPH, PAH, heavy metals, dispersant) • Sub-surface water sample collection for chemical analysis (e.g. TPH, PAH, heavy metals, dispersant)
Reporting	• Results from in-situ sampling reported daily to the Environment SME • Results from laboratory sampling reported as available to Environment SME • Final report prepared within one-week of termination criteria being met and report provided to Environment SME
Key Resources	• Monitoring Provider • Vessels • Analytical laboratory services • *Refer to OSMP Resources & Capability for list of contact details for key resources*

Key Competencies	• Monitoring Provider – Study Lead
	  ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area
	  ◦ Familiarisation with relevant requirements of the OSMP and OPEP
	• Monitoring Provider – Field Personnel
	  ◦ Familiarisation with oil and water sampling and recording techniques
	• Vessel provider
	  ◦ Certificate of survey with appropriate service category
	• Analytical laboratory
	  ◦ NATA accredited

Notes:

1. A study is considered implemented when Beach have (i) confirmed initiation criteria have been met, (ii) the Monitoring Provider/s have been notified, (iii) sampling and analysis plans (where required) have been completed, and (iv) mobilisation has commenced.

3.2 Study O2: Hydrocarbon on shorelines

An overview of the key components of Study O2 is provided below:

Component	Description
Objective	Determine hydrocarbon concentrations in shoreline sediments
Initiation trigger	• The EMT Leader (or delegate) has confirmed that a Level 2 or Level 3 offshore hydrocarbon spill has occurred **and** data from the OPEP Monitor and Evaluate response strategy indicates potential and/or actual shoreline contact **or** • The EMT Leader (or delegate) advises that either full or partial implementation of the study is to commence
Termination trigger	• Any related scientific monitoring studies have been initiated by the HSE Lead (or delegate) **and** • The EMT Leader (or delegate) considers that continuation of monitoring under Study O2 will not result in a change to the scale or location of active response options **or** • The EMT Leader (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response **or** • The HSE Lead (or delegate) has advised that continuation of monitoring under Study O2 may increase overall environmental impact

Component	Description
Timing	Study O2 is to be implemented[1] within 36 hours of the initiation criteria being met
Sampling	The following types of sampling may be implemented under Study O2: • In-situ observations of oil coverage and characteristics • Surface sediment sample collection for chemical (e.g. TPH, PAH, heavy metals) and/or physical (e.g. PSD, TOC) analysis
Reporting	• Results from in-situ observations reported daily to the Environment SME • Results from laboratory sampling reported as available to Environment SME • Final report prepared within one-week of termination criteria being met and report provided to Environment SME
Key Resources	• Monitoring Provider • Vessels (island access) • Vehicles (mainland access) • Analytical laboratory services • *Refer to OSMP Resources & Capability for list of contact details for key resources*
Key Competencies	• Monitoring Provider – Study Lead ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Familiarisation with relevant requirements of the OSMP and OPEP • Monitoring Provider – Field Personnel ◦ Familiarisation with sediment sampling and recording techniques • Vessel provider ◦ Certificate of survey with appropriate service category • Analytical laboratory ◦ NATA accredited

Notes:

1. A study is considered implemented when Beach have (i) confirmed initiation criteria have been met, (ii) the Monitoring Provider/s have been notified, (iii) sampling and analysis plans (where required) have been completed, and (iv) mobilisation has commenced.

3.3 Study O3: Oiled wildlife surveillance

An overview of the key components of Study O3 is provided below:

Component	Description
Objective	Identify the presence and condition of oiled wildlife
Initiation trigger	• The EMT Leader (or delegate) has confirmed that a Level 2 or Level 3 offshore hydrocarbon spill has occurred **and** data from the OPEP Monitor and Evaluate response strategy indicates potential and/or actual shoreline contact **or** • The EMT Leader (or delegate) advises that either full or partial implementation of the study is to commence
Termination trigger	• Any related scientific monitoring studies have been initiated by the HSE Lead (or delegate) **and** • The EMT Leader (or delegate) considers that continuation of monitoring under Study O3 will not result in a change to the scale or location of active response options **or** • The EMT Leader (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response **or**

Component	Description
	• The HSE Lead (or delegate) has advised that continuation of monitoring under Study O3 may increase overall environmental impact
Timing	Study O3 is to be implemented[1] within 24 hours of the initiation criteria being met
Surveillance	The following types of surveillance may be implemented under Study O3: • In-situ observations (vessel or aerial) to identify presence of oiled wildlife • Shoreline inspections to identify any oiled, injured or dead wildlife
Reporting	• Results from in-situ observations reported daily to the Environment SME • Final report prepared within one-week of termination criteria being met and report provided to Environment SME
Key Resources	• Monitoring Provider • Vessels • Aircraft • Vehicles • *Refer to OSMP Resources & Capability for list of contact details for key resources*

Key Competencies	• Monitoring Provider – Study Lead
	  ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area
	  ◦ Familiarisation with relevant requirements of the OSMP and OPEP
	• Monitoring Provider – Field Personnel
	  ◦ Familiarisation with the fauna observation and recording techniques
	• Vessel provider
	  ◦ Certificate of survey with appropriate service category
	• Aircraft
	  ◦ Current registration with CASA
	• Analytical laboratory
	  ◦ NATA accredited

Notes:

1. A study is considered implemented when Beach have (i) confirmed initiation criteria have been met, (ii) the Monitoring Provider/s have been notified, (iii) sampling and analysis plans (where required) have been completed, and (iv) mobilisation has commenced.

3.4 Study O4: Dispersant efficacy

An overview of the key components of Study O4 is provided below:

Component	Description
Objective	Determine the effectiveness of dispersant application
Initiation trigger	• The EMT Leader (or delegate) has confirmed that a Level 2 or Level 3 offshore hydrocarbon spill has occurred **and** the Chemical Dispersant response strategy from the OPEP has been selected for use
Termination trigger	• Any related scientific monitoring studies have been initiated by the HSE Lead (or delegate) **and** • The EMT Leader (or delegate) considers that continuation of monitoring under Study O4 will not result in a change to the scale or location of active response options **or** • The EMT Leader (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response **or**

Component	Description
	• The HSE Lead (or delegate) has advised that continuation of monitoring under Study O4 may increase overall environmental impact
Timing	Study O4 is to be undertaken at the same time as the Chemical Dispersant response strategy
Sampling and Surveillance	The following types of sampling and surveillance may be implemented under Study O4: • In-situ observations (vessel or aerial) for dispersant efficacy • Air quality monitoring (e.g. VOCs and %LELs)
Reporting	• Results from in-situ observations reported daily to the Environment SME • Final report prepared within one-week of termination criteria being met and report provided to Environment SME
Key Resources	• Monitoring Provider • Vessels • Aircraft • *Refer to OSMP Resources & Capability for list of contact details for key resources*
Key Competencies	• Monitoring Provider – Study Lead 　◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area 　◦ Familiarisation with relevant requirements of the OSMP and OPEP • Monitoring Provider – Field Personnel 　◦ Familiarisation with vessel-based and/or aerial-based hydrocarbon spill monitoring 　◦ Familiarisation with relevant sampling techniques (e.g. sub-surface video surveillance, use of fluorometer, water sample collection, air quality monitoring) • Vessel provider 　◦ Certificate of survey with appropriate service category • Aircraft 　◦ Current registration with CASA • Analytical laboratory 　◦ NATA accredited

4 Scientific Monitoring

The following sections outline the individual scientific monitoring studies that may be implemented in the event of a Level 2 or Level 3 hydrocarbon spill to the marine or coastal environment. The sections describe the objective, initiation and termination criteria, implementation timing, and provide a high-level description of monitoring, reporting, resources and competencies.

The studies are presented separately below; however, in practice they may be undertaken simultaneously.

These overviews are supported by the OSMP Implementation Plan, which has been prepared to provide Beach and their Monitoring Provider/s sufficient information to efficiently finalise a monitoring design of an appropriate nature and scale in the event of a hydrocarbon spill.

Scientific monitoring generally has objectives relating to attributing cause-effect interactions of the spill with changes to the surrounding environment. Consequently, such studies are required to account for natural or sampling variation, and study designs must be robust and produce defensible data. Scientific monitoring is typically conducted over a wider study area, extending beyond the spill footprint, and a longer time period, extending beyond the spill response.

Six scientific monitoring studies have been identified:

- S1: Offshore waters impact assessment
- S2: Shoreline sediments impact assessment
- S3: Subtidal habitats impact assessment
- S4: Intertidal habitats impact assessment
- S5: Wildlife impact assessment
- S6: Commercial fisheries exposure assessment.

Guidance on various experimental monitoring approaches for scientific monitoring (e.g. use of baseline data in 'before versus after' analyses, and alternative approaches such as 'control versus impact' and 'gradient approach') is provided in Appendix B. Specific guidance and sampling approaches are described within the implementation guides for each scientific monitoring module.

Termination criteria for some of the scientific monitoring modules require the use of guidelines and/or benchmark values. Where available, Australian guidelines (e.g. ANZECC & ARMCANZ 2000) or regionally relevant data is used. Where these are unavailable for a selected parameter, toxicity screening benchmarks developed by the USEPA in response to the Deepwater Horizon incident (e.g. USEPA 2015), or other international guidelines (e.g. USEPA 2017) may be adopted.

4.1 Study S1: Offshore waters impact assessment

An overview of the key components of Study S1 is provided below:

Component	Description
Objective	Determine the impact to, and recovery of, offshore marine water quality from hydrocarbon exposure
Initiation trigger	• The EMT Leader (or delegate) has confirmed that a Level 2 or Level 3 offshore hydrocarbon spill has occurred **and** data from the Study O1 has confirmed exposure to offshore waters **or** • The EMT Leader (or delegate) advises that either full or partial implementation of the study is to commence
Termination trigger	• The Environment SME (or delegate) considers that: ◦ Hydrocarbon concentrations in offshore waters have returned to within the expected natural dynamics of baseline state and/or control sites **or** ◦ Hydrocarbon concentrations in offshore waters are below relevant ANZECC/ARMCANZ (2000) 99% species protection levels or other applicable benchmark values **or** ◦ There has been no demonstrable impact on offshore water quality from hydrocarbons **or** • Agreement has been reached with the Statutory Authority relevant to the spill to terminate the monitoring
Timing	• Study S1 is to be activated[1] within 24 hours of the initiation criteria being met • A draft SAP, prepared by the Monitoring Provider, to be available within 7 days of the study being activated • Consultation with relevant agencies to commence as soon as practicable after study being activated • Mobilisation and monitoring to commence as soon as practicable after SAP is finalised
Sampling	The following types of sampling may be implemented under Study S1: • Surface water sample collection for chemical analysis (e.g. TPH, PAH, heavy metals) • Sub-surface water sample collection for chemical analysis (e.g. TPH, PAH, heavy metals)
Reporting	• Data report to be provided to Environment SME following the completion of each field survey • Final impact assessment report to be provided to Environment SME following the termination criteria being met
Key Resources	• Monitoring Provider • Vessels • Analytical laboratory services • *Refer to OSMP Resources & Capability for list of contact details for key resources*
Key Competencies	• Monitoring Provider – Study Lead ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Familiarisation with relevant requirements of the OSMP and OPEP • Monitoring Provider – Field Personnel ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Experienced in the relevant sampling and/or recording techniques • Monitoring Provider – Office Personnel ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Experience in water quality data analysis • Vessel provider ◦ Certificate of survey with appropriate service category

Component	Description
	• Analytical laboratory ◦ NATA accredited

Notes:

1. A study is considered activated when (i) Beach have confirmed initiation criteria have been met and (ii) the Monitoring Provider/s have been engaged.

4.2 Study S2: Shoreline sediments impact assessment

An overview of the key components of Study S2 is provided below:

Component	Description
Objective	Determine the impact to, and recovery of, shoreline sediment quality from hydrocarbon exposure
Initiation trigger	• The EMT Leader (or delegate) has confirmed that a Level 2 or Level 3 offshore hydrocarbon spill has occurred **and** data from the Study O2 has confirmed exposure to shoreline sediments **or** • The EMT Leader (or delegate) advises that either full or partial implementation of the study is to commence

Termination trigger	• The Environment SME (or delegate) considers that:
	  ◦ Hydrocarbon concentrations in shoreline sediments have returned to within the expected natural dynamics of baseline state and/or control sites **or**
	  ◦ Hydrocarbon concentrations in shoreline sediments are below relevant ANZECC/ARMCANZ SQGV (Simpson et al. 2013) other applicable benchmark values **or**
	  ◦ There has been no demonstrable impact on shoreline sediment quality from hydrocarbons **or**
	• Agreement has been reached with the Statutory Authority relevant to the spill to terminate the monitoring

Timing	• Study S2 is to be activated[1] within 24 hours of the initiation criteria being met • A draft SAP, prepared by the Monitoring Provider, to be available within 7 days of the study being activated • Consultation with relevant agencies to commence as soon as practicable after study being activated • Mobilisation and monitoring to commence as soon as practicable after SAP is finalised
Sampling	The following types of sampling may be implemented under Study S2: • Surface sediment sample collection for chemical (e.g. TPH, PAH, heavy metals) and/or physical (e.g. PSD, TOC) analysis
Reporting	• Data report to be provided to Environment SME following the completion of each field survey • Final impact assessment report to be provided to Environment SME following the termination criteria being met
Key Resources	• Monitoring Provider • Vessels (island access) • Vehicles (mainland access) • Analytical laboratory services • *Refer to OSMP Resources & Capability for list of contact details for key resources*

Key Competencies	• Monitoring Provider – Study Lead
	  ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area
	  ◦ Familiarisation with relevant requirements of the OSMP and OPEP
	• Monitoring Provider – Field Personnel

Component	Description
	◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Experienced in the relevant sampling and/or recording techniques • Monitoring Provider – Office Personnel ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Experience in sediment quality data analysis • Vessel provider ◦ Certificate of survey with appropriate service category • Analytical laboratory ◦ NATA accredited

Notes:

1. A study is considered activated when (i) Beach have confirmed initiation criteria have been met and (ii) the Monitoring Provider/s have been engaged.

4.3 Study S3: Subtidal habitats impact assessment

An overview of the key components of Study S3 is provided below:

Component	Description
Objective	Determine the impact to, and recovery of, subtidal habitats from hydrocarbon exposure
Initiation trigger	• The EMT Leader (or delegate) has confirmed that a Level 2 or Level 3 offshore hydrocarbon spill has occurred **and** data from the OPEP Monitor and Evaluate response strategy indicates potential and/or actual exposure to near-bottom waters **or** • The EMT Leader (or delegate) advises that either full or partial implementation of the study is to commence
Termination trigger	• The Environment SME (or delegate) considers that: ◦ Disturbance parameters (e.g. species composition, percent cover) and health parameters (e.g. leaf condition) have returned to within the expected natural dynamics of baseline state and/or control sites **or** ◦ There has been no demonstrable impact on subtidal benthic habitats from hydrocarbons **or** • Agreement has been reached with the Statutory Authority relevant to the spill to terminate the monitoring
Timing	• Study S3 is to be activated[1] within 24 hours of the initiation criteria being met • A draft SAP, prepared by the Monitoring Provider, to be available within 7 days of the study being activated • Consultation with relevant agencies to commence as soon as practicable after study being activated • Mobilisation and monitoring to commence as soon as practicable after SAP is finalised
Sampling	The following types of sampling may be implemented under Study S3: • Diver surveys to record in situ observations (e.g. substrate type, abundance, percent cover) • ROV surveys to record benthic habitat type and state • Biological sample collection (e.g. for chemical analysis)
Reporting	• Data report to be provided to Environment SME following the completion of each field survey

Component	Description
	• Final impact assessment report to be provided to Environment SME following the termination criteria being met
Key Resources	• Monitoring Provider • Vessels • ROV • *Refer to OSMP Resources & Capability for list of contact details for key resources*
Key Competencies	• Monitoring Provider – Study Lead ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Familiarisation with relevant requirements of the OSMP and OPEP • Monitoring Provider – Field Personnel ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Commercial dive qualifications ◦ Experienced in the relevant sampling and/or recording techniques ◦ Experienced in commercial ROV operations • Monitoring Provider – Office Personnel ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Experience in identification, analysis and interpretation of benthic habitat data • Vessel provider ◦ Certificate of survey with appropriate service category ◦ Suitable for commercial diving operations

Notes:

1. A study is considered activated when (i) Beach have confirmed initiation criteria have been met and (ii) the Monitoring Provider/s have been engaged.

4.4 Study S4: Intertidal habitats impact assessment

An overview of the key components of Study S4 is provided below:

Component	Description
Objective	Determine the impact to, and recovery of, subtidal habitats from hydrocarbon exposure
Initiation trigger	• The EMT Leader (or delegate) has confirmed that a Level 2 or Level 3 offshore hydrocarbon spill has occurred **and** data from the Study O2 has confirmed exposure to shoreline sediments **or** • The EMT Leader (or delegate) advises that either full or partial implementation of the study is to commence
Termination trigger	• The Environment SME (or delegate) considers that: ◦ Disturbance parameters (e.g. species composition, percent cover) and health parameters (e.g. leaf condition) have returned to within the expected natural dynamics of baseline state and/or control sites **or** ◦ There has been no demonstrable impact on intertidal benthic habitats from hydrocarbons **or** • Agreement has been reached with the Statutory Authority relevant to the spill to terminate the monitoring

Component	Description
Timing	• Study S4 is to be activated[1] within 24 hours of the initiation criteria being met • A draft SAP, prepared by the Monitoring Provider, to be available within 7 days of the study being activated • Consultation with relevant agencies to commence as soon as practicable after study being activated • Mobilisation and monitoring to commence as soon as practicable after SAP is finalised
Sampling	The following types of sampling may be implemented under Study S4: • In situ observations (e.g. substrate type, abundance, percent cover) • Biological sample collection (e.g. for chemical analysis)
Reporting	• Data report to be provided to Environment SME following the completion of each field survey • Final impact assessment report to be provided to Environment SME following the termination criteria being met
Key Resources	• Monitoring Provider • Vessels (island access) • Vehicles (mainland access) • *Refer to OSMP Resources & Capability for list of contact details for key resources*

Key Competencies	• Monitoring Provider – Study Lead
	  ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area
	  ◦ Familiarisation with relevant requirements of the OSMP and OPEP
	• Monitoring Provider – Field Personnel
	  ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area
	  ◦ Experienced in the relevant sampling and/or recording techniques
	• Monitoring Provider – Office Personnel
	  ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area
	  ◦ Experience in identification, analysis and interpretation of benthic habitat data
	• Vessel provider
	  ◦ Certificate of survey with appropriate service category

Notes:

1. A study is considered activated when (i) Beach have confirmed initiation criteria have been met and (ii) the Monitoring Provider/s have been engaged.

4.5 Study S5: Wildlife impact assessment

An overview of the key components of Study S5 is provided below:

Component	Description
Objective	Determine the impact to, and recovery of, wildlife from hydrocarbon exposure
Initiation trigger	• The EMT Leader (or delegate) has confirmed that a Level 2 or Level 3 offshore hydrocarbon spill has occurred **and** data from the Study O3 has confirmed exposure to wildlife **or** • The EMT Leader (or delegate) advises that either full or partial implementation of the study is to commence
Termination trigger	• The Environment SME (or delegate) considers that:

Component	Description
	◦ Disturbance parameters (e.g. population size, breeding success) have returned to within the expected natural dynamics of baseline state and/or control sites **or** ◦ There has been no demonstrable impact on wildlife from hydrocarbons **or** • Agreement has been reached with the Statutory Authority relevant to the spill to terminate the monitoring
Timing	• Study S5 is to be activated[1] within 24 hours of the initiation criteria being met • A draft SAP, prepared by the Monitoring Provider, to be available within 7 days of the study being activated • Consultation with relevant agencies to commence as soon as practicable after study being activated • Mobilisation and monitoring to commence as soon as practicable after SAP is finalised
Sampling	The following types of sampling may be implemented under Study S5: • In situ observations (e.g. counts) • Tissue sample collection and analysis
Reporting	• Data report to be provided to Environment SME following the completion of each field survey • Final impact assessment report to be provided to Environment SME following the termination criteria being met
Key Resources	• Monitoring Provider • Vessels (island access) • Vehicles (mainland access) • Analytical laboratory services • *Refer to OSMP Resources & Capability for list of contact details for key resources*
Key Competencies	• Monitoring Provider – Study Lead ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Familiarisation with relevant requirements of the OSMP and OPEP • Monitoring Provider – Field Personnel ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Experienced in the relevant sampling and/or recording techniques • Monitoring Provider – Office Personnel ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Experience in identification, analysis and interpretation of biota data • Vessel provider ◦ Certificate of survey with appropriate service category • Analytical laboratory ◦ NATA accredited

Notes:

1. A study is considered activated when (i) Beach have confirmed initiation criteria have been met and (ii) the Monitoring Provider/s have been engaged.

4.6 Study S6: Commercial fisheries exposure assessment

An overview of the key components of Study S6 is provided below:

Component	Description
Objective	Determine the presence of, and recovery from, hydrocarbon taint in commercial fish species
Initiation trigger	• The EMT Leader (or delegate) has confirmed that a Level 2 or Level 3 offshore hydrocarbon spill has occurred **and** data from the Study O1 or Study S1 has confirmed exposure to offshore waters above the ANZECC/ARMCANZ (2000) 99% species protection levels **and** this exposure occurred in waters that intersect with active fisheries **or** • The EMT Leader (or delegate) advises that either full or partial implementation of the study is to commence
Termination trigger	• The Environment SME (or delegate) considers that: ◦ PAH levels in fish or shellfish show no presence of tissue taint (i.e. levels are below guidelines in ANZECC & ARMCANZ 2000) **or** ◦ PAH levels in fish and shellfish tissue have returned to within the expected natural dynamics of baseline state and/or control sites **or** ◦ PAH levels in fish and shellfish tissue are at or below levels of concern (USFDA 2010) or screening values (USEPA 2000) United States Food and Drug Administration (USFDA) **or** ◦ There has been no demonstrable impact on wildlife from hydrocarbons **or** • Agreement has been reached with the Statutory Authority relevant to the spill to terminate the monitoring
Timing	• Study S6 is to be activated[1] within 24 hours of the initiation criteria being met • A draft SAP, prepared by the Monitoring Provider, to be available within 7 days of the study being activated • Consultation with relevant agencies to commence as soon as practicable after study being activated • Mobilisation and monitoring to commence as soon as practicable after SAP is finalised
Sampling	The following types of sampling may be implemented under Study S6: • Tissue sample collection and chemical analysis (e.g. PAH) • Olfactory analysis
Reporting	• Data report to be provided to Environment SME following the completion of each field survey • Final impact assessment report to be provided to Environment SME following the termination criteria being met
Key Resources	• Monitoring Provider • Olfactory Analysis Panel • Vessels • Analytical laboratory services • *Refer to OSMP Resources & Capability for list of contact details for key resources*
Key Competencies	• Monitoring Provider – Study Lead ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Familiarisation with relevant requirements of the OSMP and OPEP • Monitoring Provider – Field Personnel ◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Experienced in the relevant sampling and/or recording techniques • Monitoring Provider – Office Personnel

Component	Description
	◦ Bachelor degree in environmental science/engineering from a recognised institution or equivalent tertiary study in technical area ◦ Experience in analysis and interpretation of biota data • Olfactory Analysis Panel ◦ Experienced in olfactory analysis • Vessel provider ◦ Certificate of survey with appropriate service category • Analytical laboratory ◦ NATA accredited

Notes:

1. A study is considered activated when (i) Beach have confirmed initiation criteria have been met and (ii) the Monitoring Provider/s have been engaged.

5 References/Associated documents

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Appendix A Approaches for Scientific Monitoring Design

This appendix provides guidance (as provided in APPEA 2019) on survey design approaches that may be utilised for scientific monitoring:

- Impact versus Control (IvC)
- Gradient of Impacts
- Before-After-Control-Impact (BACI)
- Control Chart
- Lines of Evidence.

The design of monitoring studies should ensure, as far as possible, that the planned monitoring activities are practicable and that the objectives of the study will be met. The design must result in the collection of meaningful data and, where practicable, data that are sufficiently powerful to detect ecologically relevant changes.

The final survey design(s) can depend on a variety of factors, included but not limited to:

- Scale and pattern of potential effects of the spill
- Availability of baseline data and/or ability to rapidly obtain baseline data
- Time frame available to gather pre- and post-spill data
- Availability of operational monitoring data
- Availability of appropriate control sites
- Statistical approach proposed for data analysis
- Range of possible chronic and acute effects on the parameters of concern, based on the characteristics of the spill
- Monitoring frequency required to ensure short-and long-term impacts are detected
- Legislative requirements
- Available resources and equipment to conduct the work in terms of personnel, logistics, and access.

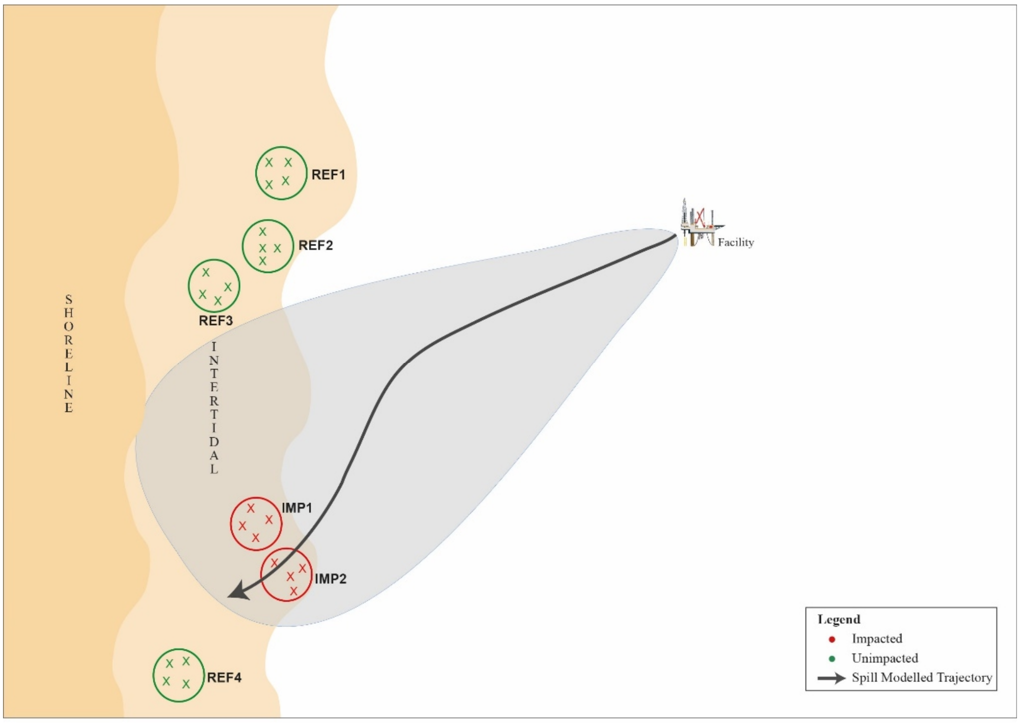
Note: data collection can depend on several constraints (as outlined above) and on access given logistical and safety constraints applicable to a spill event. Therefore, the survey designs recommended within the implementation guides for each scientific monitoring module, may not be able to be implemented exactly as intended. For example, there may be inadequate number of control sites because of the size of the spill and therefore data collected from an expected BACI design may need to be analysed as a gradient approach etc.

A. 1. Before-After-Control-Impact (BACI) approach

Where appropriate baseline data are available, consideration should be given to developing a beyond BACI monitoring program design (Underwood 1991; 1994) or similar extended BACI design (MBACI), which monitors a range of control and impact sites, and can do so over time (Figure A-1). Where robust, appropriate baseline data for exposure sites are not available, pre-exposure sampling of locations that lie within the hydrocarbon spill trajectory should be prioritised to obtain baseline data prior to hydrocarbon exposure.

Exposure sites should be selected first, encompassing a representative selection of locations within the area affected by hydrocarbons. Where practicable, the monitoring program design may consider stratified sampling along environmental gradients (e.g. level of hydrocarbon exposure etc.). Comparable control sites beyond the area affected by hydrocarbons should then be selected, with monitoring conducted at all sites. Clearly obtaining control sites pre-exposure can be challenging and is heavily reliant on predicting the extent of hydrocarbon movement.

The suggested statistical analysis of data collected using the BACI approach includes a univariate or multi-factorial analysis of variance (ANOVA) and equivalent non-parametric tests, all of which will compare between treatment (impact versus reference) and time (before versus after). Components of variation may help partition a sum of squares into different sources and describe the importance of factors within tests.



(Source: APPEA 2019)

Notes:

1. A modification to the beyond BACI design, is known as an MBACI design. MBACI designs incorporate multiple impact locations, whereas beyond BACI designs include only one impact location.
2. The above design consists of four reference/control locations and two impact locations, with four nested sites in each. The number of replicates (e.g. quadrats or transects) per site should be set based on resourcing, and /or the results of the power analysis (if applicable).
3. The area affected by the spill is indicated by the grey shaded area, or the area of influence.
4. Design assumes the area of influence has been affected equally.

Figure A-1: Example of an MBACI design for shoreline and/or intertidal communities

A. 2. Impact versus Control (IvC) approach

For some locations and receptors, baseline data may not exist, may not be recent and applicable, or was collected using methods that are unrepeatable in the current study. If there is a lack of baseline information that can feed into a BACI design, an IvC approach can be used to assess impacts. However, due to the unknown status of the parameter before impact, there is a higher likelihood of encountering Type I error (falsely concluding that an impact has occurred) with this approach. For example, if the status of the parameter to be measured was already naturally lower at impact sites than control sites before the impact occurred, but this was not measured, a conclusion may be reached using the IvC approach that an impact has occurred when it may be natural variation. For this reason, sampling designs should always try to collect or use baseline data (i.e. aim for a BACI design), and if an IvC design is used, it is important to ensure that the control sites are comparable to the impact sites in every way possible except for the presence or absence of the studied effect (hydrocarbon). This may include, but not be limited to, site physical aspect, substrate, current regimes, and community composition.

Because of the higher likelihood of Type I error, it is also useful to collect additional data on relevant physical environmental parameters that are likely to be different at impact and control sites and may affect the conclusion of the assessment. Biological information may also be relevant, such as degree of sub-lethal and lethal impacts to populations. These parameters can be examined later for any potential co-variance with the observed changes in the parameter of interest, to understand whether hydrocarbons or natural variation affected the outcome. The physical and biological information can therefore augment and act as additional evidence to help interpret conclusions from any IvC analyses. As with the BACI approach, when using the IvC approach it is important to understand the scale of natural variation that may affect the outcome of the assessment by replicating sites within sampling locations and replicating samples within each site.

The suggested statistical approach for analysing the data collected using the IvC approach is a multi-factorial ANOVA (to account for nested data), including PERMANOVA and non-parametric tests, to test whether the level of variation among treatments (IvC) is greater than the level of variation within treatments. Components of variation may help partition variance into different sources and help infer whether the effect of hydrocarbons or spatial variation was responsible for any detected change in the receptors.

A. 3. Gradient approach

The gradient approach can be used in some instances where a lack of suitable control sites prohibits using a BACI or IvC approach. Sampling should be established along a gradient of predicted effect (based on input of data from operational monitoring, surveillance or modelling), with sites established at various distances from the source of impact or along a gradient of magnitudes of concentrations of hydrocarbons. The gradient approach can also be used in combination with a BACI or IvC approach to help infer the cause of a detected impact and describe thresholds of impacts at which a response appears to have occurred. The gradient approach also provides a 'line of evidence' that the source of potential impact (hydrocarbons) was responsible for the observed effect, rather than natural variation. However, care should be taken to ensure awareness of any natural gradients in the parameter measured and take these into account when interpreting the data.

When designing a study using a gradient approach, relevant operational and scientific monitoring data (e.g. water and sediment quality), and modelling should be considered. Prior knowledge or prediction of the likely gradient of effect will greatly improve the efficiency of the sampling design by minimising the collection of data points that provide no additional information in the analysis (e.g. data points showing similar or no effects that do not help to characterise the gradient of effect), though noting these may aid in statistical power of gradient description so shouldn't necessarily be discouraged.

Typically, the level of observed impact will decline at distance from the source of a hydrocarbon release, with this decline likely to be exponential (i.e. large changes close to a release that quickly decrease in severity); therefore, sampling effort can be distributed along the gradient of effect in a way that best characterises the changes in the parameter measured.

If possible, multiple (> two) sites could be sampled at each distance along the gradient (if logistics and time permit) to provide an understanding of small-scale variation. Sites should also be sampled at distances where no environmental effect is predicted or observed, if possible, to characterise the full extent of the effect's gradient.

The suggested statistical analysis for the gradient approach includes correlation analysis between impact (measurements of hydrocarbon/stress; x-axis) and measurement parameter (biological response; y-axis), and associated regression analyses, may include least-squares regression line and hypotheses testing to determine if the trend is significantly different from zero.

A. 4. Control chart approach

The control chart approach is applicable in the following circumstances:

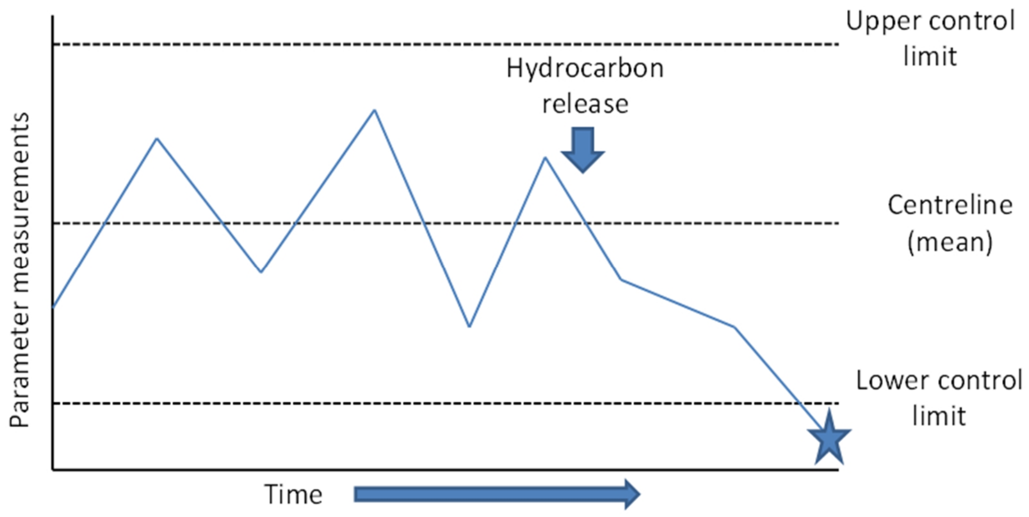
- When long-term (multi-year) datasets exist for the measured parameter;
- When a large amount of natural variation exists in the measured parameter;
- When predicting the expected range of outcomes from an impact.

One of the causal criteria described in the lines of evidence approach is 'strength of association' (Hill 1965), exemplified by a 'larger decline in individuals in areas affected by hydrocarbon than in control areas'. The control chart approach takes this causal criterion a step further and uses rules to establish whether a detected change in a parameter at impact sites is outside what would be expected to occur naturally. This technique requires tracking a parameter over time and determining whether an observed change is within the bounds of what has been observed to occur naturally at that impact site or at control sites.

A control chart has a central line for the mean, an upper control limit (UCL; e.g. typically 3 standard deviations [SD] above the mean), and a lower control limit (LCL; e.g. typically 3SD below the mean), which are typically all determined from historical data (Gotelli and Ellison 2004). The mean line can be constructed using data from i) historical data of an impact site prior to it being affected by hydrocarbons (i.e. what the mean used to be), or ii) control locations, whereby either historical or recent data is used for comparison to other sites (i.e. a control site historical data compared to impact site). The approach is then based on calculating the mean (ongoing) for an impact site to compare against the control chart. Any observations outside the UCL and LCL suggest that increased variation has been observed that are inconsistent with other data and may post a simple way to detect change in a system (Figure A-2).

In addition, if ongoing data collection is possible following a potential impact, the control chart approach can be used to examine the direction of change and whether this is consistent or inconsistent with other data. These data and interpretation may provide a weight of evidence of a directional change in a given parameter.

The control chart approach is only useful if there is an adequate knowledge of natural variability in a given parameter whether from historical sources or similar sites/locations. Control chart approaches can be a powerful tool for detecting impacts for systems that are naturally highly variable.



(Source: APPEA 2019)

Note: The star represents a measurement beyond the likely anticipated variation, which needs to be investigated.

Figure A-2: Example Control Chart showing Centreline (mean), Upper Control Limit (3 SD above mean), Lower Control Limit (3 SD below mean), and Measurements

A. 5. Lines of evidence approach

The lines of evidence approach is applicable in the following circumstances:

- Can be combined with any of the above monitoring designs to provide inferential evidence of an effect;
- Are useful to support evidence of effect if there are limited (or only one) impact locations;
- Are useful to support evidence of effect if the effect radiates outward from source;
- Are useful to infer cause of change if limited or no baseline data exist;
- Are useful to infer cause of change if limited or no control sites exist.

When a sampling design is suboptimal, or if conclusions from more formal tests are inconclusive, a lines of evidence approach can be used to help infer the cause of an observed change (i.e. attribute change to the hydrocarbon release or to other causes, such as natural variation). Within the lines of evidence approach, inference is developed based on carefully structured arguments. A weakness of this method is that the evidence may be largely circumstantial because it is based on correlations (Downes et al. 2002), which does not necessarily imply causation. Each causal argument may be weak when considered independently but combined they may provide strong circumstantial evidence and support for a conclusion (Downes et al. 2002).

This approach was originally developed in medicine (Hill 1965) but has been used more recently in ecological studies (e.g. Downes et al. 2002; McArdle 1996; Suter 1996; Beyers 1998; Fabricius 2004). Causal criteria have been developed for categorizing arguments from studies on disease on humans (Hill 1965), and these can be applied to ecological arguments (Hill 1965). With lines of evidence, there is a need to seek evidence not only to support the impact prediction, but evidence to rule out plausible alternative predictions, such as that the observed difference was due to natural processes (Downes et al. 2002; Beyers 1998).

In the lines of evidence approach, a set of descriptions should be developed for all or some of the causal criteria listed in Table A-1 before the survey is undertaken (see Downes et al. 2002 for further criteria and examples). Data would then be collected that allows each line of evidence to be tested or objectively questioned. The final assessment of whether an impact is likely to have occurred should be based on the 'weight of evidence' from examining multiple lines of evidence.

Example generalised lines of evidence descriptions are provided in Table A-2. These should be modified and tailored to individual scientific monitoring module, as required and each parameter investigated.

Table A-1: Causal criteria and description in the context of ecological impact Assessment

(Source: Hills 1965, in APPEA 2019)

Causal criterion	Description
Strength of association	A large proportion of individuals are affected in the impact area relative to control areas
Consistency of association	The association was observed by other investigators at other times and places
Specificity of association	The effect is diagnostic of exposure
Temporality	Exposure must precede the effect in time
Biological gradient	The risk of effect is a function of magnitude of exposure
Biological plausibility	A plausible mechanism of action links cause and effect
Experimental evidence	A valid experiment provides strong evidence of causation
Coherence	Similar stressors cause similar effects
Analogy	The causal hypothesis does not conflict with existing knowledge of natural history and biology

Table A-2: Causal criteria and example lines of evidence descriptions that could be used to assess whether a change in a measured parameter was due to the effects of a hydrocarbon release

(Source: APPEA 2019)

Causal criterion	Evidence supportive of a hydrocarbon release impact	Evidence unsupportive of a hydrocarbon release impact
Strength of association	Larger decline in individuals in areas affected by hydrocarbon than in control areas	Similar declines in individuals in areas affected by hydrocarbon and control areas
Consistency of association	Consistent finding of declines in a range of biota in areas affected by hydrocarbon	Inconsistent declines in biota in areas affected by hydrocarbon (e.g. declines in one species but not in other similar species)
Specificity of association	Number of individuals affected correlates with hydrocarbon concentrations	No correlation between number of individuals affected and hydrocarbon concentration
Temporality	Decline in individuals immediately preceded by contact with hydrocarbon	Decline in individuals occurred before or long after hydrocarbon contact

Causal criterion	Evidence supportive of a hydrocarbon release impact	Evidence unsupportive of a hydrocarbon release impact
Biological gradient	Changes in individuals aligned with exposure to hydrocarbon spills or concentrations	Decline in individuals occurs with increasing distance from a hydrocarbon spill or hydrocarbon concentrations
Biological plausibility	Evidence from literature of sensitivity to detected hydrocarbon concentration for species where declines are observed	Evidence from literature suggests lack of sensitivity to detected hydrocarbon concentration for species where declines are observed
Experimental evidence	A valid experiment provides strong evidence of causation	Not applicable (N/A)
Coherence	Evidence of a decline in species abundance, habitat, and food source with increasing hydrocarbon exposure	Evidence of a decline in species abundance, but no other evidence of expected declines associated with exposure
Analogy	Apparent declines in hatchling numbers despite no apparent decline in numbers of adults	Apparent declines in hatchling numbers associated with decreased numbers of adults

Appendix G EP Revision Change Register

Any changes to the EP should be assessed against the OPGGS(E)R revision submission criteria detailed in Table 8-11.

Date	EP Revision	Section Revised	Changes	MOC No.	EP Submission Required